



Cisco CloudCenter Cost Optimizer 5.1 Documentation Documentation

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Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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Cost Optimizer 5.1 Home

CloudCenter Cost Optimizer 5.1 Documentation

Cisco released [CloudCenter Suite 5.1](#) on August 19, 2019.

- [Cost Optimizer 5.1.0](#) released on August 19, 2019
- [Cost Optimizer 5.1.1](#) released on September 26, 2019
- [Cost Optimizer 5.1.2](#) released on November 14, 2019
- [Cost Optimizer 5.1.3](#) released on December 20, 2019
- [Cost Optimizer 5.1.4](#) released on February 27, 2020

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updated Apr 01, 2020

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[Cost Over Time](#)

updated Mar 23, 2020

[view change](#)

Release Notes

Cost Optimizer Release Notes

- [Cost Optimizer 5.1.4](#)
- [Cost Optimizer 5.1.3](#)
- [Cost Optimizer 5.1.2](#)
- [Cost Optimizer 5.1.1](#)
- [Cost Optimizer 5.1.0](#)

Cost Optimizer 5.1.4

Cost Optimizer 5.1.4 Release Notes

- [Release Date](#)
- [Installation and Upgrade](#)
- [Clouds](#)
- [Cost Optimizer UI](#)
- [API](#)
- [Integrations](#)
- [Known Issue](#)
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- **CloudCenter Suite:**

- Cost Optimizer cannot be installed separately and must be installed as a part of the CloudCenter Suite UI. See [Suite Admin 5.1.1](#) release notes for additional details.



If you upgrade Cost Optimizer, you must also upgrade Workload Manager and vice versa as both modules use the same shared APIs.

- **Cost Optimizer:**

- The Optimizer Admin can upgrade Cost Optimizer at the suite level to the latest version of the software. See [Update Module](#) for additional context.
- When upgrading to Cost Optimizer 5.1.0, it is recommended that you upgrade from Cost Optimizer 5.0.1 or Cost Optimizer 5.0.3.

- **Cloud Remote:**

- When updating to Cost Optimizer 5.1.0, you must also update all instances of Cloud Remote to Cloud Remote 5.1.0.
- See [Cloud Remote \(Conditional\)](#) for additional details.

The supported cloud families are as follows:

- AWS
- AzureRM
- Google (GCP)
- IBM
- VMware
 - vCenter
 - vCloud Director
- OpenStack
- Kubernetes

See [Configure Clouds](#) for additional context.



Cloud Accounts shared by the parent tenant are only applicable to Workload Manager and are not displayed in Cost Optimizer.

- **Browser Compatibility:** See [Browser Compatibility](#) for a list of compatible browsers.
- **Localization:** Cost Optimizer is only available in the English language.
- Refer to the Suite Admin for additional context on [Suite Architecture](#) and [Administration and Governance](#).
- **Tag-Based Cost Reporting:** Tag-based cost reporting is available for AWS and Azure clouds only. As part of the inventory, tags associated with corresponding resources are fetched from all cloud providers. See [Tag-Based Cost Reporting](#) for additional details.

- **AWS**

- Cost Optimizer obtains all tags but does not fetch the tag status from cost allocation tags. Effective with Cost Optimizer 5.1.2, AWS tags are disabled. To enable tags, you must set the toggle to ON in the **Cost Reporting** column against the tag for which you want to fetch and display the cost. Invoice collection is triggered 30 minutes after you have enabled the tag-based cost reporting at the top of the page. If you are using a version earlier than Cost Optimizer 5.1.2 and have enabled AWS tags for cost reporting, the specific tag will be displayed as enabled and the remaining tags will be disabled. It is recommended that you activate the tags 24 hours before enabling tags based reporting in Cost Optimizer.

- **Azure**

- All tags are fetched and displayed as disabled in Cost Optimizer. You must manually enable the tags.

See [Cost Optimizer API](#) for additional details.

As a part of cost optimizing recommendation, Cost Optimizer works seamlessly for resizing, suspending, stopping, and terminating an instance and unused volumes by working with Workload Manager in the backend. There is no need to navigate to Workload Manager for the above actions.

Cost Optimizer 5.1.4 has the following known issue:

- When you upgrade to Cost Optimizer 5.1.4, new recommendations for Suspension Candidates may not be available.

The following issue was resolved/addressed in Cost Optimizer 5.1.4:

- **CSCvt21889:** When migrating from Cost Optimizer 5.1.0 to Cost Optimizer 5.1.3 Microsoft Azure invoices are not collected. This is because Microsoft Azure invoice records were deactivated as some changes were made to track the start date and end date for the invoices.
Resolution: Cost Optimizer 5.1.4 has a fix that addresses this issue. All invoices collected for Microsoft Azure are now displayed.

The following sections were updated for technical accuracy:

- [Cost Optimizer Architecture](#) (added a new page that elucidates the Cost Optimizer architecture. The Port Requirements section in the [Cost Optimizer Overview](#) has been added to this page)
- [Cloud Overview > Minimum Permissions for Public Clouds](#) (updated for technical accuracy about additional AWS permissions required for inventory discovery)
- [Tag-Based Cost Reporting](#) (updated for technical accuracy)

Cost Optimizer 5.1.3

Cost Optimizer 5.1.3 Release Notes

- [Release Date](#)
- [Installation and Upgrade](#)
- [Clouds](#)
- [Cost Optimizer UI](#)
- [API](#)
- [Integrations](#)
- [Known Issues](#)
- [Resolved Issues](#)

First Published: December 20, 2019

- **CloudCenter Suite:**

- Cost Optimizer cannot be installed separately and must be installed as a part of the CloudCenter Suite UI. See [Suite Admin 5.1.1](#) release notes for additional details.



If you upgrade Cost Optimizer, you must also upgrade Workload Manager and vice versa as both modules use the same shared APIs.

- **Cost Optimizer:**

- The Optimizer Admin can upgrade Cost Optimizer at the suite level to the latest version of the software. See [Update Module](#) for additional context.
- When upgrading to Cost Optimizer 5.1.0, it is recommended that you upgrade from Cost Optimizer 5.0.1 or Cost Optimizer 5.0.3.

- **Cloud Remote:**

- When updating to Cost Optimizer 5.1.0, you must also update all instances of Cloud Remote to Cloud Remote 5.1.0.
- See [Cloud Remote \(Conditional\)](#) for additional details.

The supported cloud families are as follows:

- AWS
- AzureRM
- Google (GCP)
- IBM
- VMware
 - vCenter
 - vCloud Director
- OpenStack
- Kubernetes

See [Configure Clouds](#) for additional context.



Cloud Accounts shared by the parent tenant are only applicable to Workload Manager and are not displayed in Cost Optimizer.

- **Browser Compatibility:** See [Browser Compatibility](#) for a list of compatible browsers.
- **Localization:** Cost Optimizer is only available in the English language.
- Refer to the Suite Admin for additional context on [Suite Architecture](#) and [Administration and Governance](#).
- **Tag-Based Cost Reporting:** Tag-based cost reporting is available for AWS and Azure clouds only. As part of the inventory, tags associated with corresponding resources are fetched from all cloud providers. See [Tag-Based Cost Reporting](#) for additional details.

- **AWS**

- Cost Optimizer obtains all tags but does not fetch active tags associated with a resource. Effective with Cost Optimizer 5.1.2, AWS tags are disabled. To enable tags, you must set the toggle to **ON** in the **Cost Reporting** column against the tag for which you want to display the cost. Invoice collection is triggered 30 minutes after you have enabled the tag-based cost reporting at the top of the page. If you are using a version earlier than Cost Optimizer 5.1.2 and have enabled AWS tags for cost reporting, the specific tag will be displayed as enabled and the remaining tags will be disabled.

- **Azure**

- All tags are fetched and displayed as disabled in Cost Optimizer. You must manually enable the tags.

See [Cost Optimizer API](#) for additional details.

As a part of cost optimizing recommendation, Cost Optimizer works seamlessly for resizing, suspending, stopping, and terminating an instance and unused volumes by working with Workload Manager in the backend. There is no need to navigate to Workload Manager for the above actions.

Cost Optimizer 5.1.3 has the following known issue:

When migrating from Cost Optimizer 5.1.0 to Cost Optimizer 5.1.3 Microsoft Azure invoices are not displayed until the Invoice Aggregation (see [Data Collection](#)) process is run at the scheduled time. This is because Microsoft Azure invoice records are deactivated as some changes were made with respect to the tracking of the start and end dates for the invoices. This change is specific to Microsoft Azure only.

The following issues were resolved/addressed in Cost Optimizer 5.1.3:

- **CSCvs49488:** The Cost Group API (`/api/v1/costGroupTypes`) takes a very long time to load a large number of cost groups in the system.
Resolution: Cost Optimizer 5.1.3 includes performance improvements to load a large number of cost groups.

Cost Optimizer 5.1.2

Cost Optimizer 5.1.2 Release Notes

- [Release Date](#)
- [Installation and Upgrade](#)
- [Clouds](#)
- [Cost Optimizer UI](#)
- [API](#)
- [Integrations](#)
- [Resolved Issues](#)
- [Documentation](#)

First Published: November 14, 2019

Updated:

- December 11, 2019: Updated the *Documentation* section to include a list of pages that were modified.
- **CloudCenter Suite:**
 - Cost Optimizer cannot be installed separately and must be installed as a part of the CloudCenter Suite UI. See [Suite Admin 5.1.1](#) release notes for additional details.



If you upgrade Cost Optimizer, you must also upgrade Workload Manager and vice versa as both modules use the same shared APIs.

- **Cost Optimizer:**
 - The Optimizer Admin can upgrade Cost Optimizer at the suite level to the latest version of the software. See [Update Module](#) for additional context.
 - When upgrading to Cost Optimizer 5.1.0, it is recommended that you upgrade from Cost Optimizer 5.0.1 or Cost Optimizer 5.0.3.
- **Cloud Remote:**
 - When updating to Cost Optimizer 5.1.0, you must also update all instances of Cloud Remote to Cloud Remote 5.1.0.
 - See [Cloud Remote \(Conditional\)](#) for additional details.

The supported cloud families are as follows:

- AWS
- AzureRM
- Google (GCP)
- IBM
- VMware
 - vCenter
 - vCloud Director
- OpenStack
- Kubernetes

See [Configure Clouds](#) for additional context.



Cloud Accounts shared by the parent tenant are only applicable to Workload Manager and are not displayed in Cost Optimizer.

- **Browser Compatibility:** See [Browser Compatibility](#) for a list of compatible browsers.
- **Localization:** Cost Optimizer is only available in the English language.
- Refer to the Suite Admin for additional context on [Suite Architecture](#) and [Administration and Governance](#).
- **Tag-Based Cost Reporting:** Tag-based cost reporting is available for AWS and Azure clouds only. As part of the inventory, tags associated with corresponding resources are fetched from all cloud providers. See [Tag-Based Cost Reporting](#) for additional details.
 - **AWS**
 - Cost Optimizer obtains all tags but does not fetch active tags associated with a resource. Effective with Cost Optimizer 5.1.2, AWS tags are disabled. To enable tags, you must set the toggle to **ON** in the **Cost Reporting** column against the tag for which you want to display the cost. Invoice collection is triggered 30 minutes after you have enabled the tag-based cost reporting at the top of the page. If you are using a version earlier than Cost Optimizer 5.1.2 and have enabled AWS tags for cost reporting, the specific tag will be displayed as enabled and the remaining tags will be disabled.
 - **Azure**
 - All tags are fetched and displayed as disabled in Cost Optimizer. You must manually enable the tags.

See [Cost Optimizer API](#) for additional details.

As a part of cost optimizing recommendation, Cost Optimizer works seamlessly for resizing, suspending, stopping, and terminating an instance and unused volumes by working with Workload Manager in the backend. There is no need to navigate to Workload Manager for the above actions.

The following issues were resolved/addressed in Cost Optimizer 5.1.2:

- **CSCvs08194:** Cost Optimizer does not implicitly enable AWS tags.
Resolution: In Cost Optimizer 5.1.2, Cost Optimizer does not fetch AWS tags associated with a resource.

The following documentation changes were implemented in Cost Optimizer 5.1.2:

- [Tag-Based Cost Reporting](#) (updated for technical accuracy about disabling of AWS tags)
- [Configure an AWS Cloud](#) > Add an AWS Cloud Account, [Configure an AzureRM Cloud](#) > Add an AzureRM Cloud Account, [Configure an IBM Cloud](#) > Add an IBM Cloud Cloud Account, [Configure a Google Cloud](#) > Add a Google Cloud Account(updated for technical accuracy about incur expenses to retrieve cost data for Reporting accounts)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy about enabling AWS Cost Explorer to view AWS-specific costs)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy)

Cost Optimizer 5.1.1

Cost Optimizer 5.1.1 Release Notes

- [Release Date](#)
- [Installation and Upgrade](#)
- [Clouds](#)
- [Cost Optimizer UI](#)
- [API](#)
- [Integrations](#)
- [Resolved Issues](#)
- [Documentation](#)

First Published: September 26, 2019

Updated:

- December 11, 2019: Updated the *Documentation* section to include a list of pages that were modified.
- **CloudCenter Suite:**
 - Cost Optimizer cannot be installed separately and must be installed as a part of the CloudCenter Suite UI. See [Suite Admin 5.1.1](#) release notes for additional details.



If you upgrade Cost Optimizer, you must also upgrade Workload Manager and vice versa as both modules use the same shared APIs.

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 - When upgrading to Cost Optimizer 5.1.0, it is recommended that you upgrade from Cost Optimizer 5.0.1 or Cost Optimizer 5.0.3.
- **Cloud Remote:**
 - When updating to Cost Optimizer 5.1.0, you must also update all instances of Cloud Remote to Cloud Remote 5.1.0.
 - See [Cloud Remote \(Conditional\)](#) for additional details.

The supported cloud families are as follows:

- AWS
- AzureRM
- Google (GCP)
- IBM
- VMware
 - vCenter
 - vCloud Director
- OpenStack
- Kubernetes

See [Configure Clouds](#) for additional context.



Cloud Accounts shared by the parent tenant are only applicable to Workload Manager and are not displayed in Cost Optimizer.

- **Browser Compatibility:** See [Browser Compatibility](#) for a list of compatible browsers.
- **Localization:** Cost Optimizer is only available in the English language.
- Refer to the Suite Admin for additional context on [Suite Architecture](#) and [Administration and Governance](#).

See [Cost Optimizer API](#) for additional details.

As a part of cost optimizing recommendation, Cost Optimizer works seamlessly for resizing, suspending, stopping, and terminating an instance and unused volumes by working with Workload Manager in the backend. There is no need to navigate to Workload Manager for the above actions.

The following issues were resolved/addressed in Cost Optimizer 5.1.1:

- **CSCvr26139:** Cost Optimizer fails to mask user-specific cloud credentials in reservation logs.
Resolution: Cost Optimizer includes a fix to mask the information.
- **CSCvr31822:** Cost Explorer expenses are incurred for *GetTags* API call when tag-based cost reporting is disabled.
Resolution: Ensure that the tag-based cost reporting field is checked when API is called.
- **CSCvq77928:** After a deployment, VM actions triggered by the CloudCenter Suite UI failed.
Resolution: Cost Optimizer 5.1.1 includes a check to ensure that when adding cloud accounts, billing units are already configured for the account addition to succeed.

The following documentation changes were implemented in Cost Optimizer 5.1.1:

- [Settings Page](#) > *Suspension Candidates Card* (updated for technical accuracy)
- [Invoice by Category](#) (additional details about *Other* category)
- [Configure an AWS Cloud](#) > *Add an AWS Cloud Account*, [Configure an AzureRM Cloud](#) > *Add an AzureRM Cloud Account*, [Configure an IBM Cloud](#) > *Add an IBM Cloud Cloud Account*, [Configure a Google Cloud](#) > *Add a Google Cloud Account* (recommendation on adding *Reporting* account to the same tenant)
- [Cost Optimizer Troubleshooting](#) (added a new section for Kubernetes Troubleshooting)
- [Tag-Based Cost Reporting](#) (updated for technical accuracy about disabling of AWS tags)
- [Configure an AWS Cloud](#) > *Add an AWS Cloud Account*, [Configure an AzureRM Cloud](#) > *Add an AzureRM Cloud Account*, [Configure an IBM Cloud](#) > *Add an IBM Cloud Cloud Account*, [Configure a Google Cloud](#) > *Add a Google Cloud Account* (updated for technical accuracy about incur expenses to retrieve cost data for *Reporting* accounts)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy about enabling AWS Cost Explorer to view AWS-specific costs)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy)

Cost Optimizer 5.1.0

Cost Optimizer 5.1.0 Release Notes

- [Release Date](#)
- [Installation and Upgrade](#)
- [Clouds](#)
- [Cost Optimizer UI](#)
- [API](#)
- [Integrations](#)
- [Documentation](#)

First Published: August 19, 2019

Updated:

- December 11, 2019: Updated the *Documentation* section to include a list of pages that were modified.

Features

Cost Optimizer is a cloud cost management and optimization solution that helps you to save cost. The following features available in Cost Optimizer 5.1.0:

- **Alerts** – Send notifications to intended recipients when specified thresholds are crossed. See [Alerts Page](#).
- **Budgets** – Allocate budgets for cloud accounts, cost group types, etc. and view the spending against the budget. See [Allocate Budgets](#), [Budget Reports](#).
- **Enhanced Rightsizing Optimizations**
 - **Proportional Resizing** – Supported by rightsizing engine and is the default setting. Based on the factors of underutilization or overutilization, appropriate instances are identified to ensure CPU or memory ratios will be maintained approximately.
 - **Unused Volumes** – Find and terminate unused volumes, thereby helping in saving cost. See [Unused Volumes](#).
- **Saved Filters and Scheduled Reports** – Advanced filtering and reporting options in cost and inventory pages. See [Cost Reports Overview](#) > *Advanced Options*.
- **Suspension Candidates** – Reduce cost on cloud resources, when resources are not used. See [Suspension Candidates](#).
- **Tag-Based Cost Reporting** – Enables calculating costs at the cloud resources level. See [Tag-Based Cost Reporting](#).
- **CloudCenter Suite:**
 - Cost Optimizer cannot be installed separately and must be installed as a part of the CloudCenter Suite UI. See [Suite Admin 5.1.0](#) release notes for additional details.



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- **Cloud Remote:**
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The supported cloud families are as follows:

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See [Configure Clouds](#) for additional context.



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- **Browser Compatibility:** See [Browser Compatibility](#) for a list of compatible browsers.

- **Localization:** Cost Optimizer is only available in the English language.
- Refer to the Suite Admin for additional context on [Suite Architecture](#) and [Administration and Governance](#).

See [Cost Optimizer API](#) for additional details.

As a part of cost optimizing recommendation, Cost Optimizer works seamlessly for resizing, suspending, stopping, and terminating an instance and unused volumes by working with Workload Manager in the backend. There is no need to navigate to Workload Manager for the above actions.

The following documentation changes were implemented in Cost Optimizer 5.1.0:

- [Install Conditional Components](#) (added the name of the Cloud Remote artifact)
- [Conditional Component Appliance Images](#) (added the name of the Cloud Remote artifact)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (additional details pertaining to tag-based reporting for AWS clouds)
- [Cost Optimizer Overview](#) (port diagram updated for technical accuracy)
- [Suspension Candidates](#) (added Workload Manager roles required for suspension policy)
- [Settings Page](#) > *Suspension Candidates Card* (updated for technical accuracy)
- [Invoice by Category](#) (additional details about *Other* category)
- [Configure an AWS Cloud](#) > *Add an AWS Cloud Account*, [Configure an AzureRM Cloud](#) > *Add an AzureRM Cloud Account*, [Configure an IBM Cloud](#) > *Add an IBM Cloud Cloud Account*, [Configure a Google Cloud](#) > *Add a Google Cloud Account* (recommendation on adding *Reporting* account to the same tenant)
- [Cost Optimizer Troubleshooting](#) (added a new section for Kubernetes Troubleshooting)
- [Tag-Based Cost Reporting](#) (updated for technical accuracy about disabling of AWS tags)
- [Configure an AWS Cloud](#) > *Add an AWS Cloud Account*, [Configure an AzureRM Cloud](#) > *Add an AzureRM Cloud Account*, [Configure an IBM Cloud](#) > *Add an IBM Cloud Cloud Account*, [Configure a Google Cloud](#) > *Add a Google Cloud Account* (updated for technical accuracy about incur expenses to retrieve cost data for *Reporting* accounts)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy about enabling AWS Cost Explorer to view AWS-specific costs)
- [Cloud Overview](#) > *Minimum Permissions for Public Clouds* (updated for technical accuracy)

What is Supported?

What is Supported?


- [Supported Public Clouds](#)
- [Supported Container Clouds](#)
- [Supported Datacenters and Private Clouds](#)

Supported Public Clouds

Shared Supported Public Clouds

Cisco supports the following public clouds and managed private clouds for the Workload Manager and Cost Optimizer modules.

The following table identifies the cloud regions that are currently available out-of-the-box Workload Manager and Cost Optimizer modules.

Cloud Family	Available Regions
Amazon Web Services (AWS)	Asia Pacific (Mumbai)
	Asia Pacific (Osaka-Local)
	Asia Pacific (Seoul)
	Asia Pacific (Singapore)
	Asia Pacific (Sydney)
	Asia Pacific (Tokyo)
	AWS GovCloud (US-East)
	AWS GovCloud (US-West)
	Canada (Central)
	CN North (Beijing)
	China (Ningxia)
	 Invoice reports in Cost Optimizer are not supported for China regions.
	EU (Frankfurt)
	EU (Ireland)
	EU (London)
	EU (Paris)
	EU (Stockholm)
	South America (Sao Paulo)
	US East (N. Virginia)
	US East (Ohio)
US West (N. California)	
US West (Oregon)	
Google Cloud Platform	Central US (Iowa)
	Eastern Asia-Pacific (Hong Kong)
	Eastern Asia-Pacific (Taiwan)
	Eastern US (Northern Virginia)
	Eastern US (South Carolina)
	European West (Frankfurt)
	European West (London)
	European West (Netherlands)
	Northeastern Asia-Pacific (Japan)

	Northern America (Canada)
	Northern Europe (Finland)
	South Eastern Asia-Pacific (Singapore)
	South Eastern Australia (Sydney)
	Southern America (Sao Paulo)
	Southern Asia-Pacific (Mumbai)
	Western Europe (Belgium)
	Western US (California)
	Western US (Oregon)
IBM	Amsterdam 01 (ams01)
	Amsterdam 03 (ams03)
	Chennai 01 (che01)
	Dallas 05 (dal05)
	Dallas 06 (dal06)
	Dallas 09 (dal09)
	Dallas 10 (dal10)
	Dallas 12 (dal12)
	Dallas 13 (dal13)
	Frankfurt 02 (fra02)
	Frankfurt 02 (fra02)
	Frankfurt 05 (fra05)
	Hong Kong 02 (hkg02)
	Houston 02 (hou02)
	London 02 (lon02)
	London 04 (lon04)
	London 05 (lon05)
	London 06 (lon06)
	Melbourne 01 (mel01)
	Milan 01 (mil01)
	Montreal 01 (mon01)
	Oslo 01 (osl01)
	Paris 01 (par01)
	Queretaro 01 (mex01)
	San Jose 01 (sjc01)
	San Jose 04 (sjc04)
	San Jose 04 (sjc04)
	Sao Paulo 01 (sao01)
	Seattle 01 (sea01)
	Seattle 01 (sea01)
	Seoul 01 (seo01)
	Singapore 01 (sng01)

	Sydney 01 (syd01)
	Sydney 04 (syd04)
	Sydney 05 (syd05)
	Tokyo 02 (tok02)
	Tokyo 04 (tok04)
	Tokyo 05 (tok05)
	Toronto 01 (tor01)
	Washington, DC 01 (wdc01)
	Washington, DC 04 (wdc04)
	Washington, DC 06 (wdc06)
	Washington, DC 07 (wdc07)
Microsoft Azure	Australia Central (Canberra)
	Australia Central 2 (Canberra)
	Australia East (New South Wales)
	Australia Southeast (Victoria)
	Brazil South (sao Paulo State)
	Canada Central (Toronto)
	Canada East
	Central India (Pune)
	China East (Shanghai)
	China North (Beijing)
	East Asia (Hong Kong)
	Europe North (Ireland)
	Europe West (Netherlands)
	France Central (Paris)
	France South (Marseille)
	Germany Central (Frankfurt)
	Germany North
	Germany Northeast (Magdeburg)
	Germany West Central
	Japan East (Saitama)
	Japan West (Osaka)
	Korea South (Busan)
	South Africa North (Johannesburg)
	South Africa West (Cape Town)
	South India (Chennai)
	Southeast Asia (Singapore)
	Switzerland North (Zurich)
	Switzerland West (Geneva)
	UAE Central (Abu Dhabi)
	UAE North (Dubai)

UK South (London)
UK West (Cardiff)
US Central (Iowa)
US East (Virginia)
US East 2 (Virginia)
US Gov Arizona
US Gov Texas
US Gov Virginia
US North Central (Illinois)
US South Central (Texas)
US West (California)
US West 2(West US 2)
US West Central (West Central US)
West India (Mumbai)

Supported Container Clouds

Supported Container Clouds

- [Overview](#)
- [Requirements](#)
- [Upstream Support and Capability](#)

A container cloud relies on a *container* infrastructure that is configured by an administrator outside of Workload Manager. Currently, Workload Manager supports one container cloud: Kubernetes cloud.

Kubernetes cloud configurations require:

- [Kubernetes](#) version support
 - Kubernetes 1.8
 - Kubernetes 1.9
 - Kubernetes 1.10
 - Kubernetes 1.11
 - Kubernetes 1.12
 - Kubernetes 1.13
- A single Kubernetes cluster with an implicit default region
- One or more cloud accounts
- Cloud settings API endpoint
- Instance types (fractional CPU and memory)

Workload Manager supports *upstream* Kubernetes setups. *Upstream* refers to any bare Kubernetes setup like Google Kubernetes Engine (GKE), Amazon Elastic Container Service for Kubernetes (EKS), Cisco Container Platform, and so forth as these environments expose the Kubernetes APIs to users. This term does not include platforms that only use Kubernetes and then add on their own APIs.

Workload Manager's API layer handles configuration tasks such as application deployment for Kubernetes pods – at the time of application deployment, Workload Manager dynamically creates the application pod information, which can be in Kubernetes as YAML or JSON files. Workload Manager dynamically deploys applications based on the Workload Manager application profile. While you cannot directly modify the application pod information that is dynamically created, you can edit the Workload Manager application profile in JSON format.

When creating an application profile, users define the network service. Workload Manager uses these user-configured network settings to automatically deploy load balancers through Kubernetes. See [Container Service > Deploying a Container Service > Network Services](#) for details.

The Firewall Rules in the application profile correspond to a Network Policy Ingress rules in Kubernetes. See [Container Service > Deploying a Container Service > Firewall Rules](#) for details.

Supported Datacenters and Private Clouds

Supported Datacenters and Private Clouds

The Workload Manager and Cost Optimizer modules support the datacenters or private clouds built using the following technology stacks.

Cloud Family	Version
VMware vCloud Director	VMware vCloud Director 8.1
	VMware vCloud Director 9.1
VMware vCenter	VMware vCenter 6.0
	VMware vCenter 6.5
	VMware vCenter 6.7
OpenStack	OpenStack Newton
	OpenStack Mitaka
	OpenStack Pike
	OpenStack Queens

To compute costs in Cost Optimizer, you must specify the compute and storage costs for an instance family that is auto-discovered.



Cisco does not provide out-of-box image mapping for datacenters or managed private clouds. You must manually import the physical images you need to deploy and map the appropriate logical images to those physical images. See [Images](#) for more context.

Getting Started

Getting Started

- [Cost Optimizer Overview](#)
- [Cost Optimizer Architecture](#)
- [Access and Roles](#)
- [UI Behavior](#)

Cost Optimizer Overview

Cost Optimizer Overview

- [Overview](#)
- [Terminology](#)
- [Features](#)
- [Infrastructure](#)
- [Module Update Considerations](#)
- [Logging In to Cost Optimizer](#)
- [Related Information](#)

Cost Optimizer is a comprehensive cloud cost management and optimization solution that analyzes cloud-deployed workloads and consumption patterns and identifies cost-optimization strategies. The Cost Optimizer solution helps you to rightsize your cloud workload instances, minimize overprovisioning, and avoid paying for resources that do not deliver business value.

Throughout this document, you will refer to the following terms:

Term	Description
Cost Group Type	Maps to the various functions in an organization, for example, Development, HR, IT, and so on.
Cost Groups	Hierarchical structure to define your organization and distribute billing units.
Cloud Account	Credentials for logging in to a cloud provider.
Billing Units	Refers to different entities depending on the cloud. These entities are account IDs in Amazon cloud, Project IDs in Google cloud, Subscription ID in AzureRM cloud, Datacenter name (prefixed with the cloud group) in vCenter clouds, Project ID in OpenStack cloud, and Namespace UID in Kubernetes cloud.
Budgets	Ability to allocate or reserve amounts per cloud or cost group type.
Tags	Key-value pairs associated with resources in a cloud.

The new features in Cost Optimizer 5.1.0 are:

- Cost report at the resource level using tags
- Alert notifications sent to recipients when threshold limits are crossed
- Specify budget allocations and view spending against allocated budget
- Enhanced rightsizing optimizations through unused volumes
- Suspension Policies
- Save commonly used filters for future use and send reports to intended recipients at scheduled intervals

For setting up the Cost Optimizer infrastructure, see *Suite Install 5.1.0 Home > Installation Approach > Prepare Infrastructure*.

When updating the Cost Optimizer module, be aware that the update occurs for several minutes. During that time there may be a loss of connectivity between the CloudCenter Suite and individual cloud regions even after the [Suite Admin UI](#) indicates that the update has completed. Therefore, it is encouraged to keep this potential loss of connectivity in mind before applying updates.

In [Suite Admin Dashboard](#), click the **Cost Optimizer** card to open Cost Optimizer.

1. Enter the following:
 - **Email**
 - **Password**
 - **Tenant ID** of your organization
2. Click **Login**.

Cost Optimizer opens in the **Cost Optimizer Dashboard** page.

To log out, click the *Welcome <username>* text in the top-right corner and choose **Log Out**.

See the following sections for detailed information about the Cost Optimizer features:

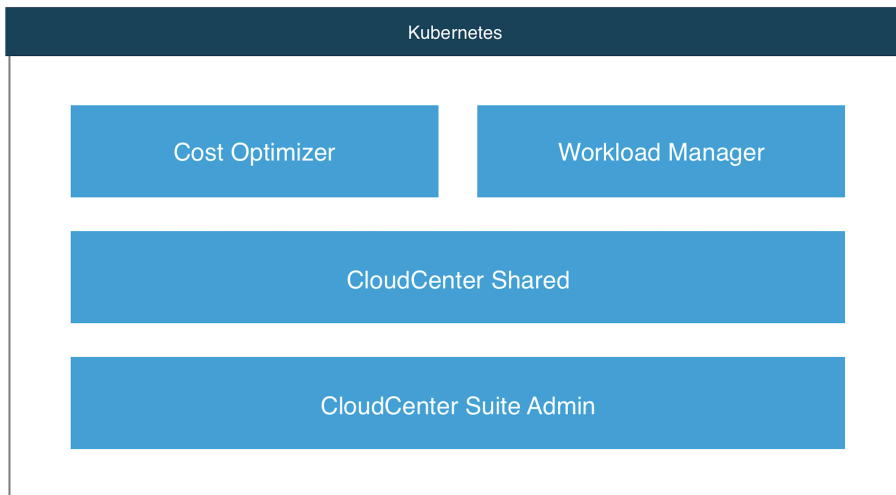
- [Access and Roles](#)
- [Cost Groups Configuration](#)
- [Allocate Budgets](#)
- [Rightsizing](#)
- [Reserved Instances](#)

Cost Optimizer Architecture

Cost Optimizer Architecture

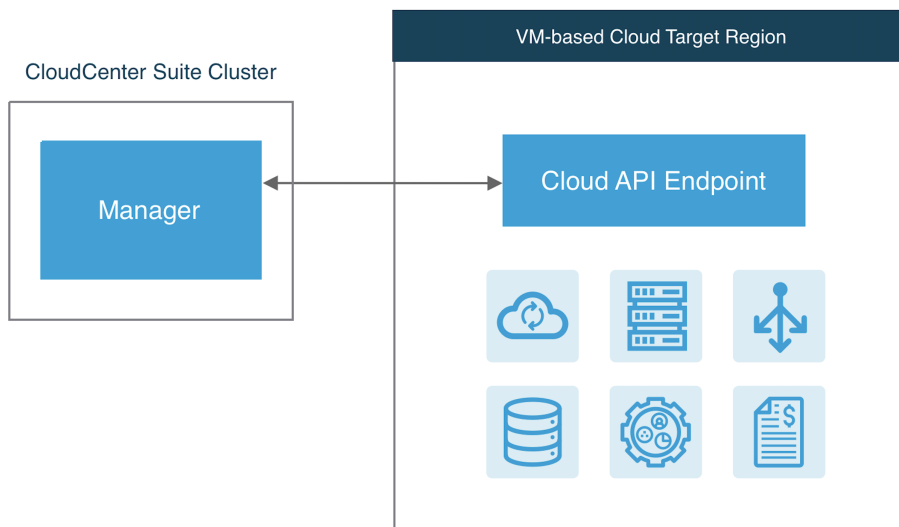
- [Deployment Architecture](#)
- [Basic Install Architecture](#)
- [Full Install Architecture](#)
- [Port Requirements](#)
 - [Without Cloud Remote](#)
 - [With Cloud Remote](#)

Cost optimizer is a module of CloudCenter Suite, that installs on a Kubernetes cluster through a Suite Chart. A suite chart is a common framework that allows the creating of tenants and users. %co is deployed using the CloudCenter Shared and Cost Optimizer helm charts. The following diagram shows the Kubernetes deployment architecture in Cost Optimizer.



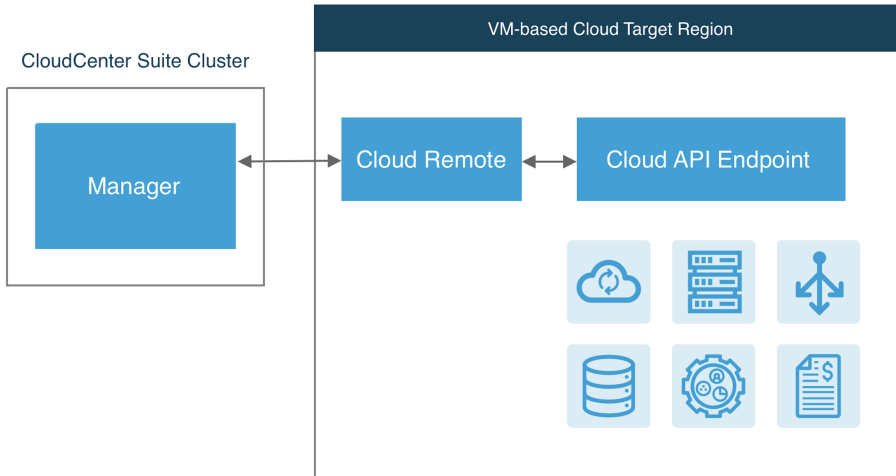
Cost Optimizer is a read-only module that connects to different cloud providers to collect information and use the collected information to generate recommendations. To act on a recommendation, to save costs, Workload Manager, another module in CloudCenter Suite is required. Workload Manager acts as an execution engine.

After installing Cost Optimizer from the Suite Admin, if your CloudCenter Suite Kubernetes cluster can receive connections from public internet addresses, you have everything that is required to use of Cost Optimizer's core features with VM-based public clouds. This includes collecting inventory, cost, metrics and generating recommendations. As mentioned above, it is recommended that you install the Workload Manager module to act on recommendations suggested by Cost Optimizer. The following diagram illustrates the basic install architecture for Cost Optimizer. Note that the icons indicate compute, storage, database, load balancer, metrics, and invoice.



The **manager** component is the main component of CloudCenter Suite. The basic install architecture installs the manager component, which is broken down into multiple microservices, running within pods in the CloudCenter Suite cluster. Some of these services are common framework services used by all CloudCenter Suite module. While some services are specific to Cost Optimizer, some services are shared between Workload Manager and Cost Optimizer. The manager communicates with the API endpoint of the target cloud region where your workloads will be launched. This communication is used to launch and control the VMs or pods running your workloads, and to extract data regarding cloud resource consumption. For Kubernetes target clouds, there are no worker VMs and the container-based workloads are controlled through the Kubernetes API. The basic install architecture relative to Kubernetes target clouds is summarized in the figure below.

The basic install architecture has a limitation. The basic install architecture assumes that the manager and the target cloud regions can initiate connections to or receive connections from public internet addresses. If either of these cases is not true, or you want to restrict internet access for security reasons, you will need to install additional components to ensure full functionality of Cost Optimizer. For VM-based clouds, you will need to install **Cloud Remote** as an additional component. The full install architecture for VM-based cloud regions is as shown in the following diagram.



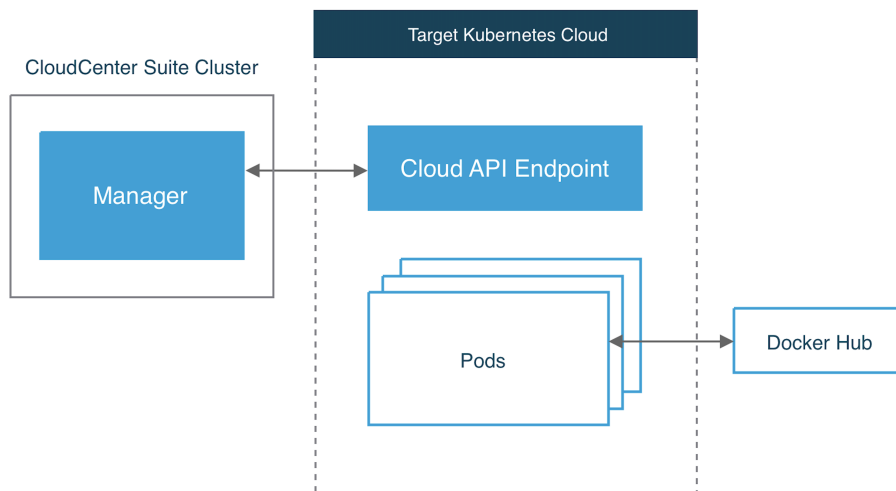
! If you use Cloud Remote, you only access in one direction either from or to the CloudCenter Suite. The Cloud Remote handles communication in the other direction.

The Cloud Remote component is delivered as a virtual appliance that you import to your target VM-based cloud region. It is a CentOS 7 image that manages a collection of containerized services. Cloud Remote can be deployed as a single VM and later scaled to a cluster of VMs.

For VM-based cloud regions, Cloud Remote acts as a communication proxy between the manager and the cloud API endpoint (also used by Workload Manager).

i If the manager cannot accept inbound connections from public addresses, you must install Cloud Remote in all VM-based target regions that are not within the same network as the manager.

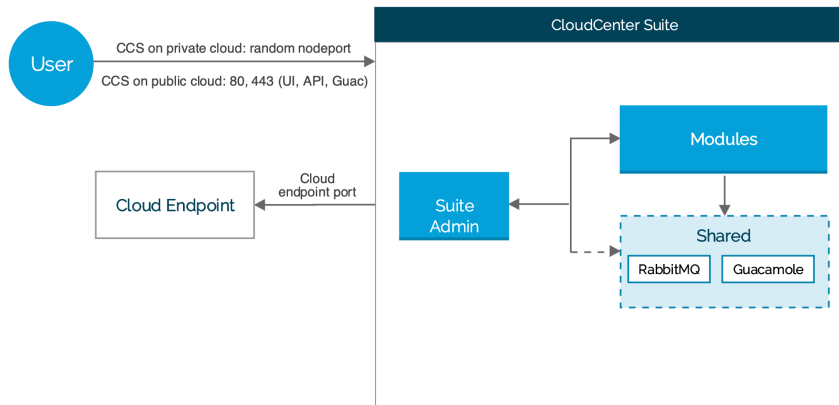
The following is a full install architecture for Kubernetes target clouds, for which you must install the Cloud Remote in an environment that is in the same network as the target Kubernetes cloud.



Without Cloud Remote

The following image identifies the ports that must be open for Cost Optimizer.

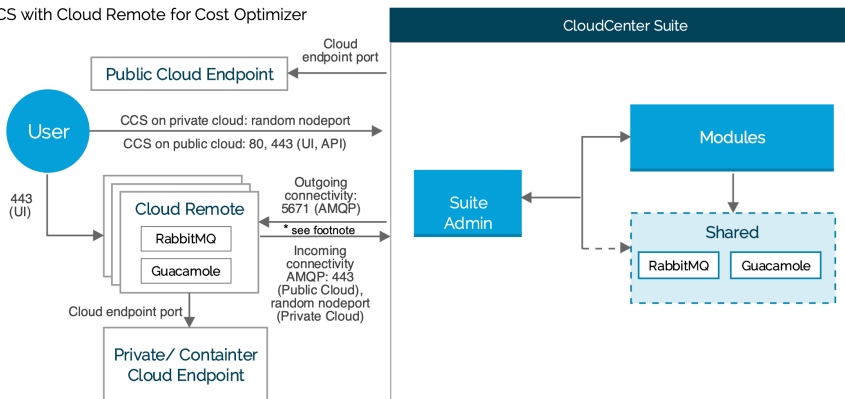
CCS with Full Cloud Connectivity (Cost Optimizer)



With Cloud Remote

The following image identifies the ports that must be open for Cost Optimizer when using the Cloud Remote component.

CCS with Cloud Remote for Cost Optimizer



* Footnote

- Is CloudCenter Suite directly accessible from your Cloud Remote? = **YES**, the arrow from Cloud Remote to CloudCenter Suite is applicable
- Is CloudCenter Suite directly accessible from your Cloud Remote? = **NO**, the arrow from CloudCenter Suite to Cloud Remote applicable

Type NodePort: If you set the type field to NodePort, the Kubernetes control plane allocates a port from a range specified by `--service-node-port-range` flag (default: 30000-32767). Refer to <https://kubernetes.io/docs/concepts/services-networking/service/> for additional context.

Access and Roles

Access and Roles

- [Overview](#)
- [User Groups](#)
- [Roles](#)
- [Access Control Lists \(ACLs\)](#)
- [Personas](#)

When you access Cost Optimizer you can see the cost, inventory, and recommendations reports and dashlets based on your group and role settings.

A user must belong to at least one group to view resources authorized for that group. Cost Optimizer ships with the following user groups.

User Group	Description
Optimizer Admin	Root or module admin. Users belonging to this group have the ability to add budgets, view costs, inventory, recommendations for all billing units. Users do not need to be explicitly assigned to cost groups. Users are also permitted to perform administrative tasks like managing cloud accounts and settings in Cost Optimizer.
Optimizer User	Cost Groups must explicitly be shared with users belonging to this group, else users cannot see costs, inventory or recommendations. Users assigned to this group can view data only pertaining to billing units associated with the cost groups. Users assigned to this group can only reallocate the budgets.
Financial Expert	Read-only users, who have view-only access to all data, regardless of cost group or billing unit association.

See: [Create and Assign Groups](#) for additional details.

Roles are a collection of privileges provided to users in a group. The users within each group can perform *permitted functions* on *permitted resources* by being part of the group. Roles are *only* associated with user groups. Coupled with Access Control Lists (ACLs), roles offer the ability to perform specific tasks and view corresponding data.

Cost Optimizer ships with the following roles, which shares the same name as user groups.

- Optimizer Admin
- Optimizer User
- Financial Expert

See: [Understand Roles](#) for additional details.

While a role gives you visibility into a resource type, ACLs determine the users with who you share that resource. Using ACLs, a resource owner can share a specific resource directly with a user thereby allowing granular privileges to individual resources. In Cost Optimizer, ACLs allow permitted users to share a resource with other users or groups by providing the following access levels to the users through the **Share** dialog in [Cost Groups Configuration](#).

Access Level	Description
View	User or group has read-only permissions but cannot modify or share this resource with others.
Manage	User or group can make changes as well as share this resource with others.

Based on the combination of user groups, roles, and ACLs, the following personas can be deduced for Cost Optimizer.

Persona	Maps to a Role or User Group in Cost Optimizer...	Function
Optimizer Administrator	Optimizer Admin	<p>Access to every function in the module. An <i>Optimizer Administrator</i> can view data in <i>all</i> cost groups and types in a tenant.</p> <p>An <i>Optimizer Administrator</i> builds the organization hierarchy by creating cost groups types, cost groups, and assign billing units to one or more cost groups in the hierarchy. The Optimizer Administrator shares Cost Groups with User A by providing <i>Manage</i> access through ACLs. The Optimizer Administrator also manages tenant-level configuration parameters.</p>












Cost Group Owner	Optimizer User	<p><i>Owner</i> of a Cost Group (for definition, see Cost Groups Configuration).</p> <p>A <i>Cost Group Owner</i> (User A) can redistribute billing units among the cost groups that the cost group owner can view and also share the cost group with others. However, User A <i>cannot</i> update or modify cost group hierarchies that an Optimizer Administrator has established.</p>
Limited Viewer	Optimizer User	<p><i>View access</i> to one or more Cost Groups through an ACL.</p> <p>A <i>Limited Viewer</i> cannot share cost groups with other users nor reassign Billing Units. For example, User B may be granted the privilege to <i>view</i> cost, inventory reports, and recommendations within <i>Cost Group A</i>. User B's view is restricted based on Billing Unit associations to Cost Groups that User B can <i>view</i>.</p>
Financial Expert	Financial Expert	Cannot make any changes to the system. Tenant-wide cost, inventory and recommendation views are displayed.






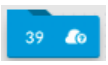


UI Behavior

UI Behavior

- [Icons](#)
- [Canceling without Saving](#)

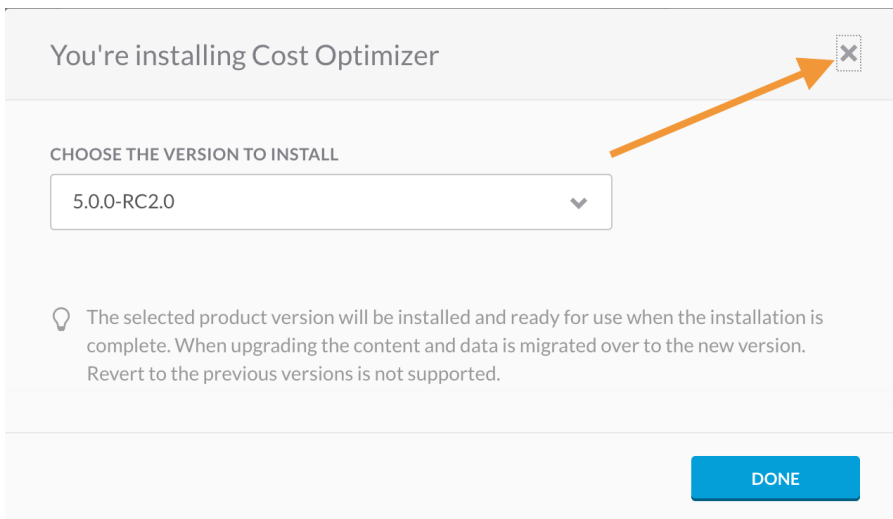
The following table identifies the Cost Optimizer icons.

Icon	Description
	Perform action-oriented tasks on Cost Groups.
	Add a Cost Group to a Cost Group Type.
	Lists Cost Group Types (departments) set up in Cost Optimizer and adds Cost Group Type.
	Choose a range to display the report.
	Downloads the report.
	Select resources from a list.
	Filters information based on the selected category.
	Navigate back and forth between the module dashboards.
	Move multiple billing units or tags to a resource.
	Sorts the listed items based on the latest or longest time period for the selected resource.
	Generates and sends a report at the specified date and time to the user or user group.

<p>Search</p> 	<p>Search resources based on the specified text for the allowed resources.</p> <div style="border: 1px solid #ccc; padding: 5px; background-color: #fff9c4;">  Not all fields and resources are searchable. </div>
<p>Select All</p> 	<p>Select all items displayed on the page by clicking the checkbox in the table header or by clicking the checkbox against each item.</p>
<p>Switch</p> 	<ul style="list-style-type: none"> • The feature is disabled and configuration is unnecessary. • Enable the feature by turning it on and then inputting configuration values.
<p>Toggle Chart</p> 	<p>Toggles graphical report display between a line chart and a pie chart.</p>
<p>Unassigned Billing Units</p> 	<p>Unassigned cloud accounts with cloud resources.</p>
<p>Unassigned Tags</p> 	<p>Unassigned tags associated with cloud resources.</p>
<p>Visibility Control</p> 	<p>Visibility of default values can be toggled using this control.</p>

During configuration, you can cancel any changes or additions to a screen by clicking the **X** at the top right corner of the screen. This action takes you back to the original page that launched the screen.

The following screenshot shows how to cancel when assigning share access.



Configure Clouds

Configure Clouds

- [Cloud Overview](#)
- [Configure Cloud End-to-End](#)
- [Cloud Remote](#)
- [Cloud Maintenance](#)

Cloud Overview

Cloud Overview

- [Overview](#)
- [Scope of a Cloud Region](#)
- [Minimum Permissions for Public Clouds](#)

In CloudCenter Suite, the features to specify clouds are shared by Workload Manager and Cost Optimizer.

A cloud is an instance of one of the supported cloud types. A cloud has at least one region, but certain cloud types have multiple cloud regions.

Workload Manager and Cost Optimizer manage clouds on a per-region basis. The main point of control for a cloud region is the cloud region API endpoint. In the case of public VM-based clouds, such as AWS, GCP, and AzureRM, each cloud can have multiple regions that correspond to different geographic regions. OpenStack clouds also support multiple regions, but they are logical regions that do not have to be in different geographical areas. Kubernetes clouds and VMware vCenter clouds have only one region each.

A cloud must also have at least one cloud account associated with it. The cloud account information is needed to launch workloads, collect billing information, and in the case of VM-based clouds, list VMs associated with a particular cloud account that was launched outside of Workload Manager.

The workflow for specifying a cloud is as follows:

- Create the cloud: specify cloud name and cloud type
- For single-region cloud types (vCenter and Kubernetes): configure region details
- For multi-region cloud types: add a region, configure region details, repeat as necessary
- Add cloud accounts

If you are using Workload Manager, you will make your clouds available to users for deploying workloads using [deployment environments](#).



Each AWS and Azure cloud account may not have access to *all regions*. To access different regions you may need to use different accounts. In CloudCenter Suite 5.x, this delineation is not enforced - when you add regions and cloud accounts to a cloud group, make sure to only add the regions that are accessible by *all the cloud accounts you add to the cloud group*. For example, AWS has separate accounts for China, Government, and other regions. The [Public Clouds](#) section provide additional details on the regions supported by AWS and Azure - for each of these cloud groups, be sure to create separate cloud accounts.




For public clouds, a cloud region is associated with a geographic region defined by the cloud provider. For OpenStack clouds, a cloud region is a logical region defined within OpenStack. For VMware – vCenter and vCD – clouds, each instance of vCenter or vCD is considered a region. For Kubernetes clouds, each Kubernetes cluster is considered a region unto itself. The following table summarizes the scope of a region for each of the supported cloud types.


Cloud Family	Cloud Region Mapping	Supports any number of these per region
AWS	Geographical Region	<ul style="list-style-type: none"> • Accounts • Sub-Accounts • Identity and Access Management (IAM)
VMware vCenter	vCenter instance	<ul style="list-style-type: none"> • Datacenter • Clusters • Resource pools • Accounts • Datastores • Datastore clusters
VMware vCloud Director	vCD instance	<ul style="list-style-type: none"> • Datacenter • Clusters • Resource pools • Accounts • Datastores • Datastore clusters
Azure RM	Geographical Region	<ul style="list-style-type: none"> • Networks • Cloud services • Accounts

Google Cloud	Geographical Region	<ul style="list-style-type: none"> • Projects • Accounts
IBM Cloud	Geographical Region	<ul style="list-style-type: none"> • Accounts
OpenStack	Logical Region	<ul style="list-style-type: none"> • Tenants • Networks • Accounts
Kubernetes	Kubernetes cluster	<ul style="list-style-type: none"> • Accounts • Namespaces • VPCs • IAM policies

The following table lists the minimum permissions for public cloud accounts supported in Cost Optimizer and Workload Manager modules of CloudCenter Suite Release 5.1.

 You must enable AWS Cost Explorer to view AWS-specific costs on the Cost Optimizer dashboard. For additional details on enabling AWS Cost Explorer, see <https://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/ce-enable.html>.

Product	Function	AWS (IAM user)	Azure RM (Application)	Google (Service Account)
Cost Optimizer and Workload Manager	Discover billing units	iam:Get* iam:List*	<i>Cost management reader</i>	resourcemanager.projects.get,list
Cost Optimizer	Discover organization hierarchy	organizations:Describe* organizations:List*	N/A	billing.accounts.get,list orgpolicy.policy.get resourcemanager.folders.get,list resourcemanager.organizations.get
Cost Optimizer	Collect invoices	ce:* cur:Describe*  AWS Cost Explorer must be enabled to view AWS-specific costs on Cost Optimizer.	<i>Billing reader</i>	storage.objects.get,list storage.buckets.get,list
Cost Optimizer and Workload Manager	Collect VMs and volumes	ec2:DescribeAvailabilityZones ec2:DescribeAddresses ec2:DescribeInstances ec2:DescribeVolumes ec2:DescribeTags tag:getTagKeys tag:getTagValues  <ul style="list-style-type: none"> • The ec2:DescribeAvailabilityZones permission is mandatory and used for validating accounts. • The ec2:DescribeAddresses permission is optional and is used for Used to populated IP allocation type of NIC during inventory collection. • The ec2:DescribeTags permission is mandatory and used for discovering tags of PassService (ELB). • The tags permissions are required for tag-based reporting and only applicable to Cost Optimizer. 	VM: <i>VM contributor</i> Volume: <i>Reader</i>  The <i>Reader</i> role must be offered because no built-in role is provided.	compute.instances.get,list compute.disks.get,list

Cost Optimizer	Collect PAAS services	<p>rds:Describe*</p> <p>elasticloadbalancing:Describe*</p>	<p>SQL Server and SQL database: <i>SQL Server contributor</i></p> <p>MySQL and PostgreSQL Server: <i>Reader</i></p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;">  The <i>Reader</i> role must be offered because no built-in role is provided. </div>	<p>cloudsql.databases.get,list</p> <p>cloudsql.instances.get,list</p> <p>compute.forwardingRules.get,list</p> <p>compute.targetPools.get,list</p>
Cost Optimizer and Workload Manager	Collect VM metrics	<p>cloudwatch:Describe*</p> <p>cloudwatch:Get*</p> <p>cloudwatch:List*</p>	<p><i>Monitoring reader or virtual machine contributor</i></p>	<p>monitoring.metricsDescriptors.get,list</p> <p>monitoring.timeSeries.list</p>
Cost Optimizer	Collect resource usage	<p>s3:Get*</p> <p>s3:List*</p>	N/A	N/A
Cost Optimizer	Collect RI subscriptions	<p>ec2:DescribeReservedInstances*</p>	N/A	N/A
Cost Optimizer and Workload Manager	Collect RI subscription data for AWS member account	<p>To allow a primary account to collect the RI subscription data on behalf of member accounts, the following is necessary:</p> <ul style="list-style-type: none"> • A primary account must be permitted to assume the role of a member account • A member account must establish trust with the primary account <p>You must associate the following permission with the primary account's IAM user, as shown below:</p> <pre style="border: 1px solid gray; padding: 10px; margin: 10px 0;"> { "Version": "2012-10-17", "Statement": [{ "Effect": "Allow", "Action": ["sts:assumerole"], "Resource": "*" }] } </pre> <p>On a member account, create a role named Optimizer. Do the following to the new role:</p> <ul style="list-style-type: none"> • Associate permissions listed above to collect invoices, inventory, metrics • Add a trust relationship to the primary account <pre style="border: 1px solid gray; padding: 10px; margin: 10px 0;"> { "Version": "2012-10-17", "Statement": [{ "Effect": "Allow", "Principal": { "AWS": "arn:aws:iam:: <primary-account-number>:root" }, "Action": "sts:AssumeRole", "Condition": {} }] } </pre>	N/A	N/A
Workload Manager	Manage VMs and volumes	<p>ec2:AssignPrivateIpAddresses</p> <p>ec2:AttachNetworkInterface</p> <p>ec2:AttachVolume</p> <p>ec2:AuthorizeSecurityGroupEgress</p> <p>ec2:AuthorizeSecurityGroupIngress</p> <p>ec2:CreateImage</p> <p>ec2:CreateKeyPair</p> <p>ec2:CreateNetworkInterface</p> <p>ec2:CreateSecurityGroup</p>		<p>Use the pre-defined <i>Project Editor</i> role,</p> <p>OR</p> <p>compute.addresses.create,delete,get,list,use</p> <p>compute.disks.create,delete,get,list,update,use</p> <p>compute.firewalls.create,delete,get,list,update</p> <p>compute.instances.*</p>

ec2:CreateSnapshot
 ec2:CreateTags
 ec2:CreateVolume
 ec2>DeleteKeyPair
 ec2>DeleteNetworkInterface
 ec2>DeleteSecurityGroup
 ec2>DeleteSnapshot
 ec2>DeleteTags
 ec2>DeleteVolume
 ec2:DescribeAccountAttributes
 ec2:DescribeAvailabilityZones
 ec2:DescribeDhcpOptions
 ec2:DescribeImageAttribute
 ec2:DescribeImages
 ec2:DescribeInstanceAttribute
 ec2:DescribeInstances
 ec2:DescribeInstanceState
 ec2:DescribeKeyPairs
 ec2:DescribeNetworkInterfaceAttribute
 ec2:DescribeNetworkInterfaces
 ec2:DescribeRegions
 ec2:DescribeSecurityGroups
 ec2:DescribeSnapshotAttribute
 ec2:DescribeSnapshots
 ec2:DescribeStaleSecurityGroups
 ec2:DescribeSubnets
 ec2:DescribeTags
 ec2:DescribeVolumeAttribute
 ec2:DescribeVolumes
 ec2:DescribeVolumesModifications
 ec2:DescribeVolumeStatus
 ec2:DescribeVpcAttribute
 ec2:DescribeVpcs
 ec2:DetachNetworkInterface
 ec2:DetachVolume
 ec2:EnableVolumeIO
 ec2:GetConsoleOutput
 ec2:GetConsoleScreenshot
 ec2:GetPasswordData
 ec2:ImportKeyPair
 ec2:ImportVolume
 ec2:ModifyImageAttribute
 ec2:ModifyInstanceAttribute
 ec2:ModifyNetworkInterfaceAttribute
 ec2:ModifyVolume
 ec2:ModifyVolumeAttribute
 ec2:RebootInstances
 ec2:RevokeSecurityGroupEgress
 ec2:RevokeSecurityGroupIngress
 ec2:RunInstances
 ec2:StartInstances

Offer the *italicized* roles to create, modify, or delete:

- NICs, Public IPs and security group: *Network Contributor*
- Diagnostics: *Storage Account Contributor*
- Unmanaged data disk: *Storage Account Contributor*
- Managed data disks: *Owner*
- VMs with managed data disks: *Owner*
- VMs with unmanaged data disks and diagnostic logs: *Virtual Machine Contributor*, *Network Contributor*, and *Storage Account Contributor*
- VMs with no data disks: *Virtual Machine Contributor* and *Network Contributor*



In some cases, the *Owner* role must be offered because no built-in role is provided.

compute.
 machineTypes.get
 compute.networks.get,
 list,use
 compute.projects.get
 compute.regions.get
 compute.
 subnetworks.get,list,
 use,useExternalIp
 compute.zones.get
 iam.serviceaccounts.
 get,list

		ec2:StopInstances		
		ec2:TerminateInstances		
		ec2:UnassignPrivateAddresses		

Configure Cloud End-to-End

Configure Cloud End-to-End

- [Configure an AWS Cloud](#)
- [Configure an AzureRM Cloud](#)
- [Configure a Google Cloud](#)
- [Configure an IBM Cloud](#)
- [Configure a Kubernetes Cloud](#)
- [Configure an OpenStack Cloud](#)
- [Configure a vCD Cloud](#)
- [Configure a vCenter Cloud](#)

Configure an AWS Cloud

Configure an AWS Cloud

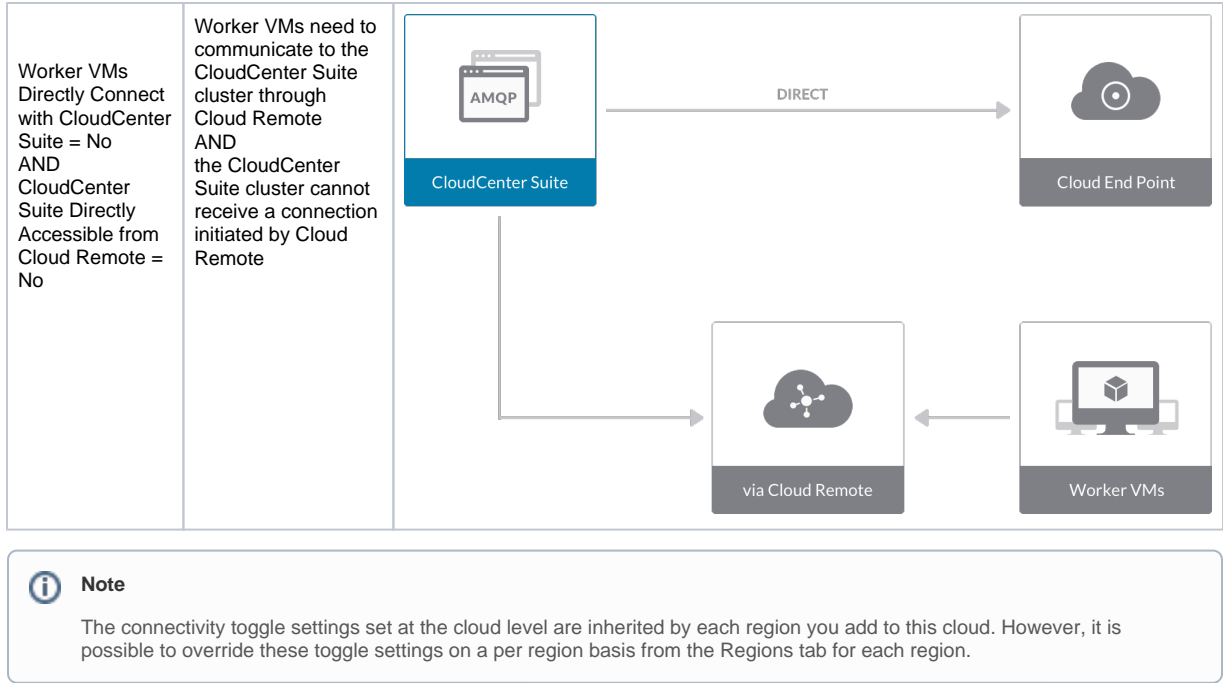
Configuring an AWS cloud is a four-step process:

- [Add an AWS Cloud](#)
- [Add an AWS Region](#)
- [Configure an AWS Region](#)
- [Add an AWS Cloud Account](#)

To add an AWS cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here. Click the **Add Cloud** link in the upper right.
2. After clicking **Add Cloud**, the Add Cloud dialog box is displayed. Enter the **cloud name** and select the **cloud provider**.
3. After clicking **Next**, the second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle switches to configure the **Cloud Connectivity** settings.
 - When adding a public VM cloud in the CloudCenter Suite UI, the Cloud Connectivity Settings page, the second page of the Add Cloud dialog box, appears with a single toggle displayed: **Worker VMs Directly Connect with CloudCenter Suite**.
 - Setting this toggle to No implies you will install Cloud Remote for each region of this cloud. This also causes a second toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
 - Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Diagram
Worker VMs Directly Connect with CloudCenter Suite = Yes	Unimpeded connectivity exists between the CloudCenter Suite cluster and the cloud region API endpoint AND Unimpeded connectivity exists between the CloudCenter Suite cluster and worker VMs Cloud Remote is not required	<p>The diagram illustrates a direct connection. On the left, a box labeled 'CloudCenter Suite' contains an 'AMQP' icon. An arrow labeled 'DIRECT' points from this box to a 'Cloud End Point' icon (a cloud with a target). Below the CloudCenter Suite box, another arrow labeled 'DIRECT' points to a 'Worker VMs' icon (a computer monitor with a cube). This indicates that both the CloudCenter Suite and the Worker VMs have direct, unimpeded access to the Cloud End Point.</p>
Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes	Worker VMs need to communicate to the CloudCenter Suite cluster through Cloud Remote AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster	<p>The diagram illustrates indirect connectivity. On the left, a box labeled 'CloudCenter Suite' contains an 'AMQP' icon. An arrow labeled 'DIRECT' points from this box to a 'Cloud End Point' icon (a cloud with a target). Below the CloudCenter Suite box, a 'Worker VMs' icon (a computer monitor with a cube) is shown. An arrow points from the Worker VMs icon to a 'via Cloud Remote' icon (a cloud with a network diagram), which then points to the CloudCenter Suite box. This indicates that the Worker VMs must communicate with the CloudCenter Suite through the Cloud Remote service.</p>



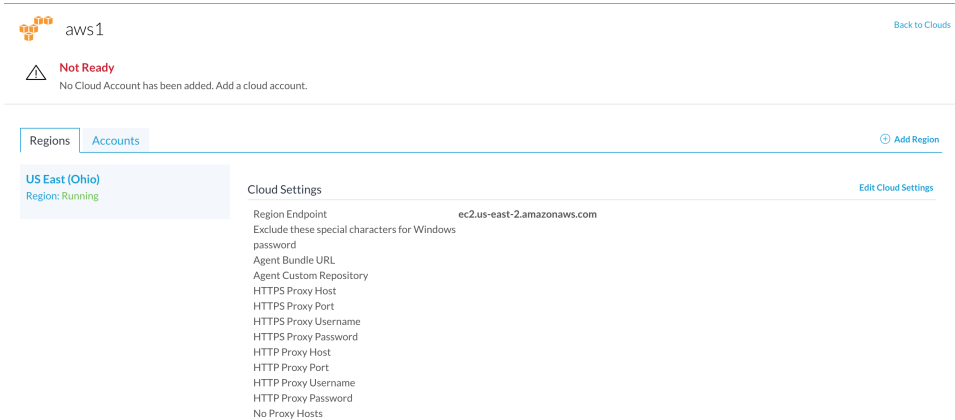
4. Click **Done** to save the configuration and close the dialog box. This brings you back to the **Clouds** page, and the cloud you just created will be added to the bottom of the list on the left side of the page.

After creating an AWS cloud, the next step is to create the first region for the cloud. Follow these steps.

1. Navigate to the **Clouds** page and select the cloud you created on the left side of the screen. Then click the **Add Region** button on the right side of the screen.
2. After clicking the **Add Region** button, the Add Region dialog box is displayed. Select a region from the list and click **Save**.
3. After clicking **Save** you are brought back to the **Clouds** page with the region you added shown on the right side of the page.

To configure a region you added to your AWS cloud, follow this procedure:

1. Navigate to Clouds page: **Admin > Clouds**. Find your AWS cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the Regions tab for this cloud as shown in the figure below with the Cloud Settings section displayed first.



After you have added multiple regions to your AWS cloud, the Regions tab will show multiple individual region tabs on the left side of the screen. Click the tab of the region you want to configure.

2. Click the **Edit Cloud Settings** link in the upper right of the **Cloud Settings** section. This opens the **Configure Cloud Settings** dialog box. The **Cloud Settings** section contains fields that are unique to AWS and settings that are common to all cloud providers. Adjust these field values per the instructions in the following tables.

AWS Specific Cloud Settings

Field	Usage
Region Endpoint	This field is set by CloudCenter Suite based on the region location you selected from the Add Region dialog box.

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.
HTTP /HTTPS proxy fields (host, username, password)	If you require VMs in your region to access public addresses through a web proxy, enter the URL and credentials of the HTTP and HTTPS proxy servers in these fields.
No Proxy Hosts	If you have specified an HTTP or HTTPS proxy using the above fields, you can specify that managed VMs in the region should bypass the proxy and connect directly to certain hosts. Use this field to create a comma-separated list of IP addresses or URLs that should be accessed directly. This field is ignored if an HTTP or HTTPS proxy is not specified.



Important information on proxy settings

In CloudCenter Suite it is possible to specify proxy settings at the region level, as described here, and at the [suite level](#). To understand the expected behavior when proxy settings are specified at both levels, see [Precedence of Proxy Settings](#).

Download Configuration and Encryption Key

After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you can download them to your local computer and then upload them to other conditional components such as Cloud Remote.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the following screenshot.

Region Connectivity Running [Download Configuration](#) [Configure Region](#)

Clicking **Download Configuration** causes two things to happen:

- An encrypted zip file named **artifacts.zip** is downloaded by your browser. Make a note of the location of this zip file as you will need if you are using Cloud Remote.
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in the following screenshot.

Region Connectivity Enabling... [Download Configuration](#) [Copy Encryption Key](#) [Edit Connectivity](#)

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to conditional components like Cloud Remote.

If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file from software.cisco.com, use the automatically create (new) encryption key, and copy the key to the clipboard by clicking the **Copy Encryption Key** link again.

When you are done editing the settings in the dialog box, click **Save**.

3. Determine if you need Cloud Remote for this region. Scroll down to the **Region Connectivity** section for the region and click on the **Configure Region** link in the upper right to open the **Configure Region** dialog box. The toggle settings should be the same as when you set them on the connectivity page of the **Add Cloud** dialog box. If all of the connectivity toggles in the **Region Connectivity** dialog box are set to **Yes**, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section. The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the **Region Connectivity** dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.

4. If any of the connectivity toggles in the **Region Connectivity** dialog box are set to No, then you must install and configure Cloud Remote for this region.

Configure Cloud Remote in an AWS Region

Configure Cloud Remote in an AWS region as follows.

Obtain and Launch the Cloud Remote Appliance in AWS

- a. Obtain the Cloud Remote shared AMI from Cisco support and launch it. Follow the same guidance for obtaining and launching the [CloudCenter Suite installer appliance for AWS](#).
- b. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
- c. Once the first instance of the appliance has been launched, use your cloud console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other instances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>

4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.




Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



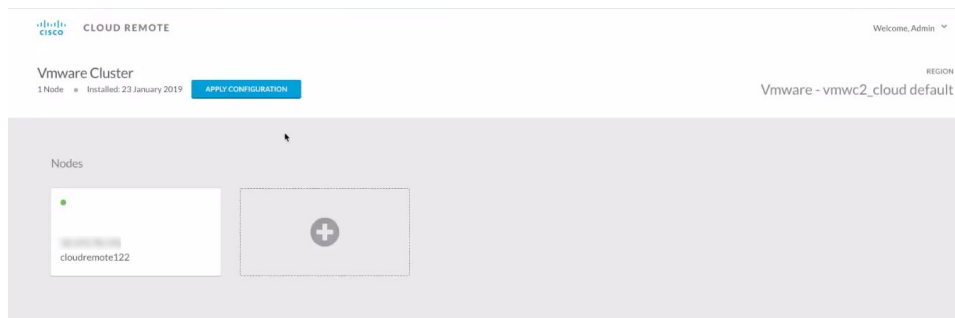
Region Connectivity Enabling... Download Configuration **Copy Encryption Key** Edit Connectivity

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

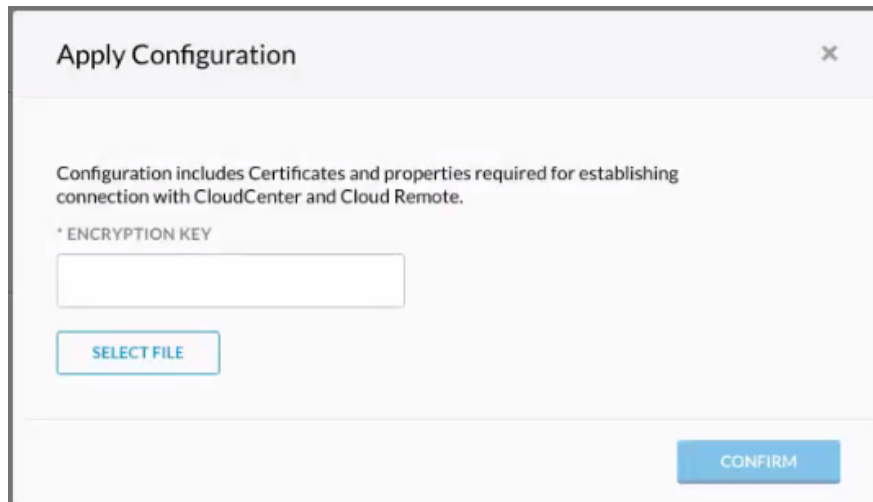
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

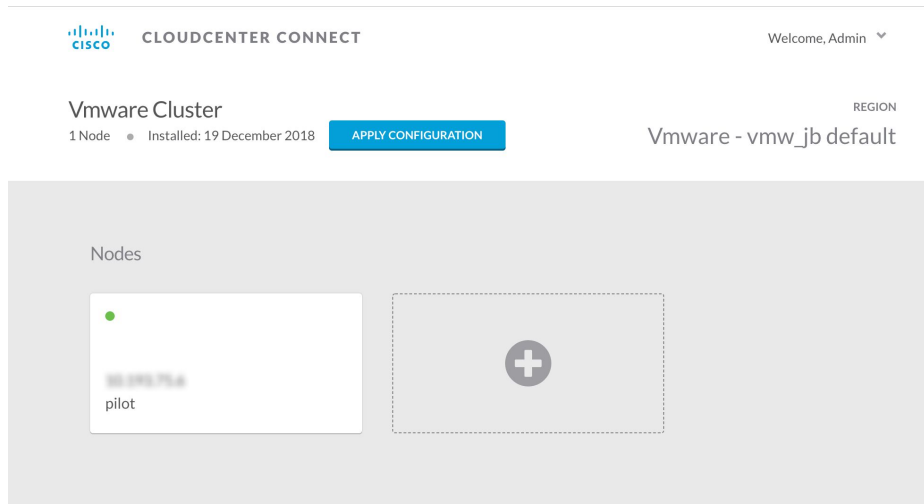
- Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

5. VM Naming and IPAM Strategy (conditional): Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
6. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
7. Instance Types (informational): CloudCenter Suite automatically synchronizes instance types for public cloud regions on a daily basis. This data includes published pricing for each instance type. It is not possible to edit AWS region instance types. See [Instance Types Settings](#) for more details.
8. Storage Types (conditional): CloudCenter Suite automatically synchronizes storage types for public cloud regions on a daily basis. This data includes the cloud provider published pricing for each storage type. It is not possible to edit AWS region storage types. See [Storage Types Settings](#) for more details.
9. Image Mappings: Image mappings allow services based on CloudCenter Suite logical images to be deployed using the appropriate physical image stored on the target cloud region. CloudCenter Suite automatically maps the [OOB logical images](#) to public cloud region physical images when you add the region to your cloud. Cisco periodically updates these mappings when new versions of OS physical images are uploaded by the cloud provider. To apply these updates to your region after it is added to your cloud, click the **Sync Image Mappings** link in the upper right of this section. If you create any custom logical images, you must manually import the corresponding physical images into your region and then map the corresponding logical images to these physical images. See [Images](#) for more context.

Prerequisites

Before adding an AWS cloud account, do the following:

- Ensure the account has the minimum permissions. See [Cloud Overview](#) > Minimum Permissions for Public Clouds for additional details.

Configuration Process

To add an AWS cloud account, follow this procedure.

1. Locate your AWS cloud on the Clouds page and click the Add Cloud Account link for this cloud. This displays the Add Cloud Account dialog box,

as shown below.

2. Assign a cloud account **Name**.



Tip

The name should not contain any space, dash, or special characters.

3. Provide the AWS cloud credentials:
 - a. **AWS Email Address:** The email address associated with your AWS cloud account.
 - b. **AWS Account Number:** The account number from your AWS account.
 - c. **AWS Access Key and Secret Key:** The security credentials to access this AWS account.
4. Scroll the dialog box down and specify the location of your AWS account's billing reports: **S3 bucket region**, **S3 bucket name**, and **Report Path Prefix**, as shown in the figure below. For information on setting up billing information, see <https://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/billing-reports-gettingstarted-s3.html>.

Add Cloud Account

Email address associated with your AWS account

AWS Account Number *

12-digit number located at the top of your AWS account profile

AWS Access Key *

20 character key located in your security credentials

AWS Secret Access Key *

40 character key located in your security credentials

Billing

S3 Bucket Region

S3 Bucket Name

Report Path Prefix

In the cloud console, create a bucket, if not already, and navigate to **Reports** to view billing information.

5. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
6. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear, namely, **Enable Account For** and **Enable Reporting By Org Structure**,

Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation. <div style="border: 1px solid #ffc107; padding: 5px; margin-top: 5px;"> <p> It is recommended that you do not add a <i>Reporting</i> account to the same tenant through different cloud groups.</p> </div> <div style="border: 1px solid #ccc; padding: 5px; margin-top: 5px;"> <p> Enabling a public cloud account for <i>Reporting</i> may incur expenses to retrieve cost data. These expenses are proportional to the number of configured cloud accounts and regions.</p> </div>
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- a. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- b. Click the **Save** button when done.

You must enable **AWS Cost Explorer** to view AWS-specific costs on the Cost Optimizer dashboard. For additional details on enabling **AWS Cost Explorer**, see <https://docs.aws.amazon.com/awsaccountbilling/latest/aboutv2/ce-enable.html>.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
Account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure an AzureRM Cloud

Configure an AzureRM Cloud

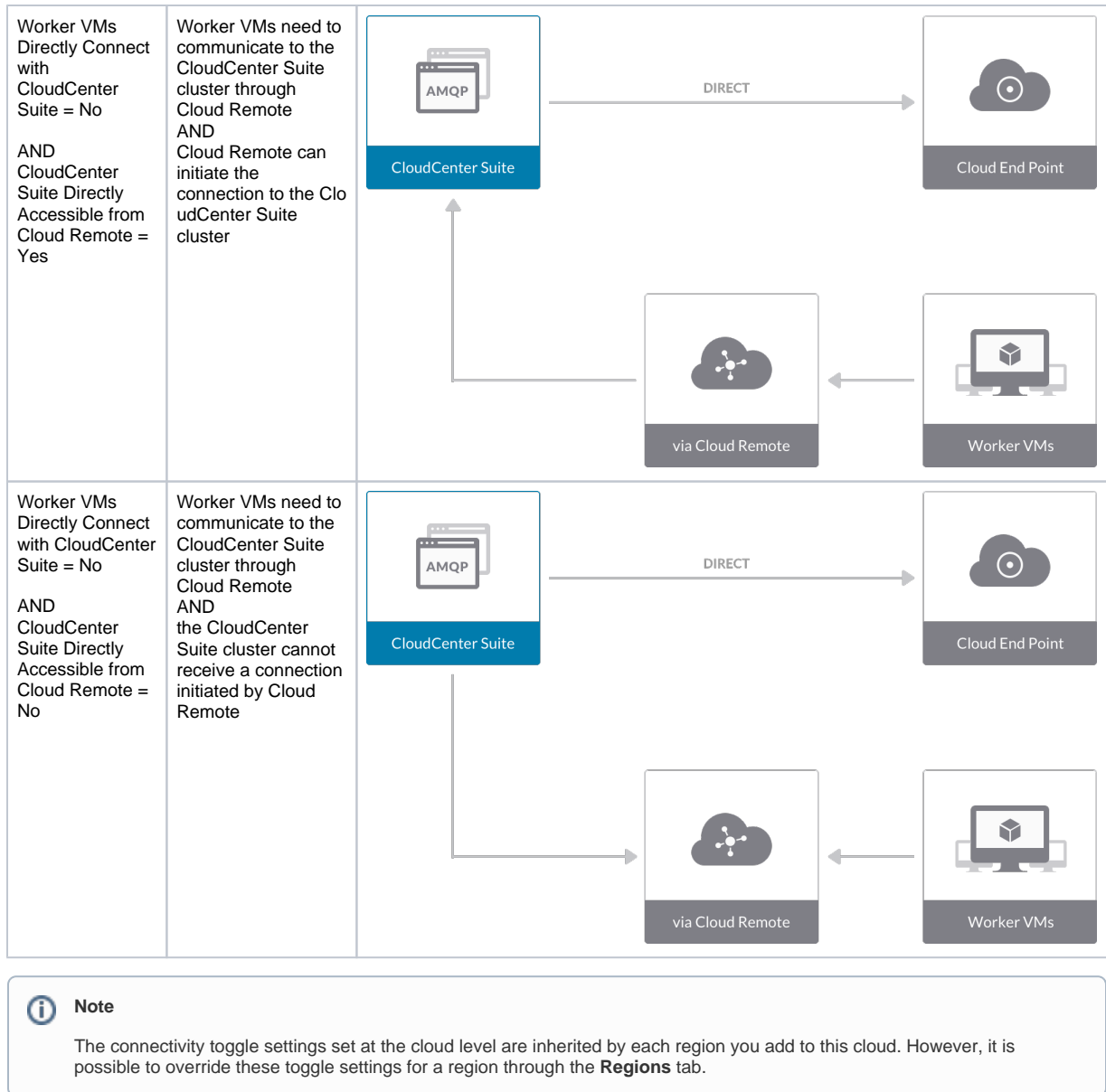
Configuring an AzureRM cloud is a four-step process:

- [Add an AzureRM Cloud](#)
- [Add an AzureRM Region](#)
- [Configure an AzureRM Region](#)
- [Add an AzureRM Cloud Account](#)

To add an AzureRM cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here. Click the **Add Cloud** link in the upper right.
2. Click **Add Cloud**. The **Add Cloud** dialog box is displayed.
3. Enter the **cloud name** and select the **cloud provider**.
4. Click **Next**. The second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle to configure the Cloud Connectivity Settings.
 - When adding a public VM cloud in the CloudCenter Suite UI, the **Cloud Connectivity Settings** page, the second page of the **Add Cloud** dialog box, appears with a single toggle displayed: **Worker VMs Directly Connect with CloudCenter Suite**.
 - Setting this toggle to **No** implies you will install Cloud Remote for each region of this cloud. This also causes a second toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
 - Use the following table for guidance to set the toggle.

Toggle settings	Use case	Diagram
Worker VMs Directly Connect with CloudCenter Suite = Yes	<p>Unimpeded connectivity exists between the CloudCenter Suite cluster and the cloud region API endpoint AND Unimpeded connectivity exists between the CloudCenter Suite cluster and worker VMs</p> <p>Cloud Remote is not required</p>	<p>The diagram illustrates a central 'CloudCenter Suite' box (containing an AMQP icon) connected via 'DIRECT' arrows to two external components: 'Cloud End Point' (represented by a cloud icon) and 'Worker VMs' (represented by a computer monitor icon). The 'DIRECT' label is placed above the arrow to the Cloud End Point and below the arrow from the Worker VMs.</p>



- Click **Done** to save the configuration and close the dialog box. This brings you back to the **Clouds** page and the cloud you just created will be added to the bottom of the list on the left side of the page.

After creating an AzureRM cloud, the next step is to create the first region for the cloud. Follow these steps.

- Navigate to the **Clouds** page and select the cloud you created on the left side of the screen.
- Click the **Add Region** button on the right side of the screen. The Add Region dialog box is displayed.
- Select a region from the list and click **Save**. You are back to the **Clouds** page with the region you added shown on the right side of the page.

To configure a region you added to your AzureRM cloud, follow this procedure.

- Navigate to Clouds page: **Admin > Clouds**. Find your AzureRM cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the **Regions** tab for this cloud as shown in the figure below with the Cloud Settings section displayed first.

After you have added multiple regions to your AzureRM cloud, the **Regions** tab will show multiple individual region tabs on the left side of the screen. Click the tab of the region you want to configure.

- Click the **Edit Cloud Settings** link in the upper right of the **Cloud Settings** section. This opens the **Configure Cloud Settings** dialog box. The **Cloud Settings** section contains fields that are unique to AzureRM and settings that are common to all cloud providers. Adjust these field values per the instructions in the following tables.

AzureRM Specific Cloud Settings

Field	Usage
Azure Environment	Automatically set by CloudCenter Suite based on the region you selected but it can be overridden by using the dropdown list.
Linux and Windows extension versions	The custom script extensions are provided by Microsoft to support dynamic bootstrapping. The diagnostics extension is provided by Microsoft to support metrics monitoring. These four fields are set to recommended values by default by CloudCenter Suite but they can be overridden by you.
Delete Boot Diagnostic Logs On VM Termination	AzureRM will store VM boot diagnostic logs after a VM terminates. CloudCenter Suite sets this value to False by default but you can change the value to True using the dropdown.

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.
HTTP /HTTPS proxy fields (host, username, password)	If you require VMs in your region to access public addresses through a web proxy, enter the URL and credentials of the HTTP and HTTPS proxy servers in these fields.

No Proxy Hosts	If you have specified an HTTP or HTTPS proxy using the above fields, you can specify that managed VMs in the region should bypass the proxy and connect directly to certain hosts. Use this field to create a comma-separated list of IP addresses or URLs that should be accessed directly. This field is ignored if an HTTP or HTTPS proxy is not specified.
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Important information on proxy settings

In CloudCenter Suite it is possible to specify proxy settings at the region level, as described here, and at the [suite level](#). To understand the expected behavior when proxy settings are specified at both levels, see [Precedence of Proxy Settings](#).

Download Configuration and Encryption Key

After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you can download them to your local computer and then upload them to other conditional components such as Cloud Remote.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the following screenshot.



Clicking **Download Configuration** causes two things to happen:

- An encrypted zip file named **artifacts.zip** is downloaded by your browser. Make a note of the location of this zip file as you will need it if you are using Cloud Remote.
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in the following screenshot.



Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to conditional components like Cloud Remote.

If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file from software.cisco.com, use the automatically create (new) encryption key, and copy the key to the clipboard by clicking the **Copy Encryption Key** link again.

When you are done editing the settings in the dialog box, click **Save**.

3. Determine if you need Cloud Remote for this region. Scroll down to the **Region Connectivity** section for the region and click on the **Configure Region** link in the upper right to open the **Configure Region** dialog box. The toggle settings should be the same as when you set them on the connectivity page of the **Add Cloud** dialog box. If all of the connectivity toggles in the **Region Connectivity** dialog box are set to **Yes**, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the **Region Connectivity** dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.


4. If any of the connectivity toggles in the **Region Connectivity** dialog box are set to No, then **you must install and configure Cloud Remote for this region**.

Cloud Remote for AzureRM

Follow these steps to obtain, launch and configure Cloud Remote for an AzureRM region.

Download and Launch the Cloud Remote Appliance in AzureRM

- a. Download the Cloud Remote appliance for AzureRM as zip file from software.cisco.com and then unzip it to reveal the VHD file.
- b. Upload the Cloud Remote appliance VHD file to AzureRM using the AzureRM CLI, then launch the appliance from the AzureRM console web UI. This process is similar to uploading and launching the [CloudCenter Suite installer appliance for AzureRM](#).

 You must use the AzureRM CLI to perform this upload.

- c. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
- d. Once the first instance of the appliance has been launched, use the AzureRM console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
-----------------	-------	-------

Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



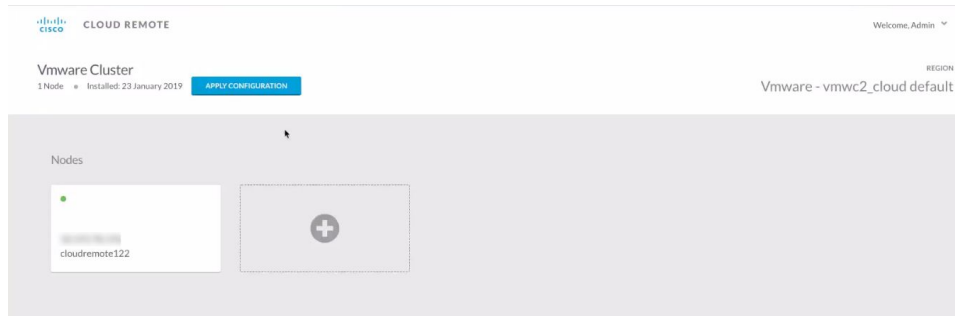
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



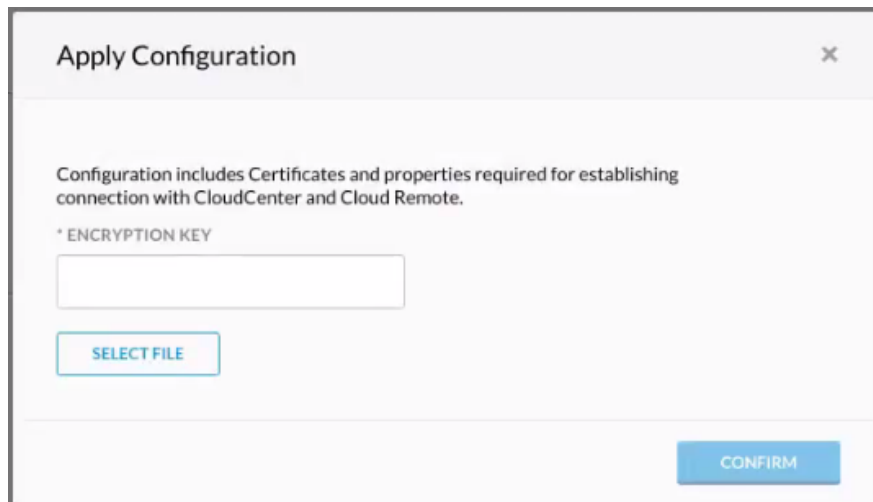
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

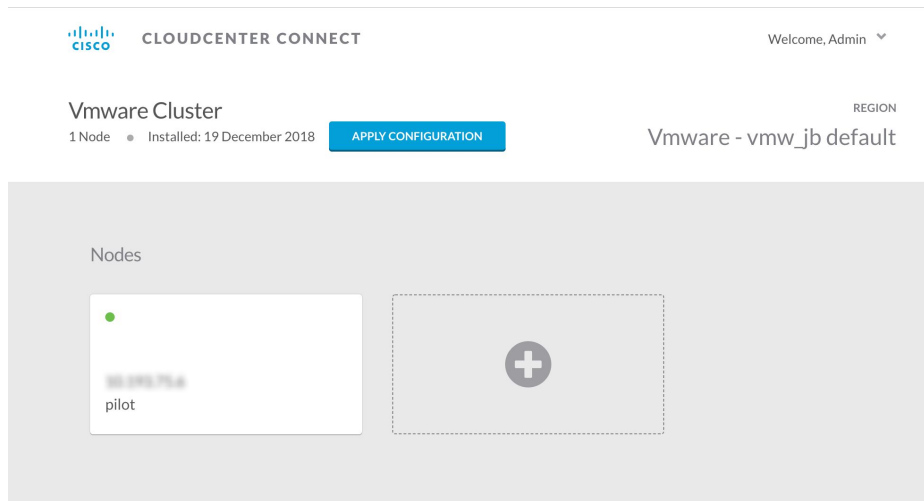
- Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).




Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.


5. VM Naming and IPAM Strategy (conditional): Configure any VM naming strategy in the Strategy section as explained in [VM Naming and IPAM Strategies](#). CloudCenter Suite currently does not support an IPAM strategy for AzureRM. If you leave the settings at the defaults, the default VM naming strategy is applied.
6. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
7. Instance Types (informational): CloudCenter Suite automatically synchronizes instance types for public cloud regions on a daily basis. This data includes published pricing for each instance type. It is possible to edit AzureRM region instance types, but only the changes in the cost are used by CloudCenter Suite. See [Instance Types Settings](#) for more details.
8. Storage Types (conditional): CloudCenter Suite automatically synchronizes storage types for public cloud regions on a daily basis. This data includes the cloud provider published pricing for each storage type. It is possible to edit AzureRM region storage types, but only the changes in the cost are used by CloudCenter Suite. See [Storage Types Settings](#) for more details.
9. Image Mappings: Image mappings allow services based on Workload Manager logical images to be deployed using the appropriate physical image stored on the target cloud region. Workload Manager automatically maps the [OOB logical images](#) to public cloud region physical images when you add the region to your cloud. Cisco periodically updates these mappings when new versions of OS physical images are uploaded by the cloud provider. To apply these updates to your region after it is added to your cloud, click the **Sync Image Mappings** link in the upper right of this section. If you create any custom logical images, you must manually import the corresponding physical images into your region and then map the corresponding logical images to these physical images. See [Images](#) for more context.

 Be aware that the screenshots may change based on the Azure portal changes. They are provided in this section as a point of reference.

Prerequisites

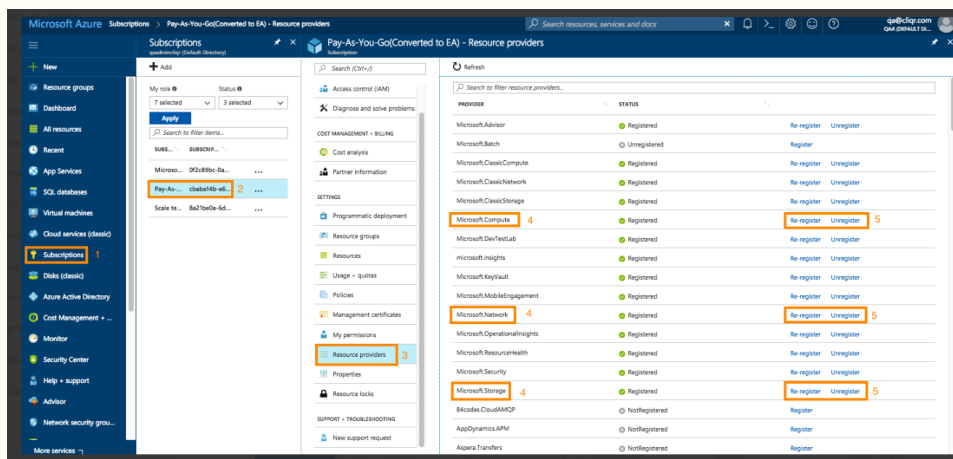
Before adding an AzureRM cloud, verify the following requirements:

- You have a valid [Windows Azure Resource Manager account](#).
- Register the required Azure providers from the Azure portal:

 Previously, you could only perform this procedure using Azure commands.

Now, you can use the UI (**All Services > Subscriptions**) to register the following Azure providers:

- Microsoft.Compute (displayed in the following image)
- Microsoft.Storage (displayed in the following image)
- Microsoft.Network (displayed in the following image)
- Microsoft.Resources
- Microsoft.Authorization



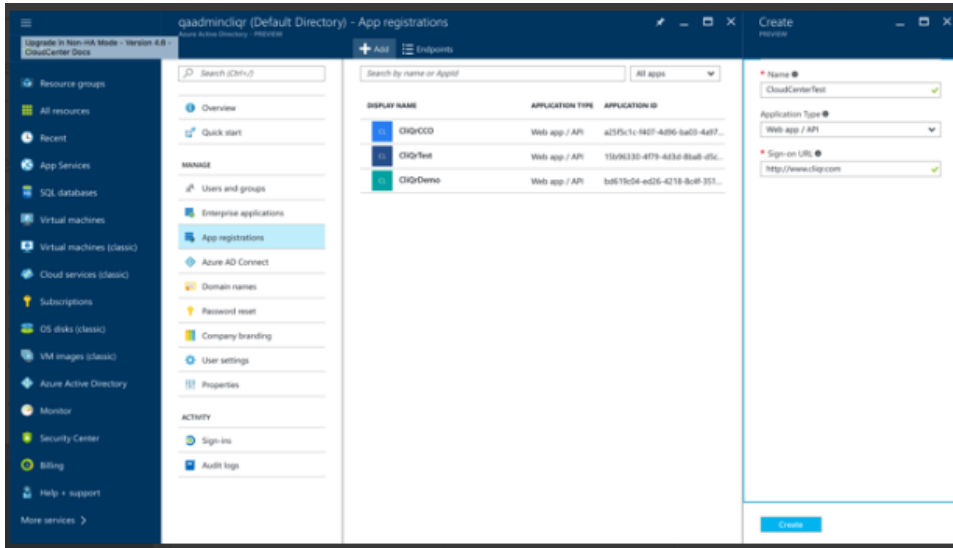
- In the **Azure Resource Manager Portal**, navigate to **Azure Active Directory** page:

1. Select **App Registration** and click **Add**.
2. Provide the **Name**, **Sign-On URL**, and **Create** the application. This value must be a standard URL and is required by the AzureRM cloud configuration – it is not used by the CloudCenter platform.



In the following screenshot, the Sign-On URL displays <http://www.cliqr.com>. This is just an example. Be sure to provide the base URL for your application using the required protocol (HTTP or HTTPS) – for example:

`http://<YourLocalHost or YourAppURL>`



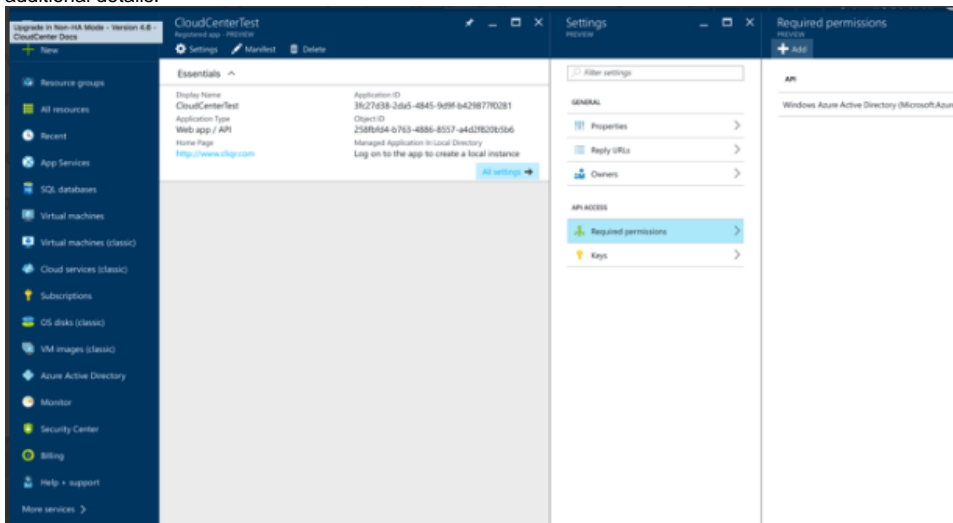
3. Select the newly created application.



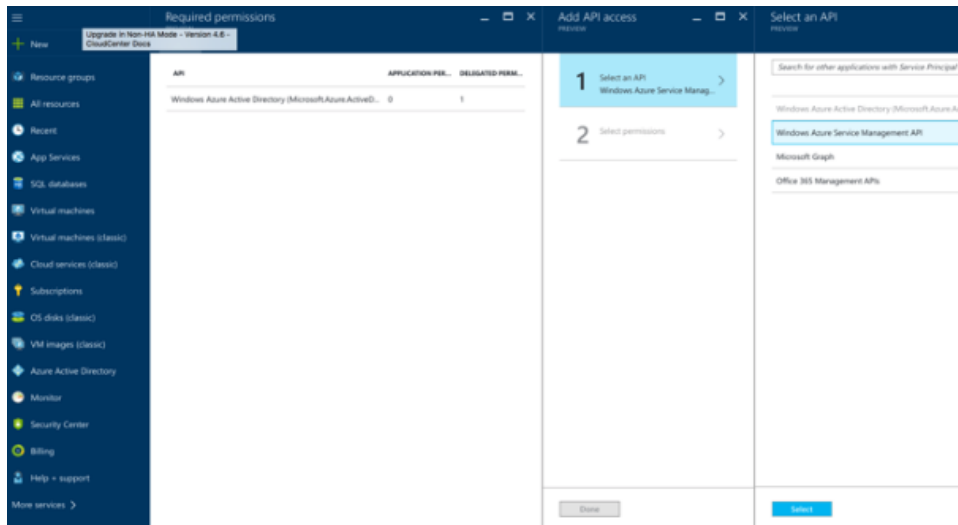
Note down the Application ID; it is required to create a Cloud Account in CloudCenter – this is the Client ID.

If you prefer to use *Certificate-Based Authentication*, see the related bullet further in this section.

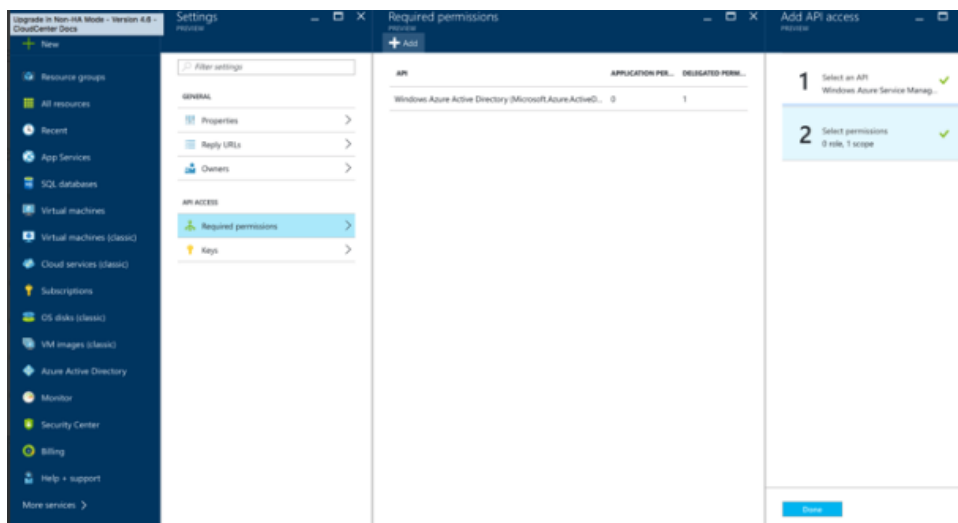
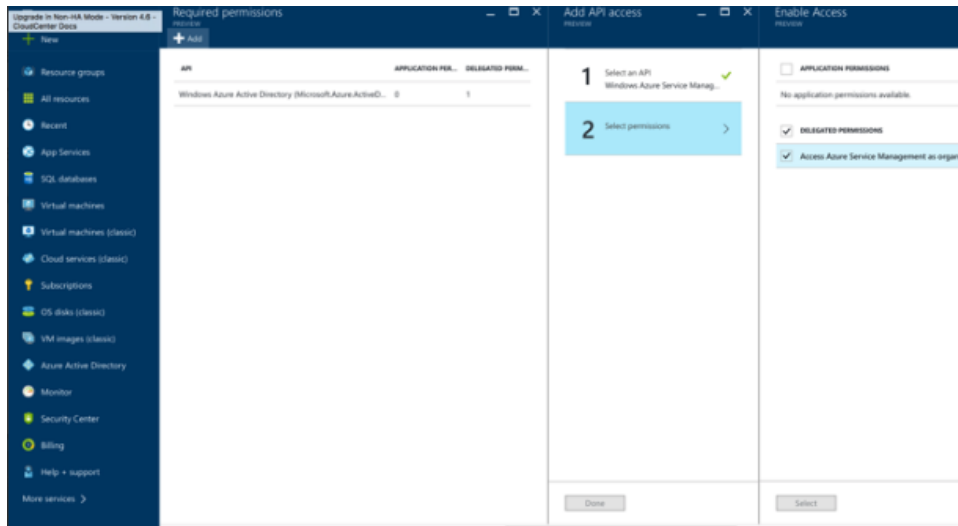
4. Click **All Settings**.
5. Select **Required Permission** under API Access and click **Add**. See [Cloud Overview](#) > *Minimum Permissions for Public Clouds* for additional details.



6. Select **Windows Azure Service Management API**.



7. Select permissions as **Delegated Permission** and click **Done**.

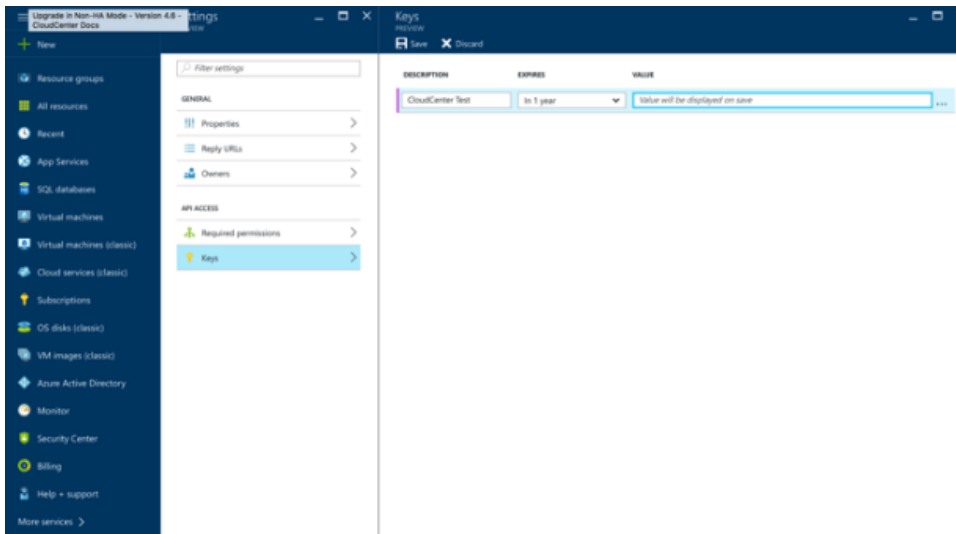


8. Select **Keys** under **API Access**.

9. Specify the **Description**, **Expires**, and click **Save**.



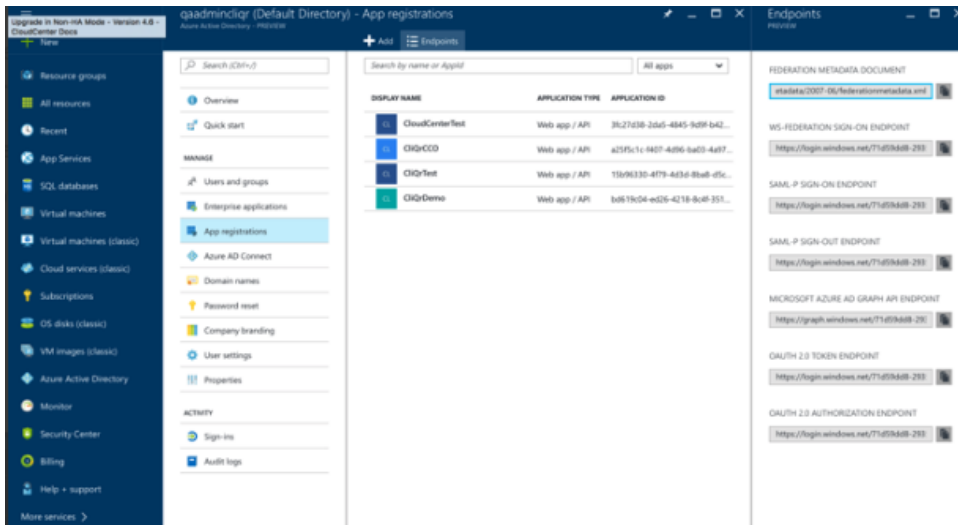
Note down the key after you click save – this key cannot be retrieved later from the portal, and it is used by the Workload Manager as the Client Key when creating the cloud account.



10. Select **App Registration** and click **Endpoints**.



Note down the Tenant-ID from the OAuth 2.0 Authorization Endpoint – this ID is used by the Workload Manager when creating a cloud account.



- *Certificate-Based Authentication* – You can select either key-based authentication or the more secure certificate-based authentication.

- The certificate used can either be one of the following options – You can create either type using the *openssl*/command from the command prompt of any Linux system:
 - A self-signed certificate: See the following example.

i Remember this password as you will need to enter it in the CloudCenter Suite UI's Certificate and Password fields when you create or edit the Cloud Account.

- Generate a key and certificate.

```
openssl req -newkey rsa:2048 -nodes -keyout key.pem -x509 -days 365 -out certificate.pem
```

- Convert the certificate.pem to PKCS 12 format.

```
openssl pkcs12 -inkey key.pem -in certificate.pem -export -out certificate.p12
```

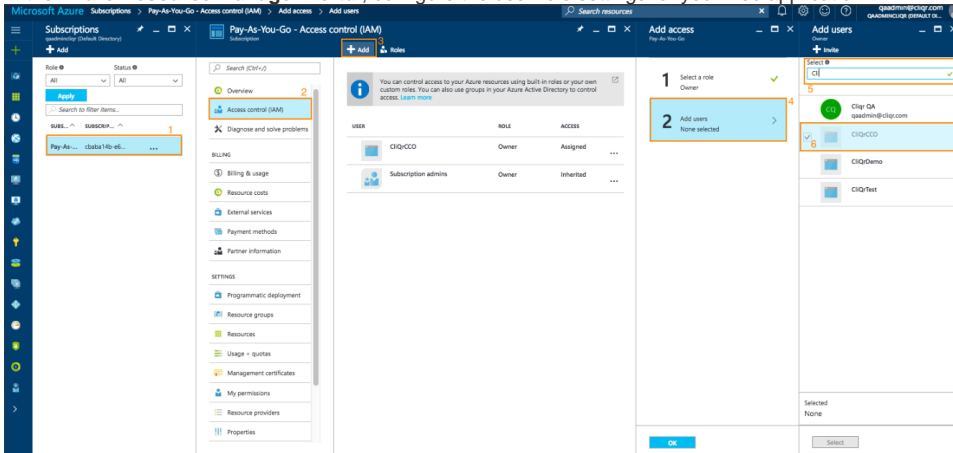
- Provide a password to this command when prompted.
- A Certificate Authority (CA) signed certificate – Generate a key and CSR, send/receive the certificate.csrfile(s) to the signature authority, convert the signed-certificate.pem to PKCS 12format, and provide a password to this command when prompted.

i Remember this password as you will need to enter it in the Workload Manager UI's Certificate and Password fields when you create or edit the Cloud Account.

- Convert the PKCS formatted certificate (certificate.p12 or signed-certificate.p12) to base64 format using the tool at <https://www.base64encode.org/>.
- Enter the base64 formatted certificate, and the export password used to create the PKCS formatted certificate, in the corresponding fields in the Workload Manager Add or Edit Cloud Account dialog box.
- Login to **Azure Resource Manager Portal** to upload the certificate PEM file (Azure Active Directory > AppRegistrations > Settings > keys > Upload public key) and save.

i The corresponding public key for the certificate must be uploaded to the Azure RM portal for the Application Registration that the user must add to the CloudCenter Suite cloud account.

- In the **Azure Resource Manager Portal**, configure the user role settings for your web application:



1. Select **Subscription > Valid subscription** (this is the subscription you want to manage).
2. Click **Access control (IAM)**.
3. Click the **+Add** icon at the top right corner of the managed subscription pane.
4. Click **Add users** and select the **OWNER** role. You can also select other roles for more granular management.



This role should be able to access and manage AzureRM resources like storage, compute, network, keyvault, and so forth to configure AzureRM for the CloudCenter Suite.

5. In the User search box, enter the web application name you defined earlier. In this example, it is **CLIQRCCO**.
6. Click **OK** to save your settings.

Configuration Process

To add an AzureRM cloud account, follow this procedure.

1. Locate the newly-added cloud and click the **Add Cloud Account** link. The Add Cloud Account dialog box displays as shown in the figure below:

Add Cloud Account

Name *

Description

Cloud Credentials

Azure Login ID *

Azure Subscription ID *

Tenant ID *

Client ID *

Save Cancel

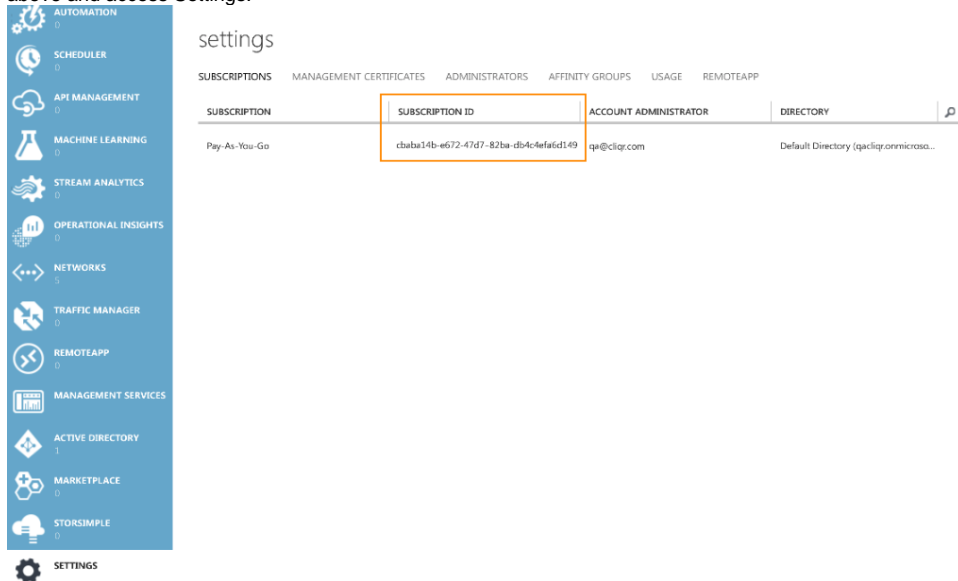
2. Assign a new cloud account name.

**Tip**

The name should not contain any space, dash, or special characters.

3. Add the following cloud Credentials associated with your Azure account.

- a. **Azure Login ID:** The email address used to login to your Azure Resource Manager cloud account
- b. **Azure Subscription ID:** To retrieve the **Subscription ID**, toggle to the **Azure Portal** Interface as described in the *Prerequisites* section above and access **Settings**:



- c. **Tenant ID:** The UUID identified in the *VIEW ENDPOINTS* bullet in the *Prerequisites* section above.
 - d. **Client ID:** The UUID identified in the blue icon bullet in the *Prerequisites* section above.
 - e. **Use Cert Based Auth:** If you enable **Use Cert Based Auth**, the **Client Key** field is *hidden* and the following fields are displayed:
 - i. **Certificate** – The certificate in PKCS 12 format as Base64 text as identified in the *Certificate-Based Authentication* bullet in the *Prerequisites* section above.
 - ii. **Password** – Enter the password used to create the certificate as identified in the *Certificate-Based Authentication* bullet in the *Prerequisites* section above.
 - f. **Client Key:** If you do not enable **Use Cert Based Auth**, use the client key identified in the *keys* bullet in the *Prerequisites* section above.
4. Scroll the dialog box down to reveal the billing fields and enter the **Region Info**, **Offer Id**, **EA Enrollment Number**, and **EA API Access Key** as shown in the figure below. For information on setting up billing information, see <https://docs.microsoft.com/en-us/azure/billing/billing-enterprise-api>.

Add Cloud Account

Use Cert Based Auth OFF

Client Key *

Billing

Region Info

Offer Id

EA Enrollment Number

EA API Access Key

The **Region Info** is the two-letter ISO code where the offer was purchased. For example, US.

The **Offer Id** is tied to the account. To find the **Offer Id** for your account, navigate to **Azure Portal > Subscriptions page** and choose a subscription. The **Offer Id** is displayed in the **Overview** section.

The **EA Enrollment Number** is displayed in the top left corner when you log in to <https://ea.azure.com/>.

The **EA API Access Key** must be generated as follows: Log in to <https://ea.azure.com/> as **EA Admin** and navigate to **Reports > Download Usage > API Access Key > Generate**.

5. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
6. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation. <div style="border: 1px solid #f0e68c; padding: 5px; margin: 5px 0;"> It is recommended that you do not add a <i>Reporting</i> account to the same tenant through different cloud groups. </div> <div style="border: 1px solid #add8e6; padding: 5px; margin: 5px 0;"> Enabling a public cloud account for <i>Reporting</i> may incur expenses to retrieve cost data. These expenses are proportional to the number of configured cloud accounts and regions. </div>
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
Account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure a Google Cloud

Configure a Google Cloud

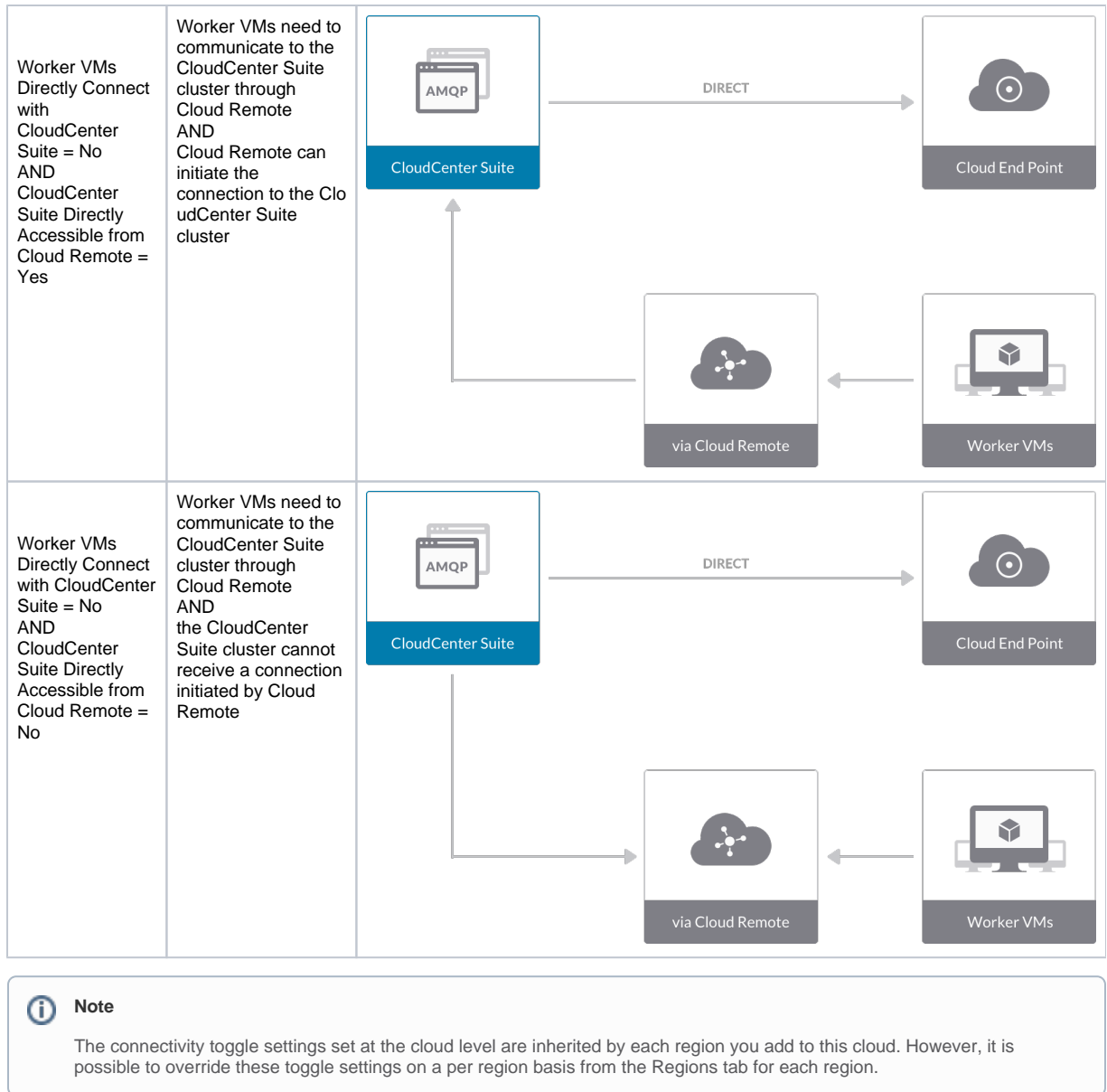
Configuring a Google cloud is a four-step process:

- [Add a Google Cloud](#)
- [Add a Google Region](#)
- [Configure a Google Region](#)
- [Add a Google Cloud Account](#)

To add a Google cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here.
2. Click the **Add Cloud** link in the upper right. The Add Cloud dialog box is displayed.
3. Enter the **cloud name** and select the **cloud provider**.
4. Click **Next**. The second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle to configure the Cloud Connectivity settings.
 - When adding a public VM cloud in the CloudCenter Suite UI, the Cloud Connectivity Settings page, the second page of the Add Cloud dialog box, appears with a single toggle displayed: **Worker VMs Directly Connect with CloudCenter Suite**.
 - Setting this toggle to No implies you will install Cloud Remote for each region of this cloud. This also causes a second toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
 - Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Diagram
Worker VMs Directly Connect with CloudCenter Suite = Yes	<p>Unimpeded connectivity exists between the CloudCenter Suite cluster and the cloud region API endpoint AND Unimpeded connectivity exists between the CloudCenter Suite cluster and worker VMs</p> <p>Cloud Remote is not required</p>	<p>The diagram illustrates a central box labeled 'CloudCenter Suite' containing an 'AMQP' icon. Two arrows labeled 'DIRECT' originate from this box. One arrow points to a box labeled 'Cloud End Point' which contains a cloud icon with a central dot. The other arrow points to a box labeled 'Worker VMs' which contains a computer monitor icon with a cube on the screen.</p>



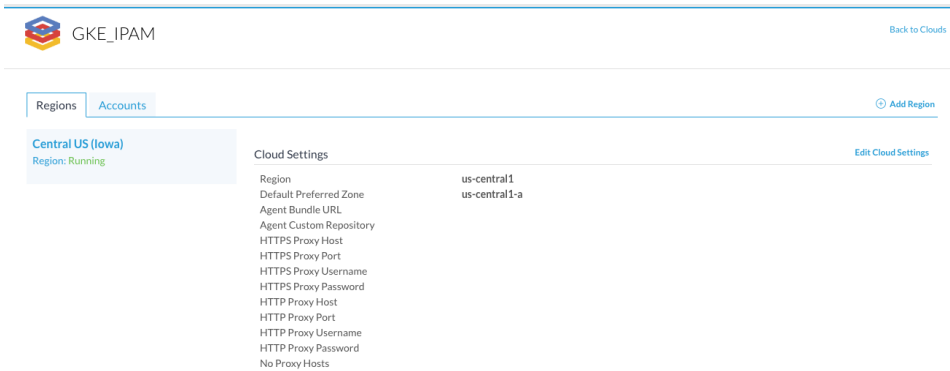
- Click **Done** to save the configuration and close the dialog box. This brings you back to the Clouds page and the cloud you just created will be added to the bottom of the list on the left side of the page.

After creating a Google cloud, the next step is to create the first region for the cloud. Follow these steps.

- Navigate to the Clouds page and select the cloud you created on the left side of the screen. Then click the **Add Region** button on the right side of the screen.
- After clicking the Add Region button, the Add Region dialog box is displayed. Select a region from the list and click **Save**.
- After clicking **Save** you are brought back to the Clouds page with the region you added shown on the right side of the page.

To configure a region you added to your Google cloud, follow this procedure.

- Navigate to Clouds page: **Admin > Clouds**. Find your Google cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the Regions tab for this cloud as shown in the figure below with the Cloud Settings section displayed first.



After you have added multiple regions to your Google cloud, the Regions tab will show multiple individual region tabs on the left side of the screen. Click the tab of the region you want to configure.

- Click the **Edit Cloud Settings** link in upper right of the Cloud Settings section. This displays the Configure Cloud Settings dialog box.

The Cloud Settings section contains fields that are unique to Google and settings that are common to all cloud providers. Adjust these field values per the instructions in the following tables:

Google Specific Cloud Settings:

Field	Usage
Region	This field is set by CloudCenter Suite based on the region location you selected from the Add Region dialog box.
Default Preferred Zone	This field is set by CloudCenter Suite based on the region location you selected from the Add Region dialog box.

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.
HTTP /HTTPS proxy fields (host, username, password)	If you require VMs in your region to access public addresses through a web proxy, enter the URL and credentials of the HTTP and HTTPS proxy servers in these fields.
No Proxy Hosts	If you have specified an HTTP or HTTPS proxy using the above fields, you can specify that managed VMs in the region should bypass the proxy and connect directly to certain hosts. Use this field to create a comma-separated list of IP addresses or URLs that should be accessed directly. This field is ignored if an HTTP or HTTPS proxy is not specified.



Important information on proxy settings

In CloudCenter Suite it is possible to specify proxy settings at the region level, as described here, and at the [suite level](#). To understand the expected behavior when proxy settings are specified at both levels, see [Precedence of Proxy Settings](#).

Download Configuration and Encryption Key

After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you can download them to your local computer and then upload them to other conditional components such as Cloud Remote.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the following screenshot.

Region Connectivity Running[Download Configuration](#)[Configure Region](#)

Clicking **Download Configuration** causes two things to happen:

- An encrypted zip file named **artifacts.zip** is downloaded by your browser. Make a note of the location of this zip file as you will need it if you are using Cloud Remote.
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in the following screenshot.

Region Connectivity Enabling...[Download Configuration](#)[Copy Encryption Key](#)[Edit Connectivity](#)

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to conditional components like Cloud Remote.

If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file from software.cisco.com, use the automatically create (new) encryption key, and copy the key to the clipboard by clicking the **Copy Encryption Key** link again.

When you are done editing the settings in the dialog box, click **Save**.

3. Determine if you need Cloud Remote for this region. Scroll down to the Region Connectivity section for the region and click on the **Configure Region** link in the upper right to open the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. If all of the connectivity toggles in the Region Connectivity dialog box are set to Yes, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave all region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the Region Connectivity dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.

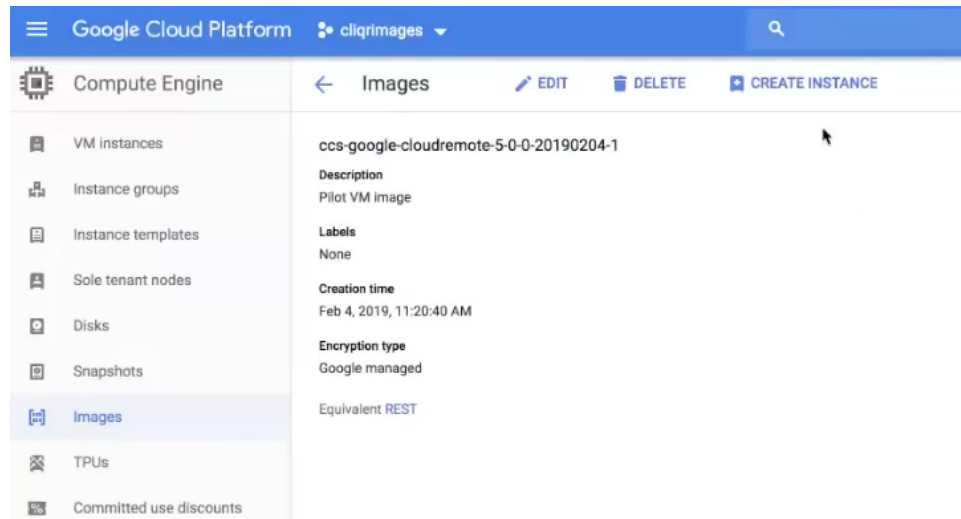
4. If any of the connectivity toggles in the Region Connectivity dialog box are set to No, then **you must install and configure Cloud Remote for this region**.

Configure Cloud Remote in a Google Region

Configure Cloud Remote in a Google region as follows.

Obtain and Launch the Cloud Remote Appliance in Google

- a. Request the Cloud Remote shared VMI form Cisco support by opening a [CloudCenter Support case](#). In your request, specify the following details:
 - i. Your GCP account number
 - ii. Your GCP project ID number
 - iii. Your CloudCenter Suite version
 - iv. Your Customer ID (CID)
 - v. Your customer name
 - vi. Specify if your setup is in production or for a POC
 - vii. Your Contact Email
- b. After you open a case, your support case is updated with the shared VMI ID. **Proceed to the next step only after your support case is updated with the VMI ID.**
- c. Navigate to the GCP dashboard and search for the VMI ID name provided in the [CloudCenter Support case](#) in the list of images for your project.
- d. Launch an instance using the shared VMI.
 - i. Click on the image name. This takes you to the page for the image



- ii. Click on Create Instance to display the Instance properties page

Name ⓘ

instance-2

Region ⓘ **Zone** ⓘ

us-west1 (Oregon) us-west1-a


Machine type
Customize to select cores, memory and GPUs.

1 vCPU 3.75 GB memory [Customize](#)

Container ⓘ

Deploy a container image to this VM instance. [Learn more](#)

Boot disk ⓘ

 New 30 GB standard persistent disk image
ccs-google-cloudremote-5-0-0-2019020... [Change](#)

Identity and API access ⓘ

Service account ⓘ

Compute Engine default service account

Access scopes ⓘ

Allow default access
 Allow full access to all Cloud APIs
 Set access for each API

Firewall ⓘ

Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management, security, disks, networking, sole tenancy

You will be billed for this instance. [Compute Engine pricing](#) ↗

iii. Complete these fields:

1. Instance name
2. Region and zone
3. Machine type: select 2 vCPU, 7.5 GB RAM
4. Click the checkbox to allow HTTPS access
5. Click the Security tab (under the Allow HTTPS traffic checkbox). In the SSH key field, add your organization's public ssh key followed by a space and then the username you want to use to login to the Cloud Remote appliance. Click the Add Item button when done.

Firewall ⓘ
Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management **Security** Disks Networking Sole Tenancy

Shielded VM ⓘ
Select a shielded image to use shielded VM features.
Turn on all settings for the most secure configuration.

Turn on Secure Boot ⓘ
 Turn on vTPM ⓘ
 Turn on Integrity Monitoring ⓘ

SSH Keys
These keys allow access only to this instance, unlike [project-wide SSH keys](#) [Learn more](#)

Block project-wide SSH keys
When checked, project-wide SSH keys cannot access this instance [Learn more](#)

centos

```

VM=FU-X9CT9Fco4XTE=KaT12a3K90/oaKaCT1DE/
J
C
C
€
Y
6J centos|

```

[+ Add item](#)

[^ Less](#)

You will be billed for this instance. [Compute Engine pricing](#) [↗](#)

[Create](#) [Cancel](#)

- iv. Click Create to launch the instance.
- e. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote > Scaling](#) for details.
- f. Once the first instance of the appliance has been launched, use the GCP console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).

Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789
---	---	---

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



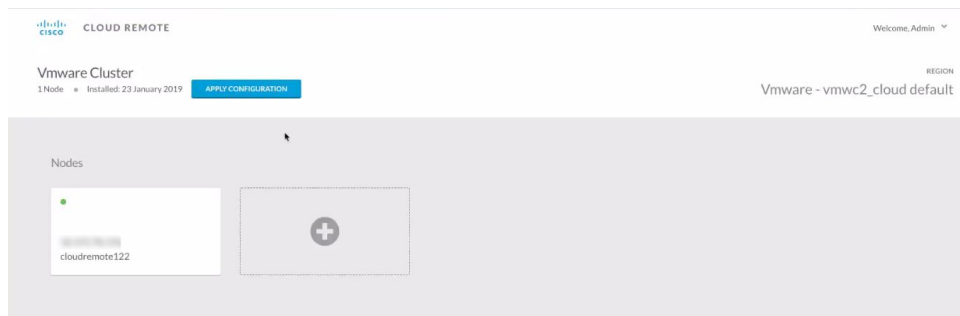
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



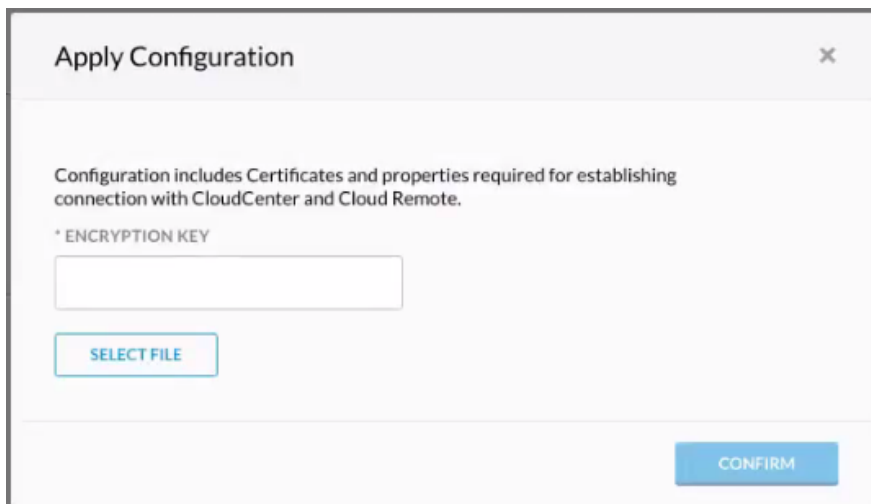
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

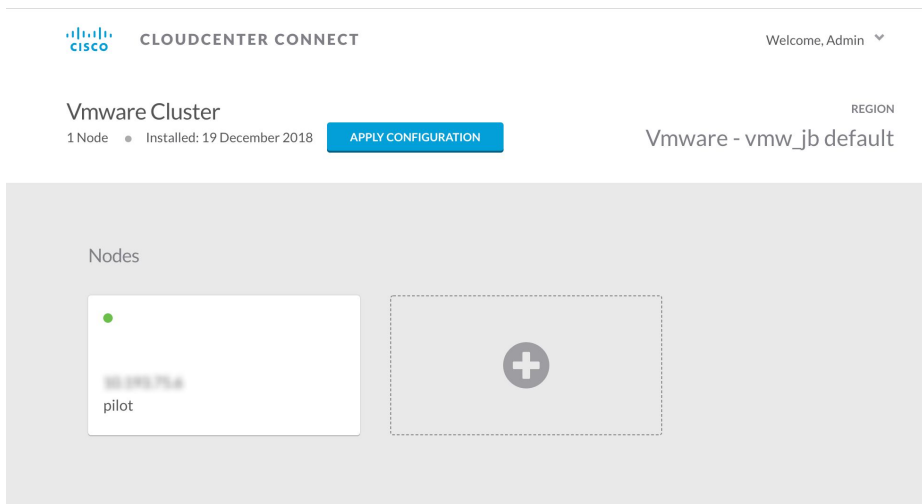
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- g. Click **Confirm**.
- h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

5. **VM Naming and IPAM Strategy (conditional)**: Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
6. **External Lifecycle Actions (conditional)**: Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
7. **Instance Types (informational)**: CloudCenter Suite automatically syncs instance types for public cloud regions on a daily basis. This data includes published pricing for each instance type. It is possible to edit Google region instance types, but only the changes in the cost are used by CloudCenter Suite. See [Instance Types Settings](#) for more details.
8. **Storage Types (conditional)**: CloudCenter Suite automatically syncs storage types for public cloud regions on a daily basis. This data includes cloud provider published pricing for each storage type. It is possible to edit Google region storage types, but only the changes in the cost are used by CloudCenter Suite. See [Storage Types Settings](#) for more details.

9. Image Mappings: Image mappings allow services based on Workload Manager logical images to be deployed using the appropriate physical image stored on the target cloud region. Workload Manager automatically maps the [OOB logical images](#) to public cloud region physical images when you add the region to your cloud. Cisco periodically updates these mappings when new versions of OS physical image are uploaded by the cloud provider. To apply these updates to your region after it is added to your cloud, click the **Sync Image Mappings** link in the upper right of this section. If you create any custom logical images, you must manually import the corresponding physical images into your region and then map the corresponding logical images to these physical images. See [Images](#) for more context.



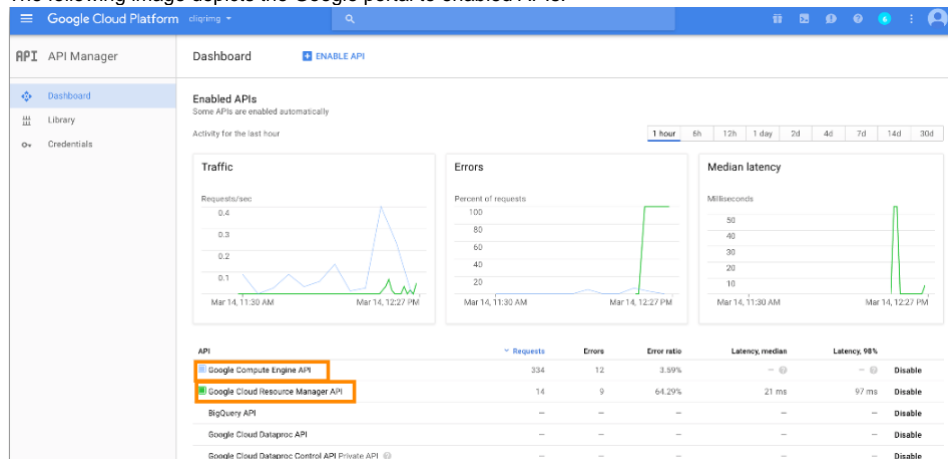
Be aware that these screenshots may change based on the Google Cloud platform changes. They are provided in this section as a point of reference.

Prerequisites

Before adding a Google cloud account, verify the following Google requirements:

- A valid [Google Cloud Platform account](#) with *Project Owner* permissions
- If using the Shared VPC network feature, you also required Shared VPC Admin permissions (see <https://cloud.google.com/vpc/docs/provisioning-shared-vpc> for additional context).
- CloudCenter Suite appends the network name with a unique ID to form the firewall rule name; the network name can be a maximum of 24 (network name) + 39 (unique ID) = 63 total characters. For example: abcdefghijklmnopqrstuvwxyz-c3f-462828f37a06acd3ee194716bfe10de0
- Enable the following APIs for each Google cloud account you will be adding to CloudCenter Suite:
 - Google Compute Engine API
 - Google Cloud Resource Manager API
 - Google Cloud SQL Admin API (needed only for Cost Optimizer for PAAS services)

The following image depicts the Google portal to enabled APIs:



- Set the minimum permissions for your cloud account. See [Cloud Overview](#) > Minimum Permissions for Public Clouds for additional details.

- Create a new **service account key in JSON format** per the GCP documentation: <https://cloud.google.com/iam/docs/creating-managing-service-account-keys>.

Make sure you use the default JSON format as shown in the create key dialog box below.

Create private key for "[REDACTED]"

Downloads a file that contains the private key. Store the file securely because this key can't be recovered if lost.

Key type

JSON
Recommended

P12
For backward compatibility with code using the P12 format

CANCEL
CREATE

- Once you click **Create**, the file will be downloaded by your browser. Make note of its name and location as you will need to specify this in the **Service Account JSON File** field in the CloudCenter Suite UI as explained below.

Configuration Process

To add a Google cloud account, follow this procedure.

1. Locate the newly-added cloud and click the **Add Cloud Account** link. The Add Cloud Account dialog box displays:

Add Cloud Account

Name *

Description

Cloud Credentials

GCP Email Address *

Email address associated with your GCP account

Service Account JSON file *

Choose File
No file chosen

Billing

Bucket Name

Save
Cancel

2. Assign a new cloud account name.

**Tip**

The name should not contain any space, dash, or special characters.

3. Add the following Cloud Credentials associated with your Google account.

The location of these details in GCP is identified in the *Prerequisites* section.

Field	Description
GCP Email Address	The email address that you used to log into the GCP account .
GCP Service Account JSON File	The JSON private key associated with the Service Account. (See <i>Prerequisites</i> section)

4. Enter the **Bucket Name** and **Report Prefix** as shown in the figure below. For information on setting up billing information, see <https://cloud.google.com/billing/docs/how-to/export-data-file>.

Add Cloud Account

Cloud Credentials

GCP Email Address *

Email address associated with your GCP account

Service Account JSON file *



 No file chosen



In the cloud console, create a bucket, if it does not exist already, and navigate to **Billing > Billing Export** to view billing information.

5. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
6. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

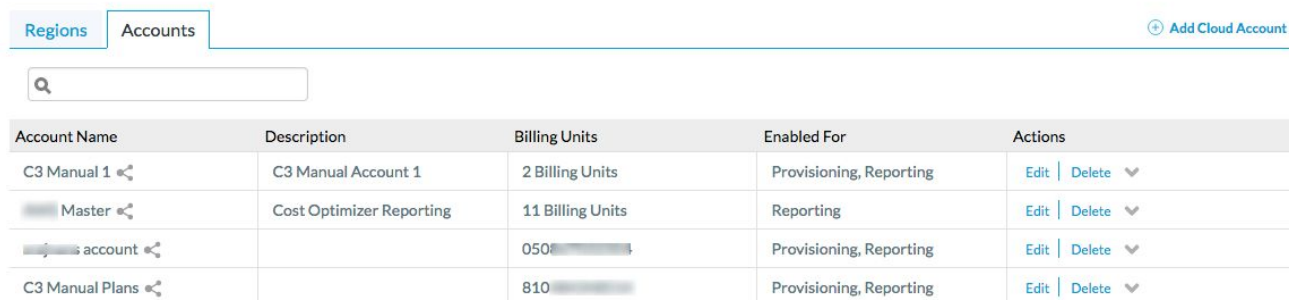
Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.

Reporting	<p>Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.</p> <div style="border: 1px solid #ccc; padding: 5px; margin: 5px 0;">  It is recommended that you do not add a <i>Reporting</i> account to the same tenant through different cloud groups. </div> <div style="border: 1px solid #ccc; padding: 5px; margin: 5px 0;">  Enabling a public cloud account for <i>Reporting</i> may incur expenses to retrieve cost data. These expenses are proportional to the number of configured cloud accounts and regions. </div>
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.



Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
Account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure an IBM Cloud

Configure IBM Cloud

Configuring IBM Cloud is a four-step process:

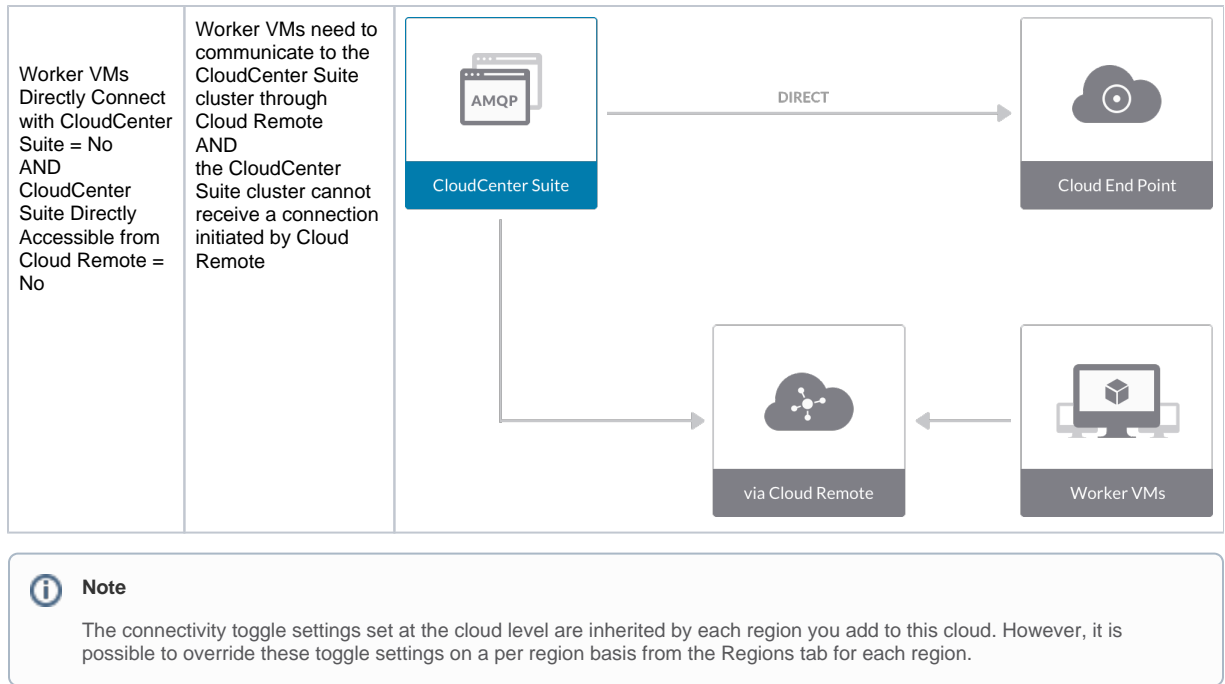
- [Add IBM Cloud](#)
- [Add an IBM Cloud Region](#)
- [Configure an IBM Cloud Region](#)
- [Add an IBM Cloud Cloud Account](#)

To add an IBM Cloud cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here. Click the **Add Cloud** link in the upper right.
2. Click **Add Cloud**, the Add Cloud dialog box is displayed.
3. Enter the **cloud name**, select the **cloud provider**, and click **Next**. The second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle switches to configure the Cloud Connectivity settings.

- When adding a public VM cloud in the CloudCenter Suite UI, the Cloud Connectivity Settings page, the second page of the Add Cloud dialog box, appears with a single toggle displayed: **Worker VMs Directly Connect with CloudCenter Suite**.
- Setting this toggle to No implies you will install Cloud Remote for each region of this cloud. This also causes a second toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
- Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Diagram
Worker VMs Directly Connect with CloudCenter Suite = Yes	Unimpeded connectivity exists between the CloudCenter Suite cluster and the cloud region API endpoint AND Unimpeded connectivity exists between the CloudCenter Suite cluster and worker VMs Cloud Remote is not required	<p>The diagram illustrates direct connectivity. On the left is the CloudCenter Suite (AMQP). On the top right is the Cloud End Point. On the bottom right is Worker VMs. A horizontal arrow labeled 'DIRECT' points from the CloudCenter Suite to the Cloud End Point. A vertical arrow labeled 'DIRECT' points from the Worker VMs up to the CloudCenter Suite.</p>
Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes	Worker VMs need to communicate to the CloudCenter Suite cluster through Cloud Remote AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster	<p>The diagram illustrates connectivity via Cloud Remote. On the left is the CloudCenter Suite (AMQP). On the top right is the Cloud End Point. On the bottom right is Worker VMs. On the bottom center is a box labeled 'via Cloud Remote'. A horizontal arrow labeled 'DIRECT' points from the CloudCenter Suite to the Cloud End Point. A vertical arrow labeled 'DIRECT' points from the Worker VMs up to the CloudCenter Suite. A horizontal arrow points from the Worker VMs to the 'via Cloud Remote' box, and another horizontal arrow points from the 'via Cloud Remote' box to the CloudCenter Suite.</p>



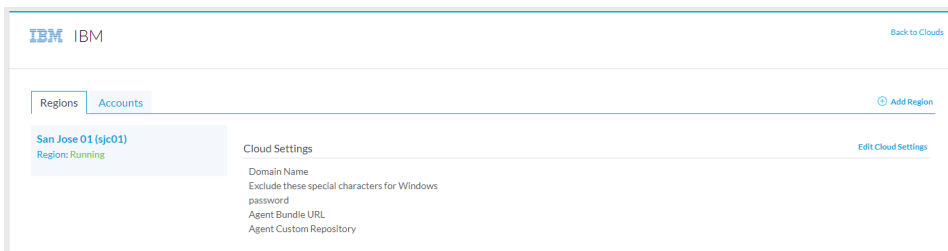
4. Click **Done** to save the configuration and close the dialog box. This brings you back to the **Clouds** page and the cloud you just created will be added to the bottom of the list on the left side of the page.

After creating an IBM Cloud cloud, the next step is to create the first region for the cloud. Follow these steps.

1. Navigate to the **Clouds** page and select the cloud you created on the left side of the screen. Click the **Add Region** button on the right side of the screen. The **Add Region** dialog box is displayed.
2. Select a region from the list and click **Save**. You are brought back to the **Clouds** page with the region you added shown on the right side of the page.

To configure a region you added to your IBM Cloud cloud, follow this procedure:

1. Navigate to Clouds page: **Admin > Clouds**. Find your IBM Cloud cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the **Regions** tab for this cloud as shown in the figure below with the **Cloud Settings** section displayed first. If you have added multiple regions to your IBM Cloud cloud, the **Regions** tab will show multiple individual region tabs on the left side of the screen.



2. Click the tab of the region you want to configure.
3. Click the **Edit Cloud Settings** link in the upper right of the **Cloud Settings** section. This opens the **Configure Cloud Settings** dialog box. The **Cloud Settings** section contains fields that are unique to IBM Cloud and settings that are common to all cloud providers. Adjust these field values per the instructions in the following tables.

IBM Cloud Specific Cloud Settings

Field	Usage
Domain Name	The URL route allocated to your organization in IBM Cloud.

Cloud Agnostic Cloud Settings

Field	Usage
-------	-------

Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.

When you are done editing the settings in the dialog box, click **Save**.

- Determine if you need Cloud Remote for this region. Scroll down to the **Region Connectivity** section for the region and click on the **Configure Region** link in the upper right to open the Configure Region dialog box. The toggle settings should be the same as when you set them on the connectivity page of the **Add Cloud** dialog box. If all of the connectivity toggles in the **Region Connectivity** dialog box are set to **Yes**, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the **Region Connectivity** dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.

- If any of the connectivity toggles in the Region Connectivity dialog box are set to No, then you must install and configure Cloud Remote for this region.

Configure Cloud Remote in an IBM Cloud Region

Configure Cloud Remote in an IBM Cloud region as follows.



Since CloudCenter Suite does not include a prebuilt appliance for Cloud Remote for IBM Cloud, the following procedure includes steps to build the Cloud Remote appliance from the Cisco-supplied Cloud Remote installer file.

Launch Cloud Remote Built from the Installer File

- Launch a Centos 7 instance, ensure the prerequisites are installed, and run the Cloud Remote installer file:

Build a Cloud Remote Appliance Using the Installer File

- Download the Cloud Remote installer file from software.cisco.com. The file name will be in a format similar to "cloudRemote5.1.0-20190614.0.bin".
- Launch a CentOS 7 instance in your target cloud. The instance should have as a minimum 2 vCPUs, 8 GB Memory, and 30 GB storage. Once launched, use your cloud console to note the instance's public and/or private IP addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI.
- Login to the instance and ensure all of the yum installed packages are up to date by executing the *yum update* command.

```
sudo yum update
```

- iv. If your instance's kernel version is 7.0 or greater, reboot your instance and skip to the next step. Otherwise, execute the following commands to install the 7.0 Linux kernel and reboot the instance:

```
sudo rpm --import https://www.elrepo.org/RPM-GPG-KEY-elrepo.org
sudo rpm -Uvh http://www.elrepo.org/elrepo-release-7.0-3.el7.elrepo.noarch.rpm
sudo yum --disablerepo='*' --enablerepo='elrepo-kernel' list available
sudo yum --enablerepo=elrepo-kernel -y install kernel-ml
sudo grub2-set-default 0
sudo grub2-mkconfig -o /boot/grub2/grub.cfg
sudo reboot
```

- v. After the instance completes its reboot, login to the instance again and use the scp command to copy the Cloud Remote installer file from your PC to the instance.
- vi. From the directory where you copied the installer file, run the installer:

```
./<cr_installer_bin> -- --host-ip <cr_private_ip>
```

Replace <cr_installer_bin> with the installer file name, and replace <cr_private_ip> with the private IP of the instance assigned by the cloud provider.



Note

The installer bin file is a self extracting installer. Therefore, it is important to include " -- " between the installer file name and the command option: "--host-ip".

- vii. When the installer completes successfully, you will see an appropriate success message on the VM's console. If you see an error message about the kernel not being of a late enough version, repeat the step above to install the version 7.0 kernel. If you receive an error message about any yum package being out of date, repeat the step above to update all yum installed packages.
- b. Optional but recommended for production environments: Repeat the step above twice to create two additional instances of the appliance to be used to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
------	----------	--------

2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



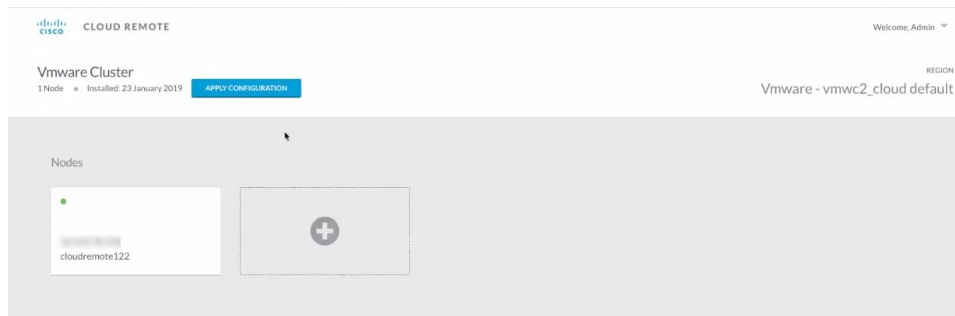
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



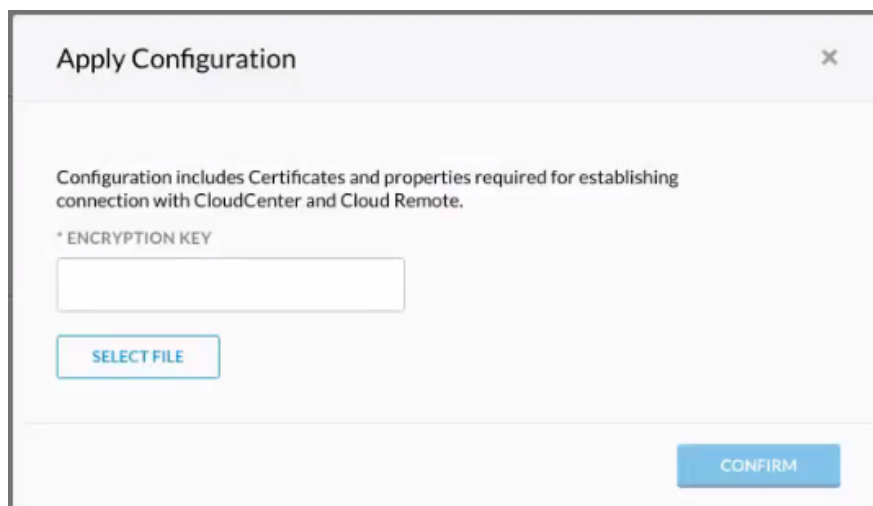
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

- Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).

Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

6. VM Naming and IPAM Strategy (conditional): Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
7. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
8. Instance Types (informational): CloudCenter Suite automatically synchronizes instance types for public cloud regions on a daily basis. This data includes published pricing for each instance type. It is not possible to edit the IBM Cloud region instance types. See [Instance Types Settings](#) for more details.
9. Storage Types (conditional): CloudCenter Suite automatically synchronizes storage types for public cloud regions on a daily basis. This data includes the cloud provider published pricing for each storage type. It is not possible to edit the IBM Cloud region storage types. See [Storage Types Settings](#) for more details.
10. Image Mappings: Image mappings allow services based on CloudCenter Suite logical images to be deployed using the appropriate physical image stored on the target cloud region. CloudCenter Suite automatically maps the [OOB logical images](#) to public cloud region physical images when you add the region to your cloud. Cisco periodically updates these mappings when new versions of OS physical images are uploaded by the cloud provider. To apply these updates to your region after it is added to your cloud, click the **Sync Image Mappings** link in the upper right of this section. If you create any custom logical images, you must manually import the corresponding physical images into your region and then map the corresponding logical images to these physical images. See [Images](#) for more context.

Configuration Process

To add an IBM Cloud cloud account, follow this procedure.

1. Locate your IBM Cloud cloud on the **Clouds** page and click the **Add Cloud Account** link for this cloud. This displays the **Add Cloud Account** dialog box as shown below.

Add Cloud Account

Name *

Description

Cloud Credentials

Account Name *

Account API Key *

Connect

2. Assign a cloud account **Name**.



Tip

The name should not contain any space, dash, or special characters.

3. Provide the IBM Cloud cloud credentials:

- a. **IBM Cloud Account Name**
- b. **IBM Cloud Account API Key**

4. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.

5. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,

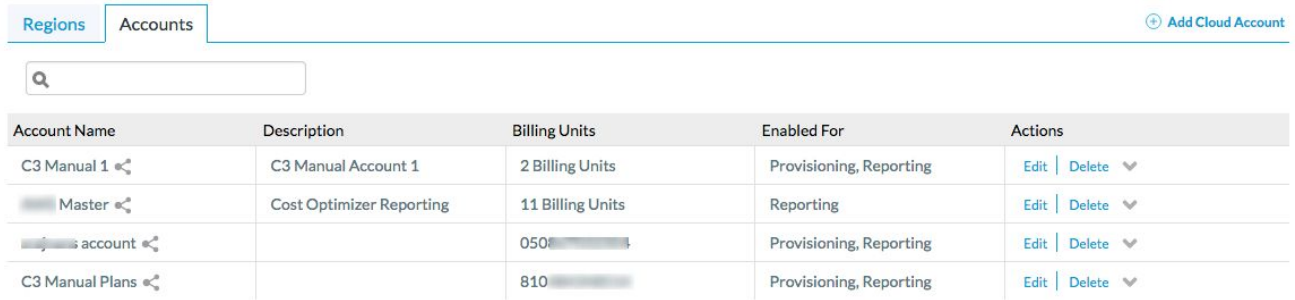
- a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	<p>Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.</p> <div style="border: 1px solid #ffc107; padding: 5px; margin: 5px 0;"> <p> It is recommended that you do not add a <i>Reporting</i> account to the same tenant through different cloud groups.</p> </div> <div style="border: 1px solid #17a2b8; padding: 5px; margin: 5px 0;"> <p> Enabling a public cloud account for <i>Reporting</i> may incur expenses to retrieve cost data. These expenses are proportional to the number of configured cloud accounts and regions.</p> </div>
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.



Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
Account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure a Kubernetes Cloud

Configure a Kubernetes Cloud

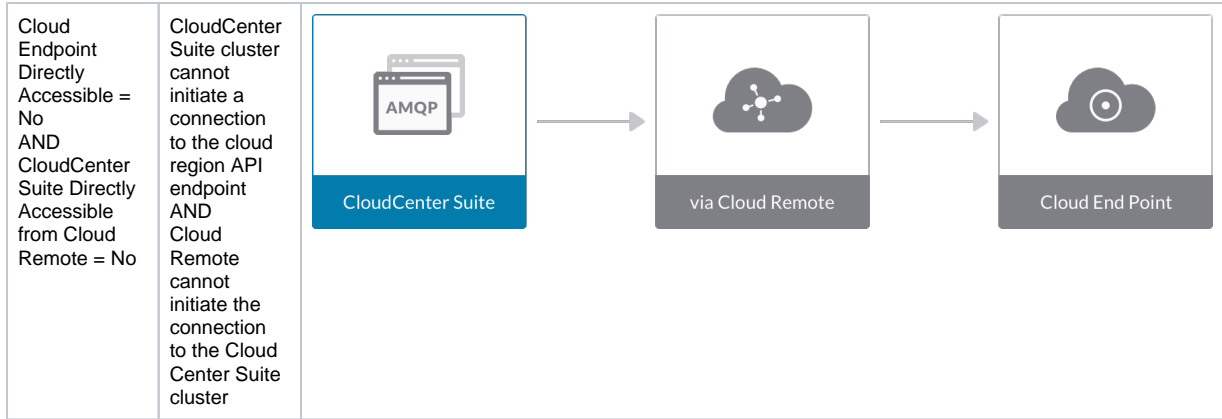
Configuring a Kubernetes cloud is a three-step process:

- [Add a Kubernetes Cloud](#)
- [Configure a Kubernetes Region](#)
- [Add a Kubernetes Cloud Account](#)

To add a Kubernetes cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here.
2. Click the **Add Cloud link** in the upper right. The **Add Cloud** dialog box is displayed.
3. Enter the **cloud name** and select the **cloud provider**.
4. Since you are selecting select a Kubernetes cloud provider, a new data entry field appears at the bottom of the dialog box called **Kubernetes Cluster API Endpoint**. You must enter the URL of the Kubernetes API endpoint in this field before the **Next** button is enabled. When done click **Next**.
5. After clicking **Next**, the second page of the Add Clouds dialog box, Connectivity Settings, appears. Set the toggle switches to indicate the Cloud Connectivity Settings for a Kubernetes Cloud
 - When adding a Kubernetes cloud in the Workload Manager or Cost Optimizer UI, the second page of the Add Clouds dialog box, Connectivity Settings, appears with a single toggle displayed: **Cloud Endpoint Directly Accessible**.
 - Setting this toggle to No implies you will install Cloud Remote in the VM cloud that is hosting this Kubernetes cloud. This also causes a second toggle to be displayed: **CloudCenter Suite Directly Accessible from Cloud Remote**
 - Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Network Diagram
Cloud Endpoint Directly Accessible = Yes	CloudCenter Suite cluster can initiate a connection to the Kubernetes API endpoint Cloud Remote is not required	<p>The diagram shows a box labeled 'CloudCenter Suite' containing an 'AMQP' icon. An arrow points from this box to a box labeled 'Cloud End Point' containing a cloud icon with a target symbol.</p>
Cloud Endpoint Directly Accessible = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes	CloudCenter Suite cluster cannot initiate a connection to the Kubernetes API endpoint AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster	<p>The diagram shows three boxes. On the left is 'CloudCenter Suite' with an 'AMQP' icon. In the middle is 'via Cloud Remote' with a cloud icon and a network diagram. On the right is 'Cloud End Point' with a cloud icon and a target symbol. Arrows point from 'via Cloud Remote' to both 'CloudCenter Suite' and 'Cloud End Point'.</p>



6. Click **Done** to save the configuration and close the dialog box. This brings you back to the Clouds page and the cloud you just created will be added to the bottom of the list on the left side of the page.

A Kubernetes cloud has one region that you configure from the Kubernetes cloud Details tab. Follow this procedure:

1. Navigate to Clouds page: **Admin > Clouds**. Find your newly created Kubernetes cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the **Details** tab for this cloud.
2. Click the **Edit Kubernetes Settings** link in the upper right to open the **Configure Cloud Settings** dialog box. Adjust the field values in the dialog box per the instructions in the following table.

Field	Usage
Kubernetes cluster API Endpoint	This field is set to the value you set for the API endpoint when you created this Kubernetes cloud. You can edit it here but should only do so if the API endpoint address of your Kubernetes cloud has changed since you added it to CloudCenter Suite.
API version override	This tells CloudCenter Suite to use an API version other than the default version for certain Kubernetes resources. This field should normally be left blank. If errors occur in your deployments, contact support regarding using a different version for selected resources. This is a semicolon-separated list of key-value pairs in the format: <resource_name_1>:<api_version_1>; <resource_name_2>:<api_version_2>; etc. Possible examples are as follows: <ul style="list-style-type: none"> • Example 1: Secret: custom_api_version; Service: custom_api_version; PersistentVolumeClaim: custom_api_version; NetworkPolicy: custom_api_version; Pod: custom_api_version; Deployment: custom_api_version • Example 2: PersistentVolumeClaim: custom_api_version; NetworkPolicy: custom_api_version; Pod: custom_api_version; Deployment: custom_api_version • Example 3: PersistentVolumeClaim: custom_api_version; NetworkPolicy: custom_api_version
Namespaces	If at least one of the cloud accounts that you add to this cloud has admin privileges for the cloud (recommended), CloudCenter Suite will automatically find all namespaces in the cloud. You can leave this field blank. If none of your cloud accounts for this cloud have sufficient privileges to retrieve the list of namespaces in the cluster, use this field to manually enter the comma-separated list of namespaces.

When you are done editing the settings in the dialog box, click **Save**.

3. Scroll down to the **Region Connectivity** section for the region and click on the **Configure Region** link in the upper right to open the **Configure Region** dialog box. The toggle settings should be the same as when you set them on the connectivity page of the **Add Cloud** dialog box. If all of the connectivity toggles in the **Region Connectivity** dialog box are set to **Yes**, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.
4. If any of the connectivity toggles in the Region Connectivity dialog box are set to No, then you must install and configure Cloud Remote for this region. Since Cloud Remote is a VM-based appliance, when used to support a Kubernetes cloud it must be installed in a VM-based cloud region that is accessible from the Kubernetes cloud. Typically, this would be the same cloud region that hosts the nodes supporting the Kubernetes cloud. Choose the option that is appropriate for your Kubernetes target cloud:

Configure Cloud Remote in a vCenter Region for a Kubernetes Cloud

Configure Cloud Remote in a vCenter region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in vCenter

- a. From your local computer, download the Cloud Remote appliance OVA from software.cisco.com.

- b. Log in to the vCenter console using the vSphere web client with Flash, or with the vSphere Windows client. Do not use the HTML5 web client.
- c. Navigate to the folder or resource pool where you want to deploy the OVA. Right click on that resource pool or folder and select Deploy OVF Template.
- d. From the Deploy OVF Template dialog box, for Source, select Local file and click Browse to find the OVA file you downloaded in step 1.
- e. Complete the fields for Name and location, Host / Cluster, Resource Pool, Storage, and Disk Format appropriate for your environment.
- f. For the Network Mapping section, make sure to properly map the Management network (public) and VM Network network (private) to the appropriate network names in your environment.
- g. For the Properties section, make sure to check the box labeled Does the VM need a second interface? if the Cloud Remote appliance needs to be multi-homed on a public network and a private network.
- h. Confirm your settings and click Finish to launch the VM.
- i. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
- j. Once the first instance of the appliance has been launched, use the vSphere client to note its IP public and private addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
-----------------	-------	-------

Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.




Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

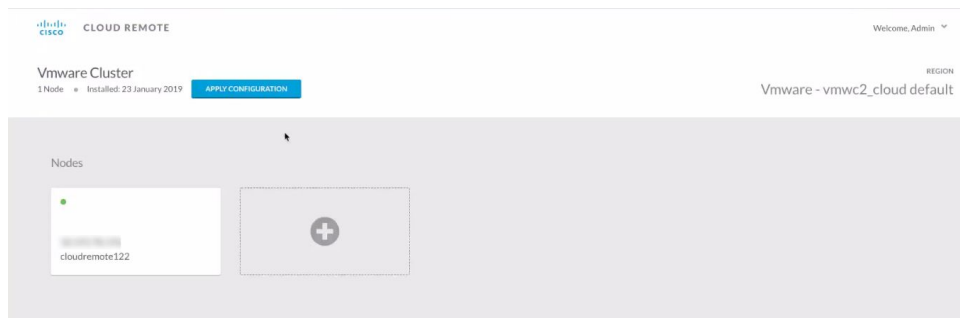


Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

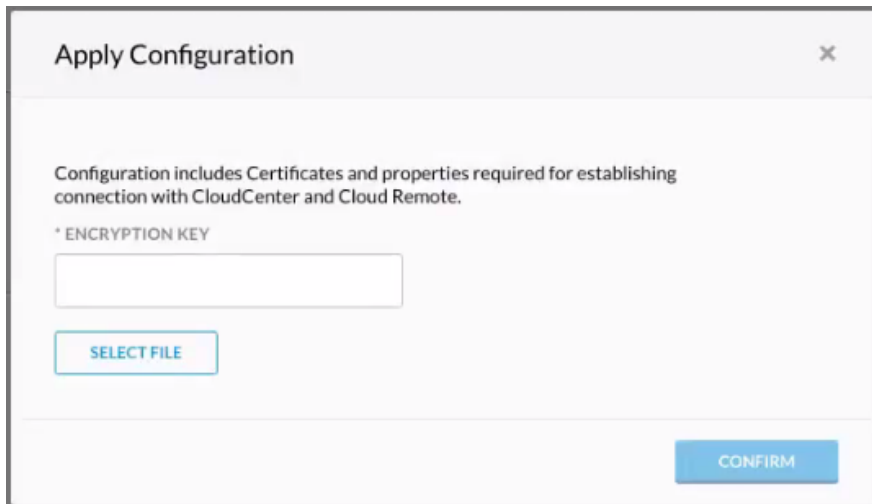
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

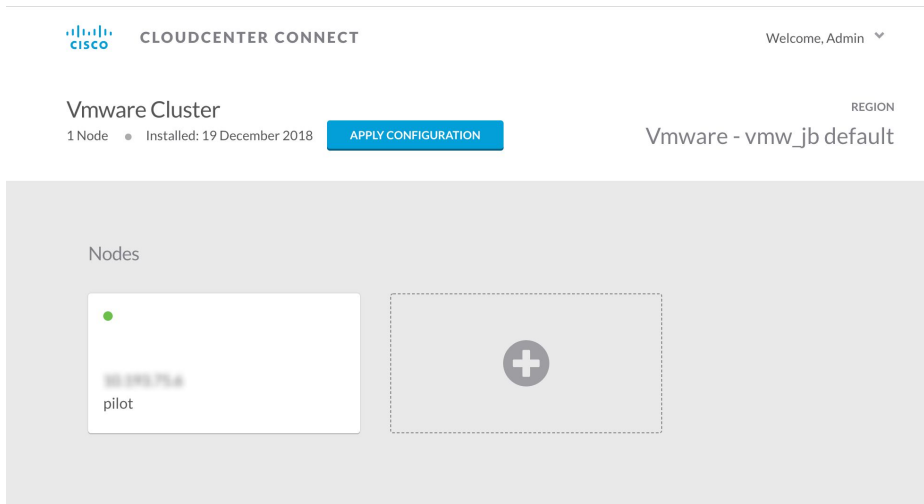
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



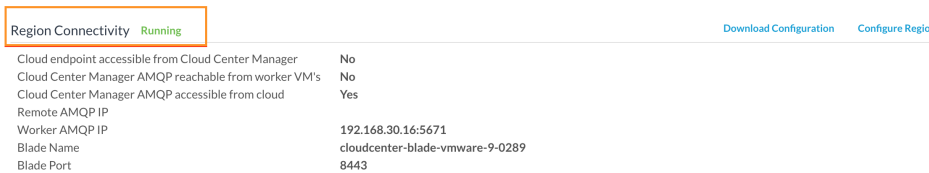
- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- g. Click **Confirm**.
- h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).



After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an OpenStack Region for a Kubernetes Cloud

Configure Cloud Remote in a OpenStack region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in OpenStack

- a. Download the Cloud Remote appliance qcow2 file from software.cisco.com.
- b. Through the OpenStack console, import and launch the Cloud Remote appliance. This process is similar to importing and launching the [CloudCenter Suite installer appliance for OpenStack](#).



Do not add 'Network Ports' while launching a Cloud Remote instance in OpenStack.

- c. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
- d. Once the first instance of the appliance has been launched, use the OpenStack console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
-----------------	-------	-------

Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

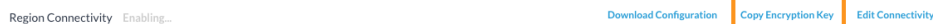
Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.




Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

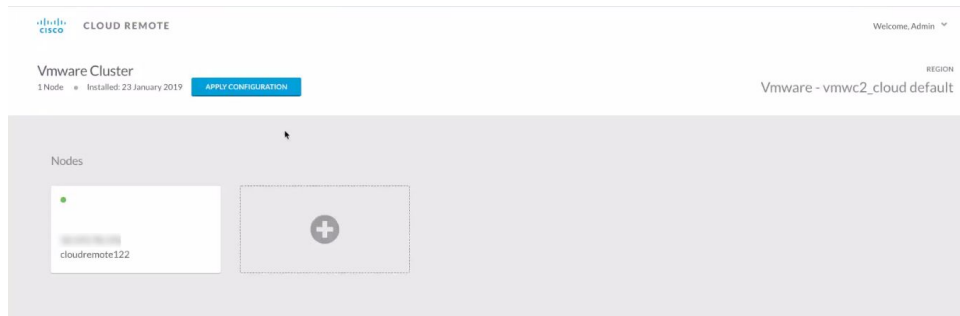


Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

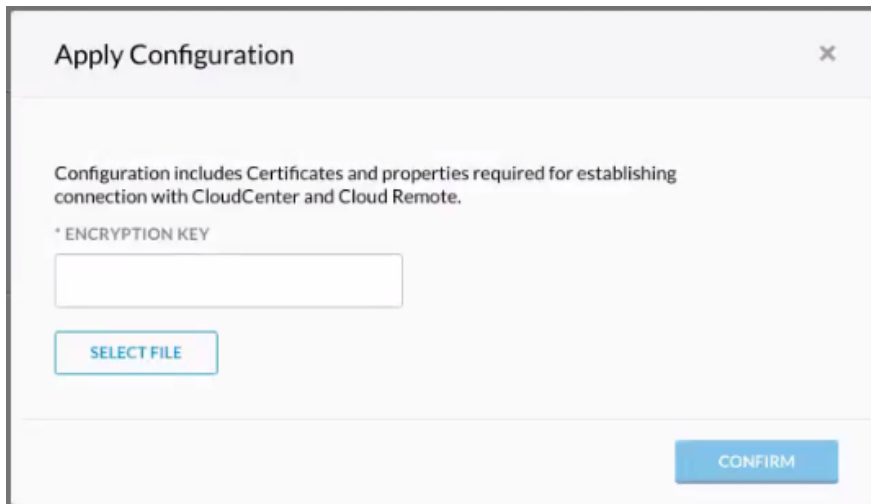
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

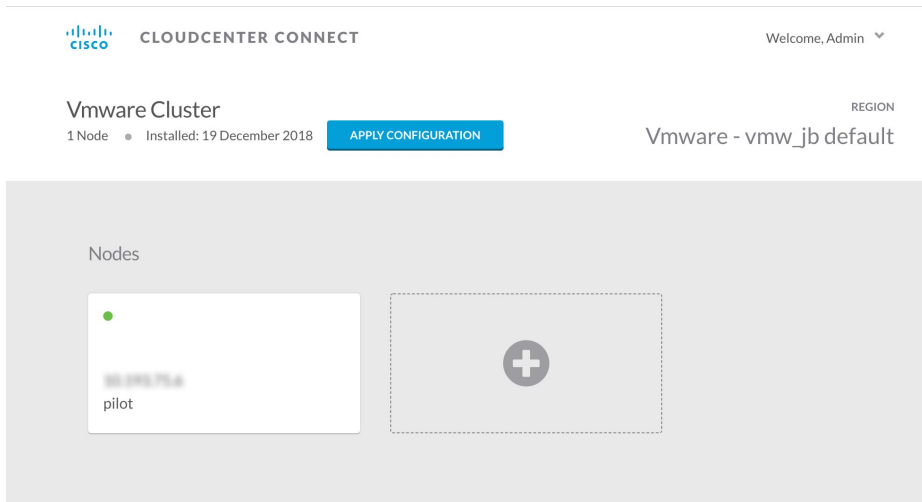
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- g. Click **Confirm**.
- h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an AWS Region for a Kubernetes Cloud

Configure Cloud Remote in an AWS region to support a Kubernetes target cloud as follows.

Obtain and Launch the Cloud Remote Appliance in AWS

- a. Obtain the Cloud Remote shared AMI from Cisco support and launch it. Follow the same guidance for obtaining and launching the [CloudCenter Suite installer appliance for AWS](#).

- b. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
- c. Once the first instance of the appliance has been launched, use your cloud console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other instances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	<p>Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).</p> <p>If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote.</p> <p>If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.</p>
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When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

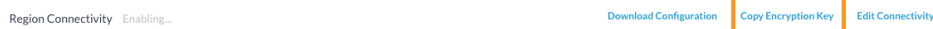
Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.




Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

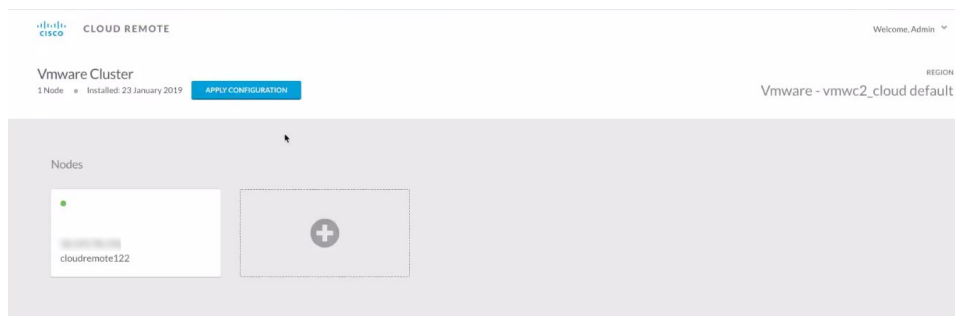


Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

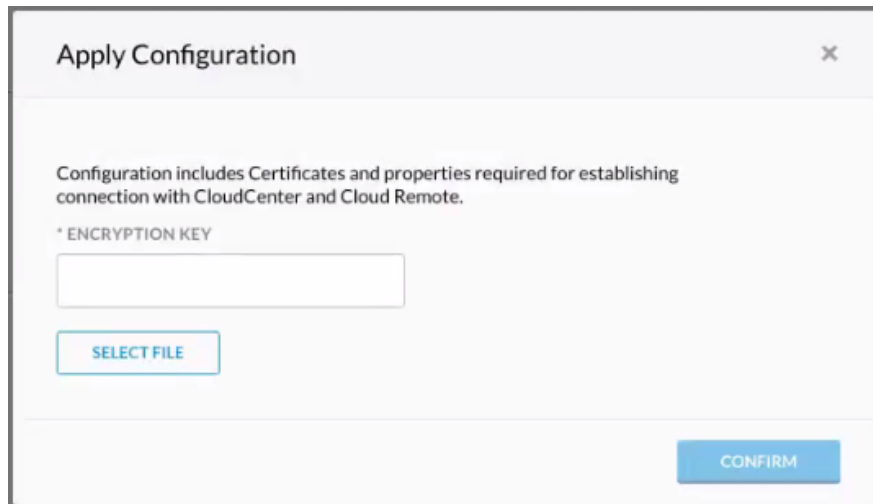
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

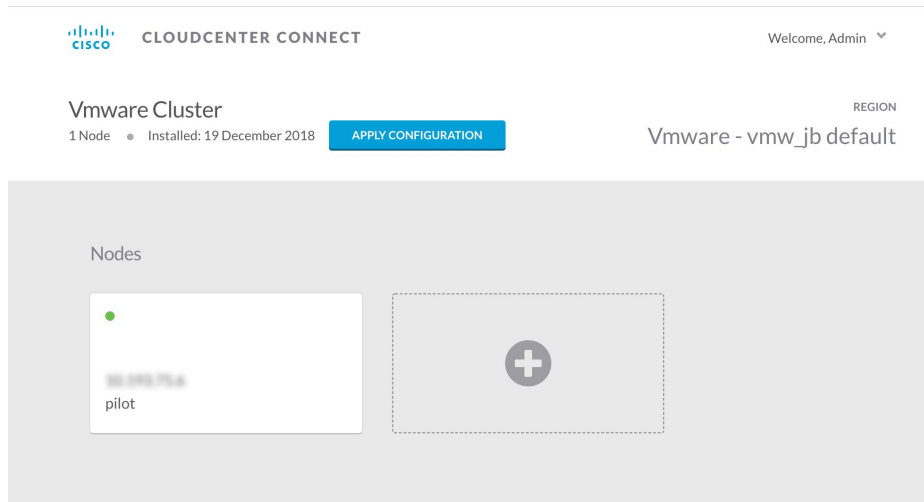
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		


After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an AzureRM Region for a Kubernetes Cloud

Configure Cloud Remote in an AzureRM region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in AzureRM

- Download the Cloud Remote appliance for AzureRM as zip file from software.cisco.com and then unzip it to reveal the VHD file.
- Upload the Cloud Remote appliance VHD file to AzureRM using the AzureRM CLI, then launch the appliance from the AzureRM console web UI. This process is similar to uploading and launching the [CloudCenter Suite installer appliance for AzureRM](#).

 You must use the AzureRM CLI to perform this upload.

- c. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
- d. Once the first instance of the appliance has been launched, use the AzureRM console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
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When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.




Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

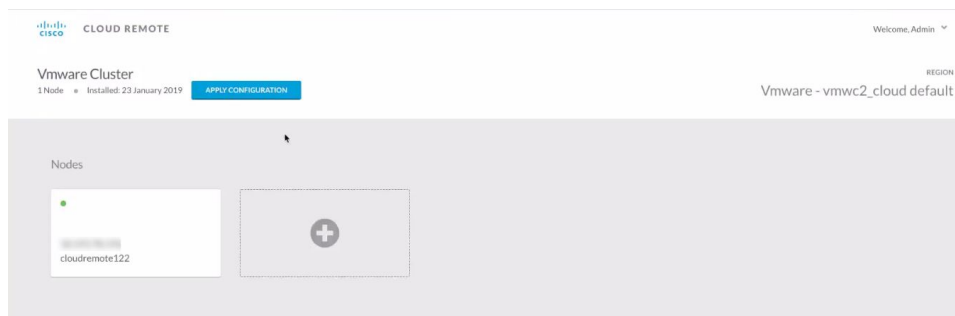


Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

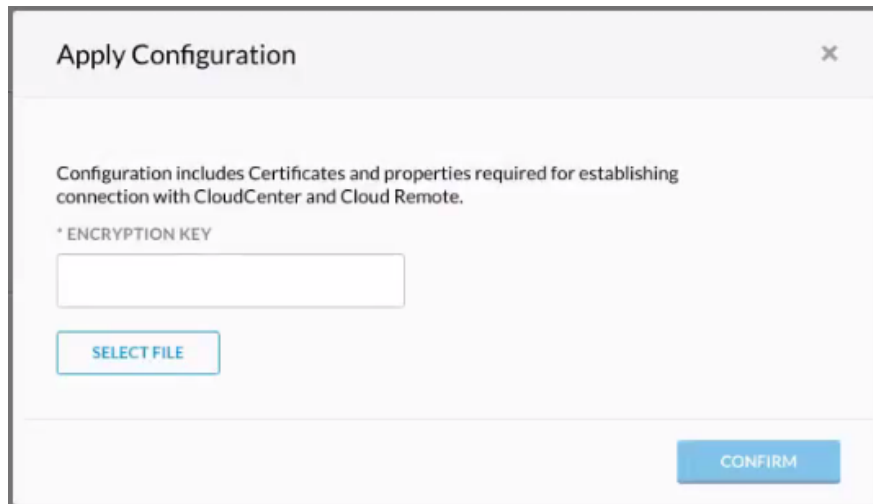
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

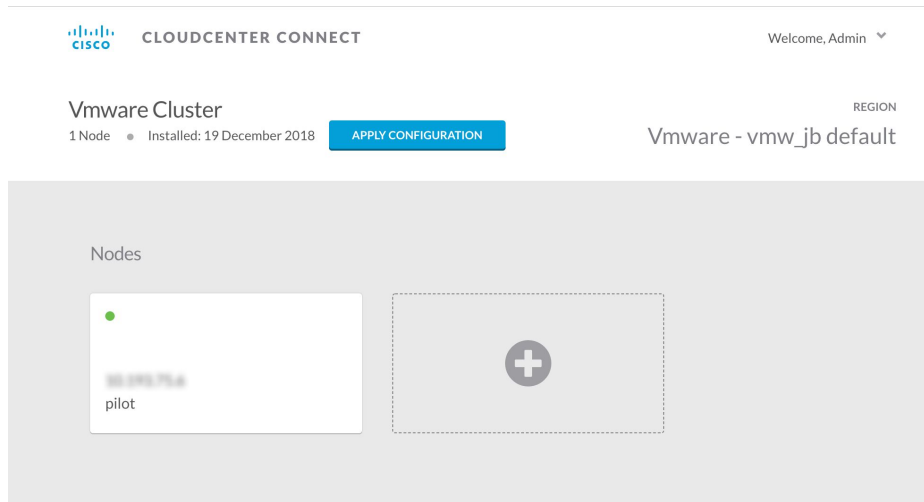
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- g. Click **Confirm**.
- h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

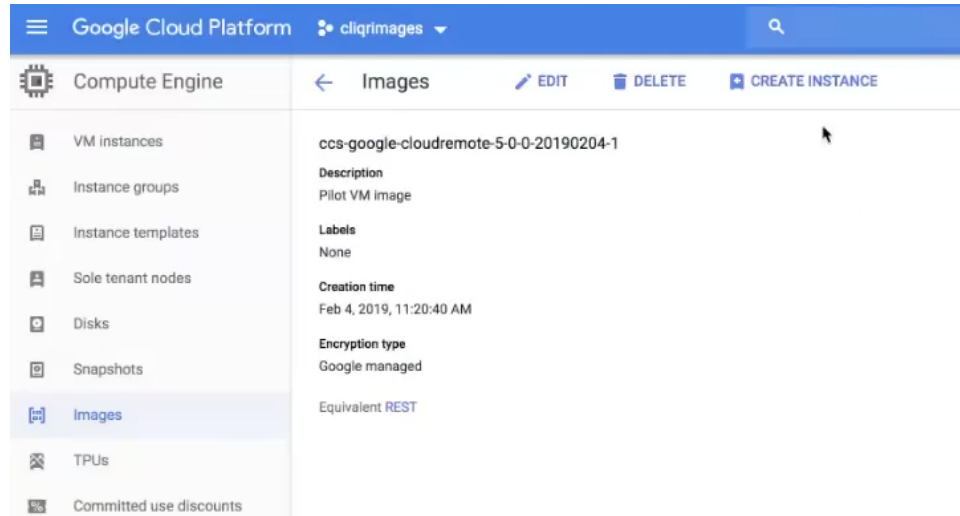
Configure Cloud Remote in a Google Region for a Kubernetes Cloud

Configure Cloud Remote in a Google region to support a Kubernetes target cloud as follows.

Obtain and Launch the Cloud Remote Appliance in Google

- a. Request the Cloud Remote shared VMI form Cisco support by opening a [CloudCenter Support case](#). In your request, specify the following details:
 - i. Your GCP account number

- ii. Your GCP project ID number
 - iii. Your CloudCenter Suite version
 - iv. Your Customer ID (CID)
 - v. Your customer name
 - vi. Specify if your setup is in production or for a POC
 - vii. Your Contact Email
- b. After you open a case, your support case is updated with the shared VMI ID. **Proceed to the next step only after your support case is updated with the VMI ID.**
- c. Navigate to the GCP dashboard and search for the VMI ID name provided in the [CloudCenter Support case](#) in the list of images for your project.
- d. Launch an instance using the shared VMI.
- i. Click on the image name. This takes you to the page for the image



- ii. Click on Create Instance to display the Instance properties page

Name ⓘ

instance-2

Region ⓘ **Zone** ⓘ

us-west1 (Oregon) ▼ us-west1-a ▼


Machine type
Customize to select cores, memory and GPUs.

1 vCPU ▼ 3.75 GB memory [Customize](#)

Container ⓘ

Deploy a container image to this VM instance. [Learn more](#)

Boot disk ⓘ

 New 30 GB standard persistent disk image
ccs-google-cloudremote-5-0-0-2019020... [Change](#)

Identity and API access ⓘ

Service account ⓘ

Compute Engine default service account ▼

Access scopes ⓘ

Allow default access
 Allow full access to all Cloud APIs
 Set access for each API

Firewall ⓘ

Add tags and firewall rules to allow specific network traffic from the Internet

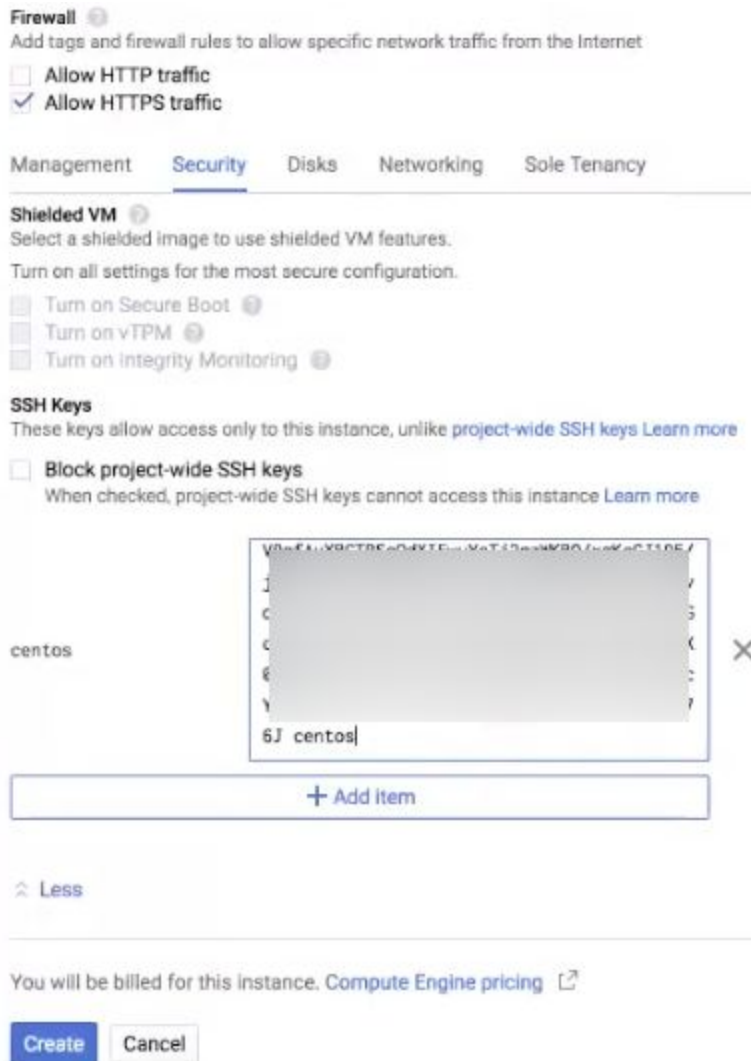
Allow HTTP traffic
 Allow HTTPS traffic

⌵ [Management, security, disks, networking, sole tenancy](#)

You will be billed for this instance. [Compute Engine pricing](#) ↗

iii. Complete these fields:

1. Instance name
2. Region and zone
3. Machine type: select 2 vCPU, 7.5 GB RAM
4. Click the checkbox to allow HTTPS access
5. Click the Security tab (under the Allow HTTPS traffic checkbox). In the SSH key field, add your organization's public ssh key followed by a space and then the username you want to use to login to the Cloud Remote appliance. Click the Add Item button when done.



- iv. Click Create to launch the instance.
- e. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote > Scaling](#) for details.
- f. Once the first instance of the appliance has been launched, use the GCP console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).

- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

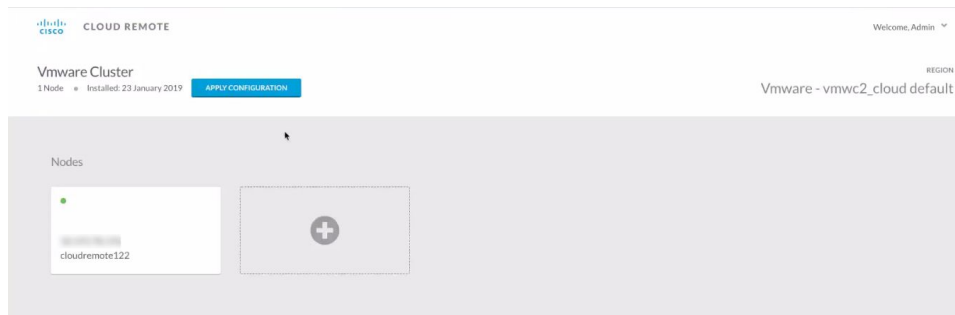


Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

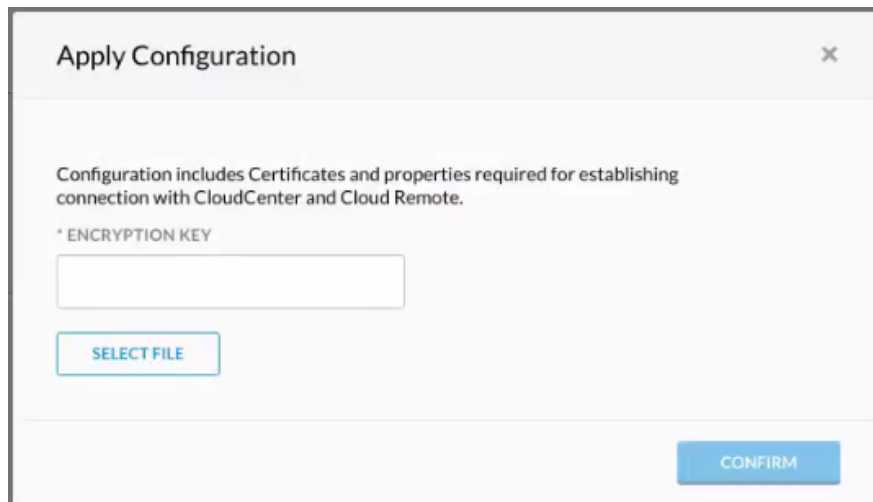
! If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

- Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).


Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

- Instance Types: A Kubernetes cloud region does not include any instance type out-of-box. You must manually add instance types to your Kubernetes cloud if you want Workload Manager to deploy jobs to it. See [Instance Types Settings](#) for more details.

Prerequisites

 Be aware that these screenshots may change based on the Kubernetes container changes. They are provided in this section as a point of reference.

Before adding a cloud account to a Kubernetes cloud in CloudCenter Suite, verify the following Kubernetes requirements:

- A valid Kubernetes service account.
- A **cluster-admin** cluster role binding exists on the API server (see the [Kubernetes Documentation](#)).
- A valid **Service Account Token**. You can retrieve the Service Account Token from Kubernetes using one of two methods:
 - Kubernetes Dashboard Method.*

1. Access the [Kubernetes web UI](#) and scroll the left menu bar down to Config and Storage and click **Secrets**. The list of secrets for the cluster is shown on the right panel:

Name	Type	Age
cisco-token-9ptfm	kubernetes.io/service-account-token	2 months
wordpress	Opaque	2 months
mysql-pass	Opaque	2 months
mysql	Opaque	3 months
default-token-j0qlx	kubernetes.io/service-account-token	3 months

2. Click the link corresponding to the **Service Account Token** to view the token details screen:

Details	
Name:	default-token-j0qlx
Namespace:	default
Annotations:	kubernetes.io/service-account.name: default kubernetes.io/service-account.uid: 67aaf3de-f668-11e7-8478-42010a8a0107
Creation Time:	2018-01-11T00:43 UTC
Type:	kubernetes.io/service-account-token

Data	
	ca.crt: 1119 bytes
	namespace: 7 bytes
	token: 846 bytes

3. Click the eyeball icon to the left of the token at the end of the Data section to reveal the token. Copy and paste to the **Service Account Token** field in the CloudCenter Suite's Add Cloud Account dialog box (see Configuration Process below).



The service account token must be in base64 format before pasting into the Add Cloud Accounts page. Retrieving the token from the Kubernetes Web UI assures this to be true.

- **The *kubect!* Command Method.**

1. Issue the following commands in sequence – the last command returns the token.

```
export NAMESPACE="default"

export SERVICE_ACCOUNT_NAME="bob-the-bot3"

kubectl create serviceaccount $SERVICE_ACCOUNT_NAME -n $NAMESPACE
serviceaccount "bob-the-bot3" created

kubectl create clusterrolebinding <name> --clusterrole=cluster-admin --
serviceaccount=$NAMESPACE:$SERVICE_ACCOUNT_NAME

export SECRET_NAME=$(kubectl get serviceaccount $SERVICE_ACCOUNT_NAME -n $NAMESPACE -o
'jsonpath={.secrets[0].name}' 2>/dev/null)

kubectl get secret $SECRET_NAME -n $NAMESPACE -o "jsonpath={.data.token}" | openssl enc -d -
base64 -
```

2. Copy and paste this token to the **Service Account Token** field in the CloudCenter Suite's Add Cloud Account dialog box (see Configuration Process below).

Configuration Process

To add a cloud account a Kubernetes cloud, follow this procedure.

1. Locate the Kubernetes cloud in the Clouds page and click the **Add Cloud Account** link. This displays the **Add Cloud Account** dialog box as shown in the figure below.

2. Assign a new cloud account name.



Tip

The name should not contain any space, dash, or special characters.

3. Add the following Cloud Credentials:

Field	Description
Service Account Name	The email address or username that you used to login to the Kubernetes cluster.
Service Account Token	The token used to access the Kubernetes service account as specified in the <i>Prerequisites</i> section above.

4. When done, click **Connect**. CloudCenter Suite will now attempt to validate your account credentials.
5. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure an OpenStack Cloud

Configure an OpenStack Cloud

Configuring an OpenStack cloud is a four-step process:

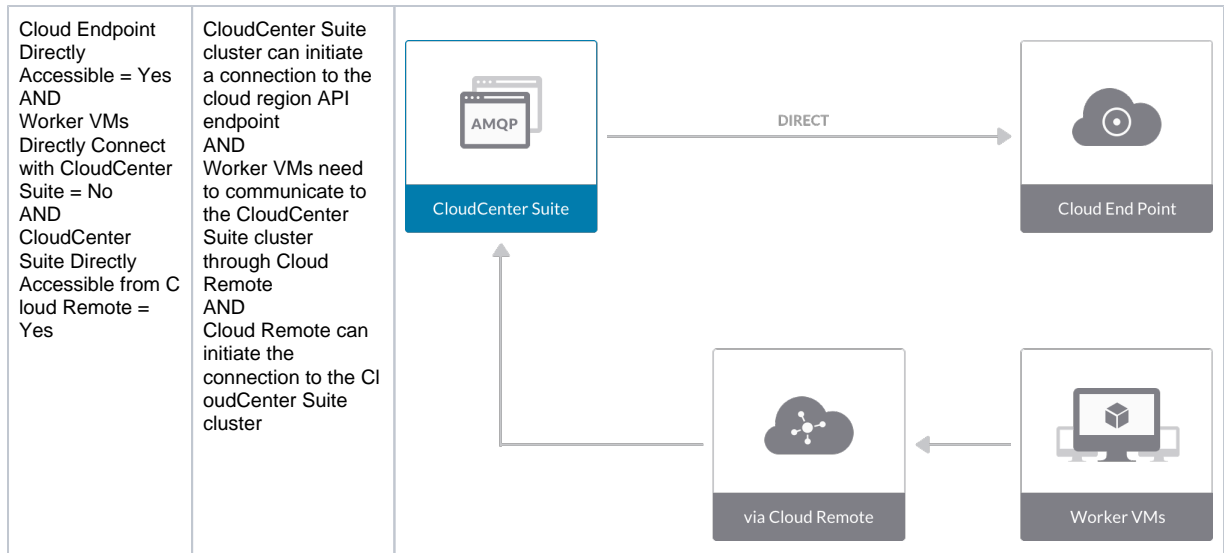
- [Add an OpenStack Cloud](#)
- [Add an OpenStack Region](#)
- [Configure an OpenStack Region](#)
- [Add an OpenStack Cloud Account](#)

To add an OpenStack cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the **Clouds** page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here.
2. Click the **Add Cloud** link in the upper right. The **Add Cloud** dialog box is displayed.
3. Enter the **cloud name** and select the **cloud provider**. When done click **Next**. The second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle switches to configure the Cloud Connectivity Settings.
 - When adding a private VM cloud in the in the Workload Manager or Cost Optimizer UI, the second page of the Add Clouds dialog box, Connectivity Settings, appears with a two toggles displayed:
 - **Worker VMs Directly Connect with CloudCenter Suite**
 - **VMs Directly Connect with CloudCenter Suite**
 - Setting either of these toggles to No implies you will install Cloud Remote for each region of this cloud. This also causes a third toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
 - Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Network Diagram
Cloud Endpoint Directly Accessible = Yes AND VMs Directly Connect with CloudCenter Suite = Yes	CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint AND Worker VMs can initiate a connection to the CloudCenter Suite cluster Cloud Remote is not required	<p>The network diagram illustrates a direct connection setup. On the left, a box labeled 'CloudCenter Suite' contains an 'AMQP' icon. On the right, there are two boxes: 'Cloud End Point' (top) and 'Worker VMs' (bottom). A horizontal arrow labeled 'DIRECT' points from the CloudCenter Suite box to the Cloud End Point box. Another horizontal arrow labeled 'DIRECT' points from the Worker VMs box to the CloudCenter Suite box.</p>

<p>Cloud Endpoint Directly Accessible = No AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes</p>	<p>CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] --> CR[via Cloud Remote] CR --> CE[Cloud End Point] W[Worker VMs] --> CR CR --> W </pre>
<p>Cloud Endpoint Directly Accessible = No AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] --> CR[via Cloud Remote] CR --> CE[Cloud End Point] W[Worker VMs] --> CR CR --> W </pre>
<p>Cloud Endpoint Directly Accessible = Yes AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] -- DIRECT --> CE[Cloud End Point] W[Worker VMs] --> CR[via Cloud Remote] CR --> CC </pre>



Note

The connectivity toggle settings set at the cloud level are inherited by each region you add to this cloud. However, it is possible to override these toggle settings on a per region basis from the Regions tab for each region.

- Click **Done** to save the configuration and close the dialog box. This brings you back to the **Clouds** page and the cloud you just created will be added to the bottom of the list on the left side of the page.

After creating an OpenStack cloud, the next step is to create the first region for the cloud. Follow these steps.

- Navigate to the **Clouds** page and select the cloud you created on the left side of the screen.
- Click the **Add Region** button on the right side of the screen. The **Add Region** dialog box is displayed.
- Enter a **Region Name** and **Display Name**.
- Click **Save**. You are brought to the **Clouds** page with the region you added shown on the right side of the page.

To configure a region you added to your OpenStack cloud, perform the following steps.

- Navigate to Clouds page: **Admin > Clouds** to find your OpenStack cloud from the cloud list on the left half of the screen
- Click its **Configure Cloud** link. This displays the **Regions** tab for this cloud as shown in the figure below with the **Cloud Settings** section displayed first. After you have added multiple regions to your OpenStack cloud, the **Regions** tab will show multiple individual region tabs on the left side of the screen.

The screenshot shows the configuration page for a region named 'r1'. The top section shows the cloud 'os3' with a 'Not Ready' status and a warning message: 'No Cloud Account has been added. Add a cloud account.' Below this, the 'Regions' tab is active, showing 'r1' with a 'Region: Running' status. The 'Cloud Settings' section is expanded, listing various configuration options for the region 'r1'.

Region	r1
OpenStack Keystone API version	
OpenStack Keystone Authentication Endpoint	
Additional Ports for Openstack endpoints	8774,9292,8776,9696
Exclude these special characters for Windows password	
Use Config Drive	
Nodes Per Batch	
Bootable Volume Mapping Required	
Agent Bundle URL	
Agent Custom Repository	
HTTPS Proxy Host	
HTTPS Proxy Port	
HTTPS Proxy Username	
HTTPS Proxy Password	
HTTP Proxy Host	
HTTP Proxy Port	
HTTP Proxy Username	
HTTP Proxy Password	
No Proxy Hosts	

- Click the tab of the region you want to configure.

4. Click the **Edit Cloud Settings** link in the upper right of the **Cloud Settings** section. This opens the **Configure Cloud Settings** dialog box. The **Cloud Settings** section contains fields that are unique to OpenStack and settings that are common to all cloud providers. Adjust these field values per the instructions in the following tables.

OpenStack Specific Cloud Settings

Field	Usage
Region	This is a read-only field based on the region name you entered when you created this region.
OpenStack Keystone API version	The default value is V2. Use the dropdown menu to change this to V3 if your version of OpenStack supports the V3 API.
OpenStack Keystone Authentication Endpoint	Enter the URL of your OpenStack API endpoint.
Additional Ports for OpenStack endpoints	These are pre-populated with the standard ports for communication between the OpenStack API and Workload Manager. Only change these values if you have a non-standard network configuration for OpenStack.
Use Config Drive	This is unchecked by default. Check this box if your deployments need to use configdrive .
Nodes Per Batch	This is the maximum number of VMs that can be launched simultaneously per application deployment. If left blank, the default value of 1 is applied. A value of 0 or 1 both means only one VM will be launched at a time.
Bootable Volume Mapping Required	Default means no mapping. You only need to change this field if OpenStack is configured along with a third-party infrastructure that is not visible to Workload Manager.

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.
HTTP /HTTPS proxy fields (host, username, password)	If you require VMs in your region to access public addresses through a web proxy, enter the URL and credentials of the HTTP and HTTPS proxy servers in these fields.
No Proxy Hosts	If you have specified an HTTP or HTTPS proxy using the above fields, you can specify that managed VMs in the region should bypass the proxy and connect directly to certain hosts. Use this field to create a comma-separated list of IP addresses or URLs that should be accessed directly. This field is ignored if an HTTP or HTTPS proxy is not specified.



Important information on proxy settings

In CloudCenter Suite it is possible to specify proxy settings at the region level, as described here, and at the [suite level](#). To understand the expected behavior when proxy settings are specified at both levels, see [Precedence of Proxy Settings](#).

Download Configuration and Encryption Key

After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you can download them to your local computer and then upload them to other conditional components such as Cloud Remote.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the following screenshot.

Region Connectivity Running

[Download Configuration](#)

[Configure Region](#)

Clicking **Download Configuration** causes two things to happen:

- An encrypted zip file named **artifacts.zip** is downloaded by your browser. Make a note of the location of this zip file as you will need if you are using Cloud Remote.
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in the following screenshot.

Region Connectivity Enabling... Download Configuration **Copy Encryption Key** Edit Connectivity

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to conditional components like Cloud Remote.

If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file from software.cisco.com, use the automatically create (new) encryption key, and copy the key to the clipboard by clicking the **Copy Encryption Key** link again.

When you are done editing the settings in the dialog box, click **Save**.

5. Determine if you need Cloud Remote for this region. Scroll down to the Region Connectivity section for the region and click on the **Configure Region** link in the upper right to open the **Configure Region** dialog box. The toggle settings should be the same as when you set them on the connectivity page of the **Add Cloud** dialog box. If all of the connectivity toggles in the **Region Connectivity** dialog box are set to **Yes**, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the Region Connectivity dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.

6. If any of the connectivity toggles in the **Region Connectivity** dialog box are set to No, then **you must install and configure Cloud Remote for this region**.

Configure Cloud Remote in an OpenStack Region

Configure Cloud Remote in an OpenStack region as follows.

Download and Launch the Cloud Remote Appliance in OpenStack

- a. Download the Cloud Remote appliance `qcw2` file from software.cisco.com.
- b. Through the OpenStack console, import and launch the Cloud Remote appliance. This process is similar to importing and launching the [CloudCenter Suite installer appliance for OpenStack](#).



Do not add 'Network Ports' while launching a Cloud Remote instance in OpenStack.

- c. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
- d. Once the first instance of the appliance has been launched, use the OpenStack console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

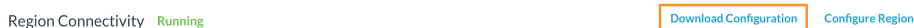
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



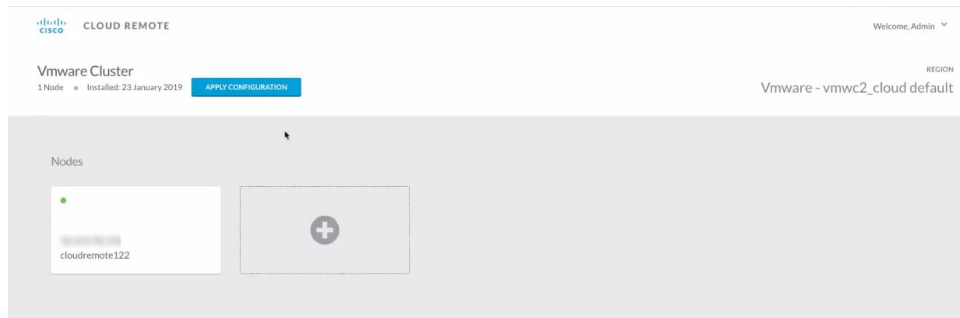
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



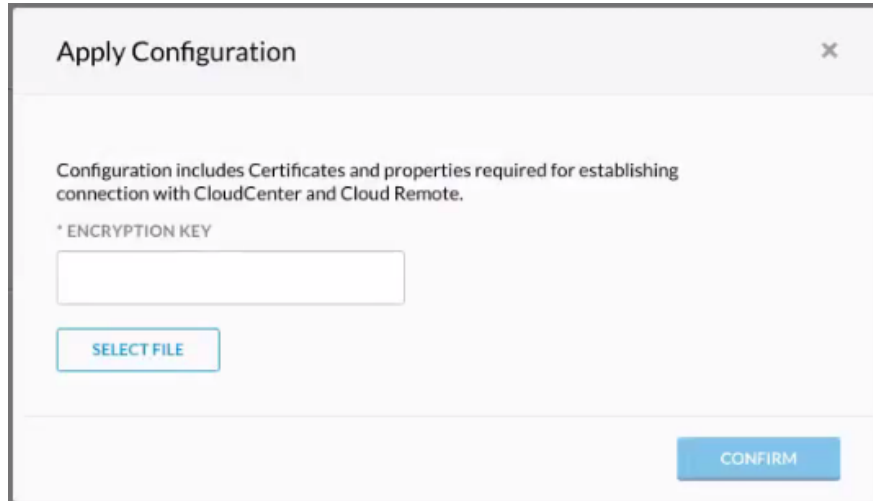
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

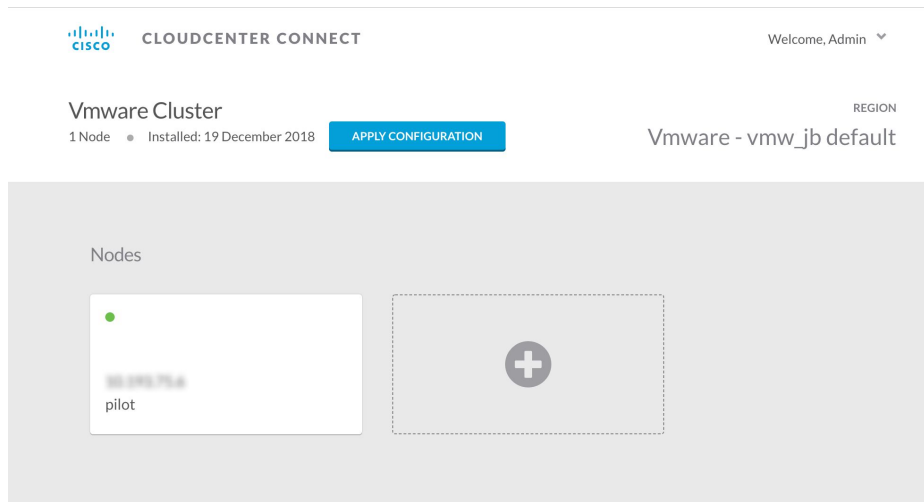
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- d. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
 f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
 g. Click **Confirm**.
 h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

7. VM Naming and IPAM Strategy (conditional): Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
8. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
9. Instance Types: For OpenStack clouds, you can sync all instance types (flavors) defined in OpenStack to CloudCenter Suite on demand. To manually sync OpenStack instance types, click the **Sync Instance Types** link in the upper right of the instances types section. Alternatively, you can manually add instance types, one by one, by clicking the **Add Instance Types** link in the upper right of the instances types sections. If you add an instance type manually, you must ensure that the instance ID you enter in CloudCenter Suite exactly matches the corresponding flavor ID in OpenStack. Furthermore, during application deployment, the CPU, RAM and storage parameters defined in the OpenStack flavor will override any of the corresponding parameters defined in CloudCenter Suite. See [Instance Types Settings](#) for more details.
10. Storage Types (conditional): For private VM-based clouds like OpenStack, CloudCenter Suite uses storage types for cost tracking purposes. CloudCenter Suite creates a default storage type with zero cost. You would manually edit this storage type to enter your own cost factor. You can optionally add more storage types to your OpenStack region. See [Storage Types Settings](#) for more details.
11. Image Mappings: Image mappings allow services based on CloudCenter Suite logical images to be deployed using the appropriate physical image stored on the target cloud region. You must manually import these physical images into your OpenStack region and then map the appropriate CloudCenter Suite logical images to these physical images. See [Images](#) for more context.

Prerequisites

Among the two OOB user roles in OpenStack – admin and member – member permissions are sufficient to perform all functions in Workload Manager and Cost Optimizer. In addition, more gradual permission can be set in the configuration files of the appropriate OpenStack components per the following table.

OpenStack Module	Minimum permissions needed by Workload Manager	Minimum permissions needed by Cost Optimizer
Compute	<pre> compute:get compute:get_all compute:get_all_tenants compute:get_instance_metadata compute:get_all_instance_metadata compute:get_all_instance_system_metadata compute:create compute:start compute:stop compute:reboot compute:delete compute:resize compute:attach_volume compute:detach_volume compute_extension:keypairs:create compute_extension:keypairs:delete compute:security_groups:add_to_instance compute:security_groups:remove_from_instance </pre>	<pre> compute:get compute:get_all compute:get_all_tenants compute:get_instance_metadata compute:get_all_instance_metadata compute:get_all_instance_system_metadata </pre>
Network	<pre> get_network get_subnet network:get_all </pre>	<pre> get_network get_subnet network:get_all </pre>

Block Storage	<pre> volume:get volume:get_all volume:create volume:delete </pre>	<pre> volume:get volume:get_all </pre>
Identity	<pre> identity:list_user_projects identity:get_user identity:list_users identity:list_projects </pre>	<pre> identity:list_user_projects identity:get_user identity:list_users identity:list_projects </pre>
Image	<pre> get_image get_images delete_image download_image add_image add_member delete_member </pre>	<pre> get_image get_images </pre>

Configuration Process

To add an OpenStack cloud account, follow this procedure.

1. Locate the OpenStack cloud you created on the Clouds page and click **Add Cloud Account**. This displays the Add Cloud Account dialog box as shown in the figure below.

Add Cloud Account

Name *

Description

Cloud Credentials

OpenStack User Name *

User Name associated with your OpenStack account

OpenStack Account Password *

Default Domain Name (V3)

Default Domain Id (V3)

2. Assign a new cloud account **Name**.



Tip

The name should not contain any space, dash, or special characters.

3. Provide the OpenStack user credentials: **OpenStack User Name** and **OpenStack Account Password**.
4. Scroll the **Add Cloud Account** dialog box down to reveal the remaining four input fields as shown in the figure below.

Populate these four optional fields per the table below.

Cloud Account Details	Description
Default Domain Name (V3)	These two fields are optional. When you add an OpenStack cloud account, you can choose V2 or V3 OpenStack endpoints: <ul style="list-style-type: none"> • Not required if you use V2 • If you use V3, provide either the default Domain ID or Default Domain Name. • The cloud region setting validates the region.
Default Domain ID (V3)	
Default Tenant Name (V3 Project Name)	Optional. The OpenStack project name.
Default Domain ID (V3 Project ID)	Optional. If set, the Default Tenant ID (OpenStack setting in CloudCenter Suite) has precedence over the Default Tenant Name.

5. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
6. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure a vCD Cloud

Configure a vCD Cloud

Configuring a vCD cloud is a four-step process:

- [Add a vCD Cloud](#)
- [Configure a vCD Region](#)
- [Add a vCD Cloud Account](#)

To add a vCD cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here.
2. Click the **Add Cloud** link in the upper right. The **Add Cloud** dialog box is displayed.
3. Enter the **cloud name**, select the **cloud provider**, then click **Next**. The second page of the **Add Clouds** dialog box, **Connectivity Settings**, appears. Set the toggle switches to configure the Cloud Connectivity settings.
 - When adding a private VM cloud in the Workload Manager or Cost Optimizer UI, the second page of the Add Clouds dialog box, Connectivity Settings, appears with two toggles displayed:
 - **Worker VMs Directly Connect with CloudCenter Suite**
 - **VMs Directly Connect with CloudCenter Suite**
 - Setting either of these toggles to No implies you will install Cloud Remote for each region of this cloud. This also causes a third toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
 - Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Network Diagram
Cloud Endpoint Directly Accessible = Yes AND VMs Directly Connect with CloudCenter Suite = Yes	CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint AND Worker VMs can initiate a connection to the CloudCenter Suite cluster Cloud Remote is not required	
Cloud Endpoint Directly Accessible = No AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes	CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster	

<p>Cloud Endpoint Directly Accessible = No</p> <p>AND</p> <p>Worker VMs Directly Connect with CloudCenter Suite = No</p> <p>AND</p> <p>CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint</p> <p>AND</p> <p>Worker VMs cannot initiate a connection to the CloudCenter Suite cluster</p> <p>AND</p> <p>Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	
<p>Cloud Endpoint Directly Accessible = Yes</p> <p>AND</p> <p>Worker VMs Directly Connect with CloudCenter Suite = No</p> <p>AND</p> <p>CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint</p> <p>AND</p> <p>Worker VMs cannot initiate a connection to the CloudCenter Suite cluster</p> <p>AND</p> <p>Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	
<p>Cloud Endpoint Directly Accessible = Yes</p> <p>AND</p> <p>Worker VMs Directly Connect with CloudCenter Suite = No</p> <p>AND</p> <p>CloudCenter Suite Directly Accessible from Cloud Remote = Yes</p>	<p>CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint</p> <p>AND</p> <p>Worker VMs need to communicate to the CloudCenter Suite cluster through Cloud Remote</p> <p>AND</p> <p>Cloud Remote can initiate the connection to the CloudCenter Suite cluster</p>	

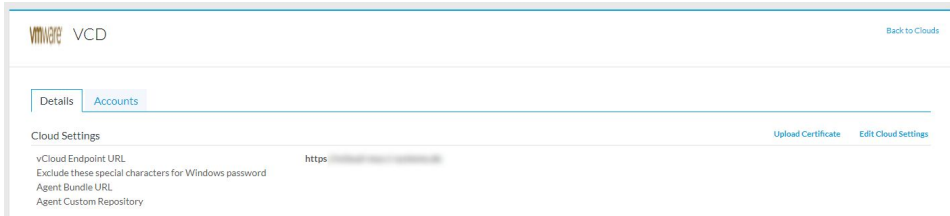
Note

The connectivity toggle settings set at the cloud level are inherited by each region you add to this cloud. However, it is possible to override these toggle settings on a per-region basis from the Regions tab for each region.

- Click **Done** to save the configuration and close the dialog box. This brings you back to the Clouds page and the cloud you just created will be added to the bottom of the list on the left side of the page.

A vCD cloud has one region that you configure from the vCD cloud Details tab. Follow this procedure.

1. Navigate to Clouds page: **Admin > Clouds**. Find your newly created vCD cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the Details tab for this cloud as shown in the figure below.



2. Upload a TLS certificate to the vCD system by clicking the **Upload Certificate** link and then using the dialog box to select a file from your PC.
3. Click **Edit Cloud Settings** to open the **Configure Cloud Settings** dialog box. The Cloud Settings section contains fields that are unique to the vCD cloud family and settings that are common to all cloud families. Adjust these field values per the instructions in the following tables.

vCD Specific Cloud Settings

Field	Usage
vCD API Endpoint	Address used by Workload Manager to deploy and manage deployment in the vCD cloud

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.

When you are done editing the settings in the dialog box, click **Save**.

4. Determine if you need Cloud Remote for this region. Scroll down to the Region Connectivity section for the region and click on the **Configure Region** link in the upper right to open the Configure Region dialog box. The toggle settings should be the same as when you set them on the connectivity page of the Add Cloud dialog box. If all of the connectivity toggles in the Region Connectivity dialog box are set to Yes, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the Region Connectivity dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

5. Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.
6. If any of the connectivity toggles in the Region Connectivity dialog box are set to No, then you must install and configure Cloud Remote for this region.

Configure Cloud Remote in a vCD Region

Configure Cloud Remote in a vCD region as follows.



Since CloudCenter Suite does not include a prebuilt appliance for Cloud Remote for vCD, the following procedure includes steps to build the Cloud Remote appliance from the Cisco-supplied Cloud Remote installer file.

Launch Cloud Remote Built from the Installer File

- a. Launch a Centos 7 instance, ensure the prerequisites are installed, and run the Cloud Remote installer file:

Build a Cloud Remote Appliance Using the Installer File

- i. Download the Cloud Remote installer file from software.cisco.com. The file name will be in a format similar to "cloudRemote5.1.0-20190614.0.bin".
- ii. **Launch a CentOS 7 instance in your target cloud. The instance should have as a minimum 2 vCPUs, 8 GB Memory, and 30 GB storage. Once launched, use your cloud console to note the instance's public and/or private IP addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI.**
- iii. Login to the instance and ensure all of the yum installed packages are up to date by executing the `yum update` command.

```
sudo yum update
```

- iv. If your instance's kernel version is 7.0 or greater, reboot your instance and skip to the next step. Otherwise, execute the following commands to install the 7.0 Linux kernel and reboot the instance:

```
sudo rpm --import https://www.elrepo.org/RPM-GPG-KEY-elrepo.org
sudo rpm -Uvh http://www.elrepo.org/elrepo-release-7.0-3.el7.elrepo.noarch.rpm
sudo yum --disablerepo='*' --enablerepo='elrepo-kernel' list available
sudo yum --enablerepo=elrepo-kernel -y install kernel-ml
sudo grub2-set-default 0
sudo grub2-mkconfig -o /boot/grub2/grub.cfg
sudo reboot
```

- v. After the instance completes its reboot, login to the instance again and use the `scp` command to copy the Cloud Remote installer file from your PC to the instance.
- vi. From the directory where you copied the installer file, run the installer:

```
./<cr_installer_bin> -- --host-ip <cr_private_ip>
```

Replace `<cr_installer_bin>` with the installer file name, and replace `<cr_private_ip>` with the private IP of the instance assigned by the cloud provider.



Note

The installer bin file is a self extracting installer. Therefore, it is important to include " -- " between the installer file name and the command option: "--host-ip".

- vii. When the installer completes successfully, you will see an appropriate success message on the VM's console. If you see an error message about the kernel not being of a late enough version, repeat the step above to install the version 7.0 kernel. If you receive an error message about any yum package being out of date, repeat the step above to update all yum installed packages.

- b. Optional but recommended for production environments: Repeat the step above twice to create two additional instances of the appliance to be used to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



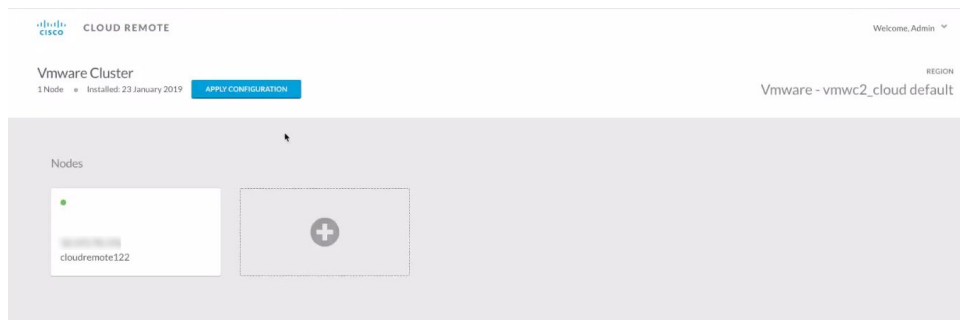
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



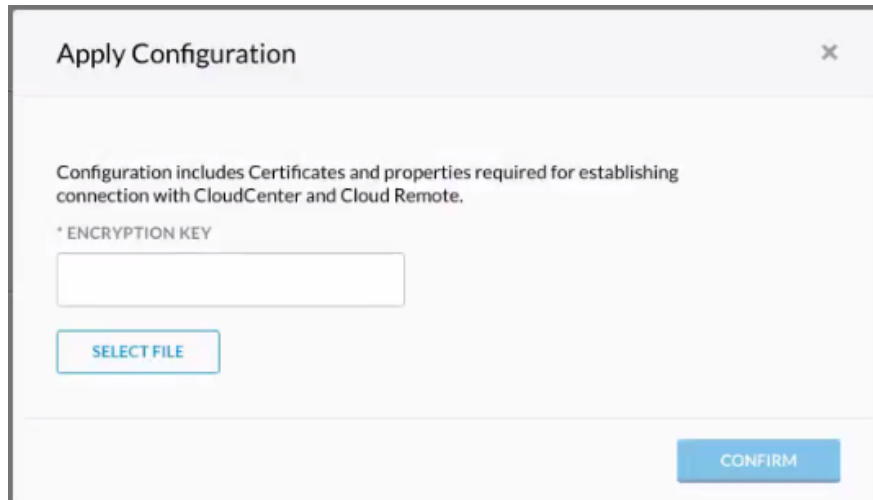
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

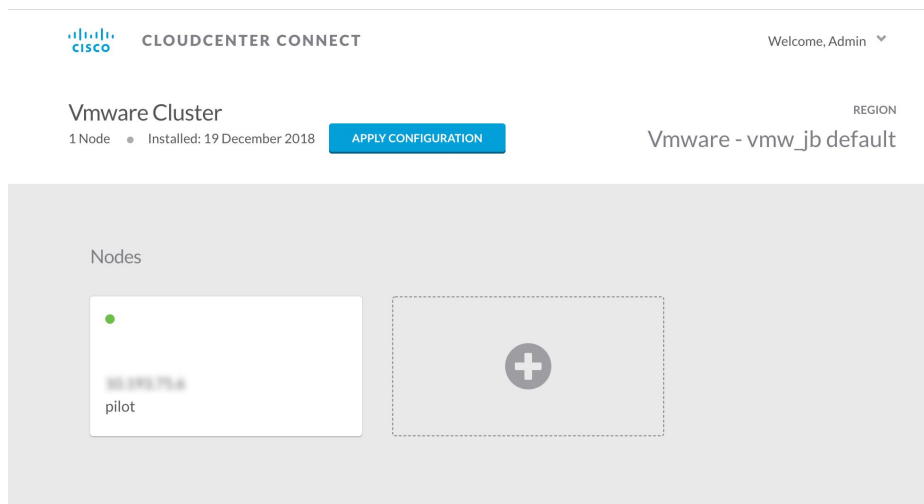
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- d. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
 f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
 g. Click **Confirm**.
 h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

7. VM Naming and IPAM Strategy (conditional): Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
8. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
9. Instance Types (conditional): A vCD cloud region includes one "default" instance type with 1 vCPU, 1 vNIC, 1024 MB RAM, and no additional disk storage. CloudCenter Suite will also automatically create instance types based on the parameters of VMs you deploy from within vCD. You would manually add more instance types to your vCD region if you want Workload Manager to deploy jobs to this region with differently sized instance types. See [Instance Types Settings](#) for more details.
10. Storage Types (conditional): For private VM-based clouds like vCD, CloudCenter Suite uses storage types for cost tracking purposes. CloudCenter Suite creates a default storage type with zero cost. You would manually edit this storage type to enter your own cost factor. You can optionally add more storage types to your vCD region. See [Storage Types Settings](#) for more details.
11. Image Mappings: Image mappings allow services based on Workload Manager logical images to be deployed using the appropriate physical image stored on the target cloud region. You must manually import these physical images into your vCD region and then map the appropriate Workload Manager logical images to these physical images. See [Images](#) for more context.

Prerequisites

For Workload Manager to deploy jobs in vCD using a particular user account, that account must have the permissions identified in the table below.

vCD Object	Required Permission	Reason
Network	Assign Network	If the default network in a template/snapshot must be changed
Datastore	Allocate space	For persistent disk operation
	Browse datastore	
	Low-level file operations	
	Remove file	
Folder	Create folder	For user folder creation
Resource	Apply recommendation	For datastore cluster support
	Assign VM to resource pool	For resource pool selection
Tasks	Create task	For VM operation
	Update task	
Virtual Machine	All permissions	
Global Role	Set Custom Attributes	To add custom attributes on virtual machines
	Manage Custom Attributes	

Configuration Process

To add a vCD cloud account, follow this process:

1. Locate the vCD cloud in the Clouds page and click **Add Cloud Account** button. This will display the **Add Cloud Account** dialog box as shown in the figure below.

2. Assign a new cloud account **Name**.

**Tip**

The name should not contain any space, dash, or special characters.

3. Provide the vCD cloud account credentials: **vCloud Organization Name**, **vCloud User Name**, and **Password**.
4. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
5. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

 - b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
 - c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Configure a vCenter Cloud

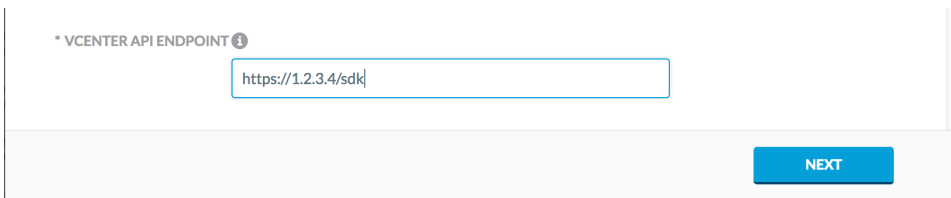
Configure a vCenter Cloud

Configuring a vCenter cloud is a three-step process:

- [Add a vCenter Cloud](#)
- [Configure a vCenter Region](#)
- [Add a vCenter Cloud Account](#)

To add a vCenter cloud follow these steps.

1. Navigate to **Admin > Clouds**. This brings you to the Clouds page. If you, or another tenant admin in your tenant, have already added clouds to your tenant, they will be listed here.
2. Click the **Add Cloud** link in the upper right. The **Add Cloud** dialog box is displayed.
3. Enter the **cloud name** and select the **cloud provider**.
4. Since you are selecting select a vCenter cloud provider, a new data entry field appears at the bottom of the dialog box called **vCenter Region Endpoint**, as shown in the figure below. You must enter the URL of the vCenter API endpoint in this field before the **Next** button is enabled.
5. When done click **Next**. The second page of the **Add Clouds** dialog box, Connectivity Settings, appears. Set the toggle switches to configure the Cloud Connectivity settings.



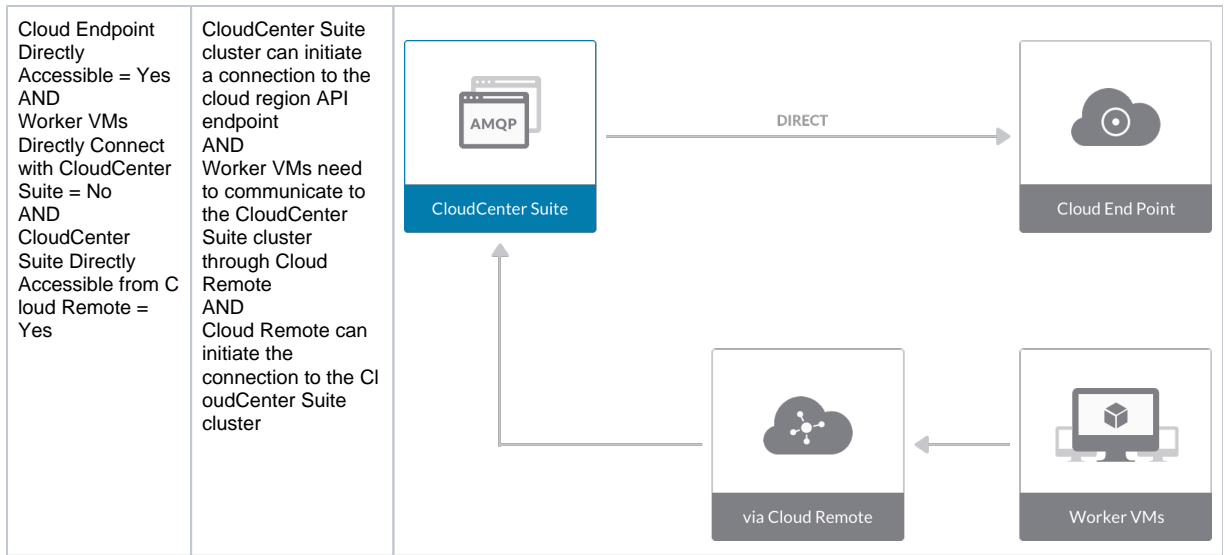
Note

For vCenter clouds, by default, the region endpoint URL is in the format:
 https://<vCenter_dns_name_or_IP>/sdk

- When adding a private VM cloud in the in the Workload Manager or Cost Optimizer UI, the second page of the Add Clouds dialog box, Connectivity Settings, appears with a two toggles displayed:
 - **Worker VMs Directly Connect with CloudCenter Suite**
 - **VMs Directly Connect with CloudCenter Suite**
- Setting either of these toggles to No implies you will install Cloud Remote for each region of this cloud. This also causes a third toggle to appear: **CloudCenter Suite Directly Accessible from Cloud Remote**.
- Follow the table below for guidance on setting these toggles.

Toggle settings	Use case	Network Diagram
Cloud Endpoint Directly Accessible = Yes AND VMs Directly Connect with CloudCenter Suite = Yes	CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint AND Worker VMs can initiate a connection to the CloudCenter Suite cluster Cloud Remote is not required	<p>The diagram shows a central box for 'CloudCenter Suite' containing 'AMQP'. To its right is a 'Cloud End Point' box, and below it is a 'Worker VMs' box. Arrows labeled 'DIRECT' point from the CloudCenter Suite to both the Cloud End Point and the Worker VMs.</p>

<p>Cloud Endpoint Directly Accessible = No AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = Yes</p>	<p>CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote can initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] --> CR[via Cloud Remote] CR --> CE[Cloud End Point] W[Worker VMs] --> CR CR --> W </pre>
<p>Cloud Endpoint Directly Accessible = No AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster cannot initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] --> CR[via Cloud Remote] CR --> CE[Cloud End Point] W[Worker VMs] --> CR CR --> W </pre>
<p>Cloud Endpoint Directly Accessible = Yes AND Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = No</p>	<p>CloudCenter Suite cluster can initiate a connection to the cloud region API endpoint AND Worker VMs cannot initiate a connection to the CloudCenter Suite cluster AND Cloud Remote cannot initiate the connection to the CloudCenter Suite cluster</p>	<pre> graph LR CC[CloudCenter Suite] -- DIRECT --> CE[Cloud End Point] W[Worker VMs] --> CR[via Cloud Remote] CR --> CC </pre>



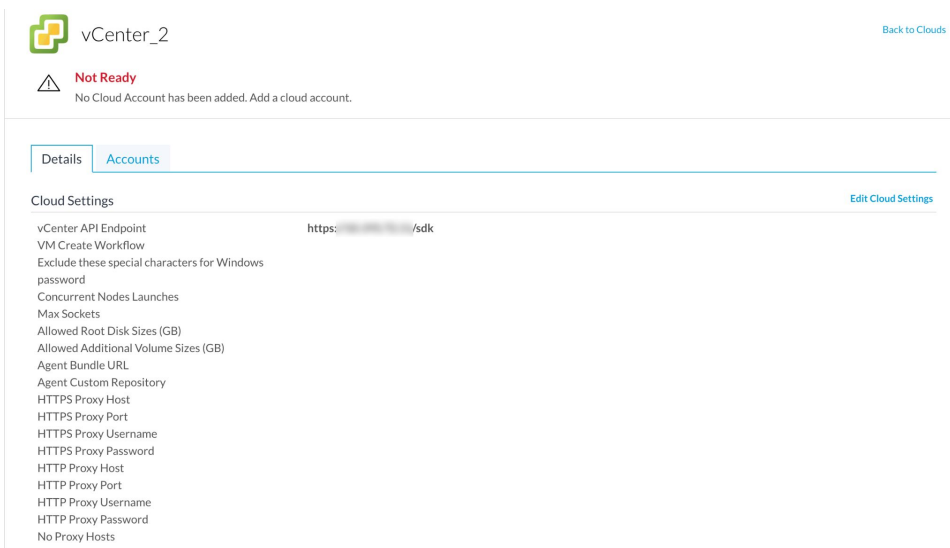
Note

The connectivity toggle settings set at the cloud level are inherited by each region you add to this cloud. However, it is possible to override these toggle settings on a per region basis from the Regions tab for each region.

- Click **Done** to save the configuration and close the dialog box. This brings you back to the Clouds page and the cloud you just created will be added to the bottom of the list on the left side of the page.

A vCenter cloud has one region that you configure from the vCenter cloud Details tab. Follow this procedure.

- Navigate to Clouds page: **Admin > Clouds**. Find your newly created vCenter cloud from the cloud list on the left half of the screen and click its **Configure Cloud** link. This displays the Details tab for this cloud as shown in the figure below.



- Click **Edit Cloud Settings** to open the Configure Cloud Settings dialog box.

The Cloud Settings section contains fields that are unique to the vCenter cloud family and settings that are common to all cloud families. Adjust these field values per the instructions in the following tables.

vCenter Specific Cloud Settings

Field	Usage
vCenter API Endpoint	This field is set to the value you set for the API endpoint when you created this vCenter cloud. You can edit it here but should only do so if the API endpoint address of your vCenter cloud has changed since you added it to CloudCenter Suite.

VM Create Workflow	<p>This field has two options that can be selected from a dropdown menu:</p> <ul style="list-style-type: none"> • "Clone, Reconfig and Customize together" (default value) and • "Clone, Reconfig and Customize separately". <p>Choose the second option only if the default value is resulting in failures to deploy VMs.</p>
Concurrent Nodes Launches	This is the maximum number of VMs that can be launched simultaneously per application deployment. If left blank, the default value of 30 is applied. A value of 0 or 1 both means only one VM will be launched at a time.
Allowed Root Disk Sizes (GB)	Entering a comma-separated string of integers will result in corresponding options for root disk size being displayed in the Deploy form.
Allowed Additional Volume Sizes (GB)	Entering a comma-separated string of integers will result in corresponding options for secondary disk size being displayed in the Deploy form.
Disable Custom Attributes	Leaving this toggle at the default Off setting causes any tags specified for the VM, including tier level and deployment level tags, to be written to the attributes field in the VM. Setting this toggle to On prevents any tags from being written to the attributes field in the VM.
Snapshot Limit	Enter an integer for limiting the number of snapshots that can be created through Workload Manager based on the number of snapshots currently stored in vCenter. Once this limit is reached you will no longer be able to create new snapshots through Workload Manager until some of the snapshots are deleted through vCenter.

Cloud Agnostic Cloud Settings

Field	Usage
Exclude these special characters for Windows password	When the Workload Manager agent is installed on a Windows worker VM, a special user account, called cliqruser, is created to support RDP sessions that may be initiated by the user through the Workload Manager UI. A Workload Manager process running on the CloudCenter Suite cluster creates a random password and passes it to the agent for creating the cliqruser account. Because some Windows deployments may restrict using certain characters for Windows passwords, this field is provided to tell the Workload Manager to exclude these special characters in the generation of the password for the cliqruser account.
Agent Bundle URL	If you plan to use a local repository to host the bundle store, you need to enter the URL of the local bundle store here. Otherwise, leave blank.
Agent Custom Repository	If you plan to use a local repository to host the package store, you need to enter the URL of the local package store here. Otherwise, leave blank.
HTTP /HTTPS proxy fields (host, username, password)	If you require VMs in your region to access public addresses through a web proxy, enter the URL and credentials of the HTTP and HTTPS proxy servers in these fields.
No Proxy Hosts	If you have specified an HTTP or HTTPS proxy using the above fields, you can specify that managed VMs in the region should bypass the proxy and connect directly to certain hosts. Use this field to create a comma-separated list of IP addresses or URLs that should be accessed directly. This field is ignored if an HTTP or HTTPS proxy is not specified.



Important information on proxy settings

In CloudCenter Suite it is possible to specify proxy settings at the region level, as described here, and at the [suite level](#). To understand the expected behavior when proxy settings are specified at both levels, see [Precedence of Proxy Settings](#).

Download Configuration and Encryption Key

After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you can download them to your local computer and then upload them to other conditional components such as Cloud Remote.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the following screenshot.

Region Connectivity Running

[Download Configuration](#)

[Configure Region](#)

Clicking **Download Configuration** causes two things to happen:

- An encrypted zip file named **artifacts.zip** is downloaded by your browser. Make a note of the location of this zip file as you will need if you are using Cloud Remote.
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in the following screenshot.



Region Connectivity Enabling... Download Configuration **Copy Encryption Key** Edit Connectivity

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to conditional components like Cloud Remote.

If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file from software.cisco.com, use the automatically create (new) encryption key, and copy the key to the clipboard by clicking the **Copy Encryption Key** link again.

When you are done editing the settings in the dialog box, click **Save**.

3. Determine if you need Cloud Remote for this region. Scroll down to the Region Connectivity section for the region and click on the **Configure Region** link in the upper right to open the Configure Region dialog box. The toggle settings should be the same as when you set them on the connectivity page of the Add Cloud dialog box. If all of the connectivity toggles in the Region Connectivity dialog box are set to Yes, then Cloud Remote is NOT needed for this cloud region. In this case, you would normally leave the region connectivity settings at their current values and continue to the next settings section.

The exception to this guidance is when a NAT firewall or proxy server exists between the CloudCenter Suite management cluster and worker VMs, or between the CloudCenter Suite management cluster and users that would use Workload Manager to initiate a Guacamole remote connection to a worker VM. In either of these cases, override the address fields in the Region Connectivity dialog box as explained below.

Networking Constraint	Field	Value
Worker VMs must use a proxy server or NAT firewall to access the "local" AMQP server running in the CloudCenter Suite cluster.	Worker AMQP IP Address	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the "local" AMQP server running in the CloudCenter Suite cluster.
Users must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole Public IP Address and Port	IP address and port number that the firewall or proxy server presents to users on behalf of the Guacamole server running in the CloudCenter Suite cluster.
Worker VMs must use a proxy server or NAT firewall to access the Guacamole server running in the CloudCenter Suite cluster.	Guacamole IP Address and Port for Application VMs	IP address and port number that the firewall or proxy server presents to the worker VMs on behalf of the Guacamole server running in the CloudCenter Suite cluster.

4. Click **OK** to save the changes and dismiss the dialog box. You can now proceed to the next region settings section: VM Naming and IPAM Strategy.
5. If any of the connectivity toggles in the Region Connectivity dialog box are set to No, then you must install and configure Cloud Remote for this region.

Configure Cloud Remote in a vCenter Region

Configure Cloud Remote in a vCenter region as follows.

Download and Launch the Cloud Remote Appliance in vCenter

- a. From your local computer, download the Cloud Remote appliance OVA from software.cisco.com.
- b. Log in to the vCenter console using the vSphere web client with Flash, or with the vSphere Windows client. Do not use the HTML5 web client.
- c. Navigate to the folder or resource pool where you want to deploy the OVA. Right click on that resource pool or folder and select Deploy OVF Template.
- d. From the Deploy OVF Template dialog box, for Source, select Local file and click Browse to find the OVA file you downloaded in step 1.
- e. Complete the fields for Name and location, Host / Cluster, Resource Pool, Storage, and Disk Format appropriate for your environment.
- f. For the Network Mapping section, make sure to properly map the Management network (public) and VM Network network (private) to the appropriate network names in your environment.
- g. For the Properties section, make sure to check the box labeled Does the VM need a second interface? if the Cloud Remote appliance needs to be multi-homed on a public network and a private network.
- h. Confirm your settings and click Finish to launch the VM.
- i. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
- j. Once the first instance of the appliance has been launched, use the vSphere client to note its IP public and private addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

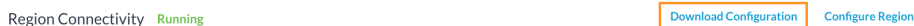
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



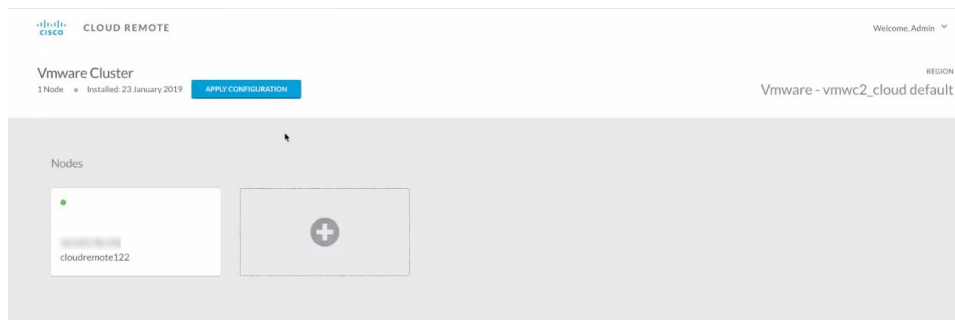
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



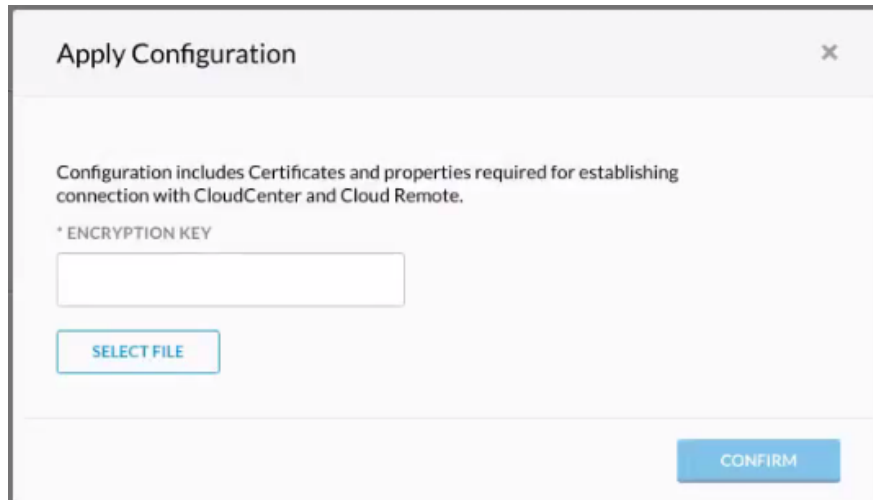
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

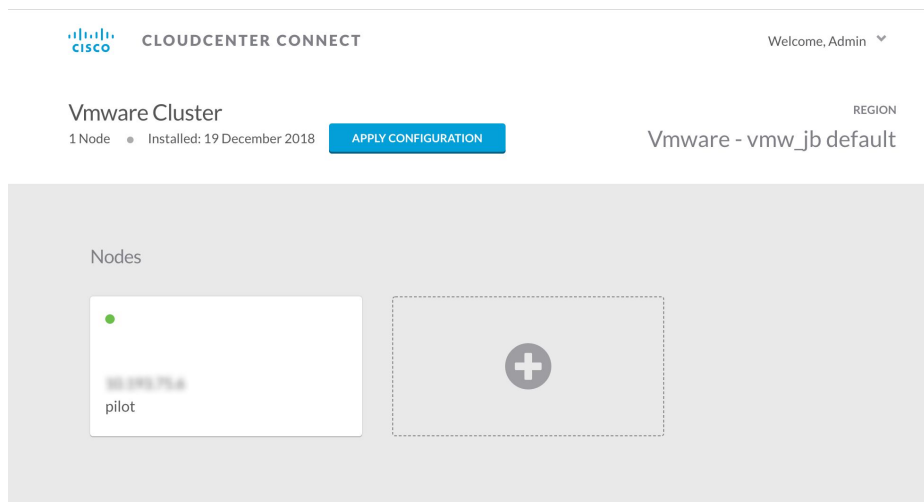
- Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
- You will immediately be required to change your password. Do so now.
- You are now brought to the Cloud Remote home page as shown in the figure below.



- d. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- e. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
 f. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
 g. Click **Confirm**.
 h. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

6. VM Naming and IPAM Strategy (conditional): Configure any VM naming or IPAM strategies in the Strategy section as explained in [VM Naming and IPAM Strategies](#). If you leave the settings at the defaults, no IPAM strategy is applied and the default VM naming strategy is applied.
7. External Lifecycle Actions (conditional): Specify any external lifecycle actions to be performed on all VMs launched by Workload Manager in this region as explained in [External Lifecycle Actions Settings](#).
8. Instance Types (conditional): A vCenter cloud region includes one "default" instance type with 1 vCPU, 1 vNIC, 1024 MB RAM, and no additional disk storage. CloudCenter Suite will also automatically create instance types based on the parameters of VMs you deploy from within vCenter. You would manually add more instance types to your vCenter region if you want Workload Manager to deploy jobs to this region with differently sized instance types. See [Instance Types Settings](#) for more details.
9. Storage Types (conditional): For private VM-based clouds like vCenter, CloudCenter Suite uses storage types for cost tracking purposes. CloudCenter Suite creates a default storage type with zero cost. You would manually edit this storage type to enter your own cost factor. You can optionally add more storage types to your vCenter region. See [Storage Types Settings](#) for more details.
10. Image Mappings: Image mappings allow services based on Workload Manager logical images to be deployed using the appropriate physical image stored on the target cloud region. You must manually import these physical images into your vCenter region and then map the appropriate Workload Manager logical images to these physical images. See [Images](#) for more context.

Prerequisites

For Workload Manager to deploy jobs in vCenter using a particular user account, that account must have the permissions identified in the table below.

vCenter Object	Required Permission	Reason
Network	Assign Network	If the default network in a template/snapshot must be changed
Datastore	Allocate space	For persistent disk operation
	Browse datastore	
	Low-level file operations	
	Remove file	
Folder	Create folder	For user folder creation
Resource	Apply recommendation	For datastore cluster support
	Assign VM to resource pool	For resource pool selection
Tasks	Create task	For VM operation
	Update task	
Virtual Machine	All permissions	
Global Role	Set Custom Attributes	To add custom attributes on virtual machines
	Manage Custom Attributes	

Configuration Process

To add a vCenter cloud account, follow this process:

1. Locate the vCenter cloud in the Clouds page and click **Add Cloud Account** button. This will display the Add Cloud Account dialog box as shown in the figure below.

2. Assign a new cloud account **Name**.

**Tip**

The name should not contain any space, dash, or special characters.

3. Provide the vCenter cloud credentials: **vCenter User Name** and **vCenter Password**.
4. Click the **Connect** button. CloudCenter Suite will now attempt to validate your account credentials.
5. After the credentials are verified, the **Connect** button changes to an **Edit** button and two new fields appear **Enable Account For** and **Enable Reporting By Org Structure**,
 - a. Set the **Enable Account For** dropdown per the table below.

Value	Usage
Provisioning	Workload Manager can deploy jobs using this account.
Reporting	Cost Optimizer and Workload Manager will track cloud costs for this account. Typical usage: master cloud accounts that are used for billing aggregation.
Provisioning, Reporting	Default. Account is used for both provisioning and reporting.

- b. **For AWS and Google clouds only:** Set the **Enable Reporting By Org Structure** toggle to On to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal. This saves the time of manually creating a comparable cost hierarchy within Cost Optimizer. See [Cost Groups Configuration](#) for more information on cost hierarchies in Cost Optimizer.
- c. Click the **Save** button when done.

Cloud Accounts Tab

After you add cloud accounts to a cloud, they will appear in the Accounts tab for the cloud as shown in the figure below.

Account Name	Description	Billing Units	Enabled For	Actions
C3 Manual 1	C3 Manual Account 1	2 Billing Units	Provisioning, Reporting	Edit Delete
Master	Cost Optimizer Reporting	11 Billing Units	Reporting	Edit Delete
account		050	Provisioning, Reporting	Edit Delete
C3 Manual Plans		810	Provisioning, Reporting	Edit Delete

The Accounts tab contains columns for data entered when creating an account: Account Name, Description, Enabled For; and two additional columns: **Billing Units** and **Actions**. **Billing Units** is a dual function:

- If the cloud account contains only one billing unit, the ID for that billing unit is displayed.
- If the cloud account contains multiple billing units, such as an AWS master account, the number of billing units in that account is displayed followed by the text *Billing Units*.

A billing unit is the most granular level of cloud cost recording in CloudCenter Suite. The definition of a billing unit varies by a cloud provider as shown in the table below.

Cloud Provider	Billing Unit
AWS	Account ID
AzureRM	Subscription ID
Google	Project ID
IBM Cloud	Account ID
vCenter	Cloud Group Prefix - Datacenter Name
vCD	Organization Name
OpenStack	Project ID
Kubernetes	Namespace UID

The last column, **Actions**, contains links to let you edit or deleted the cloud account, or [manage instance types](#) for the cloud account.

Cloud Remote

Cloud Remote

- [Overview](#)
- [Redundancy](#)
- [Install Cloud Remote](#)
 - [Configure Cloud Remote in a vCenter Region](#)
 - [Configure Cloud Remote in a vCenter Region for a Kubernetes Cloud](#)
 - [Configure Cloud Remote in an OpenStack Region](#)
 - [Configure Cloud Remote in an OpenStack Region for a Kubernetes Cloud](#)
 - [Configure Cloud Remote in an AWS Region](#)
 - [Configure Cloud Remote in an AWS Region for a Kubernetes Cloud](#)
 - [Cloud Remote for AzureRM](#)
 - [Configure Cloud Remote in an AzureRM Region for a Kubernetes Cloud](#)
 - [Configure Cloud Remote in a Google Region](#)
 - [Configure Cloud Remote in a Google Region for a Kubernetes Cloud](#)
- [The Cloud Remote Artifacts](#)
- [Static IP Address Usage](#)
- [Using Non-Conflicting Networks](#)
- [Install Cloud Remote on a Custom CentOS7 VM](#)
- [Upgrade an Existing Cloud Remote Installation](#)
- [Scaling](#)
- [Custom Port Numbers \(Conditional\)](#)
- [Navigating Cloud Remote through Proxy](#)
 - [Proxy Service on the Cloud Remote Instance](#)
 - [Proxy Service on the CloudCenter Suite Cluster](#)
- [Troubleshooting Cloud Remote Issues](#)

The Cloud Remote component is deployed on a per cloud region basis if communication between the CloudCenter Suite cluster and the target cloud region is restricted. More specifically, it is needed when

- Communication between the CloudCenter Suite cluster and the API endpoint of your private cloud region is restricted.
- or
- Communication between the CloudCenter Suite cluster and worker VMs in your VM-based cloud region is restricted.

When Cloud Remote is used to support communications with a VM-based cloud region, it is installed as a virtual appliance launched in that region. When it is used to support communications with a Kubernetes cloud, it is installed as a virtual appliance in a network accessible from that Kubernetes cloud.

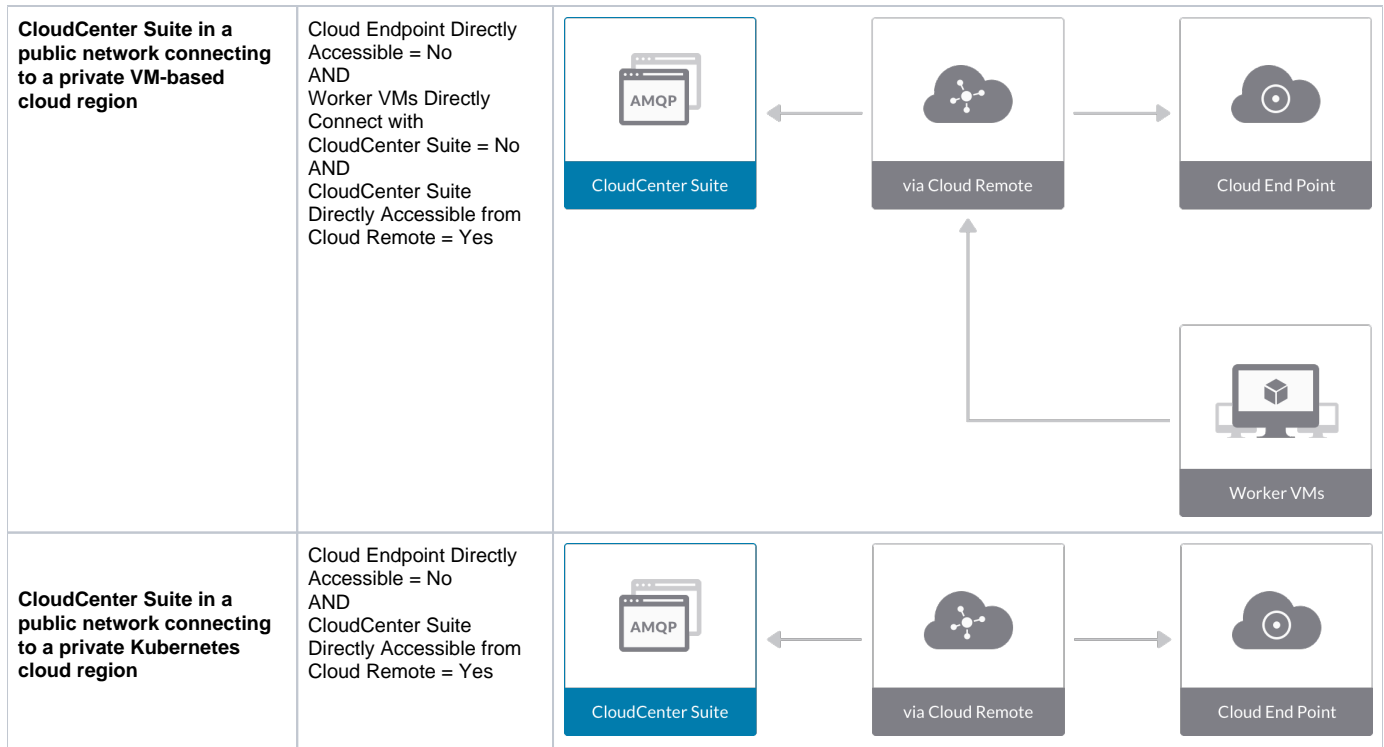
Cloud Remote can run as a single appliance or it can scale up (see the *Scaling* section below) to multiple appliances working as a single cluster.

Cloud Remote includes the following services running as containers:

- AMQP server for communicating with the CloudCenter Suite cluster and with worker VMs
- Script execution engine for executing external lifecycle action scripts
- Proxy server for communicating with the script execution engine and the cloud API endpoint
- Guacamole server for encapsulating SSH or RDP sessions to worker VMs in a browser window

Some typical network configurations involving Cloud Remote are as follows:

Use Case	Network Connectivity	Network Diagram
CloudCenter Suite in a private network connecting to a public cloud region	Worker VMs Directly Connect with CloudCenter Suite = No AND CloudCenter Suite Directly Accessible from Cloud Remote = No	



The remaining sections describe how to acquire and configure Cloud Remote, and how to scale Cloud Remote.

Redundancy is supported for Cloud Remote – A CloudCenter Suite installation launches a highly available Kubernetes cluster which consists of master(s) and worker(s) instances. See [Prepare Infrastructure](#) > **Number of VMs** for additional details.

Cloud Remote is installed as a virtual appliance obtained from Cisco. The procedure to obtain, launch and configure Cloud Remote depends on:

- The VM-based cloud in which Cloud Remote will be deployed.
and
- The overall networking constraints of the CloudCenter Suite cluster and the target cloud region.

Prior to installing Cloud Remote, make sure you have already added the cloud to CloudCenter Suite, and if a multi-region cloud, you added the first region. Then, use one of the following procedures corresponding to where Cloud Remote will be deployed and whether it will be used to support VM-based workloads in that cloud region or Kubernetes container workloads in a Kubernetes cloud hosted in that region.

Configure Cloud Remote in a vCenter Region

Configure Cloud Remote in a vCenter region as follows.

Download and Launch the Cloud Remote Appliance in vCenter

1. From your local computer, download the Cloud Remote appliance OVA from software.cisco.com.
2. Log in to the vCenter console using the vSphere web client with Flash, or with the vSphere Windows client. Do not use the HTML5 web client.
3. Navigate to the folder or resource pool where you want to deploy the OVA. Right click on that resource pool or folder and select Deploy OVF Template.
4. From the Deploy OVF Template dialog box, for Source, select Local file and click Browse to find the OVA file you downloaded in step 1.
5. Complete the fields for Name and location, Host / Cluster, Resource Pool, Storage, and Disk Format appropriate for your environment.
6. For the Network Mapping section, make sure to properly map the Management network (public) and VM Network network (private) to the appropriate network names in your environment.
7. For the Properties section, make sure to check the box labeled Does the VM need a second interface? if the Cloud Remote appliance needs to be multi-homed on a public network and a private network.
8. Confirm your settings and click Finish to launch the VM.
9. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
10. Once the first instance of the appliance has been launched, use the vSphere client to note its IP public and private addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running [Download Configuration](#) [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... [Download Configuration](#) [Copy Encryption Key](#) [Edit Connectivity](#)

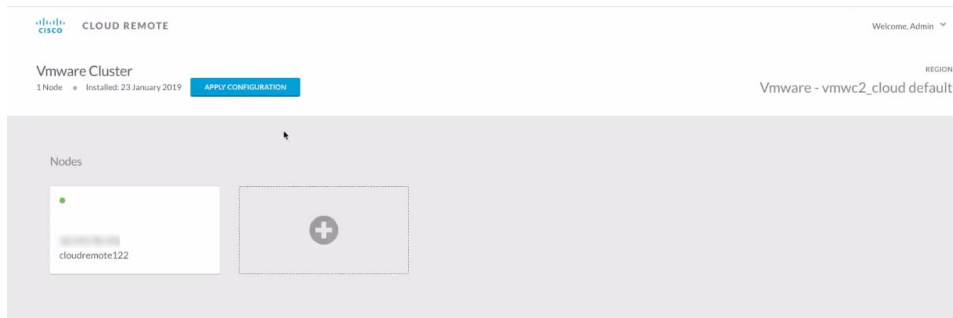
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



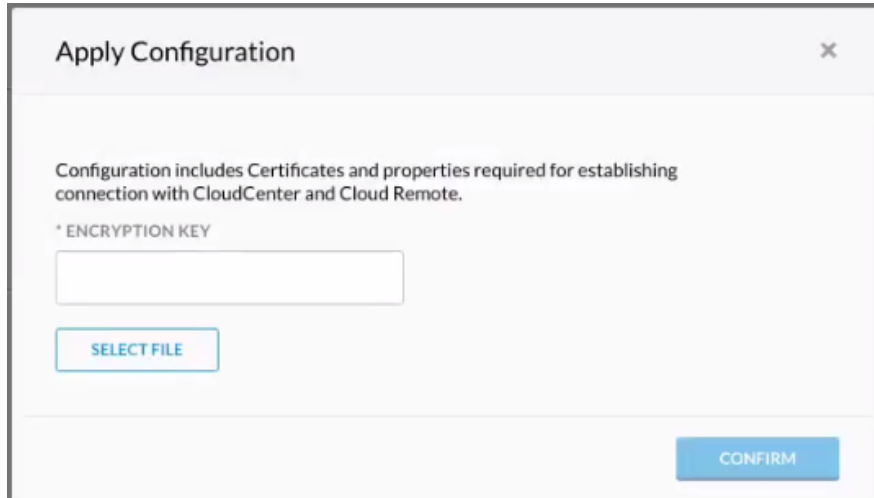
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

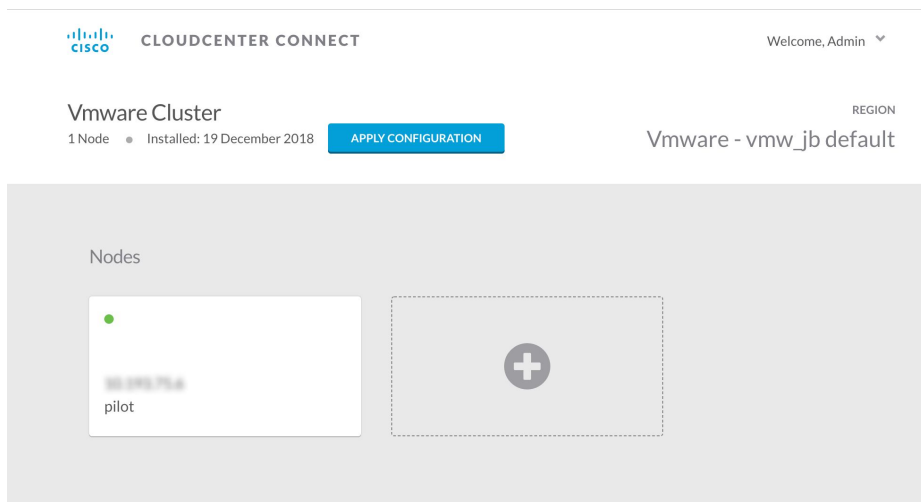
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running[Download Configuration](#) [Configure Region](#)

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in a vCenter Region for a Kubernetes Cloud

Configure Cloud Remote in a vCenter region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in vCenter

1. From your local computer, download the Cloud Remote appliance OVA from software.cisco.com.
2. Log in to the vCenter console using the vSphere web client with Flash, or with the vSphere Windows client. Do not use the HTML5 web client.
3. Navigate to the folder or resource pool where you want to deploy the OVA. Right click on that resource pool or folder and select Deploy OVF Template.
4. From the Deploy OVF Template dialog box, for Source, select Local file and click Browse to find the OVA file you downloaded in step 1.
5. Complete the fields for Name and location, Host / Cluster, Resource Pool, Storage, and Disk Format appropriate for your environment.
6. For the Network Mapping section, make sure to properly map the Management network (public) and VM Network network (private) to the appropriate network names in your environment.
7. For the Properties section, make sure to check the box labeled Does the VM need a second interface? if the Cloud Remote appliance needs to be multi-homed on a public network and a private network.
8. Confirm your settings and click Finish to launch the VM.
9. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
10. Once the first instance of the appliance has been launched, use the vSphere client to note its IP public and private addresses. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>

4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running [Download Configuration](#) [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... [Download Configuration](#) [Copy Encryption Key](#) [Edit Connectivity](#)

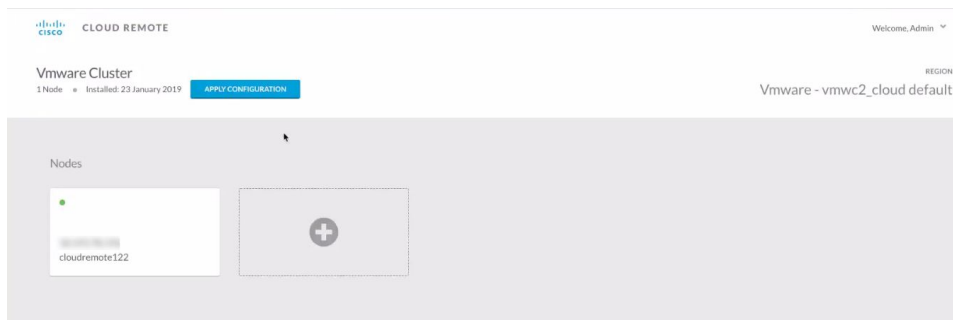
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



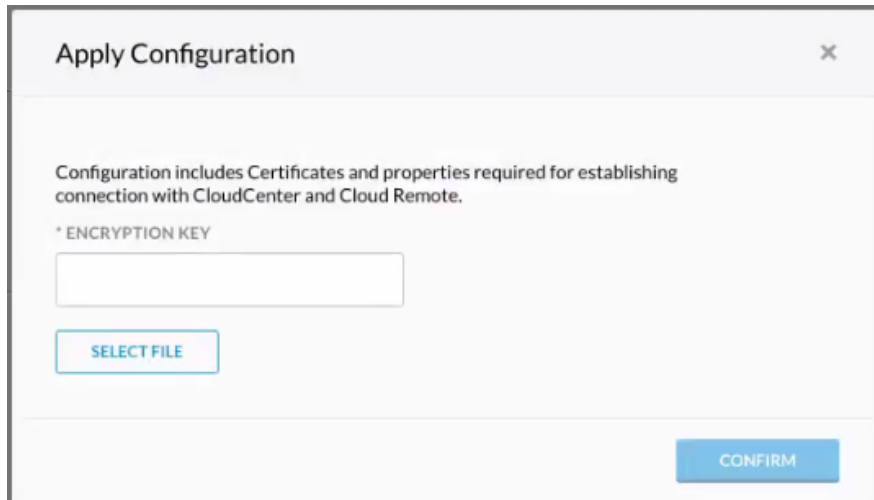
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

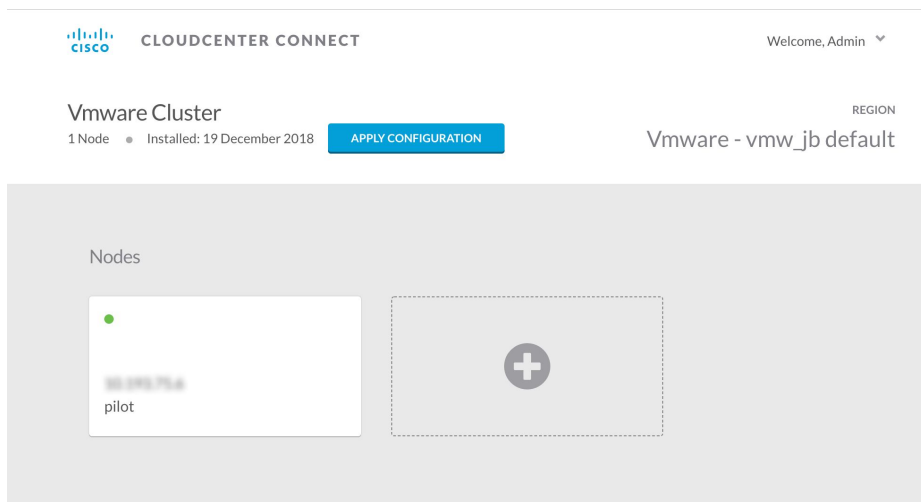
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running[Download Configuration](#) [Configure Region](#)

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an OpenStack Region

Configure Cloud Remote in an OpenStack region as follows.

Download and Launch the Cloud Remote Appliance in OpenStack

1. Download the Cloud Remote appliance qcow2 file from software.cisco.com.
2. Through the OpenStack console, import and launch the Cloud Remote appliance. This process is similar to importing and launching the [Cloud Center Suite installer appliance for OpenStack](#).



Do not add 'Network Ports' while launching a Cloud Remote instance in OpenStack.

3. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
4. Once the first instance of the appliance has been launched, use the OpenStack console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *

25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration [Configure Region](#)


Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



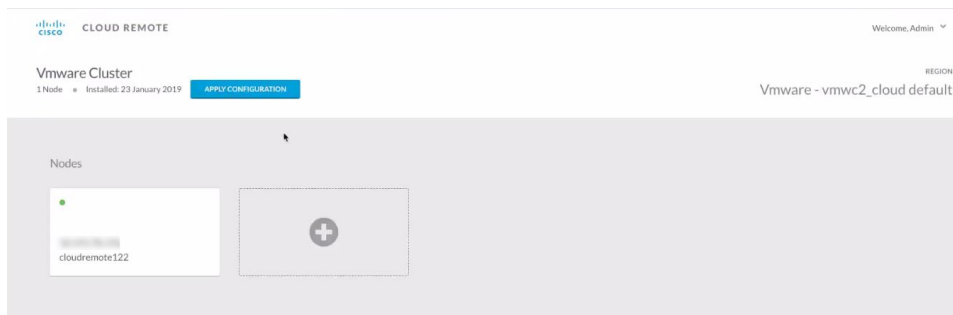
Region Connectivity Enabling... Download Configuration Copy Encryption Key Edit Connectivity

Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

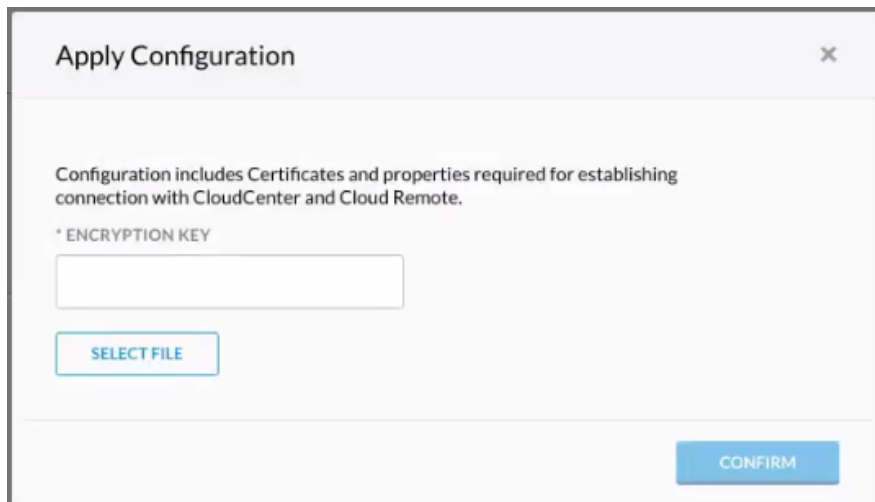
 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

1. Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).

Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an OpenStack Region for a Kubernetes Cloud

Configure Cloud Remote in a OpenStack region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in OpenStack

1. Download the Cloud Remote appliance qcow2 file from software.cisco.com.
2. Through the OpenStack console, import and launch the Cloud Remote appliance. This process is similar to importing and launching the [Cloud Center Suite installer appliance for OpenStack](#).



Do not add 'Network Ports' while launching a Cloud Remote instance in OpenStack.

3. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
4. Once the first instance of the appliance has been launched, use the OpenStack console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration Configure Region

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... Download Configuration Copy Encryption Key Edit Connectivity

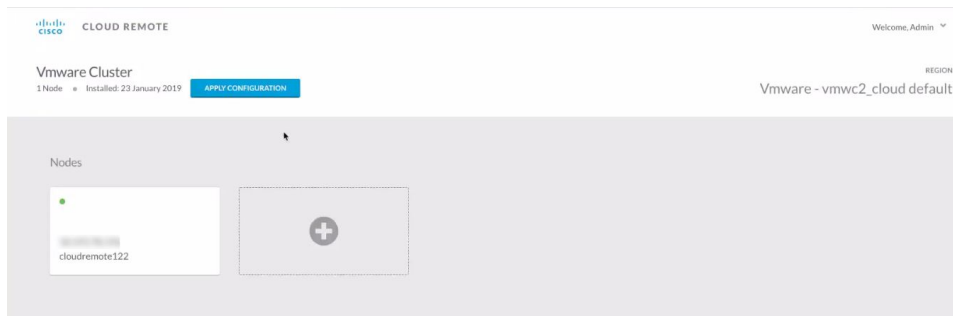
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



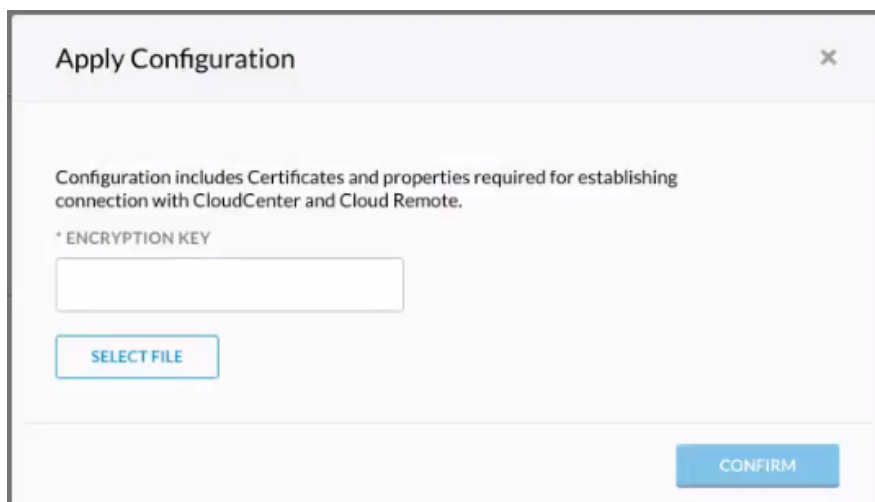
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

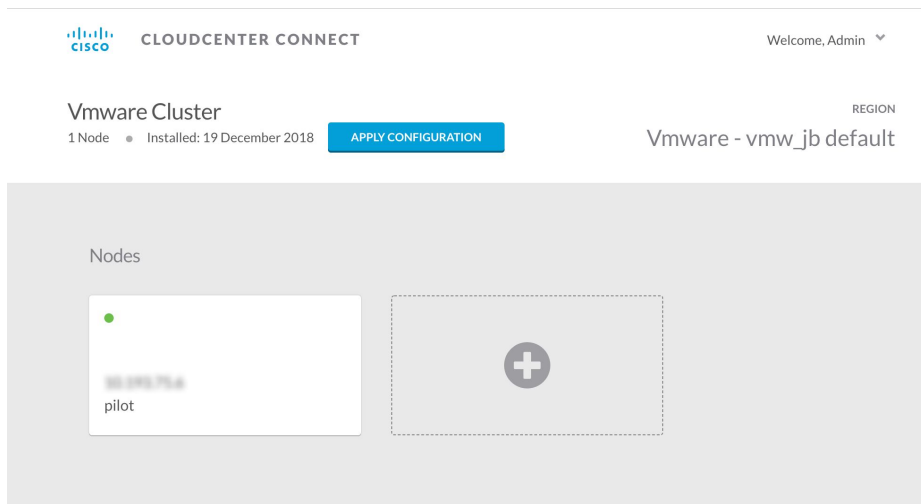
1. Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an AWS Region

Configure Cloud Remote in an AWS region as follows.

Obtain and Launch the Cloud Remote Appliance in AWS

1. Obtain the Cloud Remote shared AMI from Cisco support and launch it. Follow the same guidance for obtaining and launching the [CloudCenter Suite installer appliance for AWS](#).
2. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
3. Once the first instance of the appliance has been launched, use your cloud console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other instances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP

15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).

Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789
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When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... [Download Configuration](#) Copy Encryption Key [Edit Connectivity](#)

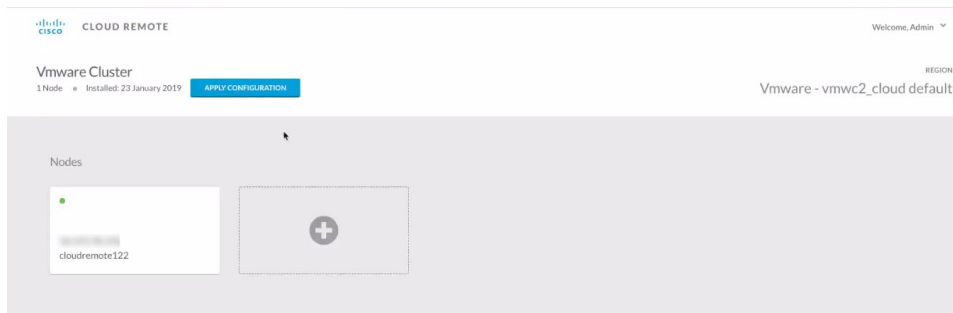
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



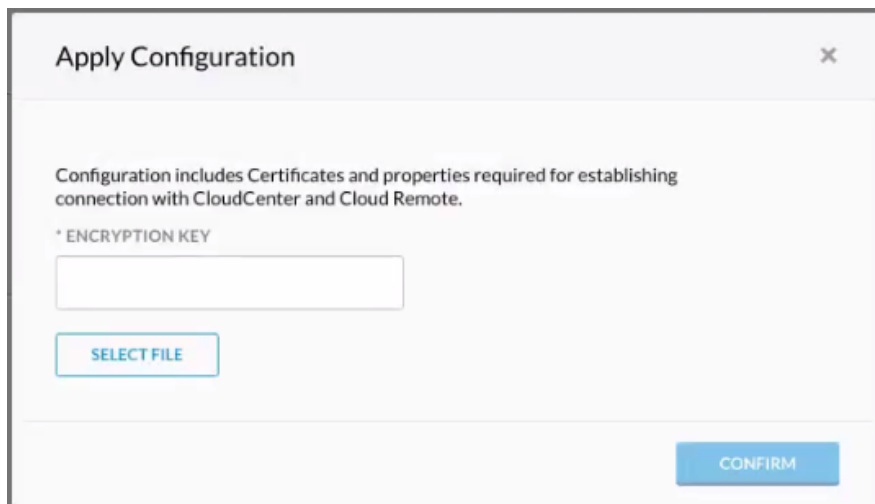
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

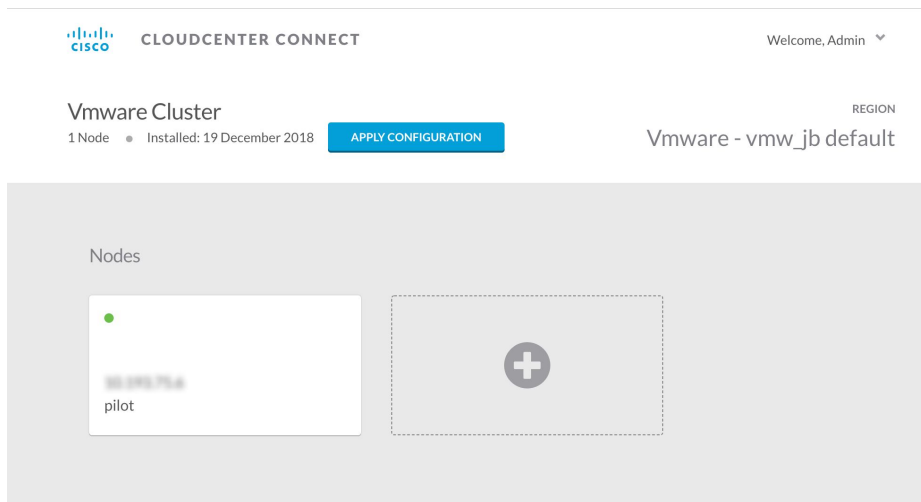
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running		Download Configuration Configure Region
Cloud endpoint accessible from Cloud Center Manager	No	
Cloud Center Manager AMQP reachable from worker VM's	No	
Cloud Center Manager AMQP accessible from cloud	Yes	
Remote AMQP IP		
Worker AMQP IP	192.168.30.16:5671	
Blade Name	cloudcenter-blade-vmware-9-0289	
Blade Port	8443	

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an AWS Region for a Kubernetes Cloud

Configure Cloud Remote in an AWS region to support a Kubernetes target cloud as follows.

Obtain and Launch the Cloud Remote Appliance in AWS

1. Obtain the Cloud Remote shared AMI from Cisco support and launch it. Follow the same guidance for obtaining and launching the [CloudCenter Suite installer appliance for AWS](#).
2. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
3. Once the first instance of the appliance has been launched, use your cloud console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other instances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.

Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	<p>Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).</p> <p>If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote.</p> <p>If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.</p>
--	------------------------	---

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

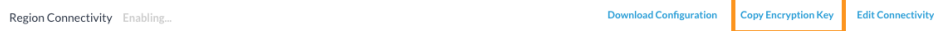
Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.



Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.



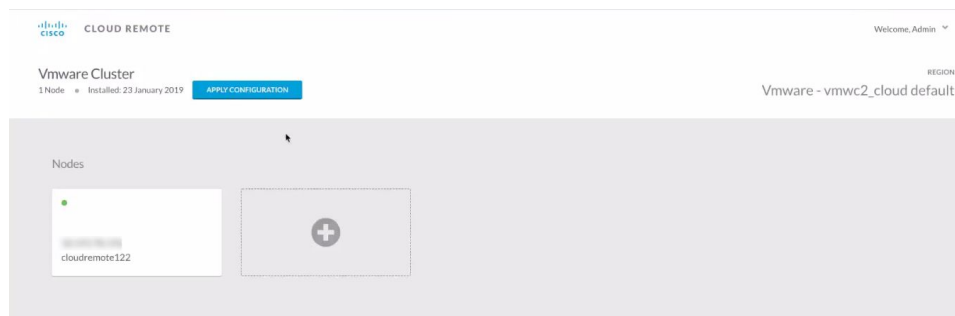
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



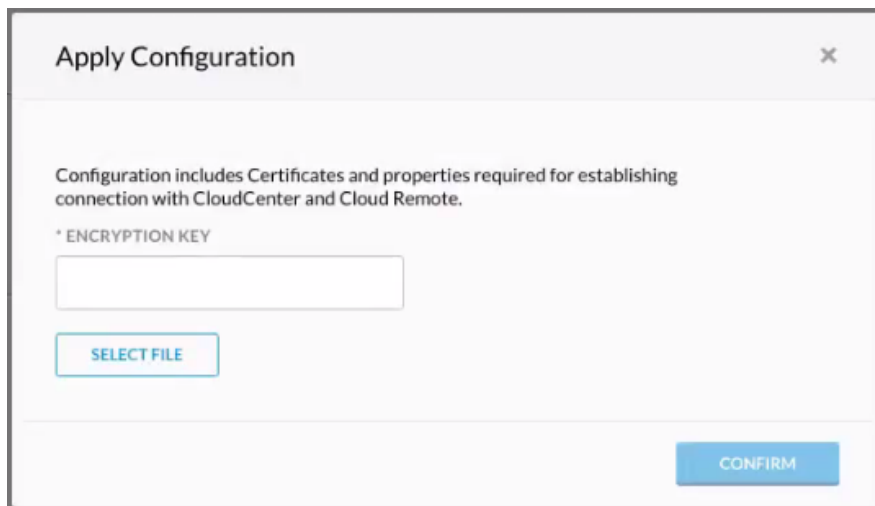
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

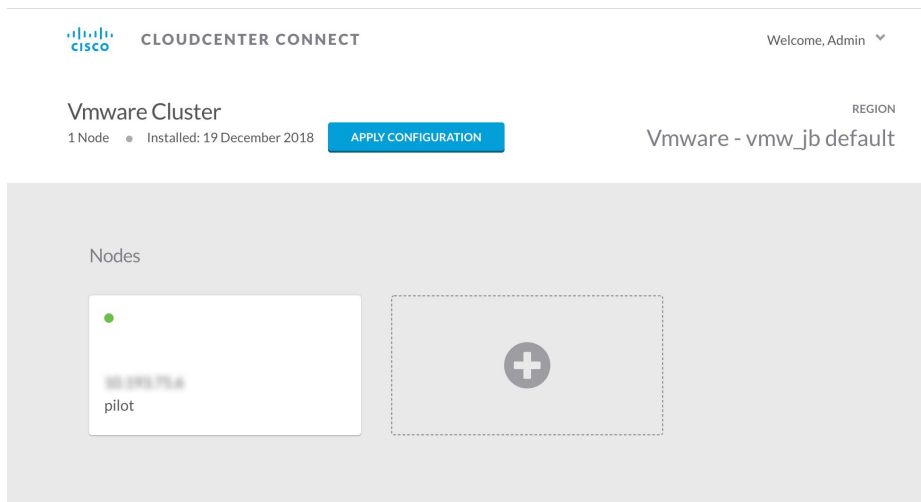
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Cloud Remote for AzureRM

Follow these steps to obtain, launch and configure Cloud Remote for an AzureRM region.

Download and Launch the Cloud Remote Appliance in AzureRM

1. Download the Cloud Remote appliance for AzureRM as zip file from software.cisco.com and then unzip it to reveal the VHD file.
2. Upload the Cloud Remote appliance VHD file to AzureRM using the AzureRM CLI, then launch the appliance from the AzureRM console web UI. This process is similar to uploading and launching the [CloudCenter Suite installer appliance for AzureRM](#).



You must use the AzureRM CLI to perform this upload.

3. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\)](#) > Scaling for details.
4. Once the first instance of the appliance has been launched, use the AzureRM console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
-----------------	-------	-------

Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... [Download Configuration](#) Copy Encryption Key [Edit Connectivity](#)

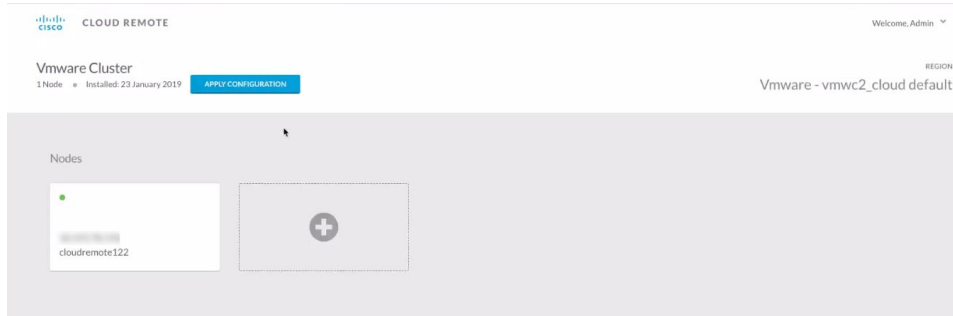
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.

 If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

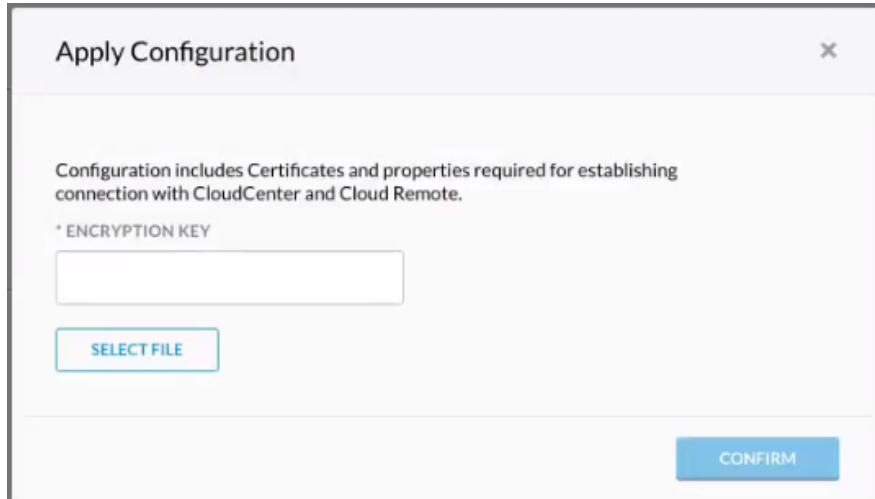
After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.

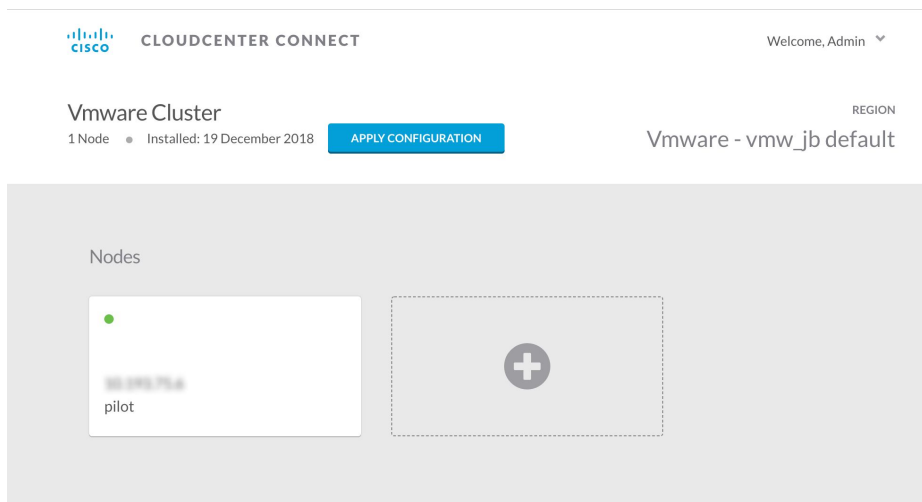
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running[Download Configuration](#)[Configure Region](#)

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in an AzureRM Region for a Kubernetes Cloud

Configure Cloud Remote in an AzureRM region to support a Kubernetes target cloud as follows.

Download and Launch the Cloud Remote Appliance in AzureRM

1. Download the Cloud Remote appliance for AzureRM as zip file from software.cisco.com and then unzip it to reveal the VHD file.
2. Upload the Cloud Remote appliance VHD file to AzureRM using the AzureRM CLI, then launch the appliance from the AzureRM console web UI. This process is similar to uploading and launching the [CloudCenter Suite installer appliance for AzureRM](#).



You must use the AzureRM CLI to perform this upload.

3. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote \(Conditional\) > Scaling](#) for details.
4. Once the first instance of the appliance has been launched, use the AzureRM console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>

9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running [Download Configuration](#) [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... [Download Configuration](#) [Copy Encryption Key](#) [Edit Connectivity](#)

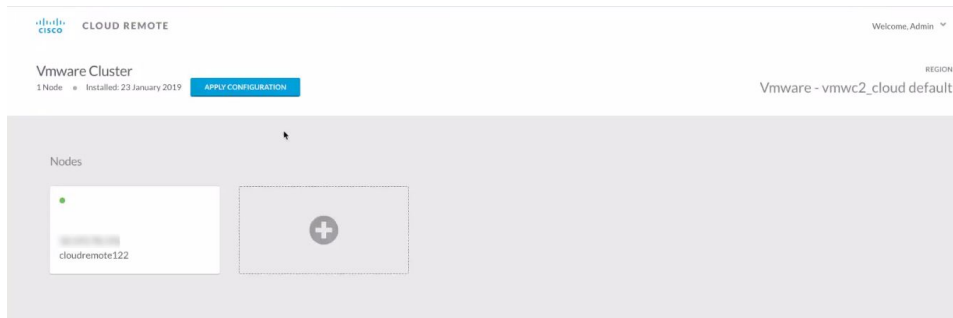
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



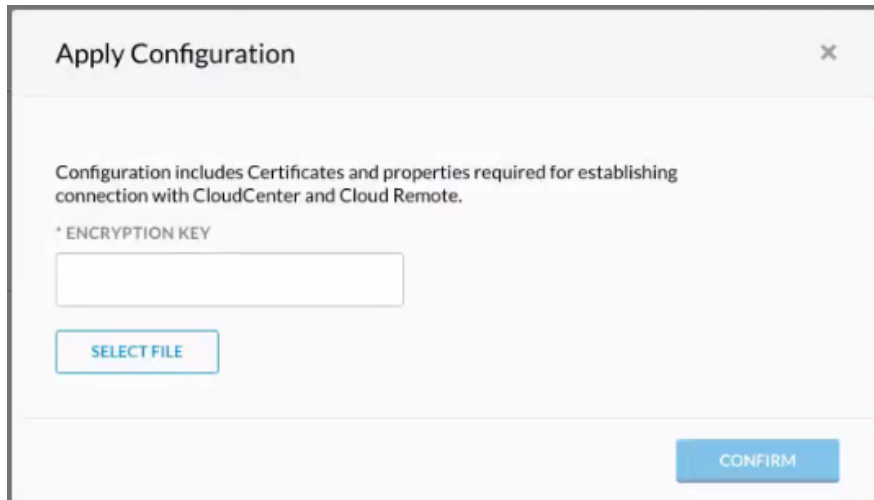
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

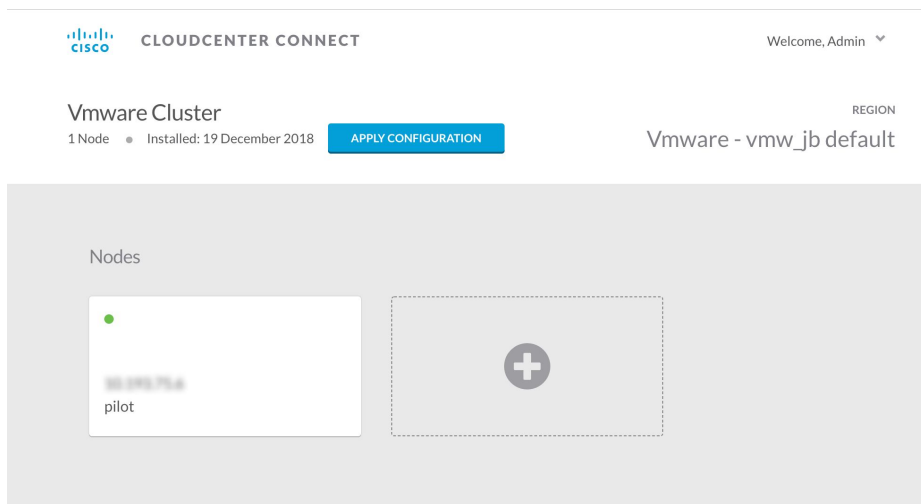
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



- Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



- Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
- Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
- Click **Confirm**.
- Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity Running[Download Configuration](#) [Configure Region](#)

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

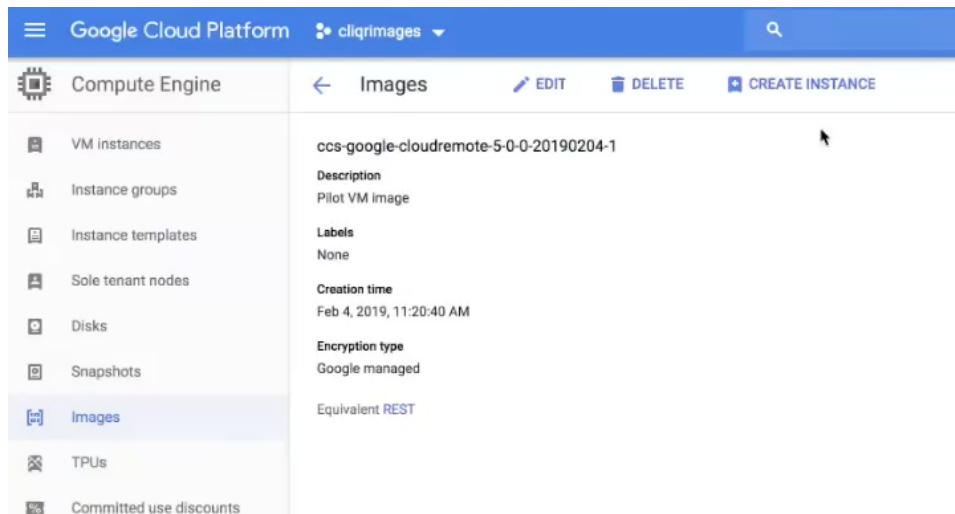
After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in a Google Region

Configure Cloud Remote in a Google region as follows.

Obtain and Launch the Cloud Remote Appliance in Google

- Request the Cloud Remote shared VMI form Cisco support by opening a [CloudCenter Support case](#). In your request, specify the following details:
 - Your GCP account number
 - Your GCP project ID number
 - Your CloudCenter Suite version
 - Your Customer ID (CID)
 - Your customer name
 - Specify if your setup is in production or for a POC
 - Your Contact Email
- After you open a case, your support case is updated with the shared VMI ID. **Proceed to the next step only after your support case is updated with the VMI ID.**
- Navigate to the GCP dashboard and search for the VMI ID name provided in the [CloudCenter Support case](#) in the list of images for your project.
- Launch an instance using the shared VMI.
 - Click on the image name. This takes you to the page for the image



- Click on Create Instance to display the Instance properties page

Name ⓘ

instance-2

Region ⓘ **Zone** ⓘ

us-west1 (Oregon) us-west1-a


Machine type
Customize to select cores, memory and GPUs.

1 vCPU 3.75 GB memory [Customize](#)

Container ⓘ

Deploy a container image to this VM instance. [Learn more](#)

Boot disk ⓘ

 New 30 GB standard persistent disk
Image
ccs-google-cloudremote-5-0-0-2019020... [Change](#)

Identity and API access ⓘ

Service account ⓘ

Compute Engine default service account

Access scopes ⓘ

Allow default access
 Allow full access to all Cloud APIs
 Set access for each API

Firewall ⓘ

Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management, security, disks, networking, sole tenancy

You will be billed for this instance. [Compute Engine pricing](#) ↗

c. Complete these fields:

- i. Instance name
- ii. Region and zone
- iii. Machine type: select 2 vCPU, 7.5 GB RAM
- iv. Click the checkbox to allow HTTPS access
- v. Click the Security tab (under the Allow HTTPS traffic checkbox). In the SSH key field, add your organization's public ssh key followed by a space and then the username you want to use to login to the Cloud Remote appliance. Click the Add Item button when done.

Firewall ⓘ
Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management **Security** Disks Networking Sole Tenancy

Shielded VM ⓘ
Select a shielded image to use shielded VM features.
Turn on all settings for the most secure configuration.

Turn on Secure Boot ⓘ
 Turn on vTPM ⓘ
 Turn on Integrity Monitoring ⓘ

SSH Keys
These keys allow access only to this instance, unlike [project-wide SSH keys](#) [Learn more](#)

Block project-wide SSH keys
When checked, project-wide SSH keys cannot access this instance [Learn more](#)

centos

```

VM=FU-X9CT95c04XTE=KaT(3a)K9B(=K)KaCT1DE/
J
C
C
€
Y
6J centos|

```

[+ Add Item](#)

⤴ Less

You will be billed for this instance. [Compute Engine pricing](#) ↗

[Create](#) [Cancel](#)

- d. Click Create to launch the instance.
5. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote > Scaling](#) for details.
6. Once the first instance of the appliance has been launched, use the GCP console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a VM-based Cloud Region

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
8443	TCP	Limit to address space of users needing SSH or RDP access to their managed VMs	User to Guacamole
5671	TCP	Limit to address space of the managed VMs and the address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)
7789	TCP	Limit to address space of the managed VMs	Worker VM to Guacamole



The Cloud Remote web UI, User-to-Guacamole, and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\)](#) > Custom Port Numbers (Conditional)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP and Guacamole Addresses for Supporting Cloud Remote

From the CloudCenter Suite UI, for the cloud region requiring Cloud Remote, navigate to the corresponding Regions or Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box. The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You must update some of the address fields in the dialog box according to the scenarios summarized in the table below.

Toggle Settings	Field	Value
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. This address must be accessible to Cloud Remote . If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.
Worker VMs Directly Connect with CloudCenter = No	Worker AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to the worker VMs , and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).
Worker VMs Directly Connect with CloudCenter = No	Guacamole Public IP and Port	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to CloudCenter Suite users , and <guac_port> = 8443 OR the custom Guacamole port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)).

Worker VMs Directly Connect with CloudCenter = No	Guacamole IP Address and Port for Application VMs	Enter <Cloud_Remote_IP>:<guac_port>, where <Cloud_Remote_IP> = the Cloud Remote IP address accessible to worker VMs , and <guac_port> = 7789
---	---	---

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration Configure Region

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling... Download Configuration Copy Encryption Key Edit Connectivity

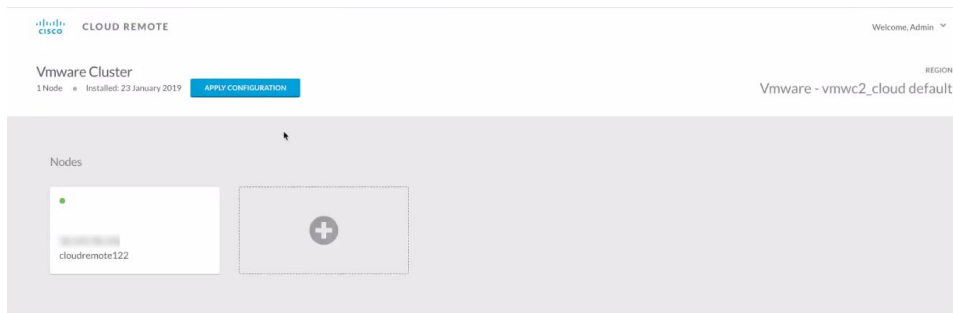
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be display temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



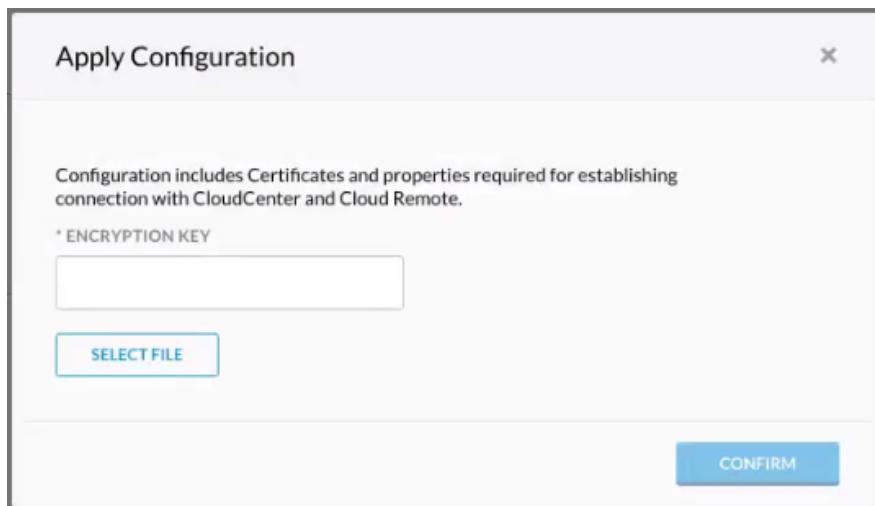
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

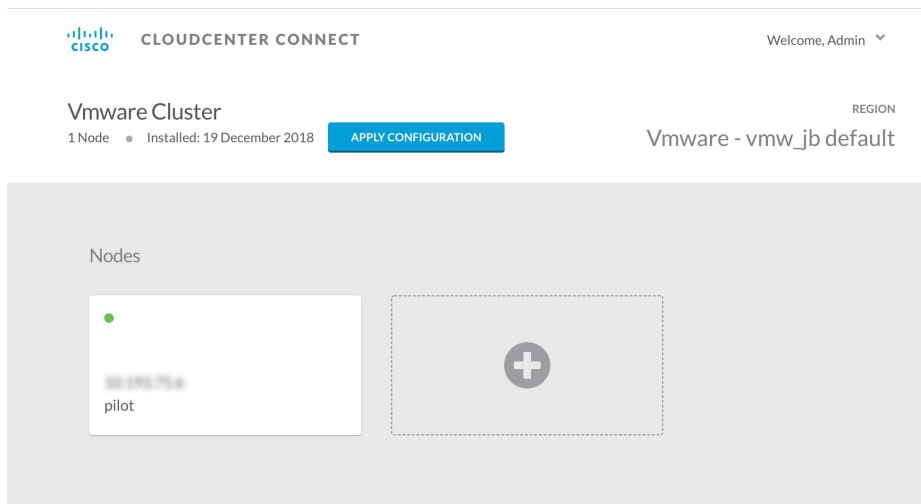
1. Open another browser tab and login to https://<Cloud_Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).



Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Region Connectivity	Running	Download Configuration	Configure Region
Cloud endpoint accessible from Cloud Center Manager	No		
Cloud Center Manager AMQP reachable from worker VM's	No		
Cloud Center Manager AMQP accessible from cloud	Yes		
Remote AMQP IP			
Worker AMQP IP	192.168.30.16:5671		
Blade Name	cloudcenter-blade-vmware-9-0289		
Blade Port	8443		

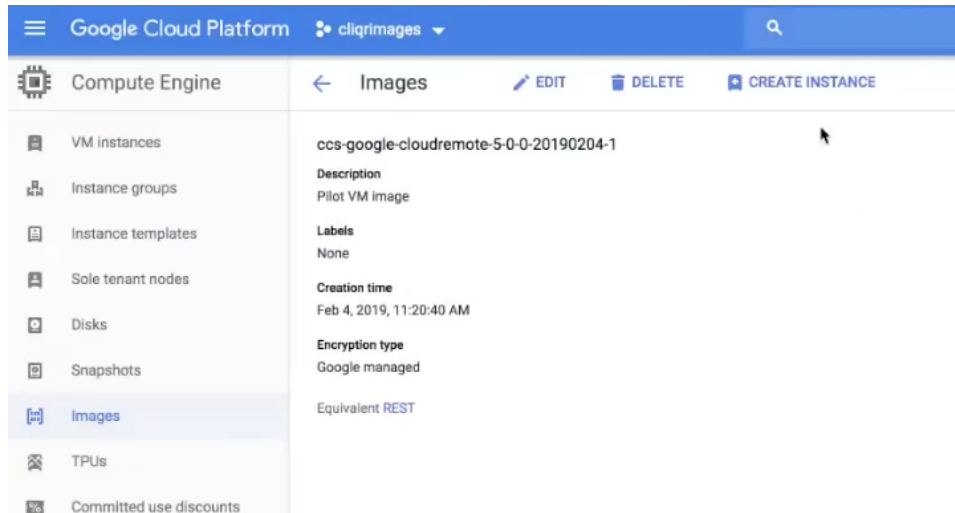
After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

Configure Cloud Remote in a Google Region for a Kubernetes Cloud

Configure Cloud Remote in a Google region to support a Kubernetes target cloud as follows.

Obtain and Launch the Cloud Remote Appliance in Google

1. Request the Cloud Remote shared VMI form Cisco support by opening a [CloudCenter Support case](#). In your request, specify the following details:
 - a. Your GCP account number
 - b. Your GCP project ID number
 - c. Your CloudCenter Suite version
 - d. Your Customer ID (CID)
 - e. Your customer name
 - f. Specify if your setup is in production or for a POC
 - g. Your Contact Email
2. After you open a case, your support case is updated with the shared VMI ID. **Proceed to the next step only after your support case is updated with the VMI ID.**
3. Navigate to the GCP dashboard and search for the VMI ID name provided in the [CloudCenter Support case](#) in the list of images for your project.
4. Launch an instance using the shared VMI.
 - a. Click on the image name. This takes you to the page for the image



- b. Click on Create Instance to display the Instance properties page

Name ⓘ

instance-2

Region ⓘ **Zone** ⓘ

us-west1 (Oregon) us-west1-a


Machine type
Customize to select cores, memory and GPUs.

1 vCPU 3.75 GB memory [Customize](#)

Container ⓘ

Deploy a container image to this VM instance. [Learn more](#)

Boot disk ⓘ

 New 30 GB standard persistent disk
Image
ccs-google-cloudremote-5-0-0-2019020... [Change](#)

Identity and API access ⓘ

Service account ⓘ

Compute Engine default service account

Access scopes ⓘ

Allow default access
 Allow full access to all Cloud APIs
 Set access for each API

Firewall ⓘ

Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management, security, disks, networking, sole tenancy

You will be billed for this instance. [Compute Engine pricing](#)

c. Complete these fields:

- i. Instance name
- ii. Region and zone
- iii. Machine type: select 2 vCPU, 7.5 GB RAM
- iv. Click the checkbox to allow HTTPS access
- v. Click the Security tab (under the Allow HTTPS traffic checkbox). In the SSH key field, add your organization's public ssh key followed by a space and then the username you want to use to login to the Cloud Remote appliance. Click the Add Item button when done.

Firewall ⓘ
Add tags and firewall rules to allow specific network traffic from the Internet

Allow HTTP traffic
 Allow HTTPS traffic

Management **Security** Disks Networking Sole Tenancy

Shielded VM ⓘ
Select a shielded image to use shielded VM features.
Turn on all settings for the most secure configuration.

Turn on Secure Boot ⓘ
 Turn on vTPM ⓘ
 Turn on Integrity Monitoring ⓘ

SSH Keys
These keys allow access only to this instance, unlike [project-wide SSH keys](#) [Learn more](#)

Block project-wide SSH keys
When checked, project-wide SSH keys cannot access this instance [Learn more](#)

centos

```

VM=FU-X9CT95c04XTE=KaT12a3K9B/uoKcT1DE/
J
C
C
€
Y
6J centos|

```

[+ Add Item](#)

⤴ Less

You will be billed for this instance. [Compute Engine pricing](#) ↗

[Create](#) [Cancel](#)

- d. Click Create to launch the instance.
5. Optional but recommended for production environments: Deploy two additional instances of the appliance to form a cluster for HA. Cloud Remote includes support for clustering of multiple nodes. You will "add" these two additional instances to the first instance after the first instance is configured. See [Cloud Remote > Scaling](#) for details.
6. Once the first instance of the appliance has been launched, use the GCP console to **note its IP public and private addresses**. You will need this information later on in order login to the Cloud Remote web UI and to complete the Region Connectivity settings in the CloudCenter Suite Web UI. Also, note the IP addresses of any other appliances you launch.

Setup Cloud Remote Firewall Rules for a Kubernetes Cloud

After you deploy the Cloud Remote appliance, you will need to open various ports on each instance of the appliance. To do this, use the tools provided by the cloud provider to create a new security group for your Cloud Remote cluster; then, associate each appliance in the cluster with that security group. Use the tables below for guidance on what port rules should be added to that security group.

Port rules for a single node Cloud Remote deployment:

Port	Protocol	Source	Usage
22	TCP	Limit to address space of users needing SSH access for debugging and changing default ports	SSH
443	TCP	Limit to address space of users needing access to the Cloud Remote web UI for setup and scaling	HTTPS (Cloud Remote web UI)
5671	TCP	Limit to address of the CloudCenter Suite cluster's local AMQP service	AMQP
15671	TCP	Limit to address space of users needing web access for debugging the remote AMQP service	HTTPS (AMQP Management)



The Cloud Remote web UI and AMQP ports listed above are the defaults used by Cloud Remote. You may change these port numbers using the **Change Ports shell script** (see [Cloud Remote \(Conditional\) > Custom Port Numbers \(Conditional\)](#)) once the appliance is fully configured and communicating with the CloudCenter Suite cluster. If you plan to modify any of these three port numbers, update the firewall rules accordingly.

For a multi-node Cloud Remote cluster deployment, these additional port rules should be added to the same security group used for the single node configuration:

Port	Protocol	Source
2377	TCP	<cr_sec_group> *
25672	TCP	<cr_sec_group>
7946	UDP	<cr_sec_group>
4369	TCP	<cr_sec_group>
9010	TCP	<cr_sec_group>
4789	UDP	<cr_sec_group>

* <cr_sec_group> represents the security group that all Cloud Remote nodes are joined to.

Specify AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud

From the CloudCenter Suite UI, for the Kubernetes cloud requiring Cloud Remote, navigate to the corresponding Details tab. Click the **Configure Region** link in the upper left of the Region Connectivity section to bring up the Configure Region dialog box.

The toggle settings should be the same as when you set them in the connectivity page of the Add Cloud dialog box. You may need to update the **Local AMQP IP Address** or the **Remote AMQP IP Address** fields per the table below.

Toggle Settings	Field	Value
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = Yes	Local AMQP IP Address	Pre-populated with the address and port number of the "local" AMQP server running in the CloudCenter Suite cluster. If Cloud Remote is accessing the CloudCenter Suite cluster through a user-supplied proxy server or NAT firewall, overwrite this field with the corresponding local AMQP IP address and port number provided by the user-supplied proxy server or NAT firewall and accessible to Cloud Remote.
Cloud Endpoint Directly Accessible = No AND CloudCenter Directly Accessible from Cloud Remote = No	Remote AMQP IP Address	Enter <Cloud_Remote_IP>:<amqp_port>, where <Cloud_Remote_IP> = the IP address Cloud Remote which is accessible to the CloudCenter Suite cluster, and <amqp_port> = 5671 OR the custom AMQP port number you would later set with the Change Ports shell script on the Cloud Remote appliance (see Cloud Remote (Conditional) > Custom Port Numbers (Conditional)). If there is no user-supplied NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, the IP address would be the public IP address of Cloud Remote. If there is a NAT firewall or proxy server between the CloudCenter Suite cluster and Cloud Remote, instead, enter the corresponding public IP address and port number that the firewall or proxy server presents to the internet on behalf of the "remote" AMQP server running in Cloud Remote.

When done, click **OK** to save the setting and dismiss the dialog box.

Download Region Connectivity Settings and Upload to Cloud Remote

Cloud Remote uses the region connectivity settings set in the Workload Manager or Cost Optimizer UI. After saving the Region Configuration settings in the Workload Manager or Cost Optimizer UI, you must download them and to your local computer and then upload them to Cloud Remote as follows.

Click the **Download Configuration** link in the upper right of the Region Connectivity section, as shown in the figure below.

Region Connectivity Running Download Configuration [Configure Region](#)

Clicking Download Configuration causes two things to happen:

- An encrypted zip file named **artifacts.zip** will be downloaded by your browser. Make note of the location of this zip file as you will need to upload it to Cloud Remote through the Cloud Remote web UI (see below).
- The Region Connectivity section header updates to display a **Copy Encryption Key** link, as shown in figure below.

Region Connectivity Enabling...

Download Configuration

Copy Encryption Key

Edit Connectivity

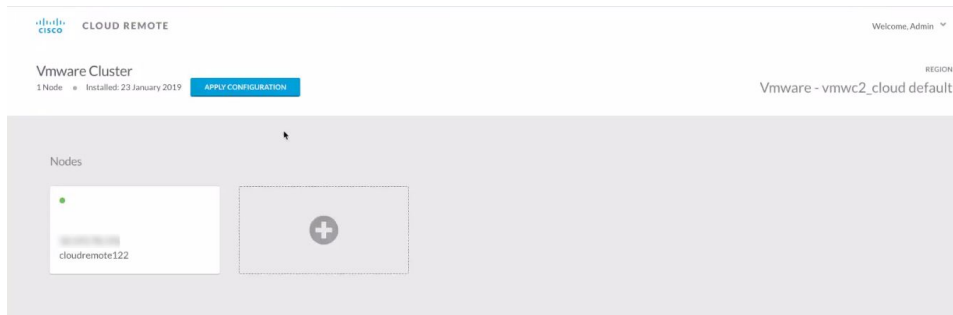
Click the **Copy Encryption Key** link to save the key to your clipboard. A success message will be displayed temporarily above the Region Connectivity section header. Make sure not to overwrite the clipboard with other data. You will need the key when you upload the configuration zip file to Cloud Remote.



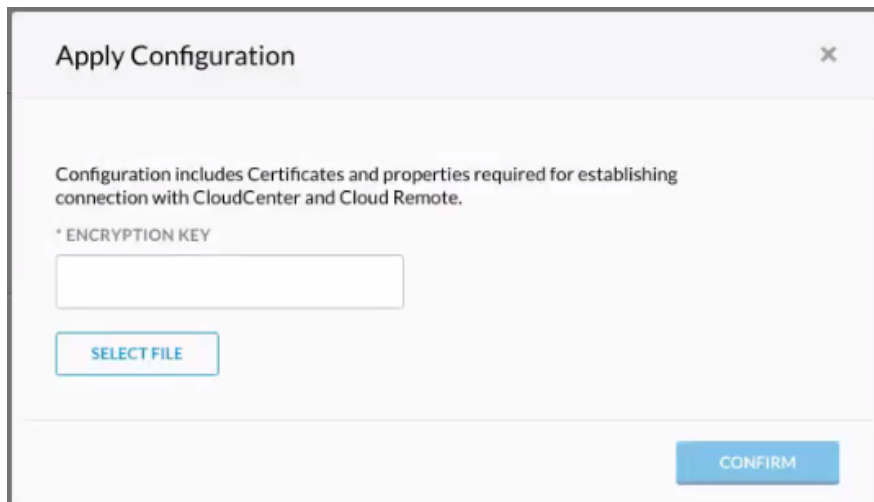
If you change the connectivity settings in the CloudCenter Suite UI and need to again download the zip file, a new encryption key is automatically created and can be copied to the clipboard by clicking the **Copy Encryption Key** link again.

After you have downloaded the zip file and copied the encryption key to your clipboard, login to Cloud Remote web UI.

1. Open another browser tab and login to https://<Cloud Remote_ip> with the default credentials: admin / cisco.
2. You will immediately be required to change your password. Do so now.
3. You are now brought to the Cloud Remote home page as shown in the figure below.



4. Click the **Apply Configuration** button in the page header. This prompts you to select a configuration file and enter the encryption key as shown in the figure below.



5. Paste the encryption key that was copied to the clipboard into the **Encryption Key** field in the dialog box.
6. Click **Select File** and browse to the artifacts.zip file that you downloaded through the CloudCenter Suite web UI and select it.
7. Click **Confirm**.
8. Once the zip file is successfully transmitted and accepted, the Cloud Remote appliance attempts to establish communication with the CloudCenter Suite cluster and the Cloud Remote web UI home page is updated to show the name of the region it is connecting to in the upper right (see figure below).

Switch your focus back to the Region Connectivity section of the target cloud region in the CloudCenter Suite web UI. The status indicator in the Region Connectivity section header will change from Not Configured to Running once connectivity between Cloud Remote and the CloudCenter Suite cluster is completely established (see figure below).

Cloud endpoint accessible from Cloud Center Manager	No
Cloud Center Manager AMQP reachable from worker VM's	No
Cloud Center Manager AMQP accessible from cloud	Yes
Remote AMQP IP	
Worker AMQP IP	192.168.30.16:5671
Blade Name	cloudcenter-blade-vmware-9-0289
Blade Port	8443

After completing these steps, Workload Manager and Cost Optimizer can use Cloud Remote for communicating with the target cloud region.

The Cloud Remote artifacts mentioned in [Conditional Component Appliance Images](#) is called **ccs-cloudremote-artifacts-<release.tag>-YYYYMMDD.0.zip** and contains the following items:

- Installer script – Only applicable for IBM Cloud and vCD Cloud.
- Upgrade script – Applicable for all supported clouds.
- The proxy service script for the CloudCenter Suite cluster – Applicable for all supported clouds.

The items from this artifact are used in the procedures provided in this section.

To use a static IP address with Cloud Remote, follow this procedure.

1. SSH into the Cloud Remote VM.
2. Set the static (private) IP address using the following commands.

```
export HOST_IP=<static IP>
/opt/cisco/pilot/builds/
cd pilot_XXXX
cd bin
./bootstrap.sh
```



If multiple pilot_XXXX folder versions exist, use the following examples to identify the **latest, major version**:

- pilot_5.1.2-20191015.1
- pilot_5.1.2-20200111.1 > this is the latest pilot folder based on major version and date

The Cloud Remote internal network uses the 10.10.0.0/16 network range of IP addresses. If the Cloud Remote VM needs to be deployed in the same network range (10.10.0.0/16), then you must change the internal network range to another non-conflicting range.

To change the Cloud Remote internal network range, follow this procedure.

1. SSH into the Cloud Remote VM.
2. Issue the following commands:

```

cd /opt/cisco/pilot/builds/
cd pilot_XXXXXX
cd docker
vi pilot_base.yml
# a. Search for 10.10.0.0/16 #Change this line to appropriate non-conflicting range
# b. Save and quit

cd ../bin/
./bootstrap.sh

```

Verify the following requirements to run the installer script on a custom CentOS7 VM:

- This procedure is only applicable to CentOS7 VMs.
- The VM should have 2 CPUs, 8GB Memory and 30G storage.
- Run **yum update** on the VM.
- Run the following commands to update the kernel:

```

sudo rpm --import https://www.elrepo.org/RPM-GPG-KEY-elrepo.org
sudo rpm -Uvh http://www.elrepo.org/elrepo-release-7.0-3.el7.elrepo.noarch.rpm
sudo yum --disablerepo='*' --enablerepo='elrepo-kernel' list available
sudo yum --enablerepo=elrepo-kernel -y install kernel-ml
sudo grub2-set-default 0
sudo grub2-mkconfig -o /boot/grub2/grub.cfg
sudo reboot

```

To install Cloud Remote in your custom CentOS system, follow this procedure.



This procedure is only applicable for IBM Cloud and vCD.

1. Locate the Cloud Remote installer script (available in the Cloud Remote artifact mentioned in the section above) at software.cisco.com and copy it to a directory in your Cloud Remote instance.
2. Establish a terminal session to the Cloud Remote instance and navigate to the directory containing the installer script.
3. Run the following commands from the Cloud Remote command prompt.

```

[root@centos7cpsgcore ~]# ./cloudRemote5.1.0.bin
Verifying archive integrity... All good.
Uncompressing cloud remote 5.1.0 installer 100%
Usage: ./INSTALLER_FILE -- [--host-ip 'PRIVATE NETWORK IP ADDRESS']
example: ./cloudRemote5.1.0-20190614.0.bin -- --host-ip '1.2.3.4'    >>> Please note the extra --
before --host-ip
[root@centos7cpsgcore ~]#

```

4. Confirm the successful execution of the script.

To upgrade Cloud Remote (script available in the Cloud Remote artifact file mentioned in the section above) in your Workload Manager or Cost Optimizer system, follow this procedure for each instance of Cloud Remote.

1. Locate the Cloud Remote upgrade script at software.cisco.com and copy it to a directory in your Cloud Remote instance.
2. Establish a terminal session to the Cloud Remote instance and navigate to the directory containing the upgrade script.
3. Run the following commands from the Cloud Remote command prompt.

```

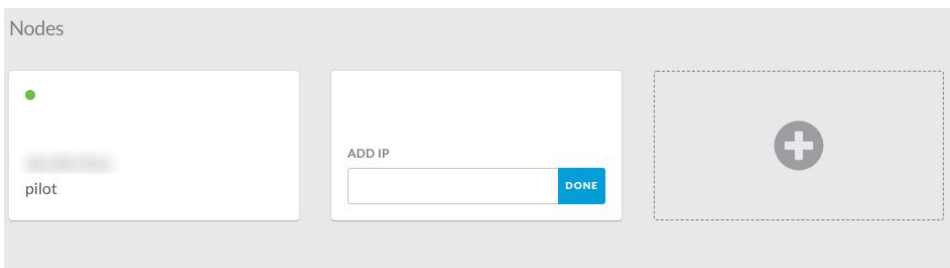
chmod +x UPGRADE_FILE
sudo ./ UPGRADE_FILE

```

4. Confirm the successful execution of the script.

After your initial Cloud Remote instance is launched and configured, it is recommended that you can add two additional nodes to form a cluster. When scaling up or down it is recommended not to run your cluster continuously with only two nodes. Follow this procedure:

1. Deploy a new instance of the appliance in the same network as the first appliance. Record its IP address. Alternatively, if you have another instance of Cloud Remote that you launched previously but stopped, restart that instance.
2. At the home page of the Cloud Remote web UI for the initial instance, click the tile with the plus icon. After clicking the plus icon, the tile will change and show an **Add IP** field as shown in the figure below. Enter the address of your newly launched (or restarted) instance in this field and then click **Done**.



Your new instance will become part of the cluster. There is no need to login to the new instance to set configuration. The cluster can be managed through the first instance's Web UI.

You can scale down the cluster in two steps:

1. From the Cloud Remote web UI home page, take note of the IP address of the node you want to remove from the cluster. Then remove it by hovering over its tile and clicking the trash icon.
2. Login to the cloud console for your target cloud and find the VM with the IP address of the node you just removed from the cluster. Stop that VM.

If firewall settings prevent you from using standard port numbers for HTTPS, AMQP, and Guacamole protocols, you can specify custom port numbers for those protocol using a **Change Ports shell script** that is included in the Cloud Remote appliance. Otherwise, Cloud Remote will use the standard port numbers as shown in the table below.

Service	Default Port
HTTPS (web UI)	443
AMQP (Rabbit MQ)	5671
Guacamole	8443



- The Guacamole service is only needed for user access to VM-based deployments. Therefore, there is no need to create a custom port number for the Guacamole service if this Cloud Remote cluster is used to support connectivity to a Kubernetes target cloud.
- Only run the script after you have downloaded the artifacts.zip file (mentioned in the section above) from the region connectivity settings section of the Regions tab in the Workload Manager or Cost Optimizer UI, and then uploaded that file to Cloud Remote through the Cloud Remote web UI. In addition, if you later need to upload a new artifacts.zip file to Cloud Remote, the custom port settings will be erased and you will need to run the Change Ports script again.

Follow these steps to run the script:

1. Establish an ssh session to master (initial) Cloud Remote instance.
2. Navigate to the directory: `/opt/cisco/pilot/builds/<pilot folder>/bin`
3. Run the shell script:

```
changeports.sh
```

4. You are first prompted to see if you want to change the web UI port number. Type **Y** or **N**.
 - a. If you enter **Y**, you are prompted for:
 - i. Current port number. Type any number and then ENTER.
 - ii. New port number. Type the new port number and then ENTER. The script will attempt to change the port number on this node and then on all other nodes in your Cloud Remote cluster. When done, you are prompted whether you want to change the value of the next port.
 - b. If you enter **N**, you are prompted whether you want to change the value of the next port.
5. When you are prompted for the Rabbit MQ port number, type **Y** and enter the old and then new port numbers as above, or type **N**, whichever is appropriate.
6. When you are prompted for the Guacamole port number, type **Y** and enter the old and then new port numbers as above, or type **N**, whichever is appropriate. If the target cloud is a Kubernetes cloud, the Guacamole server is not used and you would, therefore, enter **N**.



Be sure to verify that your proxy can access Cloud Remote's Port 5671 (RabbitMQ). If you've changed Cloud Remote's RabbitMQ port to 443, then the proxy must be able to access Cloud Remote's Port 443.

If your proxy restricts outbound ports, then you must configure Cloud Remote's's RabbitMQ port to *one of the accessible ports (usually 443)* using the **changeports.sh** script as listed in the *Custom Port Numbers (Conditional)* section.

The Cloud Remote can communicate with the CloudCenter Suite server by using the Cisco proxy to access outbound environments. Effective CloudCenter Suite 5.1, you can enable direct connectivity between CloudCenter Suite and Cloud Remote using a script that is included with the Cloud Remote artifact file mentioned in the section above. This script is backwards compatible and works with any CloudCenter Suite 5x version. This allows users to avoid the using the Cisco proxy for external communications when using the CloudCenter Suite.

This section directly relates to the setting when you specify the *AMQP and Guacamole Addresses for Supporting Cloud Remote* or when you specify the *AMQP Addresses for Supporting Cloud Remote for a Kubernetes Cloud*. This setting is highlighted in the following screenshots for a private (screenshot on the left) and public (right screenshot on the right) clouds:

Configure Region
✕

IS CLOUD END POINT DIRECTLY ACCESSIBLE?

NO

SHOULD WORKER VMS DIRECTLY CONNECT WITH CLOUDCENTER SUITE?

NO

IS CLOUDCENTER SUITE DIRECTLY ACCESSIBLE FROM YOUR CLOUD REMOTE?

YES

LOCAL AMQP IP ADDRESS

WORKER AMQP IP ADDRESS

GUACAMOLE PUBLIC IP AND PORT

GUACAMOLE IP ADDRESS AND PORT FOR APPLICATION VMS

Add Cloud
✕

Connectivity Settings

SHOULD WORKER VMS DIRECTLY CONNECT WITH CLOUDCENTER SUITE?

NO

IS CLOUDCENTER SUITE DIRECTLY ACCESSIBLE FROM YOUR CLOUD REMOTE?

YES

Diagram below is based on selections above

The diagram illustrates the connectivity between the CloudCenter Suite and the Cloud Remote Instance. On the left, the CloudCenter Suite (containing AMQP) is shown. A 'DIRECT' connection arrow points from the CloudCenter Suite to the Cloud End Point on the right. Below this, an 'AZURERM' cloud environment is depicted, containing a Cloud End Point and a Worker VM. The Worker VM is connected to the Cloud End Point within the cloud environment.

Depending on the environment, users may need the proxy service to be on the Cloud Remote or the CloudCenter Suite cluster.

Proxy Service on the Cloud Remote Instance

For this scenario, the CloudCenter Suite resides on one cloud (for example, VMware datacenter/Private cloud) and the Cloud Remote resides on another cloud (for example, GKE/SaaS/Public cloud). When you configure the region for a cloud in this scenario and you toggle the **Is CloudCenter Suite Directly Accessible from Your Cloud Remote** setting to **Yes**, then this setting is indicative of the CCS to Cloud Remote communication going through a AMQP instance.

To enable the proxy service on the Cloud Remote instance, follow this procedure.

1. Establish an SSH session to the master (initial) Cloud Remote instance.
2. Navigate to the directory: `/opt/cisco/pilot/builds/<pilot folder>/bin` folder. For example:

```
cd /opt/cisco/pilot/builds/pilot_5.1.0-PILOTVERSION/bin/config_crproxy.bin
```

3. SSH into the Cloud Remote instance and run the CR proxy installer that is located in the directory that you set in Step 2 above.
4. Here is the sample usage and output.

You have now enabled the proxy service on the Cloud Remote instance. You can verify the connectivity in the region settings Connectivity section as displayed in the following screenshot.

Region Connectivity **Running**

Cloud endpoint accessible from CloudCenter Suite	No
CloudCenter Suite AMQP reachable from worker VM's	No
CloudCenter Suite AMQP accessible from cloud	Yes
Local AMQP IP	[REDACTED]
Worker AMQP IP	[REDACTED]
Guacamole Public IP and Port	[REDACTED]
Guacamole IP Address and Port for Application VMs	[REDACTED]
Blade Name	cloudcenter-cloud-blade-[REDACTED]

Proxy Service on the CloudCenter Suite Cluster

For this scenario, the CloudCenter Suite resides on one cloud (for example, GKE/SaaS/Public cloud) and the Cloud Remote resides on another cloud (for example, VMware datacenter/Private cloud). When you configure the region for a cloud in this scenario and you toggle the **Is CloudCenter Suite Directly Accessible from Your Cloud Remote** setting to No, then this setting is indicative of the CloudCenter Suite to Cloud Remote communication going through an AMQP instance.

To enable the proxy service on the CloudCenter Suite cluster, follow this procedure.

1. Make sure KUBECONFIG environment variable is set. The user must have the applicable permissions to create Kubernetes services and deployments.

```
kubectl get svc
```

```
#The above command should return all the services in your Cisco CloudCenter Suite cluster.
```

2. Locate and download the `ccs-cloudremote-artifacts-5.1.0-20190816.1.zip` from software.cisco.com.
3. Locate and copy the `config_k8scrproxy.bin` file from the `ccs-cloudremote-artifacts-5.1.0-20190816.1.zip` file to a directory in your Cloud Remote instance, and execute it.
4. Here is the sample usage and output.

```

CISCO-M-K192:crproxy cisco$ ./config_k8scrproxy.bin
Verifying archive integrity... 100% All good.
Uncompressing Proxy for cloudremote in K8S cluster 100%
Usage:
./config_k8scrproxy.bin
-- --namespace 'K8S NAMESPACE' --region-id 'CLOUD REGION ID'
--proxy-host 'PROXY HOST' --proxy-port 'PROXY PORT' --target-amqp-host
'CLOUD REMOTE IP' --target-amqp-port 'CLOUD REMOTE AMQP PORT'
[--docker-image-url 'DOCKER IMAGE URL of CRPROXY' --proxy-user 'PROXY
USERNAME' --proxy-passwd 'PROXY PASSWORD']
if option --docker-image-url is not provided, predefined image will be used
No Authentication example: ./config_k8scrproxy.bin -- --namespace cisco --region-id 28 --proxy-host
proxy.example.com --proxy-port 80 --target-amqp-host 1.2.3.4 --target-amqp-port 443
With Authentication and non-default docker image url example: ./config_k8scrproxy.bin -- --namespace
cisco --region-id 28 --proxy-host proxy.example.com --proxy-port 80 --target-amqp-host 1.2.3.4 --target-
amqp-port 443 --proxy-user 'user' --proxy-passwd 'password' --docker-image-url devhub.example.com
/crproxy:latest

CISCO-M-K192:crproxy cisco$ ./config_k8scrproxy.bin -- --namespace cisco --region-id 28 --proxy-host
proxy.example.com --proxy-port 80 --target-amqp-host 1.2.3.4 --target-amqp-port 443 --docker-image-url
dockerhub.cisco.com/cloudcenter-dev-docker/custom/cloudcenter/crproxy:latest
Verifying archive integrity... 100% All good.
Uncompressing Proxy for cloudremote in K8S cluster 100%
cisco 28 dockerhub.cisco.com/cloudcenter-dev-docker/custom/cloudcenter/crproxy:latest proxy.example.com
80 1.2.3.4 443
service "cloudcenter-blade-crproxy-28" deleted
deployment.extensions "cloudcenter-blade-crproxy-28" deleted
service "cloudcenter-blade-crproxy-28" created
deployment.apps "cloudcenter-blade-crproxy-28" created
cloudcenter-blade-crproxy-28
ClusterIP xx.xxx.xx.xxx <none>
12850/TCP 0s
socat TCP4-LISTEN:12850,reuseaddr,fork PROXY:proxy.example.com:1.2.3.4:443,proxyport=80

```

5. In this sample procedure, the Cloud Remote is configured to use `<cloudcenter-blade-crproxy-28:12850>` proxy. You must now setup connectivity between Cloud Remote and the CloudCenter Suite cluster:
 - a. Login to the CloudCenter Suite and navigate to the corresponding `cloud Region` page.
 - b. Click the **Edit Connectivity** link.
 - c. Set the value of the **Remote AMQP IP** field to `cloudcenter-blade-crproxy-28:12850`.
 - d. Download and apply the configuration to the Cloud Remote and wait for the **Region Connectivity** status to change to **Running**.
6. You have now enabled the proxy service on the Cloud Remote instance. You can verify the connectivity in the region settings Connectivity section as displayed in the following screenshot.

Region Connectivity **Running**

Cloud endpoint accessible from CloudCenter Suite	Yes
CloudCenter Suite AMQP reachable from worker VM's	No
CloudCenter Suite AMQP accessible from cloud	No
Remote AMQP IP	cloudcenter-cloud-blade-amazon-
Worker AMQP IP	
Guacamole Public IP and Port	
Guacamole IP Address and Port for Application VMs	
Blade Name	cloudcenter-blade-amazon-

- **Issue:** When you install Cloud Remote, you may sometimes see the following issues:
 - The Cloud Remote UI does not render even after a long time.
 - The Cloud Remote installer continues to poll after the installation.

Workaround: In both situations, follow this procedure to address the issue.

1. Run the following command to verify if the `Pilot/Babl` container is crashing.

```
docker ps
```

2. If it is crashing, run following command.

```
docker service update --health-interval=30s --health-retries=1000 pilot_babl
```

3. This command can take up to 5 minutes to complete. After applying the configuration, if the Pilot/RabbitMQ container continues to crash, run the following additional command.

```
docker service update --health-interval=30s --health-retries=1000 pilot_rabbitmq
```

- **Issue:** The network connection is slow when using Cloud Remote.

Workaround: Try changing the health interval timeout period:

```
docker service update --health-interval=5m --health-start-period=10m --health-timeout=10m  
pilot_remoteproxy
```

Cloud Maintenance

Cloud Maintenance

Clouds, cloud regions, and cloud accounts that are created within a tenant are automatically co-owned by all tenant admins. In Workload Manager, standard users do not have direct access to these elements for deploying workloads. Instead users deploy workloads through an intermediary construct: the [deployment environment](#). However, it is possible to directly share specific cloud regions and cloud accounts with subtenants as explained in [Tenant Management > Manage Clouds](#). Once a cloud region or cloud account is shared with a subtenant, admin users in that subtenant can use those regions and accounts for creating their own deployment environments. However, the admins in the subtenant cannot edit or delete those shared accounts or regions.

Deleting clouds, cloud regions, and cloud accounts must be done in a certain sequence. Before you can delete a multi-region cloud, you must first delete all regions for that cloud. After you delete all regions, the delete icon appears for the cloud in the Clouds page. Before you can delete a region, you must first delete all cloud accounts associated with that cloud. If you attempt to delete a region when any cloud accounts are assigned to the cloud, you will get an error message as follows:

The screenshot shows the 'Clouds' management interface. At the top, there is a red error banner that reads: "Could not delete region. Cloud Region 'US East (Ohio)' cannot be deleted as its cloud group has associated cloud accounts." Below this, the interface displays a list of clouds. The 'asw2' cloud is selected, showing its configuration. Under the 'Cloud Accounts' section, a single account named 'jb' is listed. The 'asw2 Regions' section shows the 'US East (Ohio)' region, which is currently 'Running' and has '1 Enabled Users'. A 'Delete Region' button is visible next to the region name.

Similarly, before you can delete a single region cloud you must first delete all cloud accounts associated with that cloud. Otherwise, you will see an error message as shown below:

The screenshot shows the 'Clouds' management interface with a red error banner: "Could not delete cloud. Cloud Group [kubejb] has associated cloud accounts. Please delete the cloud accounts before trying to delete the cloud group." The 'kubernetes' cloud is selected, showing it is in the 'Running' region with '0 Enabled Users'. A 'Delete Cloud' button is visible next to the cloud name.

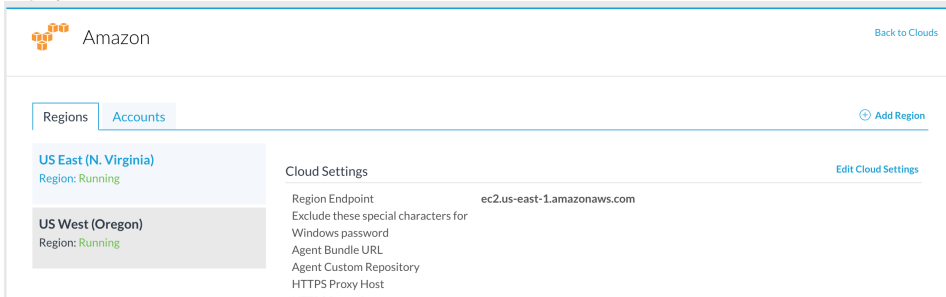
Before you can delete a cloud account you must first remove that cloud account from all [deployment environments](#) in which it is used. Otherwise, you will see an error message as shown below:

The screenshot shows the 'asw2' cloud account management page. A red error banner reads: "Failed to delete cloud account. Cloud Account is associated with the Deployment Environment." Below the error, there are tabs for 'Regions' and 'Accounts'. The 'Accounts' tab is active, showing a table of cloud accounts. The account 'jb' is listed with a 'Delete' button in the 'Actions' column.

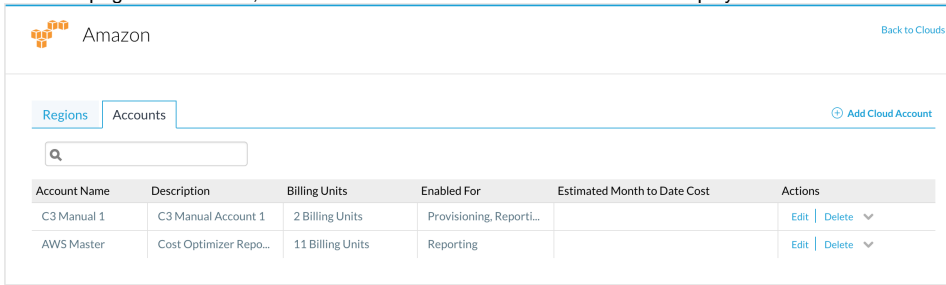
Account Name	Description	Billing Units	Enabled For	Estimated Month to Date Cost	Actions
jb		068685977692	Provisioning, Reporting		Edit Delete

Therefore, to delete a cloud follow these steps:

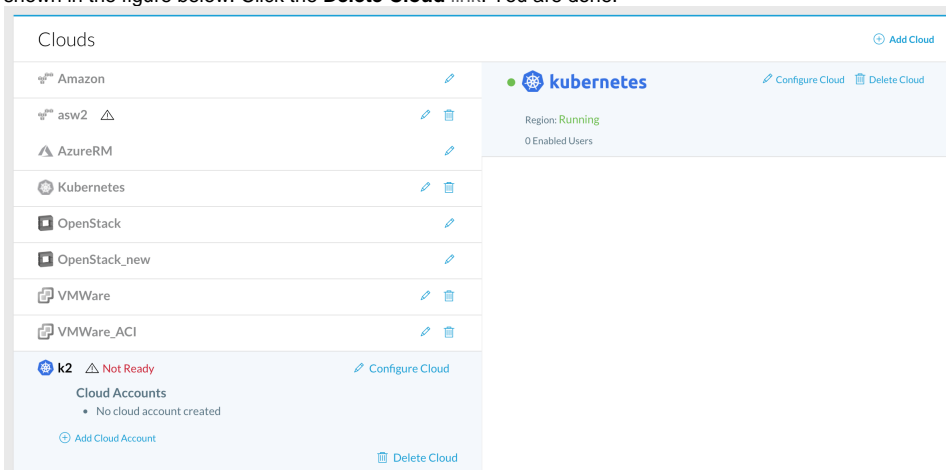
- From the Clouds page, select the cloud and click its **Configure Cloud** link which displays the page for this cloud. The page for this cloud will be displayed as shown below.



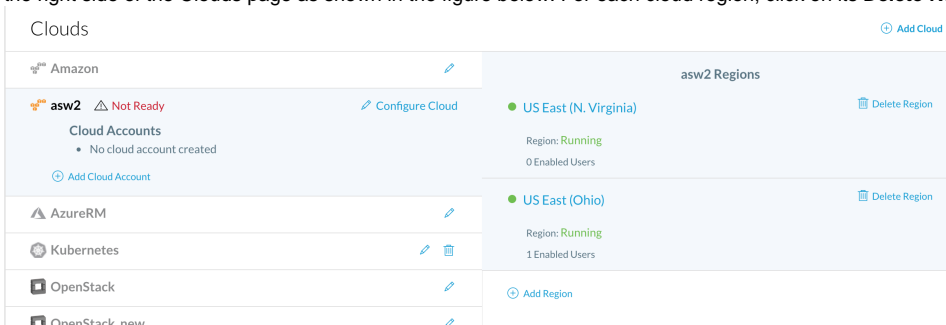
- From the page for this cloud, select the **Accounts** tab. The Accounts tab is displayed as shown below.



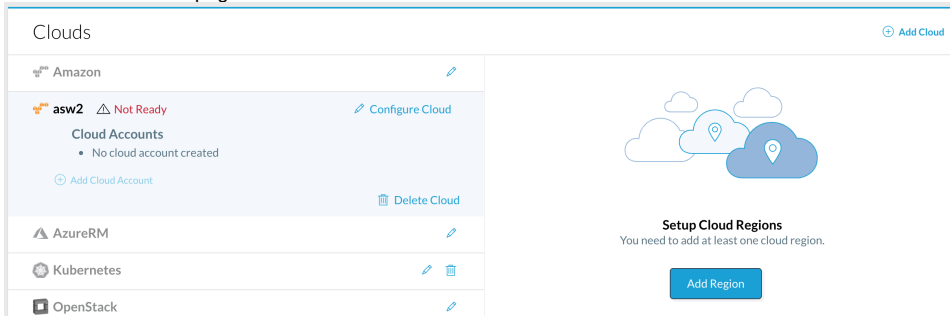
- From the Accounts tab, delete all accounts one by one by clicking the **Delete** link in the Actions column. If an error about deployment environments appears, click on the **Main Menu > Environments** menu tab, browse the deployment environments for any references to the account, and remove the account from those deployment environments. When done, return to the Clouds page.
- From the Clouds page, if the cloud is a single region cloud, the **Delete Cloud** link for that cloud will appear in the left side of the Clouds page, as shown in the figure below. Click the **Delete Cloud** link. You are done.



- If the cloud is a multi-region cloud, on the left side of the Clouds page, select the cloud. This causes the regions for this cloud to be displayed on the right side of the Clouds page as shown in the figure below. For each cloud region, click on its **Delete Region** link.



6. After you delete all cloud regions associated with a cloud, the Clouds page will appear as shown below. Click the **Delete Cloud** link for the cloud on the left side of the page. You are done.



The screenshot displays the 'Clouds' management interface. On the left, a list of cloud providers is shown:

- Amazon
- asw2 (Not Ready) with a 'Configure Cloud' link
- AzureRM
- Kubernetes
- OpenStack

The 'asw2' cloud is selected, showing a 'Cloud Accounts' section with the message 'No cloud account created' and an 'Add Cloud Account' link. A 'Delete Cloud' link is also visible at the bottom of the list.

On the right side of the page, there is a 'Setup Cloud Regions' section with the text 'You need to add at least one cloud region.' and an 'Add Region' button. An illustration of clouds with location pins is positioned above this text.

Cost Groups Configuration

Cost Groups Configuration

- [Cost Groups UI](#)
- [How Do I...](#)

Cost Groups UI

Cost Groups UI

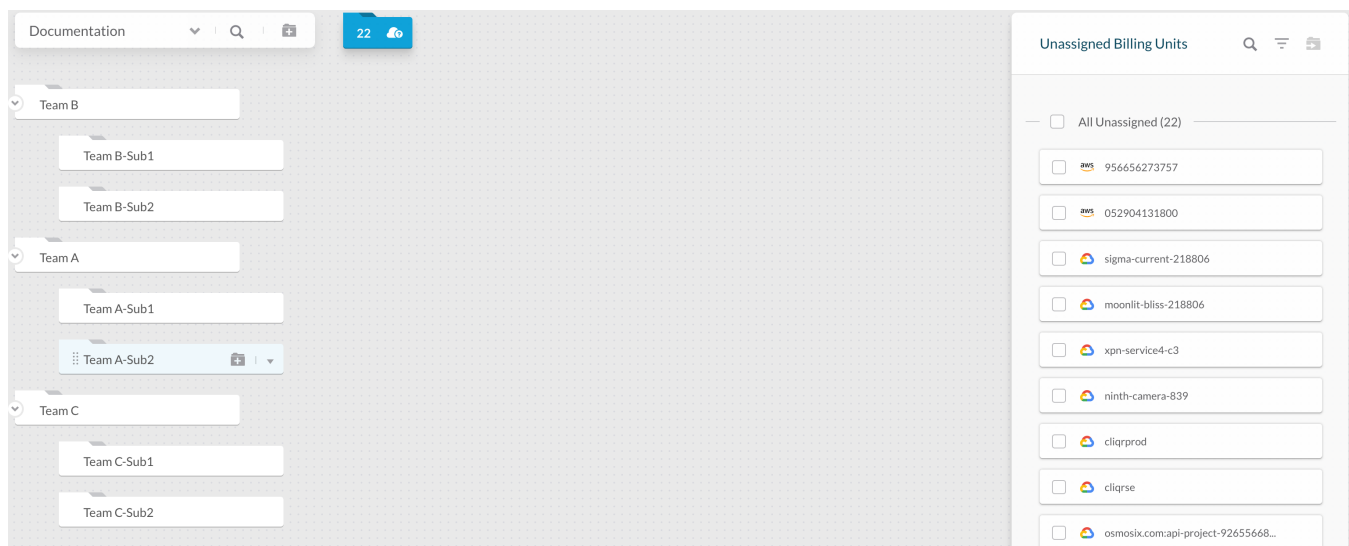
- [Overview](#)
- [Terminology](#)
- [What's in the Cost Groups UI?](#)
- [Cost Group Type](#)
- [Cost Group](#)
- [Sharing Cost Groups](#)
- [Billing Units](#)
- [Tags](#)

After you have configured clouds for Cost Optimizer, you may set up cost groups to classify the data. Data classification helps you to distinguish and identify the data. Use the **Cost Groups** page to classify data and define your hierarchy.

Throughout this document, you will refer to the following terms:

Term	Description
Cost Group Type	Maps to the various functions in an organization, for example, Development, HR, IT, and so on.
Cost Groups	Hierarchical structure to define your organization and distribute billing units.
Cloud Account	Credentials for logging in to a cloud provider.
Billing Units	Refers to different entities depending on the cloud. These entities are account IDs in Amazon cloud, Project IDs in Google cloud, Subscription ID in AzureRM cloud, Datacenter name (prefixed with the cloud group) in vCenter clouds, Project ID in OpenStack cloud, and Namespace UID in Kubernetes cloud.
Budgets	Ability to allocate or reserve amounts per cloud or cost group type.
Tags	Key-value pairs associated with resources in a cloud.

The **Cost Groups** UI, as shown in the following sample screenshot, has the following: **Cost Group Type (Department(s))** and **Unassigned Billing Units** and **Unassigned Tags**. See [UI Behavior](#) for details on icons.



The following table explains the icons in the UI (in alphabetical order).

Icon	Description
Action	Perform action-oriented tasks – Add, Delete, Rename, and Share on the Cost Group.
Add Cost Group	Add a Cost Group to a Cost Group Type.

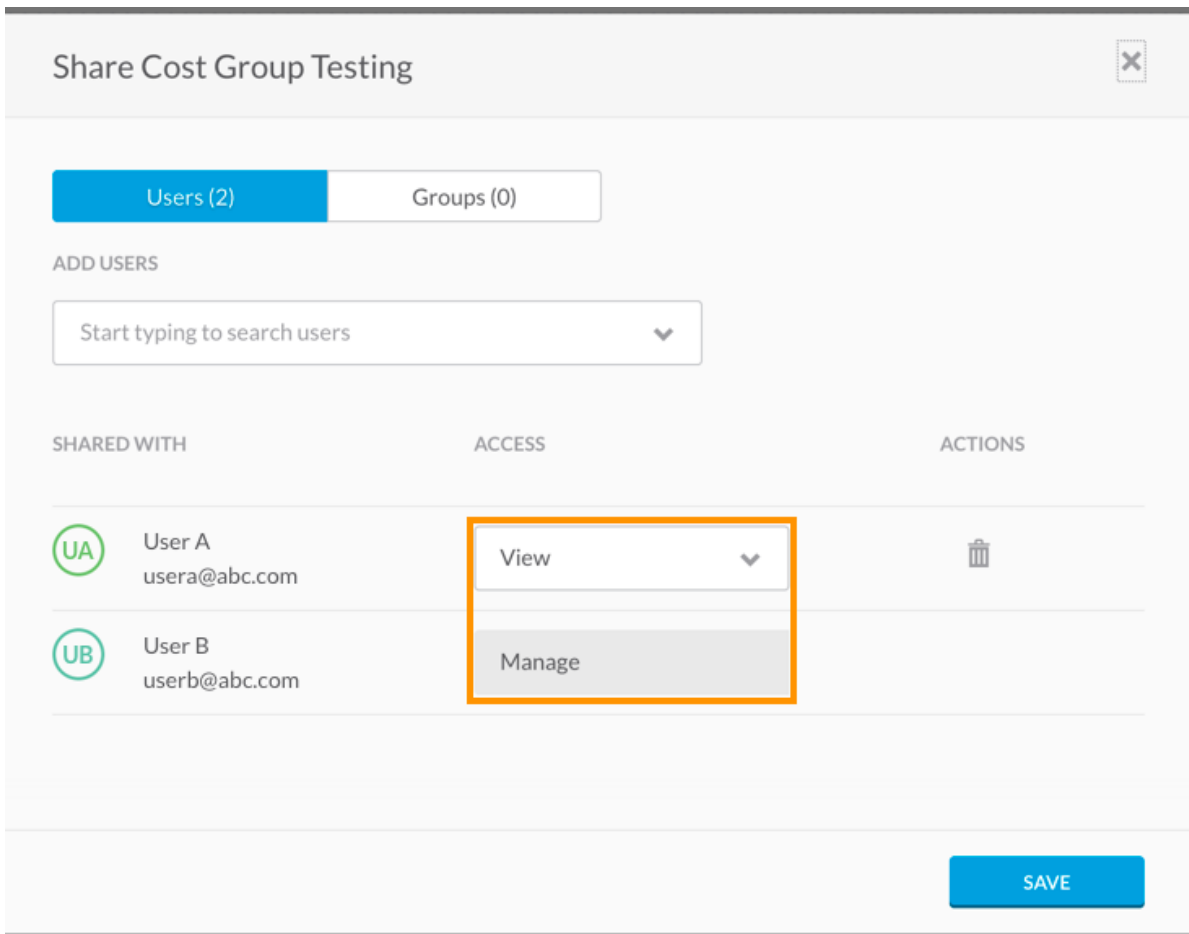
Cost Group Type	Lists Cost Group Types set up in Cost Optimizer and add Cost Group Type.
Filter	Allows you filter for the billing units based on the specified category.
Move Billing Units	Move multiple billing units to a cost group. This icon is enabled after Billing Units are selected.
Search	Search resources based on the specified text.
Select All	Select all items displayed on the page by clicking the checkbox in the table header or by clicking the checkbox against each item.
Unassigned Billing Units	Cloud accounts that have not yet been assigned to a cost group.
Unassigned Tags	Tags associated with cloud resources that have not yet been assigned to a cost group.

A Cost Group Type is equivalent, but not restricted, to the various functions in an organization. For example, an organization might have different functions, such as Development, Finance, IT, Sales, Support, etc. Cost Optimizer ships with a seeded Cost Group Type called **Department** associated with the root tenant.

A Cost Group is a hierarchical structure that you define for your organization. You can have a flat or vertical cost group, depending on your need. In case of a vertical cost group, there can be as many levels (departments and subdepartments) as you desire. For instance, Development would have sub-functions such as automation, core development, testing, release team, etc. The hierarchical structure can also be imported via a .csv file.

Sharing is the provision of an entity or service present in more than one function in an organization. Any user can share an entity by using the **Share** option. This option works on the principle of ACL functionality where a user assigned to a cost group can share the cost groups with other users or user groups.

You can configure sharing at the Users or Groups levels as determined by your access permission as shown in the following screenshot.



The following table identifies the access levels for Cost Optimizer.

Tab	Controls
Users	To assign specific permissions to individual users, add the users to this resource, then set permission options for each user.
Group	To assign permissions to a user group, add the user group to this resource, then set permission options.

See [Access and Roles](#) > Access Control Lists (ACLs).



When tag-based cost reports are shared, the sharing results in displaying additional cost, inventory, and recommendations for the resources associated with the cost groups.

Billing units are used for a cost breakdown. When validating a cloud account, billing units are automatically discovered and associated with the cloud accounts.

Tags are key-value pairs associated with cloud resources on a cloud provider. The key is mandatory and value is optional. Tags can be user-defined or system-defined. Similar to billing units, tags are also used for cost breakdown at a deeper granular level. The tags are discovered through the tag collection background process. See [Data Collection](#). This feature is available on AWS and Azure clouds only.



You can choose either a billing unit associated cost group or a tags associated cost group, not both. Once created with an association, you cannot change it later, after creating the cost group.

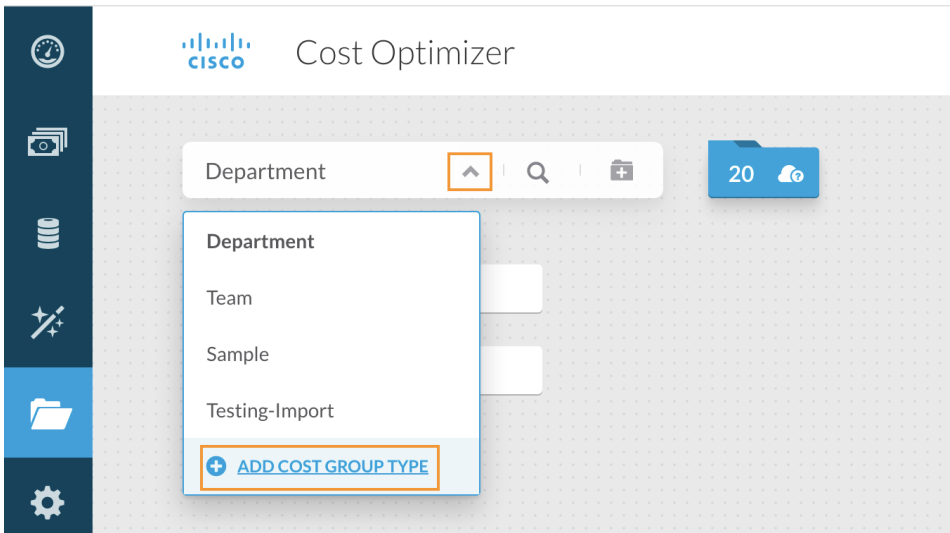
How Do I...

How Do I...

- [Add a Cost Group Type](#)
- [Add Cost Group](#)
- [Associate a Billing Unit](#)
- [Associate a Tag](#)

Perform these steps to add a cost group type:

1. Click the arrow next to the cost group type (**Department**).



2. Choose **Add Cost Group Type**.
3. Specify a name for the cost group type, in singular and plural format in the respective fields.
4. Choose the cost report base – billing units or tags.

 A screenshot of the 'Add Cost Group Type' dialog box. The dialog has a title bar with the text 'Add Cost Group Type' and a close button (X) on the right. The main content area contains three sections:

- The first section is labeled '* COST GROUP TYPE NAME (SINGULAR)' and has a text input field containing 'DevOps'.
- The second section is labeled '* COST GROUP TYPE NAME (PLURAL)' and has a text input field containing 'DevOps'.
- The third section is labeled 'COST REPORTING BASED ON' and has a dropdown menu with 'Tags' selected.

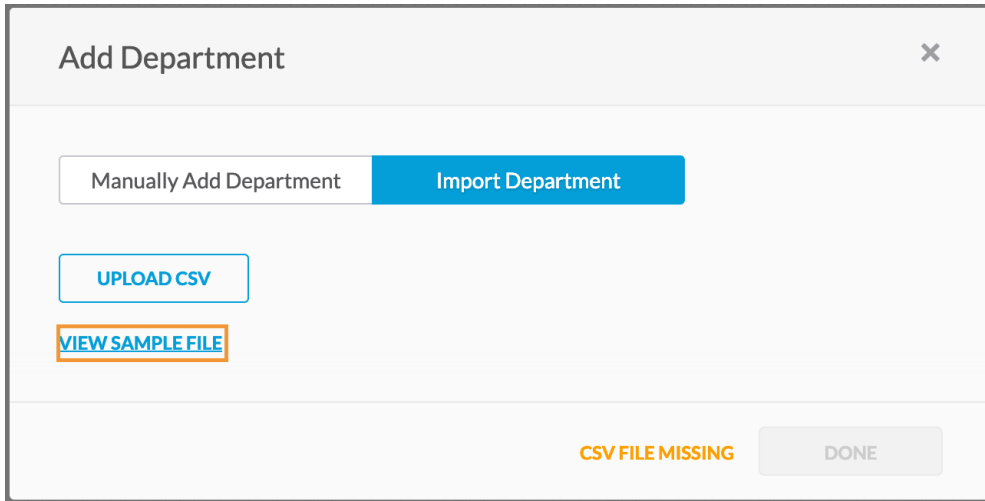
 At the bottom right of the dialog is a blue button with the text 'SAVE'.

5. Click **Save**.

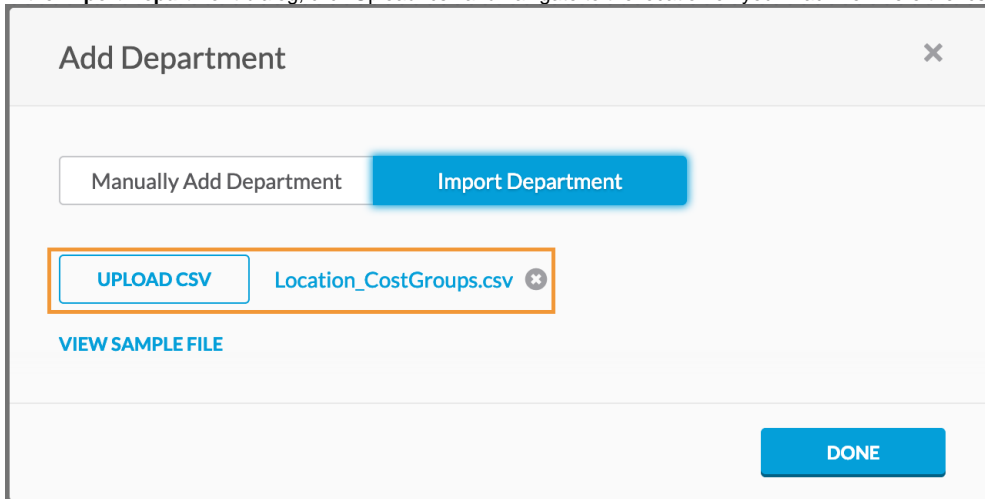
Perform these steps to add a cost group:

1. Click the **Add Department** icon. The **Add Department** dialog appears.
2. Specify the **Department Name** and choose the **Parent Department**.
3. Click **Done**.

Alternatively, you can import departments by uploading a .csv file. A sample .csv file is provided in the **Import Department** dialog for your reference, as shown in the sample screenshot below.



In the **Import Department** dialog, click Upload .csv and navigate to the location on your machine where the .csv file resides to import the file.



You associate a billing unit to a cost group type through a cost group. To associate a billing unit, do the following in the **Billing Units** area.

1. Drag a billing unit from the Billing Unit area and drop the billing unit under a cost group type or cost group.
2. Click the **Move Billing Unit** icon adjacent to a Billing Unit.
3. To move multiple billing units, select the billing units to be moved and choose the **Move Billing Units** icon in the top right corner in the **Billing Units** area.

You associate tags that are enabled for cost reporting in [Tag-Based Cost Reporting](#) to a cost group type through a cost group. To associate a tag, do the following in the **Tags** area.

1. Drag a tag from the Tag area and drop the tag under a cost group type or cost group.
2. Click the **Move Tags** icon adjacent to a Tag.
3. To move multiple tags, select the tags to be moved and choose the **Move Tags** icon in the top right corner in the **Tags** area.

Allocate Budgets

Allocate Budgets

- [Overview](#)
- [What's in the Budgets Page?](#)
- [Creating Budgets](#)

Budgets give you the ability to allocate or reserve amounts per cloud or cost group type. Use Budgets to reserve funds utilization. Budgets can be tracked annually and quarterly and provide the ability to track the total cost costs spent on a cloud or department and allocation of the cost among the various cloud services and billing units respectively.

Depending on the budget allocations, you receive periodic updates, known as Alerts, about budget spending. You also receive updates when your funds' utilization drops below the threshold you define or when the utilization exceeds (or are forecasted to exceed) your budgeted amount.

Use **Budgets** in the **Admin** menu to allocate budgets.

The following is a sample screenshot of the Budgets page.

The screenshot shows the 'Budgets' page interface. At the top, there are three summary buttons: '8 TOTAL' (highlighted), '2 DEPARTMENT', and '6 CLOUDS'. Below these is a search bar with a magnifying glass icon and the text 'Search'. To the right of the search bar is a 'CREATE BUDGET' button. The main content is a table with the following data:

NAME	TYPE	AMOUNT	VALID UNTIL	ACTIONS
Cloud FY 2019 Q2	Cloud	\$33,000 over 3 months	Jun 30, 2019	
Cloud FY 2019 Q3	Cloud	\$10,003 over 3 months	Sep 30, 2019	
Cloud FY 2019	Cloud	\$4 over 1 year	Dec 31, 2019	
Cloud FY 2021 Q1	Cloud	\$1,000 over 3 months	Jul 01, 2020	
Cloud FY 2021	Cloud	\$15,000 over 1 year	Mar 31, 2021	
Cloud FY 2022	Cloud	\$12,000 over 1 year	Mar 31, 2022	
Department FY 2019 Q2	Department	\$18,000 over 3 months	Jun 30, 2019	
Department FY 2019 Q3	Department	\$30,000 over 3 months	Sep 30, 2019	

The following table explains the **Budget Summary** that is displayed at the top of the page.

Summary	Description
Total	Number of budget allocations created.
Department	Number of budget allocations assigned to Cost Group Types (Departments).
Cloud	Number of budget allocations assigned to cloud accounts.
Search	Search budgets based on the specified text.
Create Budget	Button to create a budget for a specific year.

The following explains the various aspects of the Budgets page.

Identity	Description
Name	System-generated name, which includes the Cost Group or Cloud Type and the duration the budget is being created for.

Type	Cost Group Type or Cloud the budget is allocated to.
Amount	Displayed in the denomination as defined in Suite Admin (see Currency Conversion).
Valid Until	Duration of the budget (end of quarter or year).
Action	Perform action-oriented tasks – Edit or Delete a budget.

Use the **Create Budget** button to create budgets for a cloud, cost group type or department. When creating a budget, you can specify alerts specific to the budget by specifying threshold limits in the **Alert Settings** tab. You can choose to use the default threshold limits defined in the [Alerts Page](#) or enter new values specific to a budget by editing the values in the appropriate fields. The Alert settings set here override the generic threshold limits set in the [Alerts Page](#).

By default, the **Default Alert Settings** field is toggled **ON**, which allows you to edit or modify the alert settings fields. Toggle **OFF** this field if you wish to use the values set in the Alerts Page.

Use the **Reset to Default** button to revert to the values set in the Alerts page.

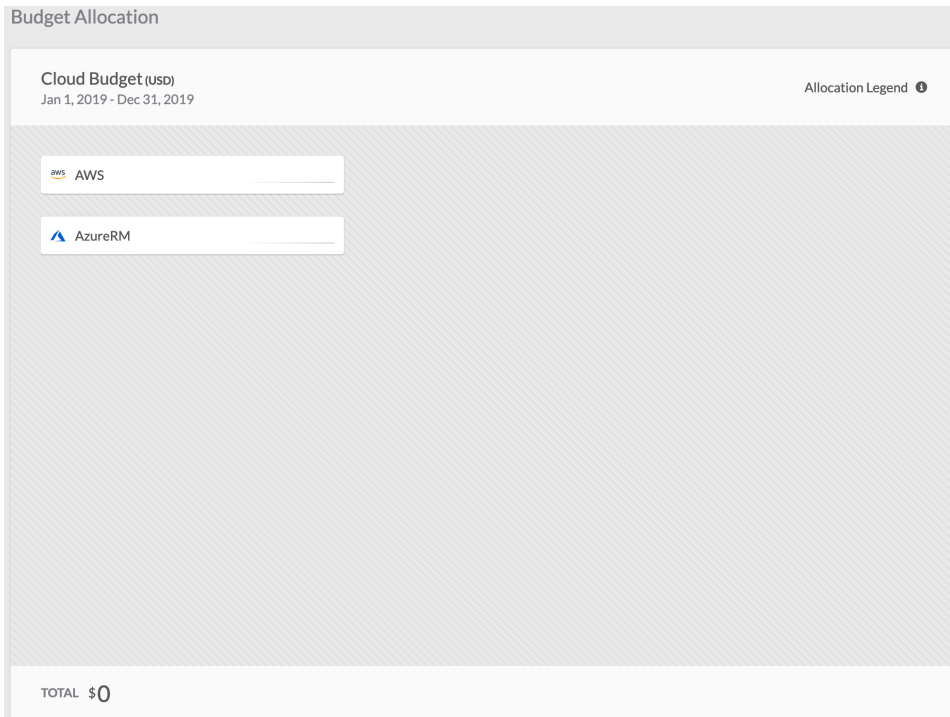
Perform the following steps to create a budget.

1. Click **Create Budget**. The **New Budget** page appears.

The screenshot shows the 'New Budget' page with the following configuration options:

- * TYPE**: A dropdown menu with 'Cloud' selected.
- Budget Period**: A section header.
- * SELECT BUDGET TIME PERIOD**: A dropdown menu with 'Fiscal Year or Quarter' selected.
- * ENABLE AUTO-RENEW**: A toggle switch currently set to 'NO'.

2. In the **New Budget** page, do the following:
 - a. Choose the type to assign the budget to.
 - b. In the **Budget Period** dropdown, specify the fiscal year or quarter for which budget is to be allocated in the **Select Budget Time Period** field. The information in this dropdown is populated from **Fiscal Year** settings from the [Settings Page](#). If you have not created a Fiscal Year, you can create the fiscal year directly in this step.
 - c. Toggle **Enable Auto-Renew** to Yes to renew the budget allocations for the next year or quarter, including the remaining allocations of the current year.
3. In the **Budget Allocations** area, choose the cloud for which the amount must be allocated and enter the amount.



4. Navigate to **Alert Settings** tab and do the following:
 - a. Specify alerts specific to this budget by updating or entering the values for the following fields as appropriate:
 - i. Overspending Threshold (Greater Than)
 - ii. Underspending Threshold (Less Than)
 - iii. Budget Threshold
 - iv. Budget Recipients
 - b. In the **Budget Alerts Recipients** field, choose the users or user groups who should be notified for budget-specific alerts when the thresholds are crossed. See [Access and Roles](#).

Budget Allocation

Cloud Budget (USD)
Jan 1, 2019 - Dec 31, 2019

Allocation Legend ⓘ

AWS

AzureRM

Historical Cost | **Alert Settings**

Amazon Alert Settings ON

System Defaults

Scheduled Alerts

OVERSPENDING THRESHOLD (GREATER THAN) ⓘ
100 %

UNDERSPENDING THRESHOLD (LESS THAN) ⓘ
30 %

Triggered Alerts

BUDGET THRESHOLD ⓘ
90 %

ADD ALERT

* ALERT RECIPIENTS

5. Optionally, you can turn off the **Alert Settings** toggle to turn off the alerts for that specific Cost Group entirely.
6. Click **Done**.

Cost Optimizer Dashboard

Cost Optimizer Dashboard

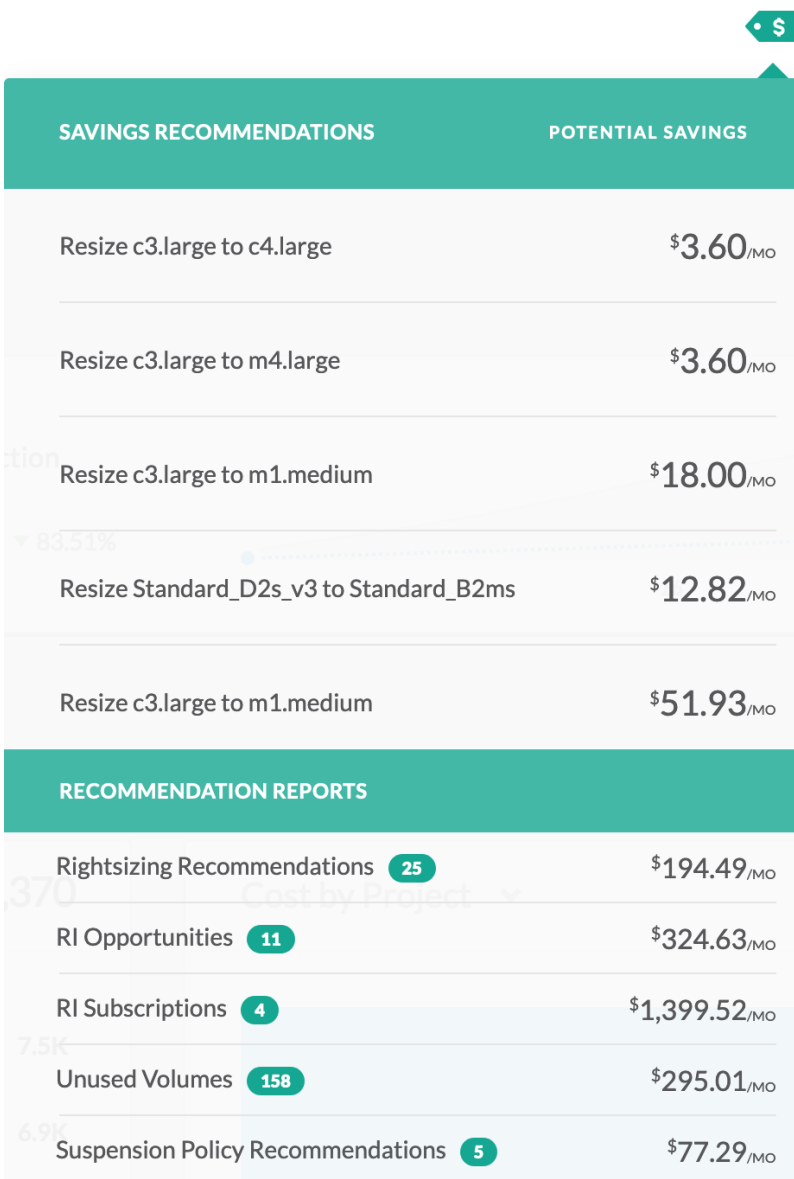
- [Overview](#)
- [Who Can Access the Cost Optimizer Dashboard?](#)
- [What's in the Cost Optimizer Dashboard?](#)
 - [Projections Dashlet](#)
 - [Cost Dashlet](#)
 - [Inventory Dashlet](#)
 - [Budget Dashlet](#)

The Cost Optimizer page provides a snapshot of costs incurred by the various clouds installed for an organization.

The *Cost Optimizer Dashboard* is visible to all users who can access Cost Optimizer. However, information is displayed according to the access levels and is the home page for this root administrator. For example, the *Cost Optimizer Admin* (see [Access and Roles](#)) can view information across all cost groups, whereas a *Cost Group Owner* can view data specific to the cost group that the *Cost Group Owner* owns.

The Cost Optimizer dashboard displays information depending on your roles defined for you in the system (see [Access and Roles](#)). The header contains the following icons:

- **Currency** – Displays recommendations specific to your cost group. A sample screenshot is shown below.



The screenshot shows a currency selector icon (a green circle with a white dollar sign) at the top right. Below it is a table with two main sections: 'SAVINGS RECOMMENDATIONS' and 'RECOMMENDATION REPORTS'. The 'SAVINGS RECOMMENDATIONS' section lists five items with their respective potential savings per month. The 'RECOMMENDATION REPORTS' section lists five categories with their respective counts and potential savings per month.

SAVINGS RECOMMENDATIONS	POTENTIAL SAVINGS
Resize c3.large to c4.large	\$3.60 _{/MO}
Resize c3.large to m4.large	\$3.60 _{/MO}
Resize c3.large to m1.medium	\$18.00 _{/MO}
Resize Standard_D2s_v3 to Standard_B2ms	\$12.82 _{/MO}
Resize c3.large to m1.medium	\$51.93 _{/MO}

RECOMMENDATION REPORTS	POTENTIAL SAVINGS
Rightsizing Recommendations 25	\$194.49 _{/MO}
RI Opportunities 11	\$324.63 _{/MO}
RI Subscriptions 4	\$1,399.52 _{/MO}
Unused Volumes 158	\$295.01 _{/MO}
Suspension Policy Recommendations 5	\$77.29 _{/MO}

- **Notifications** – Displays notifications based on settings specified in the [Alerts Page](#). A sample screenshot is shown below. See [Suite Admin Dashboard > Notifications](#) for additional context.

5 Unread All ✕
<p>{Cost Group Type} {Cost Group Name}'s spend has reached XX% of last quarter's total Exceeded its Cost Threshold 1h</p>
<p>{Cost Group Type} {Cost Group Name}'s spend has reached XX% of budget allocated Exceeded its Budget Threshold 2h</p>
<p>{Cost Group Type} XX Day Budget Overspenders report has been emailed XX overspending departments 2h</p>
<p>{Cost Group Type} XX Day Budget Underspenders report has been emailed XX underspending departments 2h</p>
<p>● {Cost Group Type} Cost Groups have changed {Budget Name} Budget has been deactivated until review 2h</p>
<p>● Budget automatically created {Budget Name} budget was auto-renewed for {Future Time Period} 3h</p>
<p>● Budget Adjustment Request approved Review {Budget Name} budget allocation 5h</p>
<p>{Cost Group Type} XX Day Trend Report has been emailed</p>

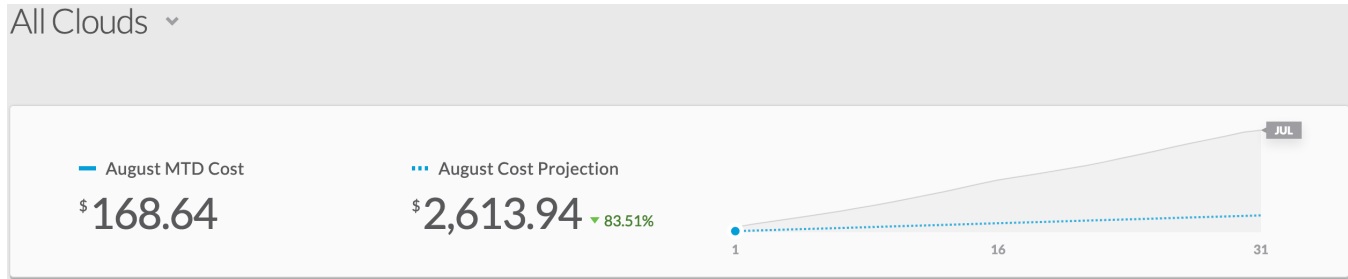
XX overspenders, XX underspenders
5h

Information on the dashboard can be controlled through the widget next to **All Clouds**. This widget helps you to display information for all clouds or specific clouds. The information is displayed as a summary of recommendations, costs, and inventory through the following:

- Projections dashlet
- Cost dashlet
- Inventory dashlet

Projections Dashlet

The Projection dashlet provides information about cost projections for the month. The graph on the right denotes the cost (incurred and project for the current month) over the previous month.

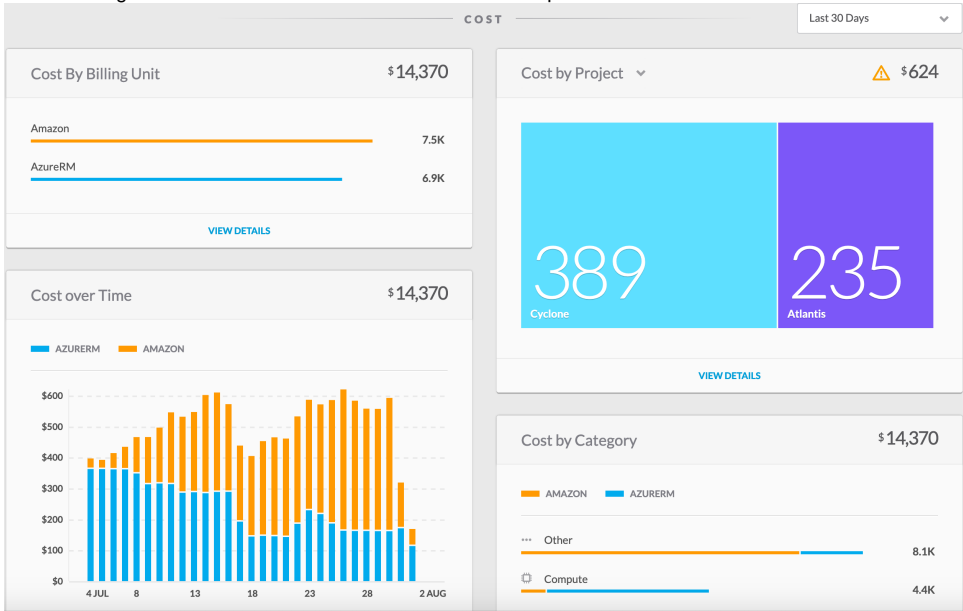


Cost is displayed in a denomination as defined in Suite Admin (see [Currency Conversion](#)).

Cost Dashlet

The Cost dashlet displays cost projections and cost reports through a high-level snapshot of cost for each cloud or all clouds in Cost Optimizer.

- By default, the cost is displayed for all clouds.
- Click the widget next to **All Clouds** to view information for a specific cloud.



The cost projections for each cloud is displayed through the following reports:

- Cost by Cloud Provider
- Cost by Department (Cost Group Type)
- Cost by Organization Hierarchy
- Cost over Time

Cost Reports

Cost Reports

- [Cost Reports Overview](#)
- [Cost by Cloud Provider](#)
- [Cost by Category](#)
- [Cost by Cloud](#)
- [Cost by Cost Group Type](#)
- [Cost by Organization Hierarchy](#)
- [Cost Over Time](#)
- [Invoice Report](#)

Cost Reports Overview

Cost Reports Overview

- [Introduction](#)
- [Cost Reports UI](#)
- [Filter](#)
 - [Advanced Options](#)
 - [Saving Filters](#)
 - [Scheduling Reports](#)
- [Cost Reports](#)

The **Cost Reports** page lists reports that help you analyze the data at a granular level. Cost is displayed in the currency and conversion rate as defined in Suite Admin (see [Currency](#)). Cost Optimizer classifies the data and displays them under the headings available in a dropdown menu in the **Cost Reports** page. Click **Cost** in the left tree pane to open the Cost Reports UI.

The Cost Reports display graphical and textual views for cost data. You can view consolidated data for all clouds or billing units you can access or specify filter criteria to view specific data that you need. The following table explains the icons specific to Cost Reports UI. Some of these icons might be displayed for some reports only. See [UI Behavior](#) for details on icons in the UI.

Icon	Description
Filter	Allows you to filter and view cost data for one or more of the following: <ul style="list-style-type: none"> • Billing units • Cloud families • Cloud groups • Regions • Invoice category • Invoice tags
Download	Downloads the report in a .csv format.
Date Range	Choose a range to display the report.
Charts	Toggles graphical report display between a bar chart and a pie chart.
Schedule	Allows you to send the report via email to recipients on the fixed date.

Cost Reports displays the following:

- **Total cost** – Graphical view of costs
- **Cost per cloud** – Expandable textual view of costs

Use **Filter** for an in-depth analysis by further granularizing the data to understand accurate cost consumption. The **Filter** panel allows you to filter reports based on a set of options, thereby allowing you to drill down to the exact details that you require.

The values for billing units, cost groups, and cost group types are autopopulated from the [Cost Groups](#) configuration and from the [cloud configuration](#) for cloud families, cloud groups, cloud regions, and [Inventory](#) for invoice categories, cloud categories, and subcategories.



The AWS Govcloud account is considered as an IAM Account on AWS master or member account. The cost for AWS Govcloud account is reported against the master or member account and the Govcloud is displayed as a region. Therefore, when a cloud is added for AWS Govcloud with a Govcloud user account, no invoice report data is populated.

Advanced Options

The advanced options in Cost Optimizer are as follows:

- [Saving Filters](#)
- [Scheduling Reports](#)

Saving Filters

You can choose to save a combination of options in the **Filter** menu for future use through the **Save Filters** feature so that you can quickly access and use the filter at a later time. To save a filter, do the following:

1. Choose the required filter options in the **Filter Panel** pane.

2. The **Save** button appears. The **Save New Filter** dialog appears.

FILTER

SAVE **RESET**

▼ Billing Units

Of2c89bc-0aa4-41f6-838b-3dcbcd17c...

▼ Clouds

AzureRM

▼ Environment

Testing

▼ Regions

All

US West - US West - AzureRM

US East - US East - AzureRM

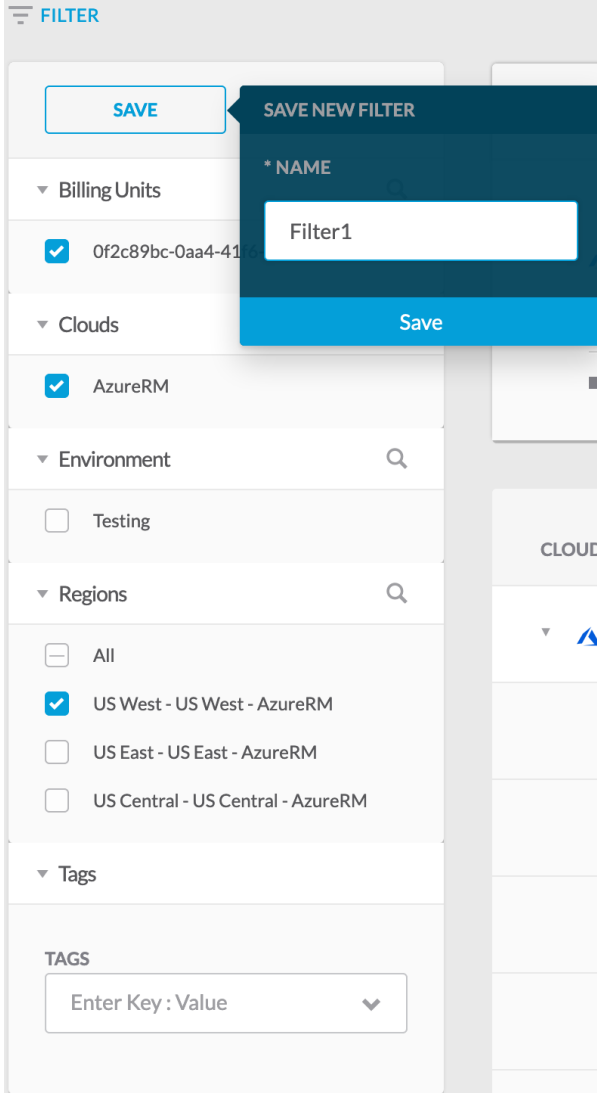
US Central - US Central - AzureRM

▼ Tags

TAGS

Enter Key : Value

3. Specify a name for this filter and click **Save**. A status message appears indicating that the filter has been saved.



4. You can access and view the saved filters from the dropdown list.

You can also perform the following additional tasks in the Filter menu:

- Mark the filter as a favorite by clicking the pin icon next to the filter name.
- Remove the chosen filters by choosing the **Reset** button at any point when saving the filter.
- Delete the saved filter by clicking the **Trash** icon next to a saved filter name. Click **OK** in the **Delete Saved Filter** dialog to confirm the deletion.

Scheduling Reports

The **Scheduler** icon allows you to schedule report generation periodically on a fixed date or at intervals. To create a schedule, do the following:

1. Click the **Scheduler** icon. The **Schedule New Report Name** dialog appears.

Schedule New Cost by Cloud Provider (By Billing Units) Report ✕

*** REPORT NAME**

FILTERED BY

Select From Saved Filters
▼

DATE RANGE

Last 30 Days
▼

*** RECIPIENTS**

Select Recipients
▼

*** SCHEDULE START DATE**

Aug 14 , 2019
📅

*** RECURRENCE**

☰ OFF

SAVE

2. Do the following:

- Enter a name for the schedule.
- Choose filtering options for the schedule from the **Filtered By** field. The information in this field is populated when you save the filtering options as described in the *Advanced Filtering Options* section. You can choose to select a filter or leave the field empty.
- Choose the date range.
- Select the recipients the report must be sent to.
- Specify the start date.
- Toggle on the **Recurrence** button to send the report at intervals.
- In the **Repeats Every** area, specify the number of times the report must be sent to the recipients and choose the interval – **Daily** or **Weekly**. If you choose **Weekly**, you can also specify the days of the week when the report is sent.
- Select the period to end the schedule. The options are:
 - Never** – Send report forever or until the schedule is deleted.
 - On** – Date when the report should be sent.
 - After** – Number of occurrences after which the report is not scheduled.

3. Click **Save**. The report is displayed in the **Scheduled Report Name** dialog as shown in the sample screenshot below.

Scheduled Cost by Cloud Provider (By Billing Units) Reports ✕

Existing Reports SCHEDULE NEW

REPORT NAME	FILTERS	RECIPIENTS	FREQUENCY	ACTIONS
CCPBU REPORT		admin@cliqrtech.com	None	

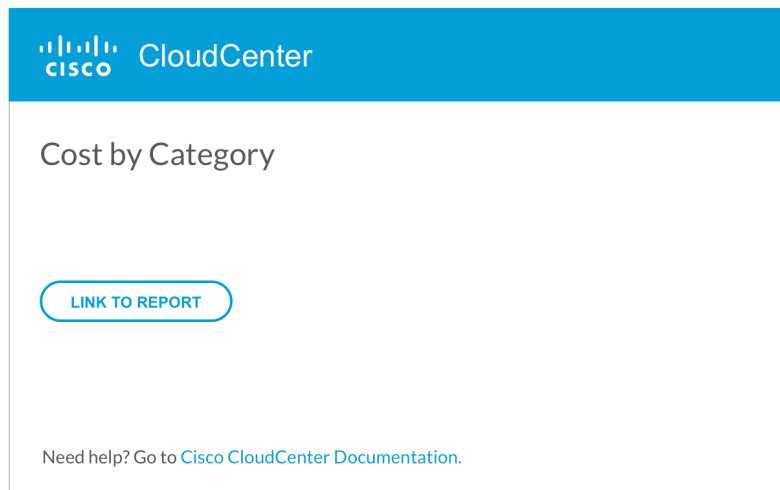
DONE



Optionally, you can use the **Edit** option in the **Actions** column to make changes to the schedule. You can also delete the report using the **Delete** option.

Click **Done** to close the dialog.

The following screenshot displays a sample email format of the report.



The following cost reports are available in Cost Optimizer.

- [Cost by Cloud Provider](#) – Cost segregation based on billing units and tags.
- [Cost by Category](#) – Cost by service categories in cloud providers.
- [Cost by Cloud](#) – Cost incurred for various clouds configured in a cloud account.
- [Cost by Cost Group Type \(Department\)](#) – Cost incurred for a cost group type.
- [Cost by Organization Hierarchy](#) – Cost associated with the various groups in an organization.
- [Cost Over Time](#) – Cost incurred for a chosen duration.
- [Invoice Reports](#) – Cost per cloud and cost segregation per region and category of supported clouds.

Cost by Cloud Provider

Cost by Cloud Provider

- [Cost by Billing Units](#)
- [Cost by Tags](#)

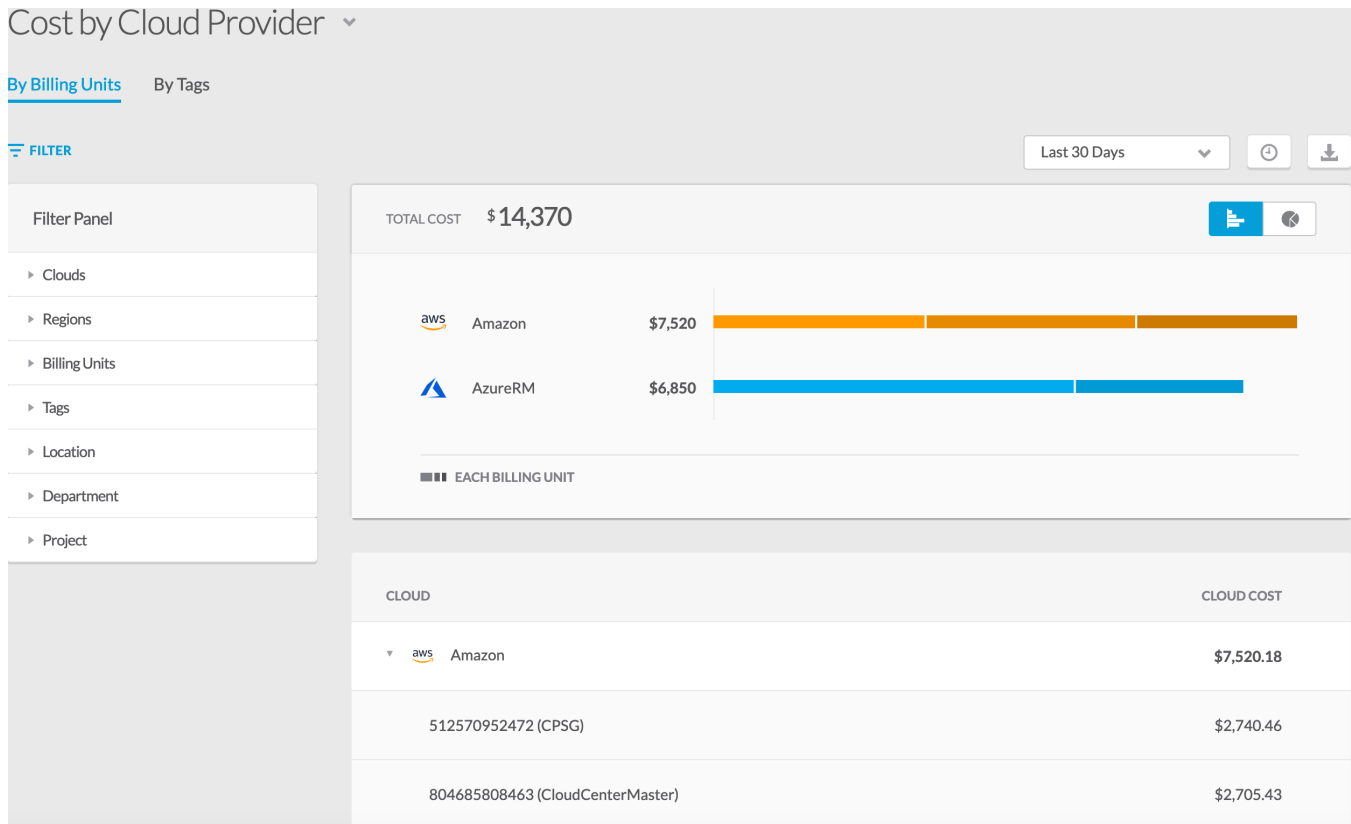
Cost by Billing Units

Cost by Billing Units

- [Overview](#)
- [Description](#)
- [Filter](#)

The **Cost by Billing Units** report displays the costs for one or more billing units. This option is listed when you have **Billing Units** not assigned to a **Cost Group** (See: [How Do I... > Associate a Billing Unit](#)).

The report displays the total cost of all billing units associated with a cloud provider and the cost incurred by the billing unit for that cloud provider. A summary of all running resources is displayed. Click the numbers against each resource to open the corresponding resource page. The **Group** section displays the actual cost for each billing unit.



You can filter the report using the following options:

- Billing Units
- Clouds
- Cost Groups
- Cost Group Types
- Regions
- Tags

Cost by Tags

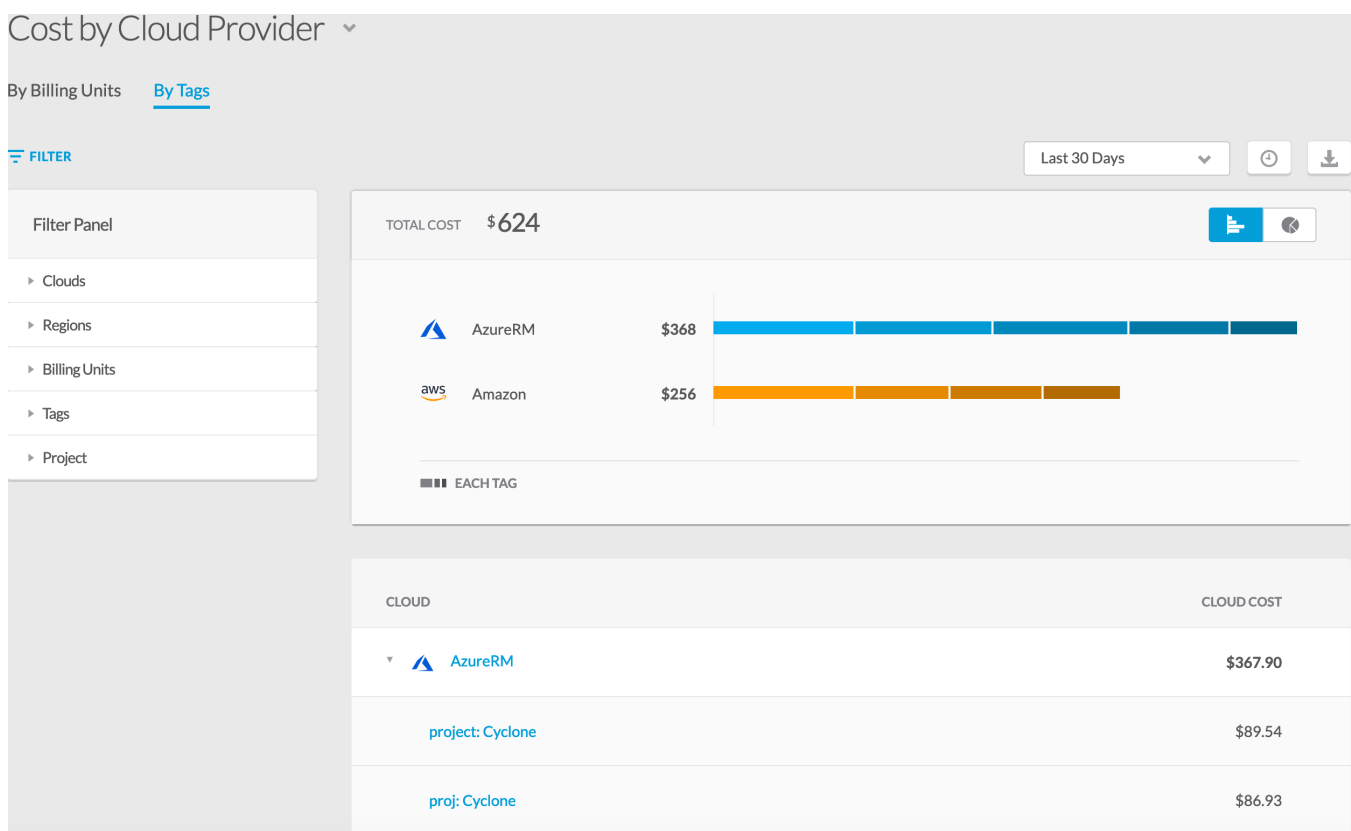
Cost by Tags

- [Overview](#)
- [Description](#)
- [Filter](#)

The Cost by Tags report displays the cost for one or more tags, for which cost is enabled in [Tag-Based Cost Reporting](#) page. See: [How Do I... > Associate a Tag](#).

 This report is available for AWS and Azure cloud accounts only.

The following is a sample screenshot of the **Cost By Tags** report. The report displays the total cost, the cost per cloud account, and cost per tag. The report displays the total cost of all tags associated with a cloud account and the cost incurred by the tag for that cloud account. **The report also displays in different shades the cost per each tag in the cloud.** Click the arrow next to the cloud account to display the tags and the costs associated with the tags in the cloud account.



You can filter the report using the following options:

- Billing Units
- Clouds
- Cost Groups
- Cost Group Types
- Regions
- Tags

Cost by Category

Cost by Category


- [Overview](#)
- [Description](#)
- [Filter](#)

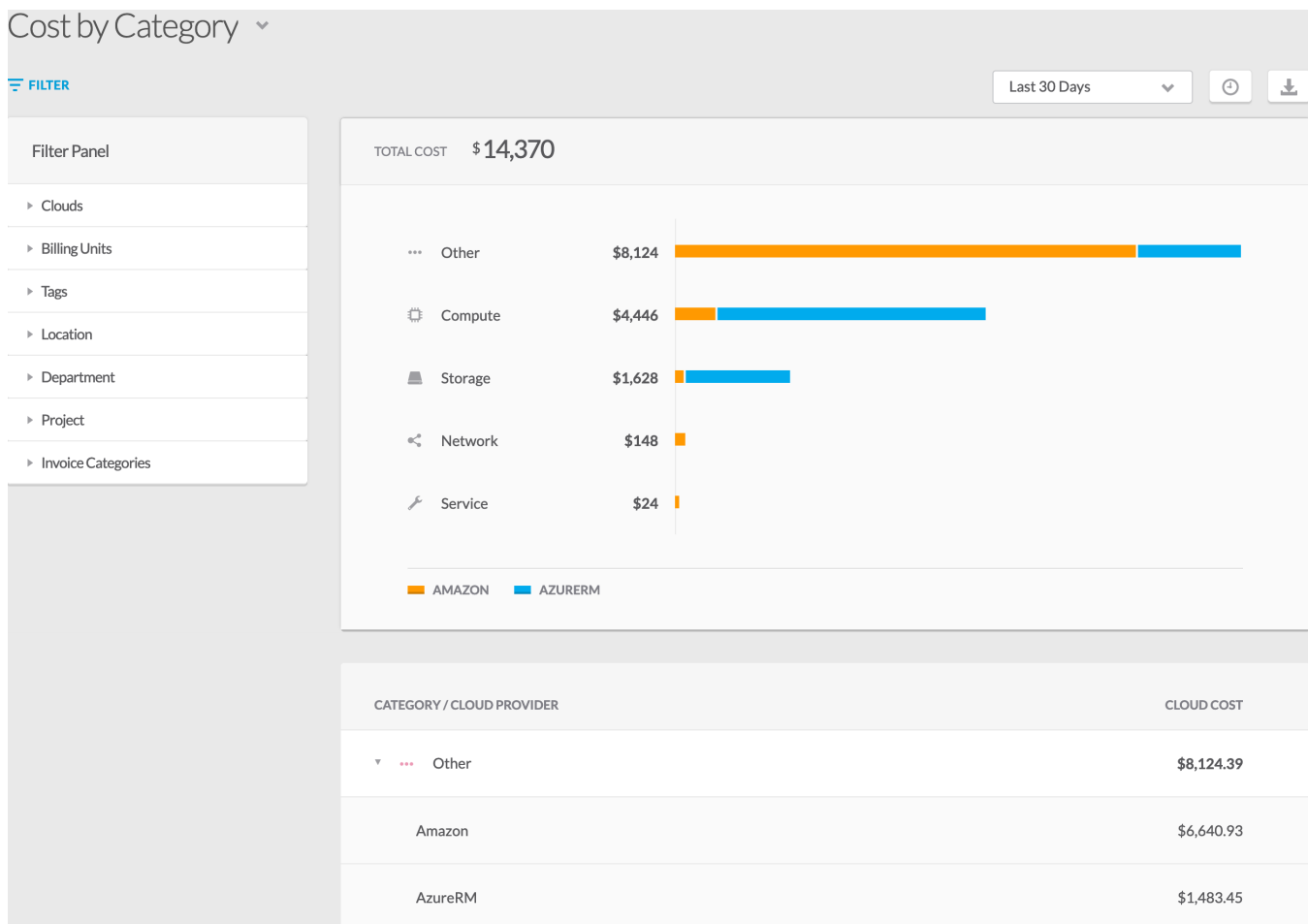
The **Cost by Category** report displays cost by service categories for one or more cloud providers. Service costs for cloud providers are displayed in this report. There are two types of categories in Cost Optimizer:

- **Invoice** – Examples: Storage, Network, Compute, etc.
- **Cloud Provider-specific** – Examples: Categories, such as App Engine, Route 53, Cloudwatch, and subcategories, such as Data Transfer In or Out, Number of Requests, EBS Volume Usage.

The following is a sample screenshot that displays:

- **Total Cost** – Display total cost and distribution of various categories across cloud providers.
- **Category per Cloud Provider** – Display category which can be expanded to reveal costs incurred by a cloud provider for each category and subcategory.

 **Other** refers to cloud categories that are not classified in Cost Optimizer.



You can filter the report using the following options:

- Billing Units
- Cloud Categories (example, App Engine, Route 53, EC2)
- Cloud Subcategories (example, Data Transfer In or Out, EBS Volume)
- Cost Groups
- Cost Group Types
- Invoice Types (for example, Service, Network, Storage)
- Tags

Cost by Cloud

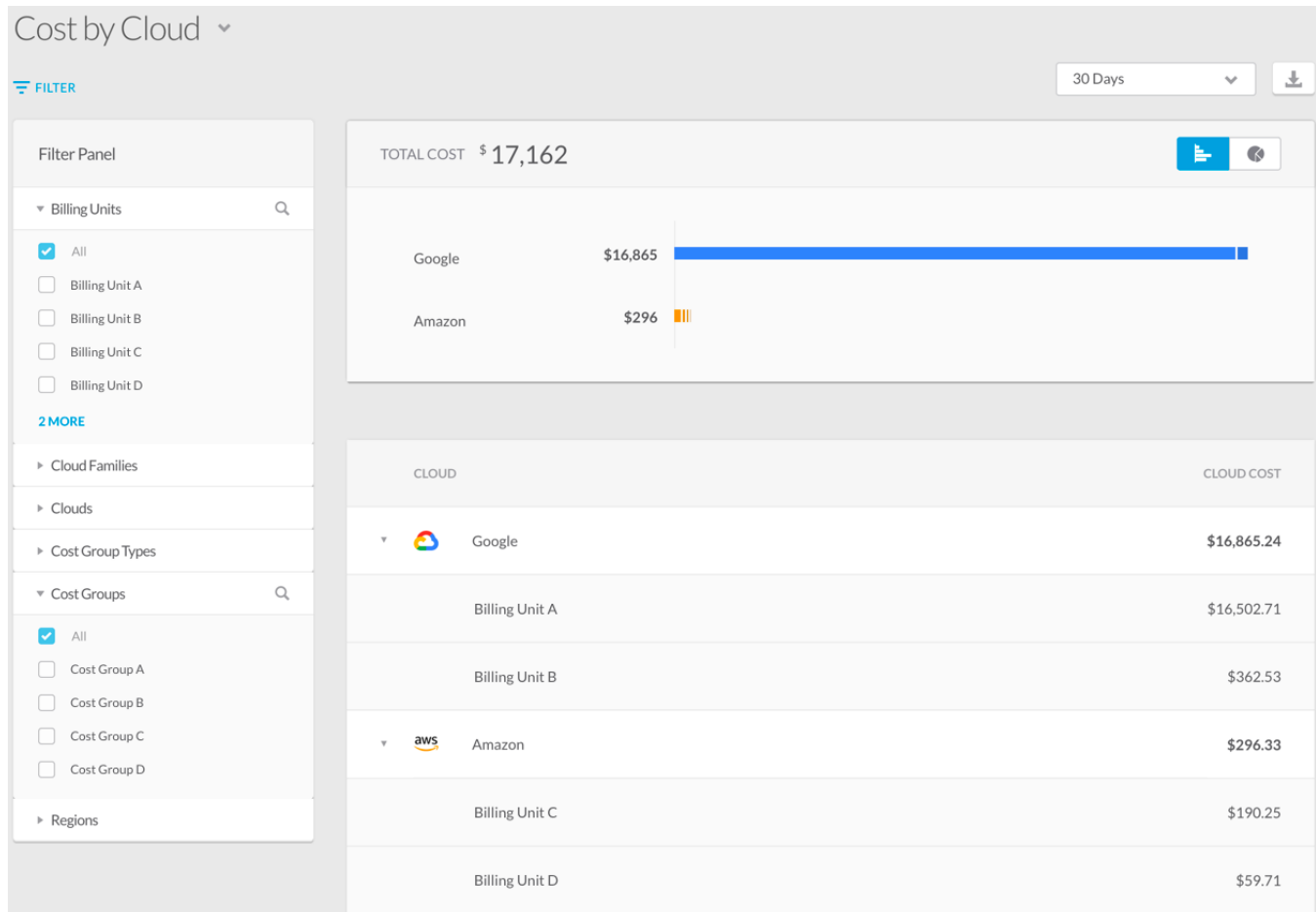
Cost by Cloud

- [Overview](#)
- [Description](#)
- [Filter](#)

The **Cost by Cloud** report displays the cost incurred for various clouds configured in a cloud account.

A sample screenshot of the Cost by Cloud report below contains the following reports:

- **Total Cost** – Displays a graphical view of costs by a cloud provider with costs for each billing unit under them.
- **Cloud** – Displays a textual view of the costs by cloud provider which can be expanded to display billing units and associated costs.



You can filter the report using the following options:

- Billing Units
- Cloud Families
- Cloud Groups
- Cloud Regions
- Cost Group Types
- Cost Groups
- Tags

Cost by Cost Group Type

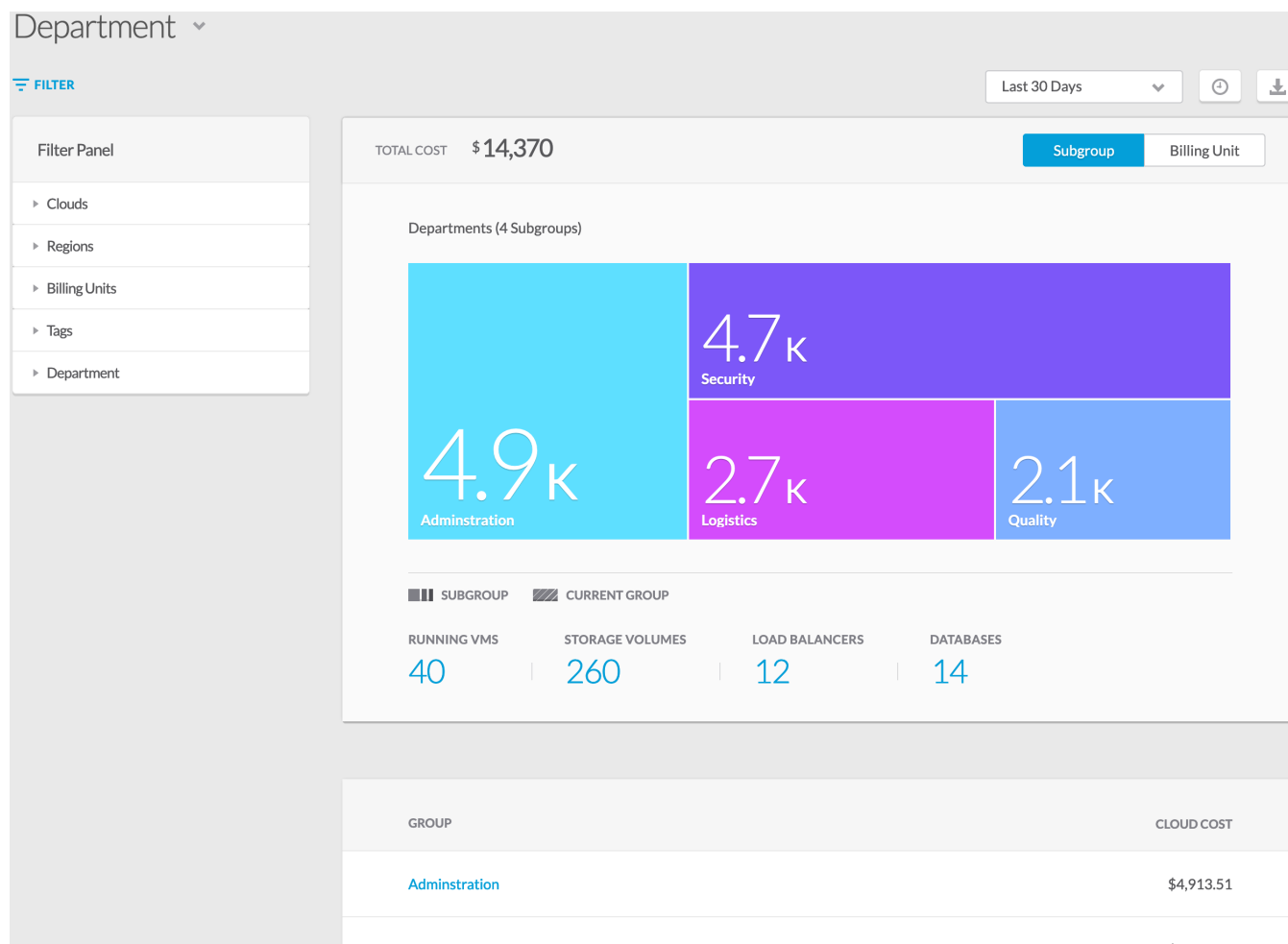
Cost by Cost Group Type (Department)

- [Overview](#)
- [Description](#)
- [Filter](#)

The **Cost by Cost Group Type** report displays the cost incurred for a specific cost group type (see [Cost Groups Configuration](#)). Click the arrow and choose the cost group type to view report for each cost group type.

The following is a sample screenshot of the Cost by Cost Group Type report that contains the following reports:

- **Total Cost** – Displays total cost across cost groups and billing units in the cost group type. You can toggle the display between cost groups and billing units associated with the cost group type. Click the number against [Running VMs](#) or [Storage Volumes](#) to open the respective pages.
- **Group** – Displays a textual view of the costs per cost group which can be expanded to reveal the cost per billing unit.



You can filter the report using the following options:

- Billing Units
- Clouds
- Cost Groups
- Regions
- Tags

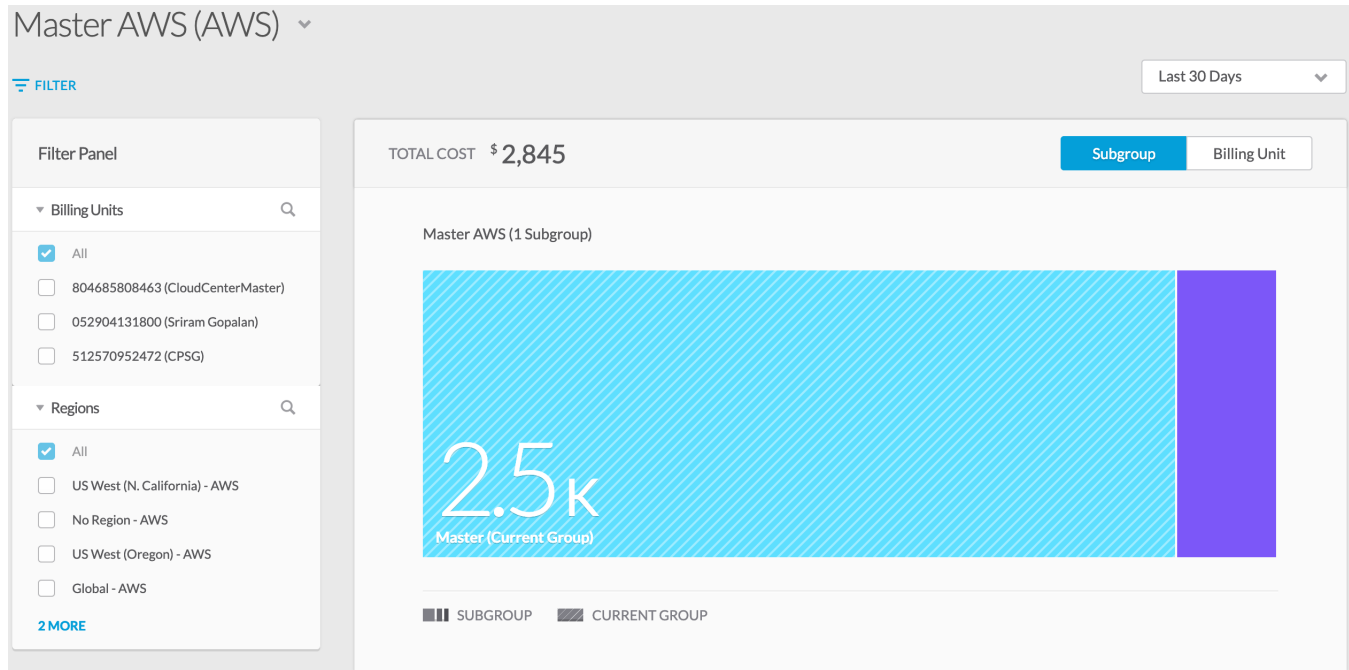
Cost by Organization Hierarchy

Cost by Organization Hierarchy

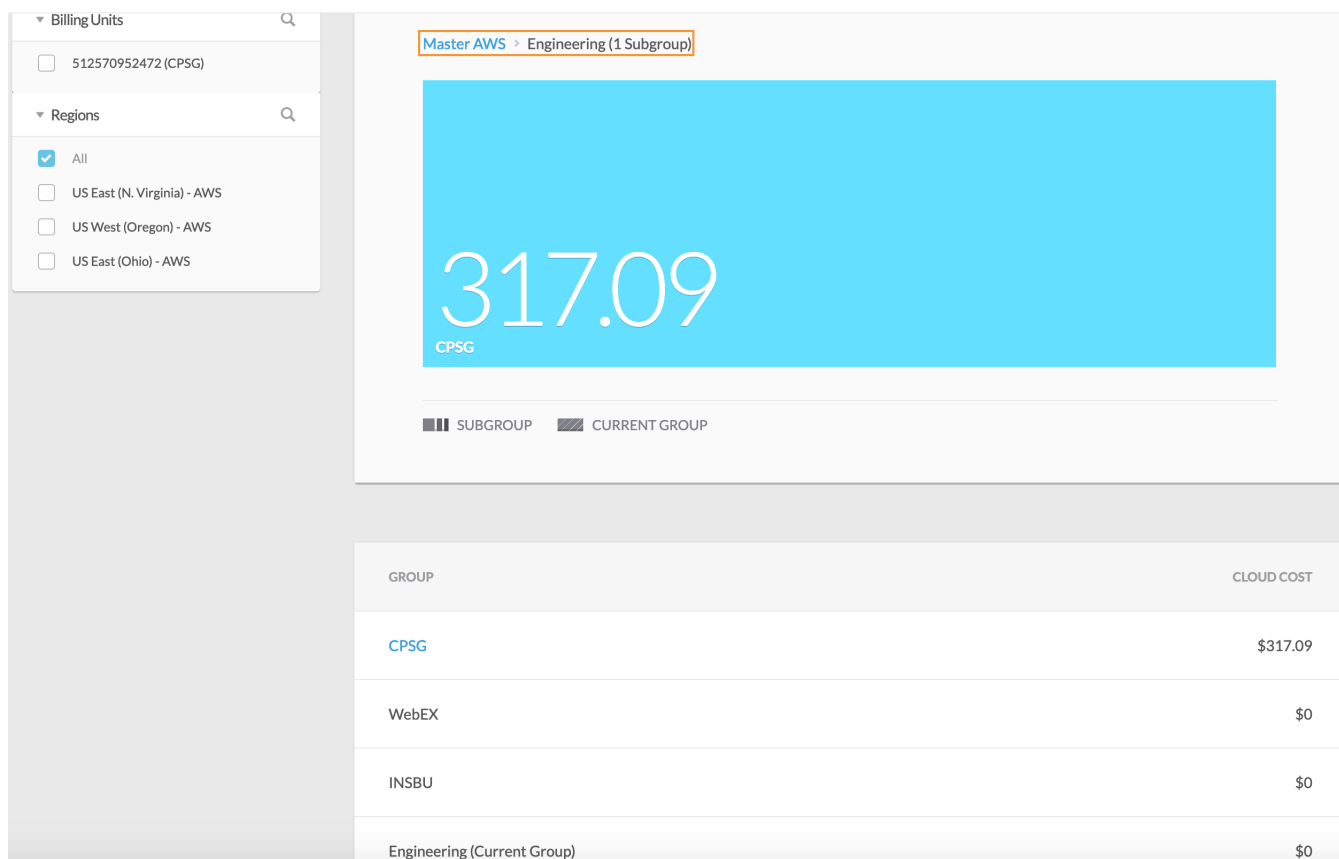
- [Overview](#)
- [Description](#)
- [Filter](#)

The **Cost by Organization Hierarchy** report displays the costs incurred by the organization. The hierarchy is created in the cloud provider portal. When configuring a cloud, change the **Enable Reporting By Org Structure** toggle to **On** to import the organization hierarchy created in the cloud provider portal into Cost Optimizer. See [Configure Clouds](#).

The report displays the cost associated with the various groups created under an organization on a cloud provider and the cost incurred by the **Engineering** group in **Master AWS** organization.



The **Group** section displays the actual cost for each group. A link on a group indicates subgroups for that group. Click **Group** link to display the individual cost for each subgroup in that group.



You can filter the report using the following options:

- Billing Units
- Cloud Regions
- Tags

Cost Over Time

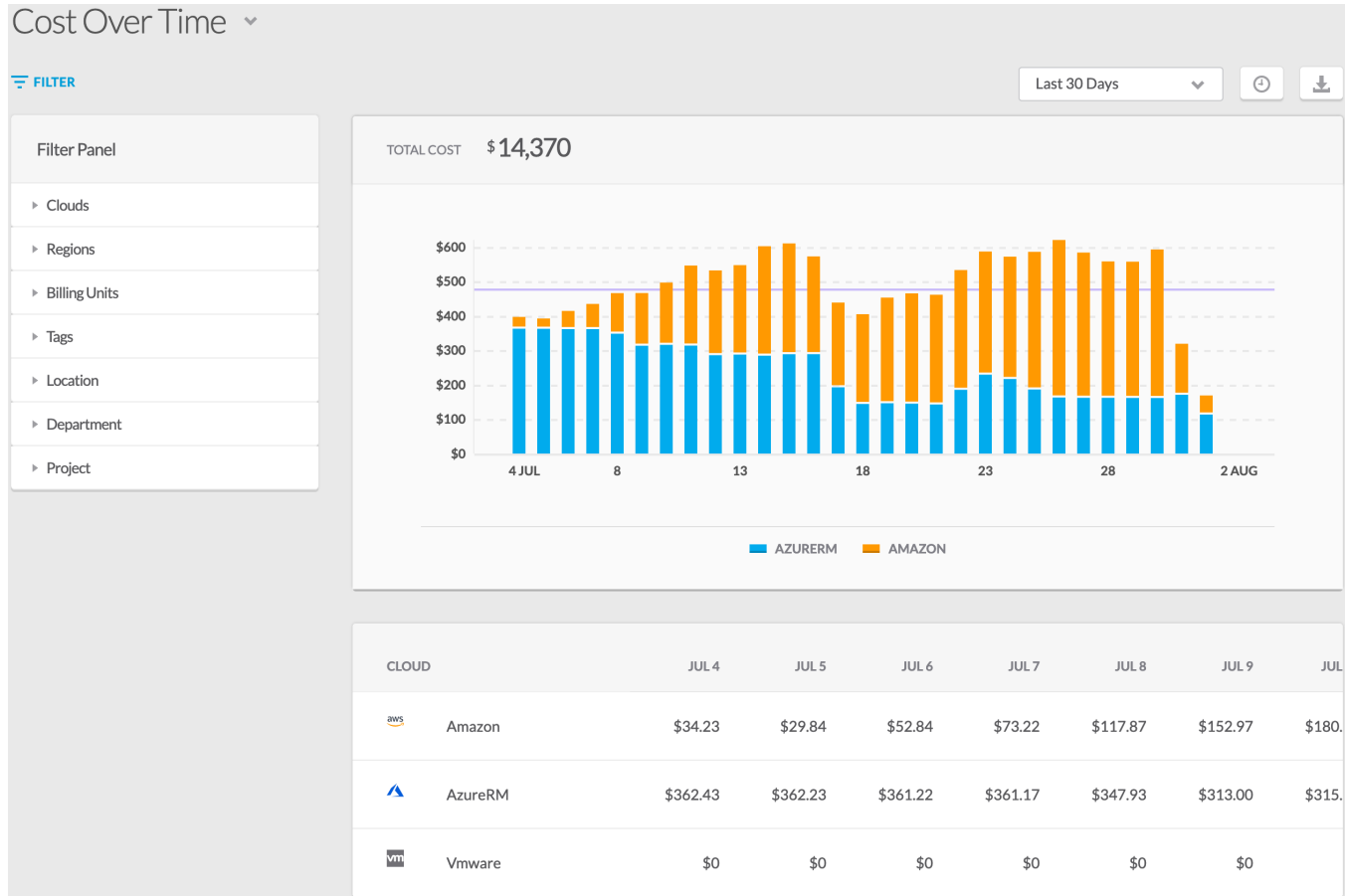
Cost Over Time

- [Overview](#)
- [Description](#)
- [Filter](#)

The **Cost Over Time** report shows the cost incurred for a duration that you choose from the dropdown for the supported clouds.

The **Cost Over Time** report displays the following reports:

- **Total Cost** – Displays the costs for the chosen clouds and period in a bar chart.
- **Cloud** – Displays a tabular view of the costs per cloud. Expanding each cloud displays the cost incurred per each account in the cloud.



You can filter the report using the following options:

- Billing Units
- Cloud Families
- Clouds
- Cost Group
- Cost Group Types
- Regions
- Tags

Invoice Report

Invoice Report

- [Invoice by Category](#)
- [Invoice by Region](#)

Invoice by Category

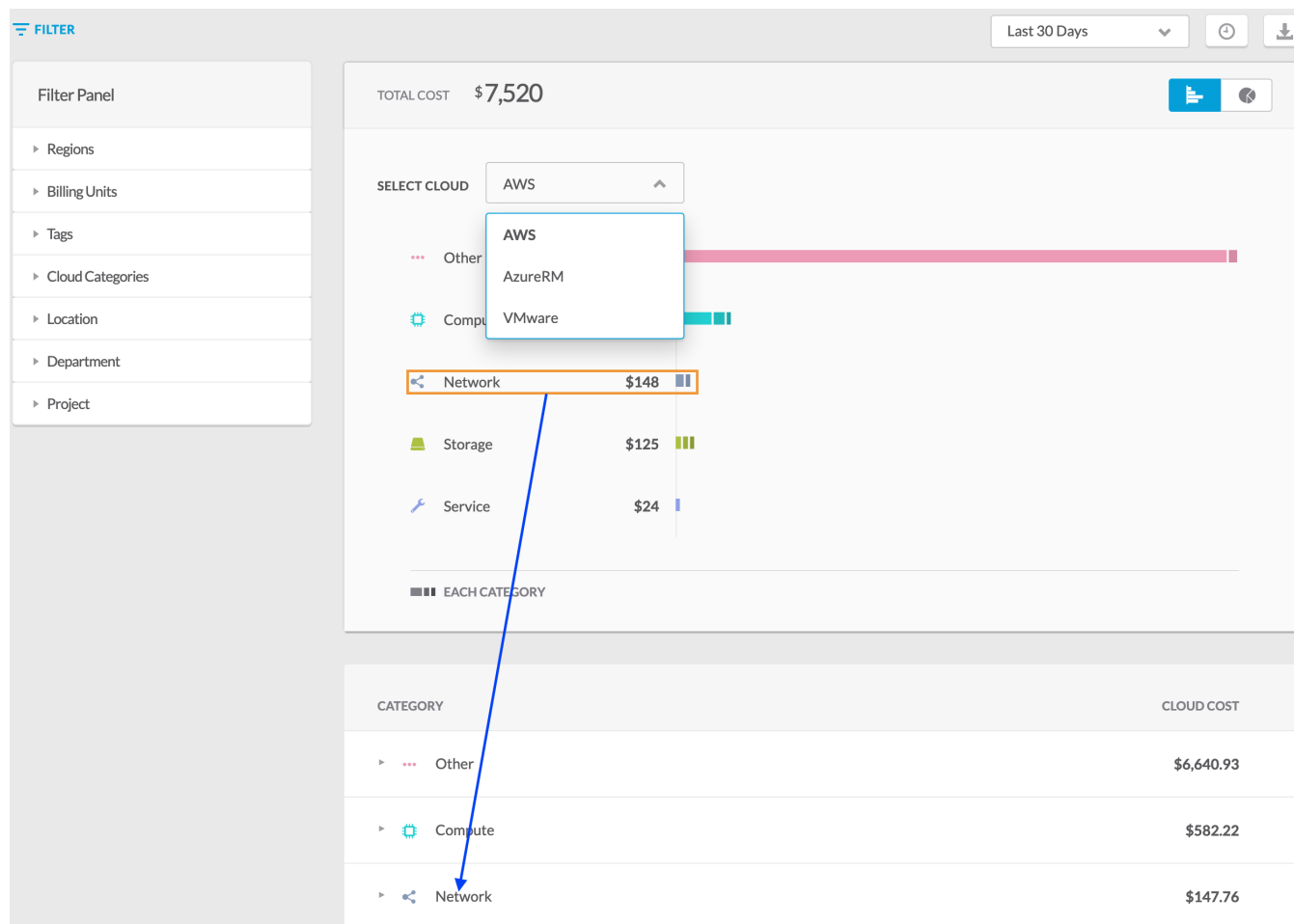
Invoice by Category

- [Overview](#)
- [Description](#)
- [Filter](#)

The **Invoice by Category Report** displays the cost of each cloud for the various categories, such as Storage, Network, Compute, and so on for a chosen duration. The report classifies the data to the lowest unit that can be billed.

The following is a sample screenshot of the report that displays the following:

- **Total Cost** – Display total cost and distribution of various categories across cloud providers. You can choose to view the invoice category for a cloud by choosing the appropriate option from the **Select Cloud** dropdown list.
- **Category** – Display category which can be expanded to display each category and subcategory.



Expenses incurred by customers are categorized by the cloud provider into cloud categories and cloud subcategories. These expenses are retrieved every day and displayed in this report. Cloud providers refer to the cloud categories and cloud subcategories by using different labels, such as services, usage types, etc.

To offer a high-level view of these expenses (invoice costs), Cost Optimizer classifies the expenses into buckets or *derived* categories when the expenses are retrieved. Cost Optimizer uses classifiers to categorize expenses into the most appropriate bucket from the cloud category and cloud subcategory. When you use a new service offered by a cloud provider, the cost incurred for this new service is displayed on the report. If the existing classifiers are not matched with the new cloud category or subcategory in an appropriate bucket, the cost incurred for the new service is added in the *Other* bucket.

You can filter the report using the following options:

- Billing Units
- Cloud Categories
- Cloud Subcategories
- Cost Groups
- Cost Group Types
- Invoice Categories

- Tags



The filter panel changes according to the cloud chosen in the **Select Cloud** dropdown list. For example, if you choose GCP from the list, the filter includes **Cost Groups Types** and **Cost Groups**, in addition to the above options.

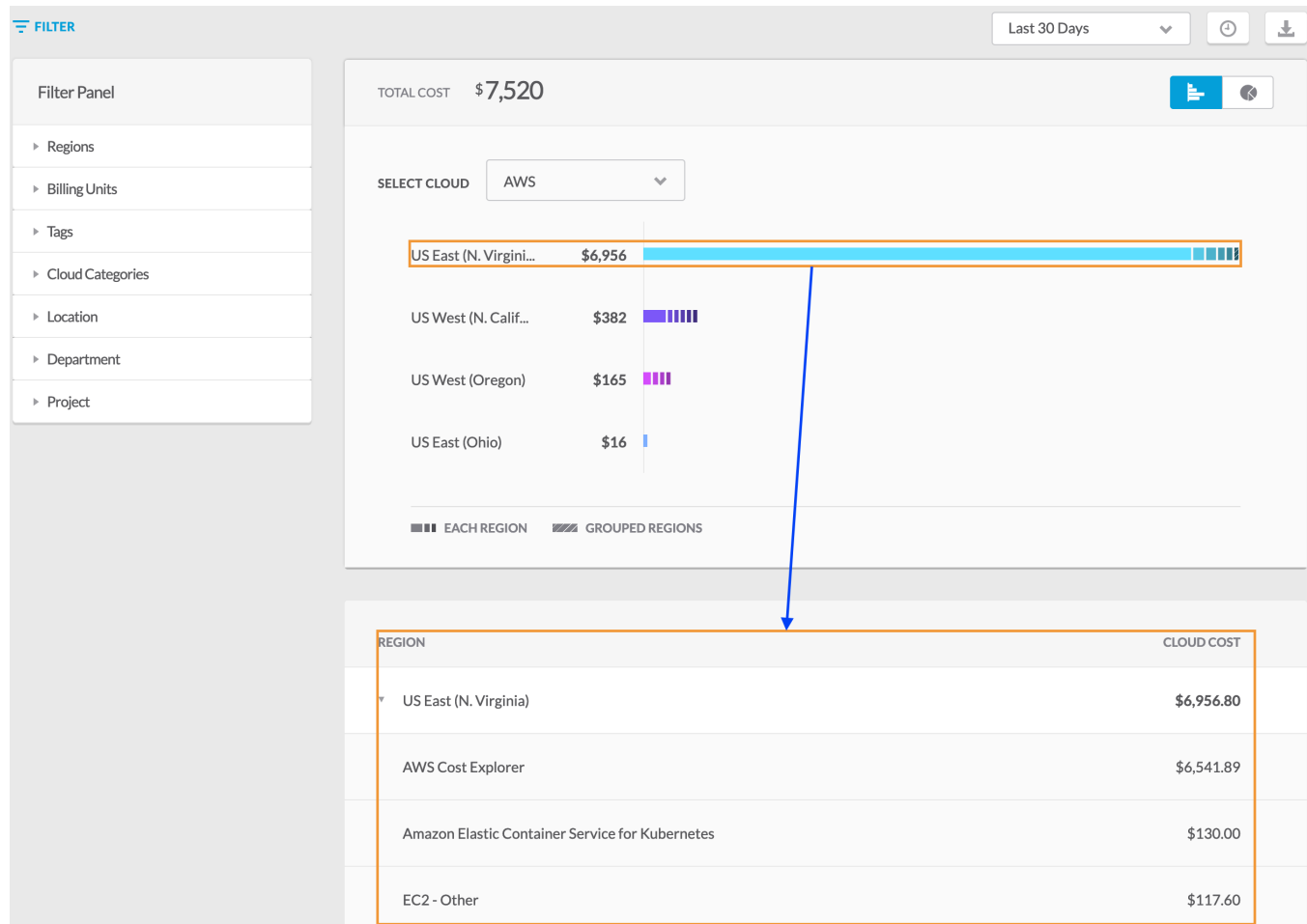
Invoice by Region

Invoice by Region

- [Overview](#)
- [Description](#)
- [Filter](#)


The **Invoice by Region Report** displays the cost of each cloud provider across geography for a chosen duration. The data is categorized based on the service used on the cloud. The value indicates the combined value of all regions. For private and container clouds, the value is displayed for each configured region.

 This report is not available for Google cloud.



The following is a sample screenshot of the report that displays the following:

- **Total Cost** – Display total cost for a cloud provider in a region. You can choose to view the cost of a cloud by choosing from the **Select Cloud** dropdown list.
- **Region** – Display cloud per region and the cloud category, such as storage, network, computer, and so forth.

 The various shades of color in the report correlate to the categories for that cloud region.

You can filter the report using the following options:

- Billing Units
- Cloud Categories
- Cost Groups
- Cost Group Types
- Regions

- Tags



The filter panel changes according to the cloud chosen in the **Select Cloud** dropdown list. For example, if you choose GCP from the list, the filter includes **Cost Groups Types** and **Cost Groups**, in addition to the above options.

Budget Reports

Budget Reports

- [Budget Reports Overview](#)
- [Budget Overspenders](#)
- [Budget Underspenders](#)
- [Budget By Cloud](#)
- [Budget By Cost Group Type](#)

Budget Reports Overview

Budget Reports Overview

- [Overview](#)
- [Who Can Access the Page?](#)
- [What's in the Budget Dashboard?](#)
- [Budget Reports](#)

The Budget Page provides a snapshot of the budget allocations and spending in an organization.

The *Budget* page is visible to all users who can access Cost Optimizer. However, information is displayed according to the access levels and is the home page for this root administrator. For example, the *Cost Optimizer Admin* (see [Access and Roles](#)) can view information across all cost groups, whereas a *Cost Group Owner* can view data specific to the cost group that the *Cost Group Owner* owns.

Information in the dashboard can be controlled through the widget below the header.

The Budgets Reports display graphical views for budget data. You can view data for all clouds or billing units you can access or specify filter criteria to view specific data that you need. The following table explains the icons specific to Budgets Reports UI. Some of these icons might be displayed for some reports only. See [UI Behavior](#) for details on icons in the UI.

Icon	Description
Download	Downloads the report in a .csv format.
Fiscal Year	Choose a fiscal year to display the report.
Schedule	Allows you to send the report via email to recipients on the fixed date.

This widget helps you to view the information in the form of following reports that includes total allocation, total spending, forecasted spending, etc.

- [Budget Overspenders](#)
- [Budget Underspenders](#)
- [Budget By Cloud](#)
- [Budget By Cost Group Type](#)

Budget Overspenders


Budget Overspenders







- [Overview](#)
- [Description](#)

The **Budget Overspenders** report displays information about all categories – clouds accounts, cost group types, departments – that have exceeded the allocated budget as of date and the forecasted spending at the end of the fiscal year.

The following is a sample screenshot of the **Budget Overspenders** report.

Budget Overspenders ▾

3 ALL 2 CLOUD 1 DEPARTMENT 

COST GROUP/CLOUD	TIME PERIOD	SPEND TO DATE	FORECAST	TOTAL BUDGET	FORECASTED DIFFERENCE	BUDGET UTILIZATION
 AzureRM	CLOUD FY2019	\$13,735.46	\$23,537.28	\$5,000.00	\$18,537.28	
 Security	DEPARTMENT FY2019	\$9,223.53	\$15,805.58	\$0	\$15,805.58	
 Amazon	CLOUD FY2019	\$9,101.55	\$15,596.55	\$1,000.00	\$14,596.55	

The information in the following table applies to the summary displayed at the top of the report.

Summary	Description
Total	Total number of items in the report that have exceeded the allocated budget.
Department/Cost Group Type	Number of departments or Cost Group Types that have exceeded the allocated budget.
Cloud	Number of cloud accounts that have exceeded the allocated budget.

The following table identifies various aspects of the report:

Identity	Description
Logo	Displays the cloud logo.
Cost Group /Cloud link	Displays the cloud, cost group type, or department name as a link. Click the link to open the budget report for the item. For instance, clicking on a cloud link opens the budget spending for the cloud.
Name	Fiscal year of the budget and the category to which the fiscal year is applied, cloud account, cost group type, or department.
Spend to Date	Amount spent as of date in the fiscal year.
Forecast	Based on the current spending, amount that will be spent for the remaining fiscal year.
Total Budget	Allocated budget for the category in the fiscal year.
Forecasted Difference	The difference amount for the fiscal year between the total budget and the forecasted spending amount.
Budget Utilization	Color-coded progress bar. The gray shaded box over the progress bar indicates the actual budget and the arrow indicates the budget utilization to date. <ul style="list-style-type: none"> • Green – Spend to date and forecasted spend is within the budget. • Orange – Spend to date is within budget but forecasted spend exceeds the budget. • Red – Spend to date and forecasted spend exceed the budget.

Budget Underspenders

Budget Underspenders

- [Overview](#)
- [Description](#)

The **Budget Underspenders** report displays information about the clouds and cost group types that have not spent the allocated budget as of the date or if the forecasted budget is less than the total budget.

The following is a sample screenshot of the **Budget Underspenders** report.

COST GROUP/CLOUD	TIME PERIOD	SPEND TO DATE	FORECAST	TOTAL BUDGET	FORECASTED DIFFERENCE	BUDGET UTILIZATION
Quality	DEPARTMENT FY2019	\$2,248.68	\$3,853.37	\$100,000.00	\$96,146.63	
Amazon	CLOUD FY2019	\$9,101.55	\$15,596.55	\$100,000.00	\$84,403.45	

The information in the following table applies to the summary displayed at the top of the report.

Summary	Description
All	Total number of items in the report that have spent less than the allocated budget.
Cloud	Number of cloud accounts that have spent less than the allocated budget.
Department	Number of departments that have spent less than the allocated budget.

The following table identifies various aspects of the report:

Identity	Description
Logo	Displays the cloud logo.
Cost Group /Cloud link	Displays the cloud, cost group type, or department name as a link. Click the link to open the budget report for the item. For instance, clicking on a cloud link opens the budget spending for the cloud.
Name	Fiscal year of the budget and the category to which the fiscal year is applied, cloud account, cost group type, or department.
Spend to Date	Amount spent as of date in the fiscal year.
Forecast	Based on the current spending, the amount that will be spent on the remaining fiscal year.
Total Budget	Allocated budget for the category in the fiscal year.
Forecasted Difference	The difference amount for the fiscal year between the total budget and the forecasted spending amount.
Budget Utilization	Color-coded progress bar. The gray shaded box over the progress bar t indicates the actual budget and the arrow indicates the budget utilization to date. <ul style="list-style-type: none"> • Green – Spend to date and forecasted spend is within the budget. • Orange – Spend to date is within budget but forecasted spend exceeds the budget. • Red – Spend to date and forecasted spend exceed the budget.\

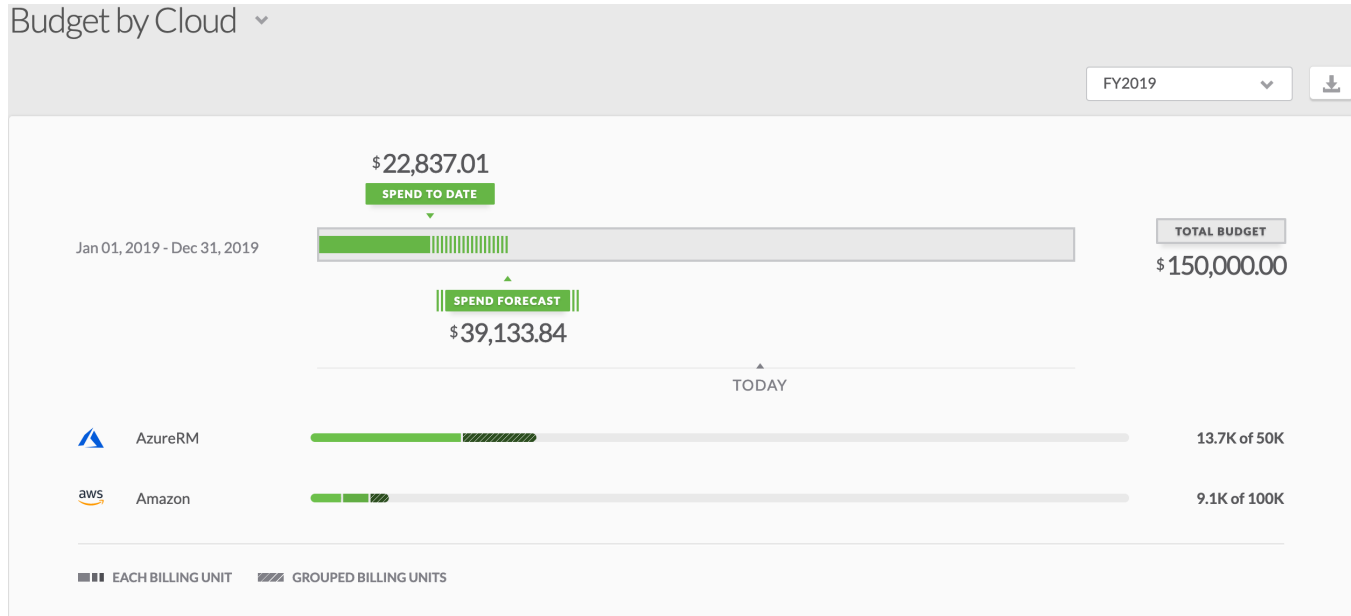
Budget By Cloud

Budget By Cloud

- [Overview](#)
- [Description](#)

The **Budget by Cloud** report displays information about the clouds providers that have not spent the allocated budget as of date.

The following is a sample screenshot of the **Budget by Cloud** report. The report displays the total budget and budget for each cloud. The report also displays in different shades the budget allocated to each billing unit in the cloud.



The legend for the above screenshot is as follows:

- Grey box – Total budget
- Deep color (in the graph) – Actual spending until the day the report was generated.
- Boxed color (in the graph) – Forecasted budget

CLOUD	SPEND TO DATE	FORECAST	TOTAL BUDGET	REMAINING BUDGET
▼ AzureRM	\$13,735.46	\$23,537.28	\$50,000.00	\$36,264.54
cbaba14b-e672-47d7-bb59-4a0613d6d149 (Pay-As-You-Go(Converted to EA))	\$9,223.53			
0f2c89bc-0aa4-41f6-838b-3dcbcd17c166 (Microsoft Azure Enterprise)	\$4,511.92			
▼ Amazon	\$9,101.55	\$15,596.55	\$100,000.00	\$90,898.45
804685808463 (CloudCenterMaster)	\$3,741.40			
512570952472 (CPSG)	\$3,111.47			
052904131800 (Sriram Gopalan)	\$2,248.68			

The following table identifies various aspects of the report:

Identity	Description
----------	-------------

Cloud	Displays the name. Click the arrow next to the Cloud Name to display the billing units in the cloud.
Spend to Date	Amount spent by the cloud or billing unit as of date in the fiscal year.
Forecast	Based on the current spending, the amount that will be spent on the remaining fiscal year.
Total Budget	Allocated budget for the cloud in the fiscal year.
Remaining budget	Amount that would remain in the total budget at the end of the fiscal year, based on the current spending.

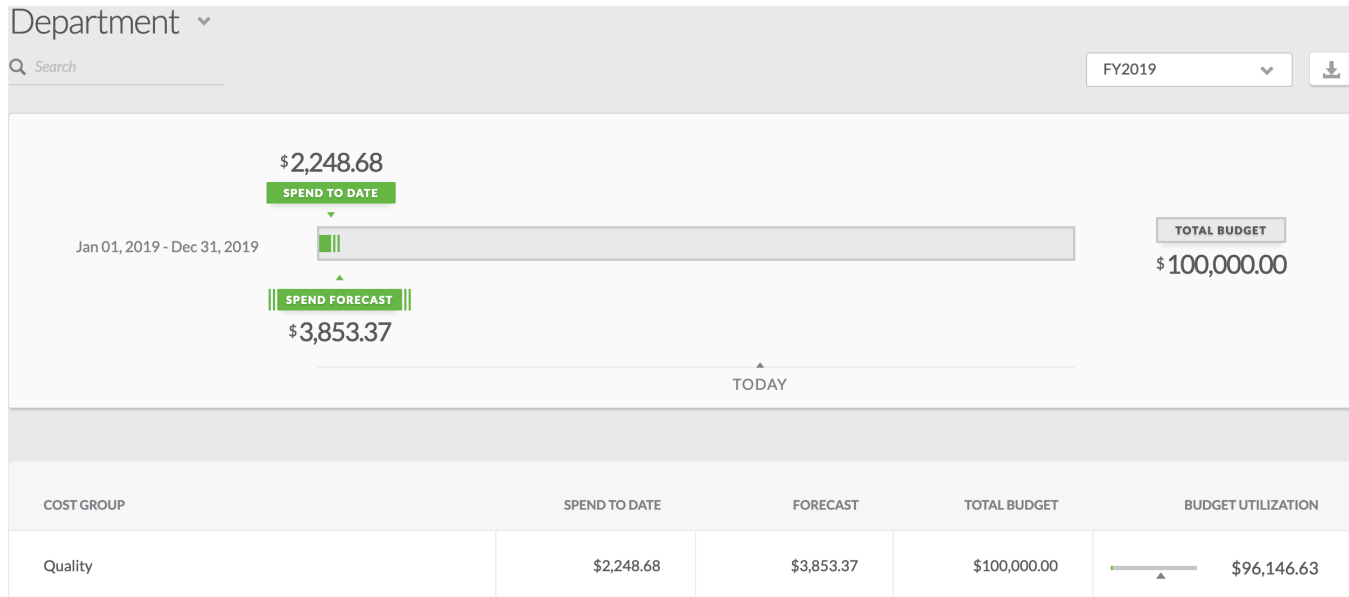
Budget By Cost Group Type

Budget By Cost Group Type

- [Overview](#)
- [Description](#)

The **Budget by Cost Group Type** report displays information about budgets allocated to the cost group type for a fiscal year and the spending of the allocated budget for the fiscal year.

The following is a sample screenshot of the **Budget by Cost Group Type** report.



The following table identifies various aspects of the report:

Identity	Description
Cost Group	Displays the cost group type.
Spend to Date	Amount spent as of date in the fiscal year or quarter.
Forecast	Based on the current spending, the amount that will be spent on the remaining fiscal year or quarter.
Total Budget	Allocated budget for the category in the fiscal year or quarter.
Budget Utilization	Color-coded progress bar. The gray shaded box over the progress bar indicates the actual budget and the arrow indicates the budget utilization to date. <ul style="list-style-type: none"> • Green – Spend to date and forecasted spend is within the budget. • Orange – Spend to date is within budget but forecasted spend exceeds the budget. • Red – Spend to date and forecasted spend exceed the budget.

Inventory

- [Inventory Overview](#)
- [Virtual Machines](#)
- [Kubernetes Workloads](#)
- [Storage Volumes](#)
- [Services](#)
- [Inventory States](#)

Inventory Overview

Inventory Overview

- [Introduction](#)
- [What's in the Inventory Pages?](#)
- [Filter](#)
 - [Advanced Options](#)
 - [Saving Filters](#)
 - [Scheduling Reports](#)
- [Inventory Types](#)

The **Inventory** page lists resources running on all cloud accounts available in Cost Optimizer. A resource is a generic collection which includes instance, storage, load balancer, and database instance details. Inventory is collected for all the combinations of cloud regions and accounts at specified intervals. See [Data Collection](#) for details on inventory processes and its intervals.



As of Cost Optimizer 5.1, custom instance prices are not displayed as part of type metadata.

Click **Inventory** in the left tree pane to open the **Inventory** page. The following table explains the icons in the **Inventory** UI for each of the above categories. See [UI Behavior](#) for details on icons in the UI.

Icon	Description
Filter	Allows you to filter data and view inventory data for one or more of the following: <ul style="list-style-type: none"> • Clouds • Cloud Regions • Status (of resources) • CPUs • Memory GB • Billing Unit • Tags
Sort	Sort the items in the page.
Find	Find an instance of an inventory type based on specific keywords.

The **Filter** panel allows you to filter data based on a set of options, thereby allowing you to drill down to the exact details that you require.

Advanced Options

The advanced options in Cost Optimizer are as follows:

- [Saving Filters](#)
- [Scheduling Reports](#)

Saving Filters

You can choose to save a combination of options in the **Filter** menu for future use through the **Save Filters** feature so that you can quickly access and use the filter at a later time. To save a filter, do the following:

1. Choose the required filter options in the **Filter Panel** pane.

2. The **Save** button appears. The **Save New Filter** dialog appears.

FILTER

SAVE **RESET**

▼ Billing Units

Of2c89bc-0aa4-41f6-838b-3dcbcd17c...

▼ Clouds

AzureRM

▼ Environment

Testing

▼ Regions

All

US West - US West - AzureRM

US East - US East - AzureRM

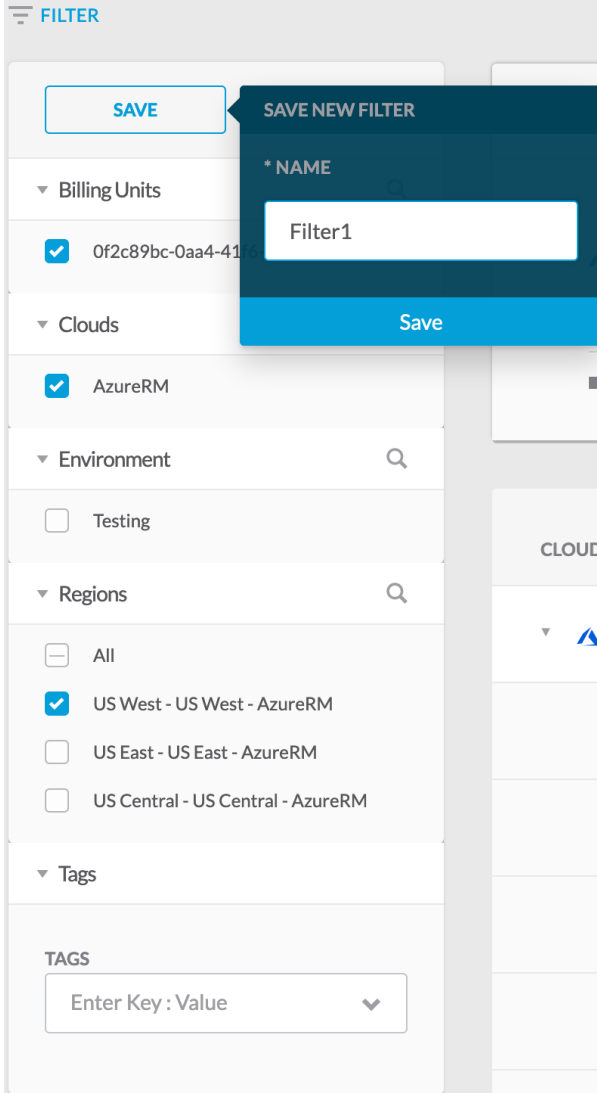
US Central - US Central - AzureRM

▼ Tags

TAGS

Enter Key : Value

3. Specify a name for this filter and click **Save**. A status message appears indicating that the filter has been saved.



4. You can access and view the saved filters from the dropdown list.

You can also perform the following additional tasks in the Filter menu:

- Mark the filter as a favorite by clicking the pin icon next to the filter name.
- Remove the chosen filters by choosing the **Reset** button at any point when saving the filter.
- Delete the saved filter by clicking the **Trash** icon next to a saved filter name. Click **OK** in the **Delete Saved Filter** dialog to confirm the deletion.

Scheduling Reports

The **Scheduler** icon allows you to schedule report generation periodically on a fixed date or at intervals. To create a schedule, do the following:

1. Click the **Scheduler** icon. The **Schedule New *Report Name*** dialog appears.

Schedule New Cost by Cloud Provider (By Billing Units) Report ✕

*** REPORT NAME**

FILTERED BY

Select From Saved Filters
▼

DATE RANGE

Last 30 Days
▼

*** RECIPIENTS**

Select Recipients
▼

*** SCHEDULE START DATE**

Aug 14 , 2019
📅

*** RECURRENCE**

☰ OFF

SAVE

2. Do the following:

- a. Enter a name for the schedule.
- b. Choose filtering options for the schedule from the **Filtered By** field. The information in this field is populated when you save the filtering options as described in the *Advanced Filtering Options* section. You can choose to select a filter or leave the field empty.
- c. Choose the date range.
- d. Select the recipients the report must be sent to.
- e. Specify the start date.
- f. Toggle on the **Recurrence** button to send the report at intervals.
- g. In the **Repeats Every** area, specify the number of times the report must be sent to the recipients and choose the interval – **Daily** or **Weekly**. If you choose **Weekly**, you can also specify the days of the week when the report is sent.
- h. Select the period to end the schedule. The options are:
 - i. **Never** – Send report forever or until the schedule is deleted.
 - ii. **On** – Date when the report should be sent.
 - iii. **After** – Number of occurrences after which the report is not scheduled.

3. Click **Save**. The report is displayed in the **Scheduled *Report Name*** dialog as shown in the sample screenshot below.

Scheduled Cost by Cloud Provider (By Billing Units) Reports ✕

Existing Reports SCHEDULE NEW

REPORT NAME	FILTERS	RECIPIENTS	FREQUENCY	ACTIONS
CCPBU REPORT		admin@cliqrtech.com	None	

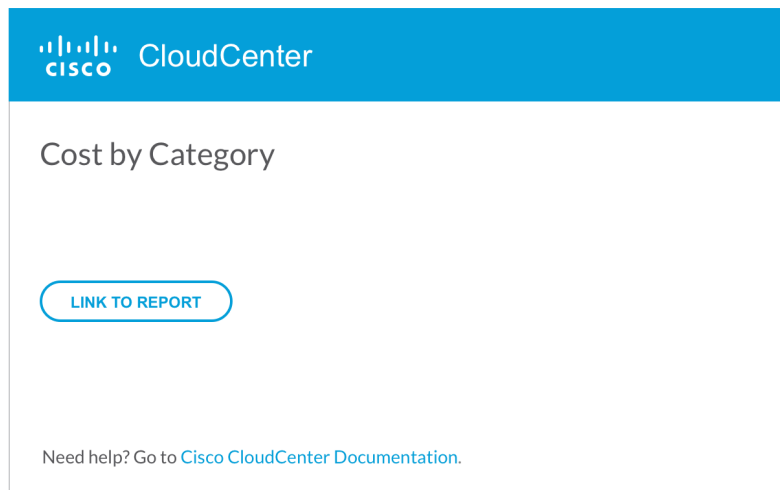
DONE



Optionally, you can use the **Edit** option in the **Actions** column to make changes to the schedule. You can also delete the report using the **Delete** option.

Click **Done** to close the dialog.

The following screenshot displays a sample email format of the report.



The inventory types in Cost Optimizer are as follows:

- [Virtual Machines](#)
- [Kubernetes Workloads](#)
- [Storage Volumes](#)
- [Services](#)

Virtual Machines

Virtual Machines

- [Overview](#)
- [Description](#)
- [Filter](#)
- [VM Details](#)

This page displays the virtual machines for a cloud provider. The following is a sample screenshot of the Virtual Machines page.

Summary	Description
Total	Total number of VMs.
Running	Total number of VMs running (billed) <i>without any time restriction</i> . This count includes VMs that display the <i>ERROR</i> status.



Identity	Screenshot and Description
Logo	Displays the OS logo.

Regardless of the filter settings, the information in the following table applies to the summary displayed at the top of the Virtual Machines page:

Identity	Screenshot and Description
Logo	Displays the OS logo.

The following table identifies various aspects of the Virtual Machines tab:

Summary	Description
Total	Total number of VMs.
Running	Total number of VMs running (billed) <i>without any time restriction</i> . This count includes VMs that display the <i>ERROR</i> status.

VM details link	<div style="display: flex; align-items: center;">  <div> <p style="color: green; font-weight: bold; margin: 0;">STARTED</p> <p style="font-size: 24px; border: 1px solid orange; padding: 2px; display: inline-block;">Ares</p> <p style="margin: 5px 0 0 0;">Amazon US West (N. California) • Master AWS</p> <p style="margin: 0 0 0 0;">2 CPU, 3840 MB, 32 GB</p> </div> </div> <p style="margin-top: 10px;">Displays the VM name as a link. Click the link to view details about the VM. For each VM, the following is displayed.</p> <ul style="list-style-type: none"> Hostname – The hostname for the VM, if configured. Else, the node ID is displayed. Cloud Region Cloud Name Private and public IP address of the VM.
Status	<p>Color-coded states that identify the VM status.</p> <p>See Inventory States for a complete list and additional details.</p> <div style="border: 1px solid orange; padding: 5px; margin-top: 10px;">  Terminated VMs are not displayed. </div>
Duration	<p>Instance runtime, in hours or minutes, the VM is in the specified state.</p>
Cost	<p>Calculated on on-demand prices available in the instance types. For private clouds, the cost is as decided by the admin when setting up the clouds. See Supported Datacenters and Private Clouds.</p>

You can filter the items based on the following:

- Clouds
- Cloud Region
- Status
- CPUs
- Memory GB
- Billing Unit
- Tags
- Location
- Department
- Project

Clicking the VM Name displays information about the VM which contains the following tabs:

- The **Details** tab (default) provides exhaustive details for the *VM*.
- The **Stats** tab provides information about resizing recommendations.

The following is a sample screenshot of the VM **Details** page.



STARTED
 Ares
 Amazon US West (N. California) • Master AWS
 2 CPU, 3840 MB, 32 GB

RUN TIME
23 DAYS 3 HRS | COST
\$ 66.66
 \$ 0.12/hour

DETAILS STATS

Recommendation **\$30.96/mo** | Resize to

^ VM details

VM ID
 i-0b3e516e359ef05c8
 STATUS
 STARTED
 LAUNCH DATE
 Jul 9, 2019 at 1:00:06 PM
 OPERATING SYSTEM
 Linux

C3.LARGE

2 VIRTUAL CPU
 3840 MB MEMORY
 32 GB TEMP STORAGE

\$ 0.12/hour
 APPROX \$86.40/MONTH

SOURCE IMAGE
 ami-33c1ca76
 SECURITY GROUP

^ Tags

Name:Ares
 purpose:underutilized
 project:
 prj:Cyclone

^ Cloud details

CLOUD	AWS	CLOUD ACCOUNT	Master AWS
CLOUD REGION	US West (N. California)	BILLING UNIT	804685808463
ZONES	us-west-1c		

^ Volume details

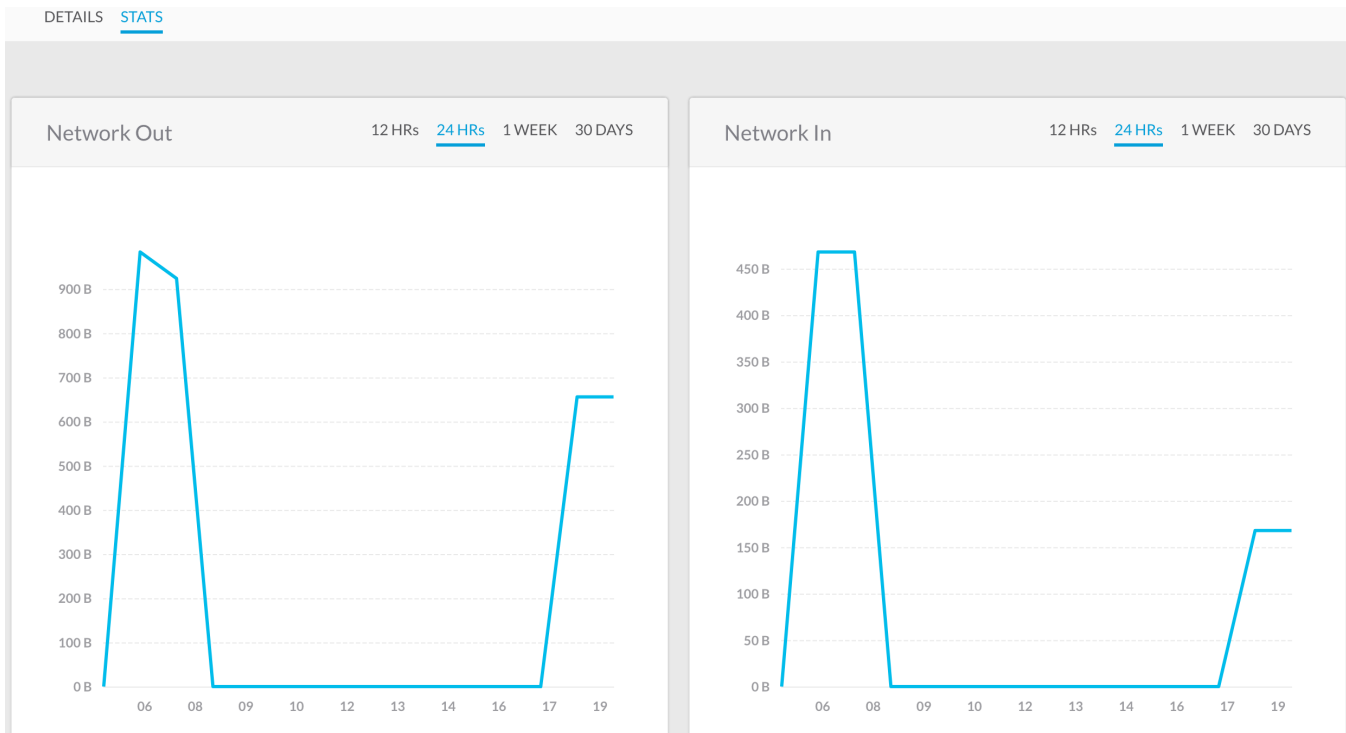
VOLUME NAME	SIZE	TYPE	PRICE
vol-0ee981858cbe2b048	8	General Purpose	\$ 0.96/month

This table identifies significant aspects of the **Details** Tab.

Area	Identity	Description
Recommendation	Resize to	Recommendation engine's resize recommendation, which is based on the utilization of this instance and does not affect the performance of the VM.
VM Details	VM ID	Billing unit that owns the VM.

	Status	Status of the VM. The options are as follows: <ul style="list-style-type: none"> • Started • Stopped • Terminated
	Source Image	Machine from which VM is launched.
	Security Group	Rules that control traffic in or out of a VM.
Tags	Name	Tag name.
	Purpose	Usage of the tag in Cost Optimizer.
	Project	Tag key-value pair.
Cloud Settings	Network	Network name issued by the cloud provider.
Volume Details	Type	Types of storage volume, varies for each cloud, for example, General Purpose, Provisioned IOPS, Throughput Optimized.
	Price	Price of volume per hour.

This table identifies significant aspects of the **Stats** Tab. A sample screenshot is shown below.



Identity	Description
Network Out	Outbound traffic in kilobytes.
Network In	Inbound traffic in kilobytes.
CPU	CPU utilization in percent.
Disk Write	Volume of data written to a disk in kilobytes.
Disk Read	Volume of data read from a disk in kilobytes.

Kubernetes Workloads

Kubernetes Workloads

- [Overview](#)
- [Description](#)
- [Filter](#)
- [Kubernetes Workloads Details](#)

To display information about Kubernetes Workloads items, choose **Kubernetes Workloads** in the **Inventory** header drop-down list.

The screenshot shows the Kubernetes Workloads interface. At the top, there are two tabs: "154 TOTAL" and "154 RUNNING", with the latter being selected. On the left, there is a "Filter" sidebar with options for Status, Deployment Type, Cloud Account, Cloud Region, and Cloud Group. The main area displays a list of five Kubernetes Workloads, each with a checkbox, a status indicator (RUNNING), a name, a description, and a cost. The workloads are:

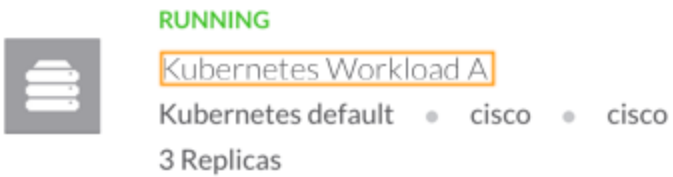
Workload Name	Replicas	Days	Cost
Kubernetes Workload A	3 Replicas	3 DAYS	\$ 0.00
Kubernetes Workload B	2 Replicas	2 DAYS	\$ 0.00
Kubernetes Workload C	1 Replica	3 DAYS	\$ 0.00
Kubernetes Workload D	2 Replicas	6 DAYS	\$ 0.00
Kubernetes Workload E	1 Replica	1 DAY	\$ 0.00

Regardless of the filter settings, the information in the following table applies to the summary displayed at the top of the page:

Summary	Description
Total	Total number of Kubernetes workloads.
Running	Total number of running (billed) Kubernetes workloads <i>without any time restriction</i> .

The following table identifies various aspects of the Kubernetes Workloads tab:

Identity	Screenshot and Description
----------	----------------------------

Kubernetes details link	 <p>Displays the Kubernetes Workload name as a link. Click the link to view details about the Kubernetes Workload. For each workload, the following is displayed.</p> <ul style="list-style-type: none"> • Hostname – The hostname for the workload, if configured, else the node ID is displayed • Cloud Region • Billing Unit • Number of Replicas–Pods that are running
Status	Color-coded status that identifies the Kubernetes workload status. See Inventory States for a complete list and additional details.
Duration	Runtime of the Kubernetes workload (hours or minutes).
Cost	Calculated on on-demand prices available in the instance types. For private clouds, the cost is as decided by the administrator when setting up the clouds. See Supported Datacenters and Private Clouds .

You can filter the items based on the following:

- Status
- Deployment Type
- Cloud Account
- Cloud Region
- Cloud Group

Clicking the Kubernetes Workload name displays the following tabs:

- The **Details** tab (default), which provide exhaustive details for the workload.
- The **Replicas** tab, which provides information about pod replicas.

The following is a sample screenshot of the Kubernetes **Details** tab.



RUNNING

Kubernetes Workload A

Kubernetes default • cisco • cisco
3 Replicas[DETAILS](#) REPLICAS

^ Workload Details

HOST NAME	STATUS
fd65c310-1044-11e9-8aa3-42010a80019e	RUNNING
TYPE	LAUNCH DATE
STATEFUL_SET	Jan 5, 2019 at 10:50:10:000 PM
	END DATE
	Aug 6, 1754 at 4:37:09:129 AM

> Container Configuration

> Cloud Details

> Network Services

> Network Policy


> Deployment Details

The following table explains significant items in the tab.

Area	Identity	Description
Workload Details	Type	Could be one of the following <ul style="list-style-type: none"> • Deployment • StatefulSet • DaemonSet
	Status	Workload status. The options are: <ul style="list-style-type: none"> • Failed • Pending • Running • Succeeded • Terminated
Container Configuration	Port/Protocol	Port and protocol to establish a connection.
	Source Namespace	Source cluster in the Kubernetes workload.
Network Services	Type	Type of IP Address assigned to the workload.
	ClusterIP	Unique internal IP address assigned to a service.

 The **Deployment Details** area is not applicable to Cost Optimizer.

The following is a sample screenshot of the **Replica** tab.




RUNNING

Kubernetes Workload A

Kubernetes default • cisco • cisco

3 Replicas

DETAILS
REPLICAS





RUNNING

Kubernetes Workload A

10.212.89.8 • gke-usera-optimizer-cluster-preemp-1-abc19ef1-a1bc

Containers

	NAME	STATUS	IMAGE
	es-master	RUNNING	devhub-docker.abc.com/productname/quay.io/piers/docker-elasticsearch-kubernetes:6.4.2.




RUNNING

Kubernetes Workload B

10.212.88.10 • gke-usera-optimizer-cluster-preemp-1-abc19ef1-a2bc

Containers

	NAME	STATUS	IMAGE
	es-master	RUNNING	devhub-docker.abc.com/productname/quay.io/piers/docker-elasticsearch-kubernetes:6.4.2.

The following table explains significant aspects of the tab.

Identity	Description
Replica IP	Private IP address of the cluster.
Image	Location of the image for the Kubernetes cluster from Docker registry.

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Storage Volumes

Storage Volumes


- [Overview](#)
- [Filter](#)
- [Details Page](#)

A storage volume is a virtual disk that provides persistent block storage space for instances. You can use storage volumes to store data and applications.

Status	Name	Location	Size / Type	Cost
AVAILABLE	checkmetrics_OsDisk_1_5a62db59a0504c16ae7e4d8a42291662	AzureRM US West (California) • AzureRM:Master AzureRM	30 GB / Premium SSD(Managed)	\$5.28/mo 5 MOS \$26.01
AVAILABLE	standard-managed	AzureRM US West (California) • AzureRM:Master AzureRM • standard-managed	10 GB / Standard HDD(Managed)	\$1.54/mo 5 MOS \$7.57
AVAILABLE	cqjw-7ccf0750a-osdisk.vhd	AzureRM US West (California) • AzureRM:Master AzureRM • cqjw-7ccf0750a-osdisk.vhd	30 GB / Standard HDD(Managed)	\$1.54/mo 5 MOS \$7.52
AVAILABLE	stop-instance_disk1_1a9a9b1043c04b399e2632921549e198	AzureRM US West (California) • AzureRM:Master AzureRM	30 GB / Premium SSD(Managed)	\$5.28/mo 5 MOS \$25.72
IN_USE	opt-dev-test_OsDisk_1_217ec4d59b6f4505b7adbc15773d4d62	AzureRM US East (Virginia) • AzureRM:Master AzureRM • opt-dev-test_osdisk_1_217ec4d59b6f4505b7adbc15773d4d62	32 GB / Standard HDD(Managed)	5 MOS \$7.48

The following table identifies various aspects in the Storage Volumes page:


Identity	Screenshot and Description
Total	Total number of available storage spaces.
Running	Total number of running (billed) storage <i>without any time restriction</i> .
Status	Color-coded status that identifies the Storage Volume state. The status could be one of the following: <ul style="list-style-type: none"> • Available • In Use See Inventory States for a complete list and additional details.

Storage Volume link	<div style="display: flex; align-items: flex-start;"> <div style="margin-right: 10px;">  </div> <div> <p style="color: orange; font-weight: bold; font-size: small;">AVAILABLE</p> <p style="border: 1px solid orange; padding: 2px; font-weight: bold; font-size: small;">checkmetrics_OsDisk_1_5a62db59a0504c16ae7e4d8a42291662</p> <p style="font-size: x-small; margin-top: 5px;"> AzureRM US West (California) • AzureRM:Master AzureRM • checkmetrics_osdisk_1_5a62db59a0504c16ae7e4d8a42291662 30 GB / Premium SSD(Managed) </p> </div> </div> <p style="margin-top: 10px;">Displays the storage name as a link. Click the link to view additional information. For each volume, the following is displayed.</p> <ul style="list-style-type: none"> Storage Name Cloud Region Cloud Account Volume ID Storage space and type, for example, PD-standard, Standard Persistent Disk
Duration	Hours or minutes, the storage is in the specified state.
Cost	Cost calculated on on-demand prices.

You can filter the items based on the following:

- Clouds
- Cloud Region
- Status
- Billing Unit
- Tags
- Location
- Department
- Project

Click the storage name link to open the Storage Details page. The following is a sample screenshot of the Storage Details page.



AVAILABLE

checkmetrics_OsDisk_1_5a62db59a0504c16ae7e4d8a42291662

AzureRM US West (California) • AzureRM:Master AzureRM • checkmetrics_osdisk_1_5a62db59a0504c16ae7e4d8a42291662
 30 GB / Premium SSD(Managed)

5 MOS | \$ 26.01

[DETAILS](#)

← \$

Recommendation **\$5.28**/mo | Current Size: 30

TERMINATE

^ Volume details

<p>ID</p> <p>5d421854bd1aedf8ba159169</p> <p>OWNER</p> <p>cbaba14b-e672-47d7-bb59-4a0613d6d149</p>	<p>LAUNCH DATE</p> <p>Mar 6, 2019 at 10:57:05 PM</p>
--	--

^ Cloud details

<p>CLOUD</p> <p>AzureRM</p> <p>CLOUD REGION</p> <p>US West (California)</p> <p>CLOUD ACCOUNT</p> <p>Master AzureRM</p>	<p>BILLING UNIT</p> <p>cbaba14b-e672-47d7-bb59-4a0613d6d149</p>
--	---

Storage details	
STORAGE SIZE	THROUGHPUT READ LIMIT
30 GB	25
STORAGE TYPE	THROUGHPUT WRITE LIMIT
Premium SSD(Managed)	25
IOPS READ LIMIT	SOURCE IMAGE ID
120	Skus/7.5/Versions/7.5.201808...
IOPS WRITE LIMIT	
120	

This table identifies significant aspects of the **Details** Tab.

Area	Identity	Description
Recommendation	Current Size	Potential savings when the recommendation is implemented.
Volume Details	ID	ID assigned by a cloud provider.
	Owner	Billing unit that owns the VM.
Storage Details	Size	Size of volume in GB.
	Type	Types of storage volume, varies for each cloud, for example, General Purpose, Provisioned IOPS, Throughput Optimized.
	IOPS Read Limit	Maximum IO (input or output) read operations per second.
	IOPS Write Limit	Maximum IO (input or output) write operations per second.
	Throughput Read Limit	Maximum data transfer rate in mebibyte (MiB) per second for read operation.
	Throughput Write Limit	Maximum data transfer rate in mebibyte (MiB) per second for write operation.
	Source Image Snapshot ID	Snapshot from which the volume was created.

Services

Services

- [Overview](#)
- [Description](#)
- [Filter](#)
- [Details Page](#)

A cloud provider offers services such as load balancer, databases, and so on. This information is displayed when you choose **Services** in the **Inventory** header drop-down list.


The following is a sample screenshot of the **Services** page.

29 TOTAL		14 LOAD BALANCER	15 DATABASE	
ACTIVE	TestAwsElbNet	LOADBALANCER	Amazon US East (N. Virginia) • Master AWS 512570952472	9 MOS \$149.09
	TestAwsElbClas	LOADBALANCER	Amazon US East (N. Virginia) • Master AWS 512570952472	\$0.00
	a0ca710f5e94411e8b821025a0afd4a5	LOADBALANCER	Amazon US East (N. Virginia) • Master AWS 804685808463	\$0.00
	a0c417a45e94711e8b821025a0afd4a5	LOADBALANCER	Amazon US East (N. Virginia) • Master AWS 804685808463	\$0.00
ONLINE	sqldatabase-jaya	DATABASE	AzureRM US West (California) • Master AzureRM 0f2c89bc-0aa4-41f6-838b-3dcbcd17c166	5 MOS \$948.24
ONLINE	new_sql_db	DATABASE		

The following table identifies various aspects in the **Services** page:

Identity	Screenshot and Description
Services Header	Identifies the total number of services and the available service types.
Services Status	This could be one of the following: <ul style="list-style-type: none"> • Active • Available • Healthy • Unhealthy • Terminated
Service Type	Displays the type of service. This could be Loadbalancer or Database.

Services details link



TestAwsElbClas

LOADBALANCER

Amazon US East (N. Virginia) • Master AWS

512570952472


Displays the Services name as a link. Click the link to view additional information. For each service, the following is displayed.

- Hostname
- Cloud Region
- Cloud Account Name
- Billing Unit

You can filter the items based on the following:

- Clouds
- Cloud Region
- Status
- Tags
- Location
- Department
- Project

The following is a sample screenshot of the Services Details page.



TestAwsElbClas LOADBALANCER

Amazon US East (N. Virginia) • Master AWS

512570952472

\$0.00

[DETAILS](#)

^ Service Details

<p>ID</p> <p>5d4217dcbd1aedf8ba14b56f</p>	<p>LAUNCH DATE</p> <p>Oct 29, 2018 at 4:17:27 PM</p>
<p>TYPE</p> <p>LOADBALANCER</p>	

^ Cloud Details

<p>CLOUD</p> <p>AWS</p>	<p>CLOUD ACCOUNT</p> <p>Master AWS</p>
<p>CLOUD REGION</p> <p>US East (N. Virginia)</p>	<p>BILLING UNIT</p> <p>512570952472</p>
<p>ZONES</p> <p>0</p>	

Service Settings

CANONICAL HOSTED ZONE NAME
TestAwsElbClas-1643372214.us-east-1.elb.amazonaws.com

CANONICAL HOSTED ZONE NAME ID
Z35XDOTRQ7X7K

ACCOUNT LIMITS

CLASSIC LISTENERS	CLASSIC LOAD BALANCERS	CLASSIC REGISTERED INSTANCES
100	20	1000

INSTANCES
N/A

HEALTH CHECK

HEALTHY THRESHOLD	INTERVAL	TARGET	TIMEOUT	UNHEALTHY THRESHOLD
10	30	index.html	5	2

SCHEME
internet-facing

SECURITY GROUP IDS
sg-10975064, sg-92297ce6

The following table identifies various aspects of the page.



The **Deployment Details** area does not apply to Cost Optimizer.

Area	Identity	Description
Service Details	ID	ID assigned by a cloud provider.
	Status	Status of the Service (varies for cloud providers). Options include: <ul style="list-style-type: none"> • Available • Active • Healthy • Unhealthy
	Type	Loadbalancer or database.
Service Settings	DNS Name	DNS name assigned by the cloud provider.
	Health Probes	Periodic requests send to the check the instance health.
	Health Check Status	Options include: <ul style="list-style-type: none"> • Active • Inactive
	Scheme	Type of Loadbalancer, which could be: <ul style="list-style-type: none"> • Internal • Internet-facing • Public • Private
	Instances	VMs used for load balancing.
	Security Group IDs	Rules that control traffic in or out of service.
	Account Limits	Loadbalancer resource limits.

	Listener Descriptions	Process that checks for connection requests.
--	-----------------------	--

Inventory States

Inventory States

This following table lists the states of inventory resources (Virtual Machines, Storage Volumes, Load Balancers, Database, Containers) in Cost Optimizer.

Inventory	State	Description
Virtual Machines (VM)	Error	VM is in an error state.
	Paused	VM is in an interrupted state.
	Pausing	VM is in the process of being interrupted.
	Started	VM is in a ready, rebooted, or reachable state.
	Starting	VM is in a start, reboot, or resume state.
	Stopped	VM is in a stop state.
	Suspended	VM is in suspension.
	Suspending	VM is in the process of being suspended.
	Stopping	VM is in the process of being stopped.
	Running	VM is in the start, ready, reboot, resumed, or reachable state.
	Terminating	VM is in the terminating state.
	Terminated	VM is in a clean state.
Kubernetes Workloads	Failed	Kubernetes Workload is in a failed state.
	Pending	Kubernetes Workload has been accepted by the system.
	Running	Kubernetes Workload is bound and in the start, ready, reboot, resumed, or reachable state.
	Succeeded	Kubernetes Workload have terminated in success.
	Terminated	Kubernetes Workload is in a clean state.
Storage Volume	In Use	Storage space is being utilized.
	Available	Storage space is available for use.
Services	Active	Service is in a start, ready, reboot, or resumed state.
	Available	Service is available for use.
	Healthy	Service has not undergone any issues recently.
	Unhealthy	Service underwent issues recently.
	Terminated	Service is in a clean state.

Rightsizing

Rightsizing

- [Overview](#)
- [Recommendation Engine](#)
 - [Proportional Resizing](#)
- [Rightsizing Report](#)
 - [Instance Utilization](#)
 - [Recommendations](#)
 - [Underutilized Tab](#)
 - [Unused Tab](#)
 - [Overutilized Tab](#)
 - [Advanced Options](#)
 - [Saving Filters](#)
 - [Scheduling Reports](#)
- [Options in the Actions Column](#)
 - [Resize](#)
 - [Stop and Terminate](#)

Rightsizing is the process of recommending the use of right instance type or right resources for an application to optimize cost for an organization. Typically, instances are overprovisioned for an application. Overprovisioning of resources results in resources, such as CPU, memory, and so on, being unused. In turn, underutilization leads to an increase in cost – you spend much more than what you should.



If some instances are underprovisioned, the recommendation engine recommends upsizing of instances which might not result in cost savings, but improvement in application performance.

The recommendation engine uses an algorithm based on CPU and memory and recommends the right set of actions (downsizing of instances) that results in significant cost reduction without affecting the application performance. This algorithm uses the default thresholds (for CPU and memory) to arrive at downsize or upsize recommendations.

The recommendation engine works as follows:

- The algorithm matches the attributes (CPU, memory, network, and storage capabilities) of running a virtual machine and compares the attributes with operational metrics, such as CPU utilization to arrive at the rightsize for instance.
- The algorithm is cost-conscious and offers multiple candidate choices to resize the instance.
- The threshold limitations can be set or modified in the [Settings](#) submenu of the **Admin** menu.
- The Resize action is handled by the Workload Manager.
- When suggesting resizing recommendations, an instance with RI opportunities is preferred for instances of the same type. This ensures maximum utilization of resources and minimum cost.



Rightsizing is not supported for custom instances (OpenStack, for example). Cisco does not recommend custom instance sizes for Google Cloud Platform (GCP). Only predefined instance types are supported for rightsizing recommendation.

Proportional Resizing

The recommendation engine recommends instances based on the CPU or memory utilization of the instance over a period of time. Based on the factors of underutilization or overutilization, appropriate instances are identified to ensure CPU or memory ratios will be maintained approximately. If Proportional Resizing, in the [Settings](#) submenu of the **Admin** menu, is turned off, equal memory instances with appropriate CPU counts will be recommended.

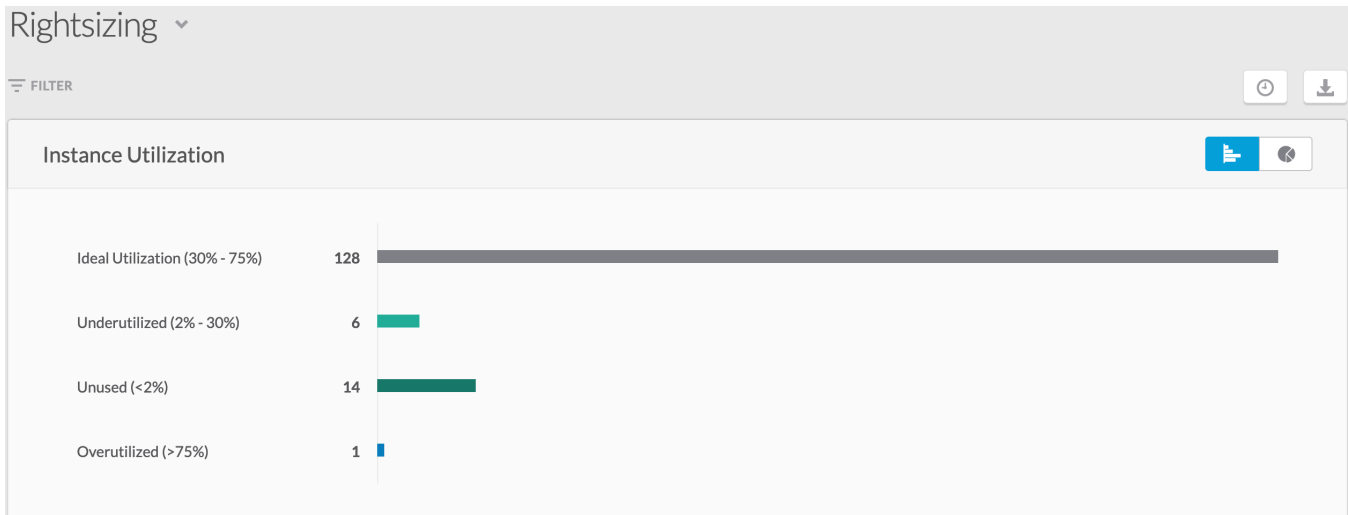
The Rightsizing report is divided into the following:

- [Instance Utilization](#)
- [Recommendations](#)

Instance Utilization

This report provides information about all running instances against the resize threshold limits, which is displayed in braces, as defined in the [Settings](#) submenu of the **Admin** menu.

- **Ideal Utilization** – Instances running between the maximum and minimum threshold limits and for which no action is required.
- **Unused** – Instances not being used, which can be stopped or terminated.
- **Underutilized** – Instances running below the minimum threshold limit and must be downsized.
- **Overutilized** – Instances running above the maximum threshold limit and must be upsized.



Recommendations

The Recommendations report provides detailed recommendations for all running – managed and unmanaged VMs – under the following tabs:

- Underutilized
- Unused
- Overutilized



Accounts must be enabled with **PROVISIONING_REPORTING** for the rightsizing engine to offer rightsizing recommendations. Support for recommendations in accounts with other roles will be added in a future release.

The following table explains the columns in the Recommendations report.

Column Heading	Description
VM	Displays the VM name as a link. Click the link to view details about the VM.
Current Size	Current instance model type on which the VM is running.
Low/High Utilization	Actual utilization numbers (in percent) for the instances observed for a specific time.
Resize Recommendation	Instance model type to which the VM can be resized from the current size and the potential savings that can be achieved by choosing the specified instance.
Potential Savings	Savings, based on current utilization, incurred as a result of choosing the recommended VM.
Actions	<p>Allows you to do the following:</p> <ul style="list-style-type: none"> • Resize – Resizes to the recommended instance. • Dismiss – Remove the instance from the recommendation list. Use the Show Dismissed icon to display dismissed instances. • Stop – Stops the instance temporarily to restart it at a later time. • Terminate – Shuts down the instance. <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> <p> While Resize is available in Underutilized and Overutilized recommendations report, Stop and Terminate are available in Unused recommendations report.</p> </div>

Underutilized Tab

The following is a sample screenshot of the Underutilized tab in the Recommendations report. A VM is considered underutilized if the value in the **High Utilization** field is consistently lower (for a specific time) than the value mentioned in **Min. CPU Threshold** field in the [Settings](#) submenu of the **Admin** menu

Underutilized						Unused	Overutilized
RECOMMENDATIONS		MAXIMUM POTENTIAL SAVINGS \$					
6		\$ 129/mo				SHOW DISMISSED III OFF	
VM	CURRENT SIZE	LOW/HIGH UTILIZATION i	RESIZE RECOMMENDATION	POTENTIAL SAVINGS \$	ACTIONS		
Ares	c3.large 2 CPUs = 3.8GB Memory	0.08% / 8%	m3.medium	\$30.96			
Sutelej	c3.large 2 CPUs = 3.8GB Memory	0.08% / 9%	m3.medium	\$30.96	RESIZE	DISMISS	
Ganga	m3.large 2 CPUs = 7.7GB Memory	0.08% / 9%	m4.large	\$26.64			
Morpheus	m1.medium 1 CPU = 3.8GB Memory	0.16% / 2%	m3.medium	\$14.40			
cqjw-654d789ae	Basic_A1 1 CPU = 1.8GB Memory	3% / 4%	Standard_B1s	\$13.39			
amqp	Standard_D2s_v3 2 CPUs = 8.2GB Memory	1% / 2%	Standard_B2ms	\$12.82			

Unused Tab

An instance is termed as an unused instance if the utilization is below the terminate threshold as specified in the Rightsizing card of the [Settings](#) submenu when the Rightsize Analyzer collects the data. If the utilization is above the terminate threshold settings as specified in the Rightsizing card when the rightsize analyzer (see [Data Collection](#)) runs the next day, the instance ceases to be an unused instance.


The following is a sample screenshot of the **Unused** tab in the Recommendations report.

Underutilized						Unused	Overutilized
RECOMMENDATIONS		MAXIMUM POTENTIAL SAVINGS \$					
14		\$ 1,138/mo				SHOW DISMISSED III OFF	
VM	CURRENT SIZE	LOW/HIGH UTILIZATION	POTENTIAL SAVINGS \$	ACTIONS			
Rightsz	Standard_D4s_v3 4 CPUs = 16.4GB Memory	0.12% / 0.54%	\$168.48				
jaguar	Standard_D4s_v3 4 CPUs = 16.4GB Memory	0.16% / 0.6%	\$168.48	▼	DISMISS		
rightsizednt	Standard_D4s_v3 4 CPUs = 16.4GB Memory	0.08% / 0.55%	\$168.48				
QAcentralCCO	Standard_D4s_v3 4 CPUs = 16.4GB Memory	0.17% / 2%	\$138.24				
opt-dev-test	Standard_D4s_v3 4 CPUs = 16.4GB Memory	0.09% / 1%	\$138.24				
pkrvml78n8ua807	Standard_DS2_v2 2 CPUs = 7.2GB Memory	0.62% / 2%	\$100.80				
cqjw-76e514df2	Standard_B2ms 2 CPUs = 8.2GB Memory	0.45% / 2%	\$71.42				
Neo	t2.large 2 CPUs = 8.2GB Memory	0% / 0.25%	\$66.82				

Overutilized Tab

The following is a sample screenshot of the **Overutilized** tab in the Recommendations report. A VM is considered overutilized if the value in the **High Utilization** field is consistently higher (for a specific time) than the value mentioned in the **Max. CPU Threshold** field in the **Settings** submenu of the **Admin** menu.

If the **Show Cost-incurring Upsize Recommendations** option in the **Settings** submenu is turned on, upsize recommendations for overutilized instances are provided though the recommendations do not result in potential savings.

Underutilized		Unused		Overutilized	
RECOMMENDATIONS		MAXIMUM POTENTIAL SAVINGS ↔			
1		\$ 15 /mo		SHOW DISMISSED ☰ OFF	
VM	CURRENT SIZE	LOW/HIGH UTILIZATION !	RESIZE RECOMMENDATION	POTENTIAL SAVINGS ↔	ACTIONS
 aks-agentpool-3336101...	Standard_DS1_v2 1 CPU + 3.6GB Memory	95% / 95%	Standard_B2s ▼	\$14.69	RESIZE DISMISS

Advanced Options

You can do the following on the Rightsizing report:

- Download the report
- Save filters in the report
- Schedule a report

Saving Filters

You can choose to save a combination of options in the **Filter** menu for future use through the **Save Filters** feature so that you can quickly access and use the filter at a later time. To save a filter, do the following:

1. Choose the required filter options in the **Filter Panel** pane.

2. The **Save** button appears. The **Save New Filter** dialog appears. At this point, you can remove the selected filters by choosing the **Reset** button.

FILTER

SAVE **RESET**

▼ Billing Units Of2c89bc-0aa4-41f6-838b-3dcbcd17c...

▼ Clouds AzureRM

▼ Environment Testing

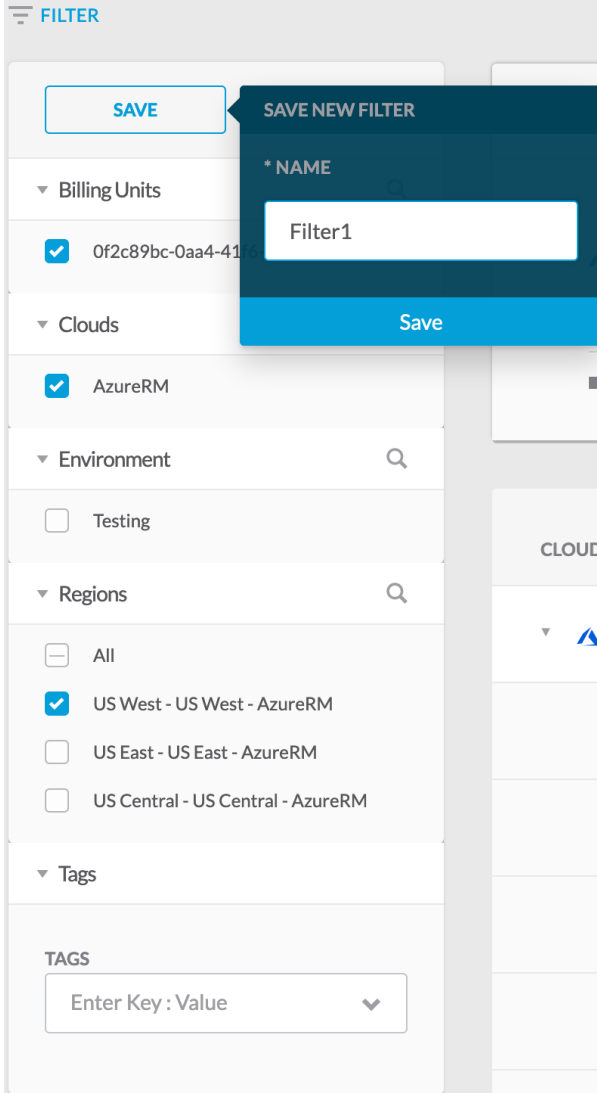
▼ Regions All US West - US West - AzureRM US East - US East - AzureRM US Central - US Central - AzureRM

▼ Tags

TAGS

Enter Key : Value

- Specify a name for this filter and click **Save**. A status message appears indicating that the filter has been saved.



- You can access and view the saved filters from the dropdown list.

You can mark the filter as a favorite by clicking the pin icon next to the filter name.

Scheduling Reports

The **Scheduler** icon allows you to schedule report generation periodically on a fixed date or at intervals. To create a schedule, do the following:

- Click the **Scheduler** icon. The **Schedule** dialog appears.
- Click **Schedule New**.

Schedule New Rightsizing Report ✕

*** REPORT NAME**

FILTERED BY

Select From Saved Filters
▼

*** RECIPIENTS**

Select Recipients
▼

*** SCHEDULE START DATE**

Aug 02 , 2019
📅

*** RECURRENCE**

☰ OFF

SAVE

3. Do the following:

- a. Enter a name for the schedule.
- b. Choose filtering options for the schedule from the **Filtered By** field. The information in this field is populated when you save the filtering options in the page. You can choose to select a filter or leave the field empty.
- c. Choose the date range.
- d. Select the recipients the report must be sent to.
- e. Specify the start date.
- f. Toggle on the **Recurrence** button to send the report at intervals.
- g. In the **Repeats Every** area, specify the number of times the report must be sent to the recipients and choose the interval – **Daily** or **Weekly**. If you choose **Weekly**, you can also specify the days of the week when the report is sent.
- h. Select the period to end the schedule. The options are:
 - i. **Never** – Send report forever or until the schedule is deleted.
 - ii. **On** – Date when the report should be sent.
 - iii. **After** – Number of occurrences after which the report is not scheduled.

4. Click **Save**. The report is displayed in the **Scheduled Report Name** dialog as shown in the sample screenshot below.

Scheduled Rightsizing Reports ✕

Existing Reports SCHEDULE NEW

REPORT NAME	FILTERS	RECIPIENTS	FREQUENCY	ACTIONS
RIGHTSIZING		admin@cliqrtech.com	None	

DONE



Optionally, you can use the **Edit** and **Delete** options in the **Actions** column to make changes to the schedule or delete the report respectively.

5. Click **Done** to close the dialog.

As mentioned in the table above, the **Action** button performs the following:

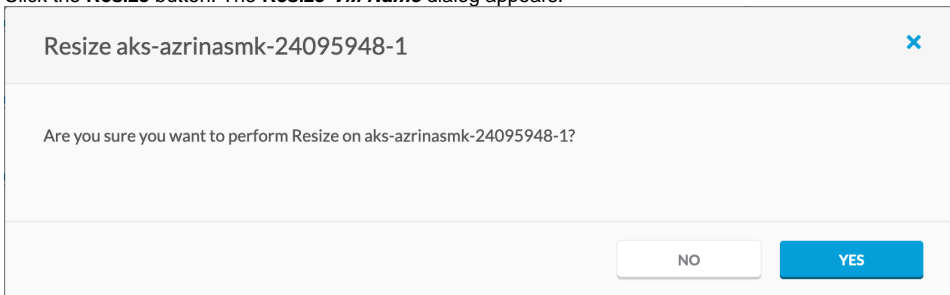
- Dismiss
- Resize
- Stop
- Terminate

Choose **Dismiss** to remove the recommendations for a VM from the report.

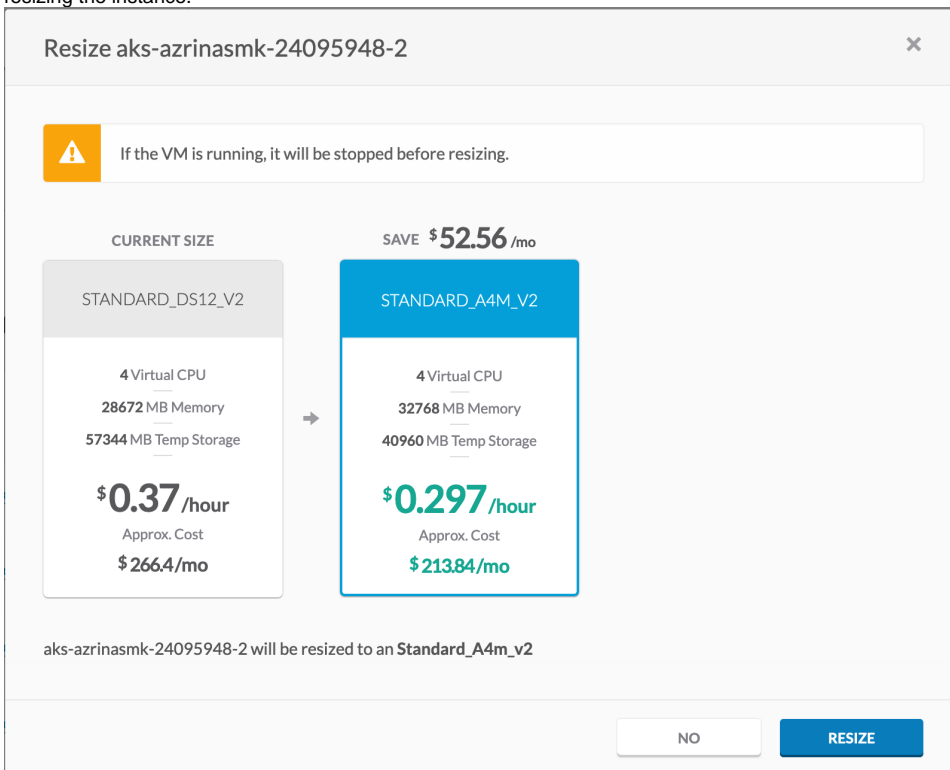
Resize

The **Resize** button resizes a VM to the recommended instance type. If a VM in the recommendations table is an unmanaged VM, the VM must be imported first before it is resized. To resize a VM, perform the following steps:

1. Click the **Resize** button. The **Resize *VM Name*** dialog appears.



2. Click **Yes**. A dialog appears displaying the current size of the VM, the recommended size of the VM, and the potential savings as a result of resizing the instance.



3. Click **Resize**. A spinning circle icon appears in the **Actions** column indicating that resize is in progress.
4. On completion, a notification appears displaying that the VM has been resized.

Navigate to the **History** tab in **VM Details** page in Workload Manager (see [Virtual Machine Management](#) > *VM Details*) for a complete history of *actions* performed on this VM.

Stop and Terminate

When you stop a VM, the VM is shut down and you will not be charged for the usage until you plan to start it again in the near future. When you terminate a VM, the VM is shut down and permanently removed. You are not charged for the usage any longer. Therefore, you should stop a VM if you plan to start it again else, you may terminate the VM instead of stopping it to save cost.



If a VM in the recommendations table is an unmanaged VM, the VM must be imported first before it is stopped or terminated.

To stop or terminate a VM, perform the following steps:

1. Hover on the **Actions** column. A drop-down icon appears.
2. Click the icon to display the options – Stop or Terminate and choose the appropriate option. The **Stop VM Name** dialog appears.

Stop jaguar

Are you sure you want to perform Stop on jaguar?

NO YES

3. Click **Yes**. A spinning circle icon appears in the **Actions** column indicating that chosen action is in progress.
4. On completion, a notification appears displaying that the VM has been stopped or terminated.

Cloudcenter50-env has been stopped.

Suspension Candidates

Suspension Candidates

- [Overview](#)
- [Suspension Reports](#)
 - [Advanced Options](#)
 - [Saving Filters](#)
 - [Scheduling Reports](#)
- [The Actions Column](#)
 - [Procedure](#)

Suspension policies are a powerful method to conserve cloud resources by moving a cloud resource from Running state to Suspended state (see [Inventory States](#)) when the resource is not needed or to prevent a deployment from running during times that it should not be accessed. Thus, suspension policies help in reducing cost on cloud resources when resources are not used. Suspension policies are an everyday activity, in which Instances could be suspended for specific hours in a day for a minimum of 30 minutes. The metric collector background process (see [Data Collection](#)) collects the data for analysis based on the utilization pattern.



The Suspension Policy Analyzer uses a python package named *numpy* as part of its machine learning code. The latest version of *numpy* package, which is 1.16.4, is used in Cost Optimizer 5.1.0. There is a known issue about loading untrusted scripts and is documented here: <https://snyk.io/blog/numpy-arbitrary-code-execution-vulnerability/>. The vulnerable function (*numpy.load*) is not used or invoked as part of CloudCenter Suite machine learning code. This issue will be addressed when a patch is available.

The Suspension Candidates Report lists VMs and deployments for which you can apply a suspension policy based on the specifications defined in the Suspension Candidates card in the [Settings](#) submenu of the **Admin** menu. You specify a schedule when a VM must be in the Running state (see [Inventory States](#)) during a certain time period every day. At other times, the deployment remains suspended.

The following is a sample screenshot of the Suspension Candidate report.

SUSPENSION CANDIDATE	AVG UTILIZATION DURING OFF HOURS	POLICY RECOMMENDATION	POTENTIAL SAVINGS	ACTIONS
Morpheus	0.37 %	00:00 - 22:00 (GMT)	\$57.42	
Godavari	3.51 %	00:00 - 14:00 (GMT)	\$5.80	SUSPEND DISMISS
Gomti	0.65 %	00:00 - 12:00 (GMT)	\$4.97	
Zeus	4.29 %	00:00 - 11:00 (GMT)	\$4.55	
Nemesis	0.04 %	00:00 - 11:00 (GMT)	\$4.55	

The following table explains the columns in the report.

Column Heading	Description
Recommendations	Total number of VMs on which suspension policies can be applied.
Total Potential Savings	Total savings that can be incurred by applying the suspension policy on each VM.
Suspension Candidate	Displays the VM name as a link. Click the link to view details about the VM.
Avg Utilization During Off Hours	Actual utilization numbers (in percent) in non-peak hours.
Policy Recommendation	Suspension policy recommendation based on VM utilization pattern.
Maximum Potential Savings	Savings that will be incurred as a result of effecting the suspension policy.

Actions	Allows you to do the following: <ul style="list-style-type: none">• Suspend – Attach a suspension policy to the VM.• Dismiss – Dismiss the recommendation.
----------------	---

Advanced Options

You can do the following on the Suspension Candidates report:

- Download the report
- Save filters in the report
- Schedule a report

Saving Filters

You can choose to save a combination of options in the **Filter** menu for future use through the **Save Filters** feature so that you can quickly access and use the filter at a later time. To save a filter, do the following:

1. Choose the required filter options in the **Filter Panel** pane.

2. The **Save** button appears. The **Save New Filter** dialog appears. At this point, you can remove the selected filters by choosing the **Reset** button.

FILTER

SAVE **RESET**

▼ Billing Units Of2c89bc-0aa4-41f6-838b-3dcbcd17c...

▼ Clouds AzureRM

▼ Environment Testing

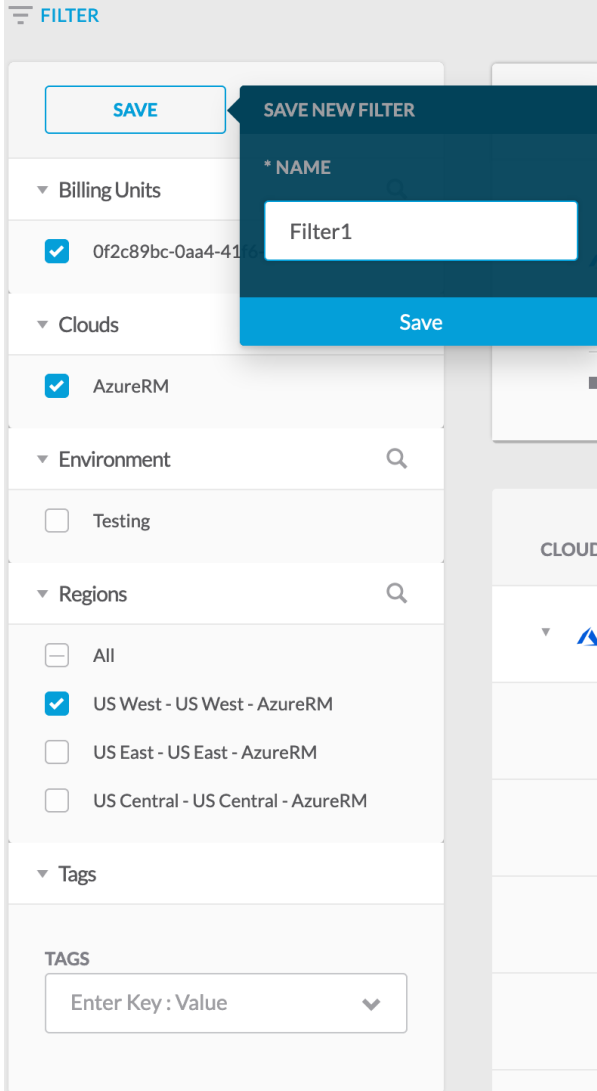
▼ Regions All US West - US West - AzureRM US East - US East - AzureRM US Central - US Central - AzureRM

▼ Tags

TAGS

Enter Key : Value

- Specify a name for this filter and click **Save**. A status message appears indicating that the filter has been saved.



- You can access and view the saved filters from the dropdown list.

You can mark the filter as a favorite by clicking the pin icon next to the filter name.

Scheduling Reports

The **Scheduler** icon allows you to schedule report generation periodically on a fixed date or at intervals. To create a schedule, do the following:

- Click the **Scheduler** icon. The **Schedule New *Report Name*** dialog appears.

Schedule New Suspension Candidate Report ✕

*** REPORT NAME**

FILTERED BY

Select From Saved Filters
▼

*** RECIPIENTS**

Select Recipients
▼

*** SCHEDULE START DATE**

Aug 02 , 2019
📅

*** RECURRENCE**

☰
OFF

SAVE

2. Do the following:

- a. Enter a name for the schedule.
- b. Choose filtering options for the schedule from the **Filtered By** field. The information in this field is populated when you save the filtering options in the page. You can choose to select a filter or leave the field empty.
- c. Choose the date range.
- d. Select the recipients the report must be sent.
- e. Specify the start date.
- f. Toggle on the **Recurrence** button to send the report at intervals.
- g. In the **Repeats Every** area, specify the number of times the report must be sent to the recipients and choose the interval – **Daily** or **Weekly**. If you choose **Weekly**, you can also specify the days of the week when the report is sent.
- h. Select the period to end the schedule. The options are:
 - i. **Never** – Send report forever or until the schedule is deleted.
 - ii. **On** – Date when the report should be sent.
 - iii. **After** – Number of occurrences after which the report is not scheduled.

3. Click **Save**. The report is displayed in the **Scheduled Report Name** dialog as shown in the sample screenshot below.

Scheduled Suspension Candidate Reports ✕

Existing Reports SCHEDULE NEW

REPORT NAME	FILTERS	RECIPIENTS	FREQUENCY	ACTIONS
SUSPENSION REPORT		admin@cliqrtech.com	None	

DONE



Optionally, you can use the **Edit** and **Delete** options in the **Actions** column to make changes to the schedule or delete the report respectively.

4. Click **Done** to close the dialog.

The Actions column displays the **Suspend** button when you hover over the Actions column against a VM. You can either apply an existing suspension policy or create a new suspension policy. If you choose to use an existing suspension policy, the **Suspension Policy** field displays a list of policies, which are policies that are available for the VM or deployment in Workload Manager. Only existing suspension policy that matches the schedule and does not contain any blackout dates are listed in the **Suspension Policy** field.



If the VM or deployment for suspension is not available in Cost Optimizer, it must be imported first.

The following rules apply for a suspension policy:

- To apply a policy, you must be assigned to at least one Workload Manager role.
- You can create a new suspension policy only if you are part of the **WM_POLICY_MANAGER** role.

See [OOB Groups, Roles, and Permissions](#) for additional details about Workload Manager roles.

Procedure

Perform the following steps to apply a suspension policy using the Suspend button.

1. Click **Suspend**. The **Suspend VM** dialog appears, requesting confirmation if you would like to import the VM into Workload Manager before it can be suspended.
2. Click **Yes**. The **Suspend VM** dialog with two tabs – **Apply Existing Policy** and **Create New Policy** appears.
3. If you choose the **Apply Existing Policy** tab, select an existing policy from the **Suspension Policy** drop-down list.

If the recommended suspension schedule matches an existing policy, the *Apply Existing Policy* tab will list the matching policy schedule in the *Suspension Policy* dropdown.

Suspend packer-5d064ee0-231f-f034-5afe-b3851339a658
✕

Apply Existing Policy

Create New Policy

Are you sure want to apply the recommended suspension policy? Any change after applying the policy can be made through Workload Manager.

* SUSPENSION POLICY	AVG UTILIZATION	POTENTIAL SAVINGS
<div style="border: 1px solid #ccc; padding: 2px; display: flex; align-items: center;"> Select Policy ▼ </div>	0.251%	\$4.275/mo

APPLY




4. If you choose the **Create New Policy** tab, you can do the following:
 - a. Specify a name for the suspension policy in the **Name** field.

- b. Choose the duration when the VM must be suspended in the **Suspend From** and **To** fields. You may specify a schedule that is different from the recommended or an existing suspension policy.

Suspend packer-5d064ee0-231f-f034-5afe-b3851339a658 ✕

Are you sure want to apply the recommended suspension policy? Any change after applying the policy can be made through Workload Manager.

* NAME

* SUSPEND FROM	* TO	AVG UTILIZATION	POTENTIAL SAVINGS 
<input type="text" value="0:30"/> 	<input type="text" value="3:30"/> 	0.251%	\$4.275/mo

5. Click **Apply**. On completion, a dialog appears that the suspension policy has been attached. You can verify the successful attachment of suspension policies in the VM Details page (see [Virtual Machines > VM Details](#)).

After a suspension policy is applied, changes to the policy can be made in Workload Manager only, not in Cost Optimizer.

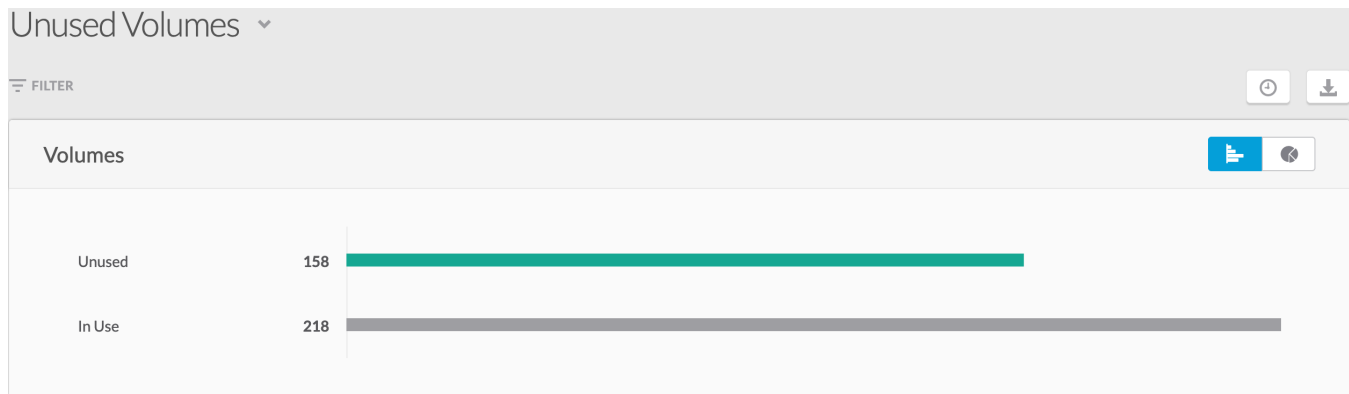
Unused Volumes

Unused Volumes

- [Overview](#)
- [Unused Volumes Report](#)
 - [Advanced Options](#)
 - [Saving Filters](#)
 - [Scheduling Reports](#)
- [The Actions Column](#)


Organizations may incur additional costs due to the underprovisioning or overprovisioning of storage volumes. A good solution is to find storage volumes that are not used and terminate them, thereby saving costs.

The Unused Volumes report displays storage volumes that are listed as **Available** in the [Storage Volumes](#) page. The following is a sample screenshot of the **Unused Volumes** report.



The following is a sample screenshot of the unused volumes, which are same as the ones listed in the [Storage Volumes](#) page. The information in the following table applies to the summary displayed at the top of the page:

Summary	Description
Recommendations	Total number of volumes that are not used.
Total Potential Savings	Total savings that can be incurred by terminating the volume.

RECOMMENDATIONS		TOTAL POTENTIAL SAVINGS ← 3				
158		\$ 295 /mo			SHOW DISMISSED ☰ OFF	
VOLUME	CURRENT SIZE	REGION	POTENTIAL SAVINGS ← 3	ACTIONS		
checkmetrics_OsDisk_1_5a62db59a0504c16ae...	30 GB	US West California	\$5.28			
customImage_OsDisk_1_c6cb94fe06543dfbb...	127 GB	US West California	\$5.28			
jaya-instancetest_disk1_90555d21935349a39...	30 GB	US West California	\$5.28			
rightsize-jaya_OsDisk_1_4b97a195e1da4ac98...	30 GB	US West California	\$5.28			
stop-instance_disk1_1a9a9b1043c04b399e26...	30 GB	US West California	\$5.28	TERMINATE	DISMISS	
terminated-jaya_disk1_0bc64e1bff21405f8d01...	30 GB	US West California	\$5.28			
TESTING-Azure_disk1_84fc9c9c25a94035944...	30 GB	US West California	\$5.28			
 kubernetes-dynamic-pvc-0c155850-e947-11e...	15 GB	US East N. Virginia	\$1.88			
cqjw-7ccf0750a-osdisk.vhd	30 GB	US West California	\$1.54			

The following table explains the significant columns in the report.

Column Heading	Description
Volume	Displays the storage volume name as a link. Click the link to view details about the storage volume.
Current Size	The size of the volume that is not in use.
Region	Geographic location of the storage volume.
Potential Savings	Savings that will be incurred as a result of terminating the volume.
Actions	Allows you to do the following: <ul style="list-style-type: none"> • Dismiss – Remove the volume from the recommendation list. • Terminate – Deletes or terminates the volume.

Advanced Options

You can do the following on the Unused Volumes report:

- Download the report
- Save filters in the report
- Schedule a report

Saving Filters

You can choose to save a combination of options in the **Filter** menu for future use through the **Save Filters** feature so that you can quickly access and use the filter at a later time. To save a filter, do the following:

1. Choose the required filter options in the **Filter Panel** pane.

2. The **Save** button appears. The **Save New Filter** dialog appears.

FILTER

SAVE **RESET**

▼ Billing Units

Of2c89bc-0aa4-41f6-838b-3dcbcd17c...

▼ Clouds

AzureRM

▼ Environment

Testing

▼ Regions

All

US West - US West - AzureRM

US East - US East - AzureRM

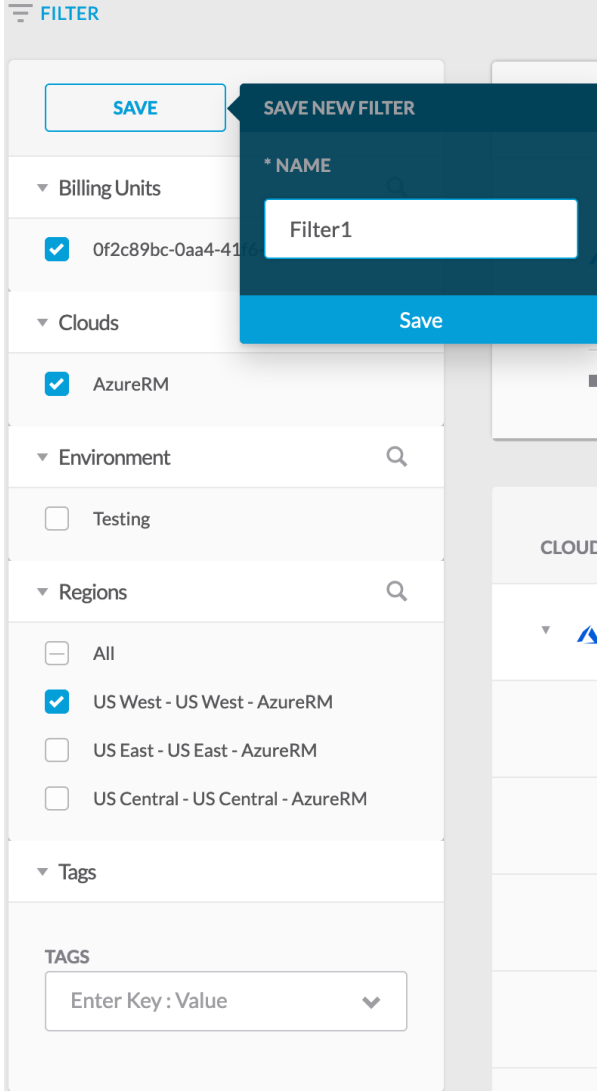
US Central - US Central - AzureRM

▼ Tags

TAGS

Enter Key : Value

- Specify a name for this filter and click **Save**. A status message appears indicating that the filter has been saved.



- You can access and view the saved filters from the dropdown list.

You can mark the filter as a favorite by clicking the pin icon next to the filter name. At any point when saving the filter, you can remove the chosen filters by choosing the **Reset** button.

Scheduling Reports

The **Scheduler** icon allows you to schedule report generation periodically on a fixed date or at intervals. To create a schedule, do the following:

- Click the **Scheduler** icon. The **Schedule** dialog appears.
- Click **Schedule New**.

Schedule New Unused Volumes Report ✕

*** REPORT NAME**

FILTERED BY

Select From Saved Filters
▼

*** RECIPIENTS**

Select Recipients
▼

*** SCHEDULE START DATE**

Aug 02 , 2019
📅

*** RECURRENCE**

ON
|||

REPEATS EVERY

SAVE

3. Do the following:

- a. Enter a name for the schedule.
- b. Choose filtering options for the schedule from the **Filtered By** field. The information in this field is populated when you save the filtering options in the page. You can choose to select a filter or leave the field empty.
- c. Choose the date range.
- d. Select the recipients the report must be sent to.
- e. Specify the start date.
- f. Toggle on the **Recurrence** button to send the report at intervals.
- g. In the **Repeats Every** area, specify the number of times the report must be sent to the recipients and choose the interval – **Daily** or **Weekly**. If you choose **Weekly**, you can also specify the days of the week when the report is sent.
- h. Select the period to end the schedule. The options are:
 - i. **Never** – Send report forever or until the schedule is deleted.
 - ii. **On** – Date when the report should be sent.
 - iii. **After** – Number of occurrences after which the report is not scheduled.

4. Click **Save**. The report is displayed in the **Scheduled Report Name** dialog as shown in the sample screenshot below.

Scheduled Unused Volumes Reports ✕

Existing Reports SCHEDULE NEW

REPORT NAME	FILTERS	RECIPIENTS	FREQUENCY	ACTIONS
UNUSED VOLUMES		admin@cliqrtech.com	None	

DONE



Optionally, you can use the **Edit** and **Delete** options in the **Actions** column to make changes to the schedule or delete the report respectively.

5. Click **Done** to close the dialog.

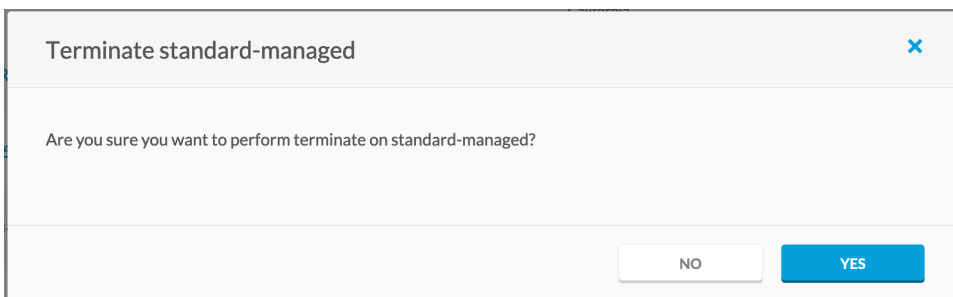
As mentioned in the table above, the **Action** button performs the following:

- Dismiss
- Terminate

Choose **Dismiss** to remove a storage volume from the report.

Hover over the **Actions** column against a VM to display the **Terminate** button. Perform the following steps to terminate a storage volume.

1. Click **Terminate**. The **Terminate *Volume Name*** dialog appears.



2. Click **Yes**. A spinning circle icon appears in the **Actions** column indicating that chosen action is in progress.

Reserved Instances

Reserved Instances

- [Reserved Instances Overview](#)
- [RI Subscription Report](#)
- [RI Opportunities Report](#)

Reserved Instances Overview

Reserved Instances Overview

- [Introduction](#)
- [Terminology](#)
- [Payment Methods](#)
- [Reports](#)



This feature is supported on AWS EC2 only.

Reserved Instances (RI) is a method of purchasing a cloud reserve to reserve the cloud resource for a specific period. RIs offer the ability to significantly reduce instance costs over a defined term, thus, benefitting from the capacity reservation for predictable usage or workloads.

RIs offer up to 80% discount over on-demand instance costs, depending on the cloud provider, payment terms and duration. RIs is one of the most popular ways for enterprises to get great discounts on computing costs.

By combining RIs with on-demand instances, organizations can save on running costs without sacrificing reliability and flexibility.

The following table explains the RI terminologies.

Term	Definition
Reservation	A commitment made by a customer to the cloud service provider (AWS, in this case) for using resources for a defined period. The cloud service provider in honor of this commitment offers a discount to the customer. Depending on the duration and payment terms, discounts may vary from 35% to 80%.
Utilization	The actual duration (in hours and percentage) that a RI subscription was used for a selected period. Once a reservation is purchased, you must provision or run instances of a matching type to benefit from the purchased RI hours and applicable discounts. Unused hours are not carried forward or accumulated.
Float	Transfer of utilization from one account to another. For example, if you reserve instance in one account and the instance is not used for an hour in that account, the usage can be applied to another account. <div style="border: 1px solid #ccc; padding: 5px; margin-top: 10px;"> To take advantage of Float, you must have consolidated billing enabled because Float is limited to the billing account and the linked accounts. </div>
Convertible Reserved Instances	Exchange one or more RIs for another with a different configuration. There is no limit on the number of times you can exchange a RI, as long as the target Convertible Reserved Instance is of an equal or higher value than the Convertible Reserved Instances that you are exchanging.

Reserved Instances can be purchased for a period of 1 year to 3 years for these resources:

- Instance Type
- Region
- Duration
- Payment Terms
- Operating System
- Availability Zone (Optional)

For each resource, the payment methods are as follows:

- **Full Upfront** – The entire amount for the duration of the RI term is paid in advance, providing you with a large discount. There are no per hour charges.
- **Partial Upfront** – A low amount is paid to reserve the instance. A discounted hourly rate is applied for the duration of the instance.
- **No Upfront** – No upfront payment. A discounted hourly rate is applied during the duration of the instance term.



For partial or no upfront payment, the hourly cost for the RI is applied irrespective of whether the instance is running and the cost of the instance is charged to account as reservation charges.

Cost Optimizer provides a variety of out-of-the-box reports that help you to track and to manage the performance and status of RI investments in your organization. The RI reports allow you to do the following:

- Assess ROI on purchased RIs
- Discover underutilized RIs to optimize usage
- Uncover opportunities for additional RI purchases for maximum savings

RI helps in answering the following critical questions that you may have about your RIs.

- How much did I save from using RIs?
- How many RIs should I purchase?
- How can I optimize my RIs?
- What would be the additional on-demand usage that I can convert to RI to reduce my cost?
- How are my RIs performing?
- Which groups in my organization use RIs?
- Is float applicable to the groups in my organization that use RIs?
- What is the utilization of RI across departments?
- How much of my instances are running as RIs?



This is not an exhaustive list, but a compilation of common questions that you may have on RIs.

The list of RI reports are as follows:

- [RI Subscription Report](#)
- [RI Opportunities Report](#)

RI Subscription Report

RI Subscription Report

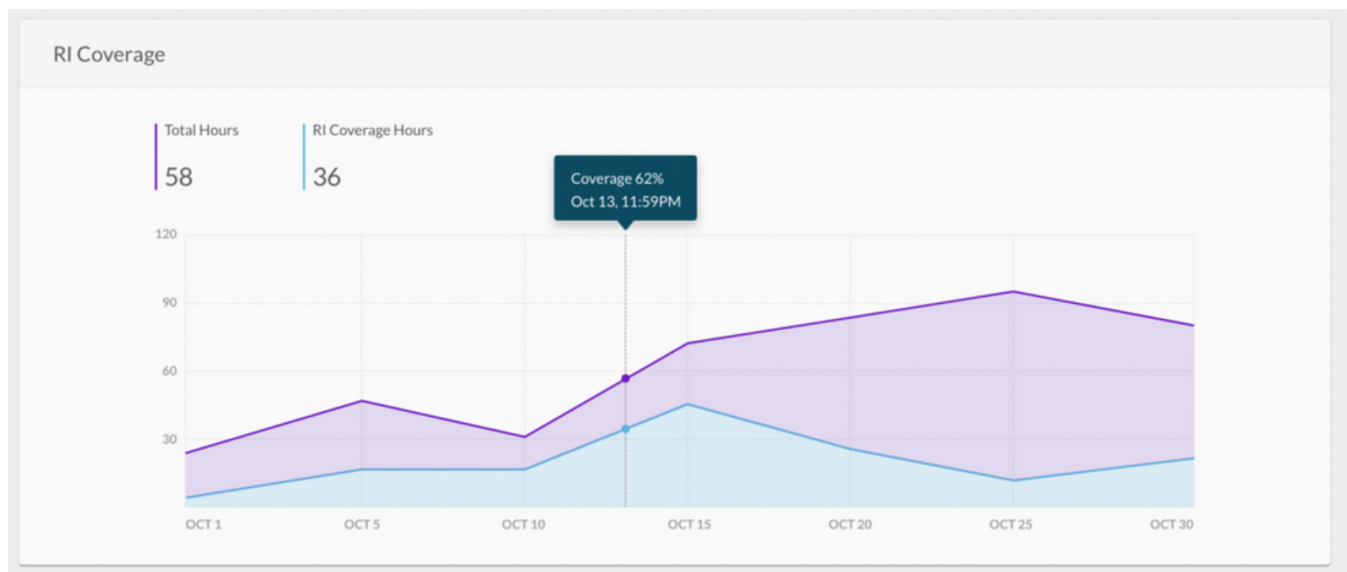
- [Overview](#)
- [RI Coverage](#)
- [RI Subscription Summary](#)
- [Subscription Details](#)
 - [Group Subscription Details](#)
 - [Individual Subscription](#)

The **RI Subscription Report** contains the following:

- RI Coverage
- RI Subscriptions

This report presents the percentage of running instance hours that were covered by purchased RIs. Use this report to identify opportunities to buy matching RIs for more significant cost savings.






In the following screenshot, **Coverage 62%** indicates the number of running instance hours covered by purchased RIs, and thus, the instances benefited from RI discounts.



The following screenshot displays a sample RI Subscriptions report, which provides information about individual and group subscriptions. The RI Utilization (**Utilization** column in the screenshot) displays the percentage of purchased RI hours that were used by matching instances over a selected period. This field helps in assessing the ROI on your RI purchases and take steps to optimize utilization, such as provisioning matching instances or switching to another instance type that is not covered by RIs or enabling float.

Subscription Summary

RI SUBSCRIPTIONS	RETURN ON INVESTMENT	RECOMMENDATIONS	AVG COVERAGE
10	\$66.62	0	45.92%

SUBSCRIPTION	REGION/AZ	OWNER	UTILIZATION	EXCESS ON DEMAND HRS	ROI ⓘ	RECOMMENDATION
 T2.SMALL ACTIVE	US West (Oregon)	804685808463 CloudCenterMaster	56.06 % 56.06 % AVG	15 15 AVG	\$ 2.21 \$ 2.21 AVG	
 T2.LARGE	US East (N. Virginia)		1.99 % 0.92 % AVG	128.75 224.75 AVG	\$ 42.79 \$ 92.81 AVG	
c45da4d5-be9f-452e-... ACTIVE		804685808463 CloudCenterMaster	1.94 % 0.85 % AVG			
8370e848-e556-46e6... ACTIVE		804685808463 CloudCenterMaster	2.03 % 0.99 % AVG			
 T2.MICRO	US East (N. Virginia)		1.46 % 1.41 % AVG	538.06 1078.06 AVG	\$ 21.62 \$ 45.98 AVG	
 T2.MEDIUM ACTIVE	US East (N. Virginia)	804685808463 CloudCenterMaster	0 % 0 % AVG	0 0 AVG	\$ 0 \$ 0 AVG	
 T2.SMALL	US East (N. Virginia)		0 % 0 % AVG	0 0 AVG	\$ 0 \$ 0 AVG	

The significant fields in the report are explained in the following table.


Field	Description
RI Subscriptions	Number of RI subscriptions for the specified filter criteria (Accounts, Regions, Instance Types).
ROI	Average ROI achieved till date by the subscriptions for the period this report is generated. The value in smaller font indicates the ROI for the subscription.
Recommendations	Number of recommendations based on the filter criteria.
Subscription	RI Subscriptions are grouped based on the following similarities: <ul style="list-style-type: none"> Instance type Operating system type Region
Utilization	Subscription utilization, in percentage. In the above image highlighted in green, a value of 50% indicates that on an average only half the purchased subscriptions were utilized during the period (30-day) for which the report is generated. The value in smaller font indicates the average utilization of subscription since purchase.
Excess on Demand Hrs	Displays the available, unused hours for a subscription.
ROI	ROI for RI subscriptions purchased for an instance type. The value in smaller font indicates the average ROI of subscription since purchase.
Recommendation	Recommendation for the specific instance type or subscription. The options include: <ul style="list-style-type: none"> Enable Float Purchase another subscription Increase Utilization Renew Fix Payment issue

You can drill-down the RI Subscriptions Report for the following to understand additional information:

- Group subscription details – Opens when group name in the RI subscription report is clicked
- Individual subscription details (part of a group) – Opens when IDs listed under a group is clicked
- Individual subscription details (not part of a group) – Opens when IDs that are not listed under a group

Group Subscription Details

The following is a sample screenshot that displays detailed information about group subscriptions. Click the down arrow adjacent to the logo to expand display the individual subscriptions in that group. This page enumerates the amount of savings that an organization can achieve by acting on the recommendations.



t2.large Group

Amazon US East (N. Virginia)

SUBSCRIPTIONS


2

OVERALL ROI

\$92.81

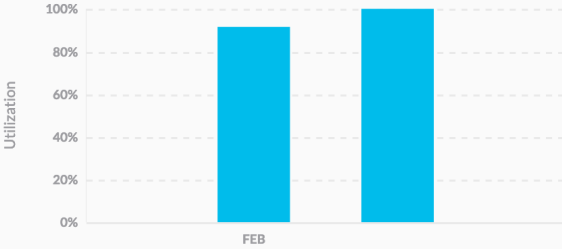
AVG \$42.79

RI Details Last 30 Days ▾

SUBSCRIPTION	REGION/AZ	OWNER	UTILIZATION	EXCESS ON DEMAND HRS	ROI ⓘ	RECOMMENDATION
▾  t2.large	US East (N. Virginia)		705.69 % <small>1533.19 % AVG</small>	0 <small>0 AVG</small>	\$ 42.79 <small>\$ 92.81 AVG</small>	
c45da4d5-be9f-452e-... <small>ACTIVE</small>		804685808463 CloudCenterMaster	706 % <small>1642 % AVG</small>			
8370e848-e556-46e6... <small>ACTIVE</small>		804685808463 CloudCenterMaster	705.38 % <small>1424.38 % AVG</small>			

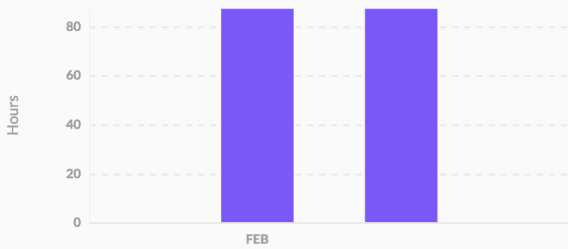
Average Utilization & Excess Hrs Over Time

Avg Utilization



Utilization

Excess Hours over Time



Hours

■ UTILIZATION ■ EXCESS ON DEMAND HRS


The **Average Utilization and Excess Hours over Time** report display information about the group utilization, in percentage, and the additional on-demand subscription that was purchased for the instance.

Individual Subscription

Individual subscriptions can either be included in a group or as standalone subscriptions (not part of any group). The following screenshot is an example of the individual subscription that is part of a group. This page appears when you click any individual subscription listed under a group.

← T2LARGE

ACTIVE



c45da4d5-be9f-452e-baf8-c8ca24a15391

Amazon, us-east-1 • CloudCenterMaster

4 Months Left

Ends on Jun 14, 2019

OVERALL ROI

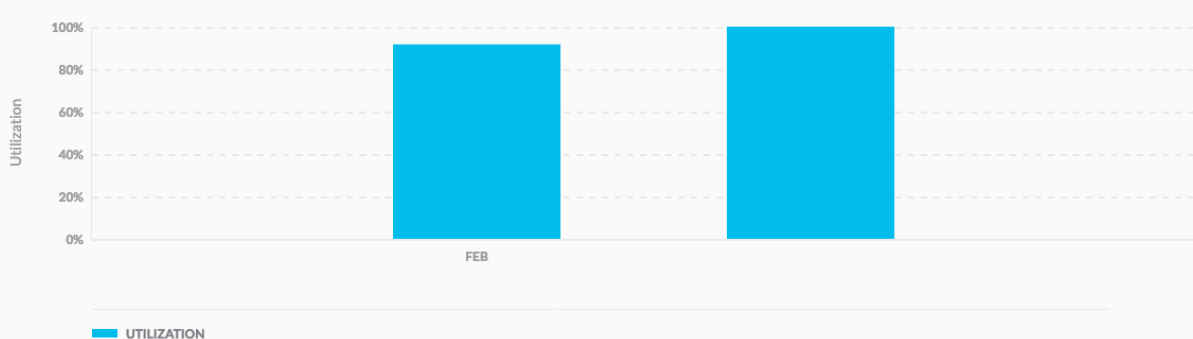
\$49

AVG \$21/MO

STATS DETAILS

RI Details Last 30 Days ▾

Utilization Over Time



Avg Utilization

Utilization

100%
80%
60%
40%
20%
0%

FEB

■ UTILIZATION

Utilization Details

USAGE 706


BILLING UNIT	COST GROUP(S)	HOURS	PERCENTAGE
4		706	100%

Subscription Performance

AVG HRS USED/MONTH	DISCOUNT
0	0%
AVG UTILIZATION	ROI
706%	\$48.59
ON DEMAND PRICE	AVG \$20.89/MO
\$0	

The information of an individual subscription is displayed in two tabs: **Stats** and **Details**.

The following table explains significant fields in the **Stats** tab:

Area	Field	Description
Subscription Header	Status	Color-coded state of the subscription – Active or Expired. The information in the right indicates the remainder period of a subscription.
	Instance Details	<ul style="list-style-type: none"> • Hostname – The hostname for the VM, if configured, else the node ID is displayed. • Cloud Region • Billing Unit ID
	Remainder Duration	Duration, in months or years, before the subscription expires.
	Overall ROI	Total ROI achieved by this subscription.
Utilization over Time	Date	Graphical display of past utilization for the subscription for a chosen period (from the Date drop-down field).
Utilization Details	Hours	Graphical display of instance utilization against various billing units associated with the instance.
Subscription Performance	Average Hours Used/Month	Number of instances available as of date.
	Discount	Discount applicable to the instance if the recommended subscription type is purchased.
	Average Utilization	Instance utilization, in percent, for the chosen period.
	ROI	Total ROI achieved by the subscription and the average ROI achieved per month.
	On-Demand Price	On-Demand price for the instance if the subscription had not been purchased. See Reserved Instances Overview > Payment Methods.
	Average Excess On-Demand Hours per Month	On-demand purchases made in addition to RI subscription purchase. <div style="border: 1px solid #f96; border-radius: 10px; padding: 5px; background-color: #fff9e6;">  This field appears for an individual subscription not part of any group. </div>

The **Details** tab presents information about the subscription scope, term, type.

← T2.LARGE

ACTIVE



c45da4d5-be9f-452e-baf8-c8ca24a15391

Amazon, us-east-1 • CloudCenterMaster

4 Months Left

Ends on Jun 14, 2019

OVERALL ROI

\$49

AVG \$21/MO

STATS

DETAILS

Subscription Details

START DATE

June 14th 2018, 9:50 am

PAYMENT TERMS

Partial Upfront

END DATE

June 14th 2019, 9:50 am

UPFRONT COST

\$276.00

SCOPE

us-east-1

TYPE

Convertible

TERM

a year

AVG UTILIZATION

706%

SELLER

Amazon

ROI

\$48.59

AVG \$20.89/MO

INSTANCE PURCHASED

1

RI Opportunities Report

RI Opportunities Report

- [Overview](#)
- [Purchase Report](#)
- [Savings Report](#)

The **RI Opportunities Report** provides information about the number of new RIs that must be purchased and the potential savings that can be achieved as a result of the purchase. This report contains the following:

- Purchase report
- Savings report

RI OPPORTUNITIES	EXCESS ONDEMAND HRS	POTENTIAL SAVINGS					
321	102,199	\$10,345					
<div style="display: flex; justify-content: space-between; align-items: center;"> FILTER Download </div>							
Filter Panel			INSTANCE TYPE	AVG MONTHLY EXCESS ONDEMAND HRS	RECOMMENDED # OF INSTANCES TO PURCHASE	TYPE	DIS
<div style="margin-bottom: 10px;"> Billing Units <input type="checkbox"/> All <input type="checkbox"/> 464379232231 <input type="checkbox"/> 461927365478 <input type="checkbox"/> 462625243849 <input type="checkbox"/> ProjectABC (project-123) 989 MORE </div> <div style="margin-bottom: 10px;"> Cloud Regions <input checked="" type="checkbox"/> All <input type="checkbox"/> AWS Region 1 <input type="checkbox"/> AWS Region 2 <input type="checkbox"/> AWS Region 3 <input type="checkbox"/> AWS Region 4 2 MORE </div> <div style="margin-bottom: 10px;"> Instance Types <input checked="" type="checkbox"/> All <input type="checkbox"/> M3-XL <input type="checkbox"/> M3-Large <input type="checkbox"/> C3-Large <input type="checkbox"/> C4-Large 2 MORE </div> <div style="margin-bottom: 10px;"> Departments </div> <div> Labels </div>			T2-Micro Region	42,903	1,000	3 YR, Not convertible, All upf...	
			T2-Micro Region	21,990	500	3 YR, Not convertible, All upf...	
			T2-Micro Region	17,252	400	3 YR, Not convertible, All upf...	
			T2-Micro Region	10,000	250	3 YR, Not convertible, All upf...	
			T2-Micro Region	7,435	220	3 YR, Not convertible, All upf...	
			T2-Micro Region	3,021	110	3 YR, Not convertible, All upf...	
			T2-Micro Region	1,099	50	3 YR, Not convertible, All upf...	
			T2-Micro Region	500	25	3 YR, Not convertible, All upf...	
			T2-Micro Region	400	23	3 YR, Not convertible, All upf...	
			T2-Micro Region	201	12	3 YR, Not convertible, All upf...	

This report appears as a header and provides an overview of the total RIs to be purchased, the total number of on-demand hours (across instance types), and potential savings.

This report presents the following data in a tabular format. You can filter this table using the **Filter** option.

- Individual instance types to be purchased
- Number of on-demand hours that the instance types are currently running
- Recommended instances to be purchased
- Type of RIs that can be purchased. This is a dropdown list. Depending on your selection, the savings and discount (in the **Discounts** field) vary.

The following table explains significant aspects of the Savings Report.

Aspect	Description
RI Opportunities	The opportunities present across the organization.
Excess On Demand Hours	Instance hours that ran at on-demand rates, not covered by RI subscription.
Potential Savings	Savings that can be achieved by moving to RI.
Average Monthly Excess On Demand Hours	Number of on-demand hours that were purchased each month for an instance.
Type	Recommended instance type and payment method.
Discount	Discount that can be availed as of a date if the recommended RI is chosen.

Administration

Administration

- [Admin Tasks in Cost Optimizer](#)
- [Settings Page](#)
- [Data Collection](#)
- [Alerts Page](#)
- [Tag-Based Cost Reporting](#)

Admin Tasks in Cost Optimizer

Admin Tasks in Cost Optimizer

- [Overview](#)

Navigate to the **Admin** menu to perform the following administrative tasks:

- [Configure Clouds](#) - Set up clouds and cloud accounts.
- [Define Settings](#) - Enable recommendations.
- [Allocate Budgets](#) - Set up budgets for a financial year or quarter.
- [Define Alerts](#) - Send notifications to specific users or user groups.
- [Tag-Based Cost Reporting](#) - Enable cost reporting for AWS and Azure tags.

The availability of the **Admin** menu is subject to roles and permissions; it is visible to administrators only. For more information, see [Access and Roles](#).

Settings Page

Settings Page

- [Rightsizing Card](#)
- [Suspension Candidates Card](#)
- [RI Opportunities Card](#)
- [Historical Collection Card](#)
- [Fiscal Year Card](#)

The **Rightsizing card** allows you to define rightsizing thresholds in Cost Optimizer.

▼ Rightsizing
EDIT
ON

RECOMMENDATION VALIDITY 3 Days	MIN. COST SAVINGS 1%
Resize Settings	
MAX. RECOMMENDATIONS 4	MIN. RUNNING DAYS 1 Day
MIN. THRESHOLD 25%	MAX. THRESHOLD 80%
PROPORTIONAL RESIZING ON	SHOW EXPENSIVE RECOMMENDATIONS ON
Termination Settings	
TERMINATION THRESHOLD 2%	UNUSED DAYS 7 Days

The following table explains the fields in the **Rightsizing** card of the **Settings** tab.

Field	Description
Recommendation Validity	Duration, in days, a recommendation is valid or visible in Cost Optimizer.
Min Cost Savings	Minimum savings offered by recommended downsize alternatives. Instances that do not meet this criterion are not recommended.
Resize Settings	
Max Recommendations	Desired number of alternate recommendations.
Min Running Days	Duration, in days, an instance must be run for rightsizing analysis and recommendations.
Min Threshold	Downsizing recommendation. If a CPU utilization is below the threshold specified in this field, small instances are recommended.
Max Threshold	Upsizing recommendation. If a CPU utilization crosses the threshold specified in this field, large instances are recommended.
Proportional Resizing	Resizes the memory in proportion to CPU usage.
Show Expensive Recommendations	Enables upsizing recommendation. Toggling this option provides recommendations for overutilized instances (see Rightsizing > Recommendations > Overutilized Tab) even though the recommendation does not result in saving costs.
Termination Settings	
Termination Threshold	Termination recommendation. If the utilization is lesser than the threshold specified in this field, it is recommended that the instance be stopped or terminated.
Unused Days	Duration, in days, an instance must be in an unused state to be recommended to stop or terminate the instance.

The **Suspension Candidates card** allows you to define suspension thresholds in Cost Optimizer.

▼ Suspension Candidates
EDIT
ON

<p>RECOMMENDATION VALIDITY</p> <p>1 Day</p>	<p>MIN. COST SAVINGS</p> <p>5%</p>
<p>MIN. RUNNING DURATION</p> <p>7 Days</p>	

The following table explains the fields in the **Suspension Candidates** card.

Field	Description
Recommendation Validity	Duration, in days, a recommendation is valid or visible in Cost Optimizer.
Min. Cost Savings	Minimum savings offered by suspending a resource. Resources that do not meet this criterion are not recommended.
Min. Running Duration	Duration, in days, an instance should be running. If the instance is running below the threshold specified in this field, it is recommended that the instance is suspended.

Use the **RI Opportunities** card to enable or disable reserved instances recommendations.

RI Opportunities
ON

The **Historical Collection** card allows you to specify in the **Number of Days** field the duration, in days, for which data (metrics, costs, etc.) must be collected.

▼ Historical Collection
EDIT

NUMBER OF DAYS

45 Days

The default is 45 days. To change the value, click **Edit** and enter a value between 0 and 60 days in the **Number of Days** field.

Use the **Fiscal Year** card to define a financial year and quarters in the financial year for budget allocation.

▼ Fiscal Year
+ ADD YEAR

FISCAL YEAR	Q1	Q2	Q3	Q4	ACTIONS
2019	Jan 1, 2019 - Mar 31, 2019	Apr 1, 2019 - Jun 30, 2019	Jul 1, 2019 - Sep 30, 2019	Oct 1, 2019 - Dec 31, 2019	
FY 2021	Nov 1, 2019 - Jan 31, 2020	Feb 1, 2020 - Apr 30, 2020	May 1, 2020 - Jul 31, 2020	Aug 1, 2020 - Nov 30, 2020	





An Optimizer Admin only can define a fiscal year. See [Access and Roles](#).


Perform the following steps to add a fiscal year:


1. Click **Add Year**. The **Fiscal Year** dialog appears.


Fiscal Year 2021 ✕


START DATE Jan 01, 2021  **END DATE** Dec 31, 2021 

Fiscal Year Quarter Breakdown

Q1 START DATE Jan 01, 2021 

Q2 START DATE Apr 01, 2021 

Q3 START DATE Jul 01, 2021 

Q4 START DATE Oct 01, 2021 

DONE

2. Select an appropriate value in the **Start Date** and **End Date** for the fiscal year and accept the quarter breakdown.
3. Click **Done**.

Data Collection

Data Collection

Cost Optimizer runs background processes to collect data from a cloud provider for reporting and analysis. The processes are scheduled at specific intervals to connect with a cloud provider to receive the latest information. The following table lists the background processes and corresponding schedules.

Process	Description	Schedule
Inventory Collector	Inventory details from a cloud provider (Virtual Machines, Storage Volumes, Load Balancers, Database, Containers)	Every 15 minutes—starting at 0, 15, 30, and 45 minutes of the hour
Cost Calculator	Resource cost	Every hour
Metrics Collector	Metrics for all resources	Every 30 minutes – at 20 and 50 minutes of the hour
Invoice Aggregation	Billing information from a cloud provider	Daily at 04:00 hours GMT
Rightsize Analyzer	Analyses resources to identify resource wastage	Daily at 01:00 hours GMT
Reservation Analyzer	Analyzes all AWS RI resources	Daily at 02:00 hours GMT
Metadata Sync	Cloud provider metadata information for public clouds (regions, zones, instance types, rate card, and so on)	Daily at 00:00 hours GMT
Tag Sync	Fetch tags from all clouds. For AWS, collects tags which are enabled in AWS console.	Daily at 01:00 hours GMT
Unused Volumes Analyzer	Fetch details of unused volumes	Daily at 01:00 hours GMT
Suspension Policy Analyzer	Fetch details of suspension policies	Daily at 03:00 hours GMT

Alerts Page

Alerts Page

- [Overview](#)
- [Budget Alerts](#)
- [Trend Alerts](#)

The **Alerts** tab allows you to send notifications to specified users or user groups when the threshold limits cross the limits as mentioned in the page. You can modify the thresholds by using the **Edit** button in the header. Notifications are sent via the SMTP settings in Suite Admin. For more information about SMTP settings, see [Email Settings](#).

Budget alerts compare expenses against the budget allocated in the current quarter. Budget Alerts are applicable globally at a tenant level. These settings can be overridden on a per cost group level when creating a budget through the **Alert Settings** tab (see [Allocate Budgets](#) > *Creating a budget*).

▼

Budget Alerts
Spend in the current fiscal quarter is compared to budget allocated. Budget Alerts override Trend Alerts.

EDIT | ON

Scheduled Alerts

These alerts will be sent 20 days into the quarter, 45 days into the quarter, and 10 days before quarter end.

OVERSPENDING THRESHOLD ⓘ

> 100%

UNDERSPENDING THRESHOLD ⓘ

< 30%

Triggered Alerts

BUDGET THRESHOLD ⓘ

90%

Default Alert Recipients

Trend Alerts compare the expenditure and cost in the current quarter against the last quarter.

▼

Trend Alerts
Spend in the current quarter is compared to the last quarter.

EDIT | ON

Scheduled Alerts

These alerts will be sent 20 days into the quarter, 45 days into the quarter, and 10 days before quarter end.

OVERSPENDING THRESHOLD ⓘ

> 100%

UNDERSPENDING THRESHOLD ⓘ

< 30%

Triggered Alerts

COST THRESHOLD ⓘ

90%

Default Alert Recipients

The following table explains the significant fields in the **Alerts** page.

Field	Description
-------	-------------

Overspending Threshold	A cost group is considered an overspender if its forecasted total expenditure for a duration exceeds this threshold. An alert is sent at specific intervals about overspending cost groups.
Underspending Threshold	A cost group is considered an underspender if its forecasted total expenditure for a duration is below this threshold. An alert will be sent at specific intervals about underspending cost groups.
Triggered Alerts	An alert is sent the day the cost group's expenditure reaches the defined cost threshold.
Default Recipients	Persons who receive alert notifications.

Tag-Based Cost Reporting

Tag-Based Cost Reporting

- [Overview](#)
- [Enable Cost Reporting](#)

Tags are key-value pairs associated with cloud resources on a cloud provider. The key is mandatory and value is optional. Tags can be user-defined or system-defined. Similar to billing units, tags are also used for cost breakdown at a deeper granular level. The tags are discovered through the Tag Sync background process. See [Data Collection](#).

Use the Tag-Based Cost report to enable cost reporting for tags in the associated cloud accounts. Tag-based cost reporting is disabled by default. By enabling this feature and by enabling the tags, you may incur an expense on your billing account (for example, on AWS the expenses are recorded as Cost Explorer expenses).



Sharing of tag-based cost groups is supported in Cost Optimizer 5.1.2 and later releases. When tag-based cost reports are shared, the sharing results in displaying additional cost, inventory, and recommendations for the resources associated with the cost groups.

Tag-based cost reporting is available for AWS and Azure clouds only. The tags are automatically fetched from the cloud providers by the Tag Sync background process that runs every day at 01:00 hours GMT. As mentioned, tag-based cost reporting is disabled, you enable tag-based cost reporting by setting the toggle On the button at the top of the page. Invoice collection is triggered 30 minutes after you have toggled On the button. You would also notice that all Azure tags are OFF by default, whereas few AWS tags are enabled by default. The AWS tags that are On by default are the incurring costs tags. To enable tag-based cost reporting for Azure tags, you must set the toggle to **ON** in the **Cost Reporting** column against the tag for which you want to display the cost. Additionally, you can set the toggle to **ON** for AWS tags, as appropriate.

Tags that are enabled (toggle set to ON) only will be listed in the **Unassigned Tags** list for association with a cost group. See [How Do I... > Associate a Tag](#) for additional context.

Tag-based Cost Reporting ON

Select tags for which cost reporting should be enabled.

458 TOTAL **135 ENABLED**

TAG	CLOUDS	COST GROUP TYPE	COST REPORTING
▶ API_smk_az_adm_SysTag_002 : (All)	AzureRM	None	OFF
▼ API_smk_az_adm_SysTag_005 : (All)	AzureRM	None	OFF
USER_DEFINED_TAG	AzureRM	None	OFF
▼ ApplicationName : (All)	AWS	None	ON
CSBConfigBucket	AWS	None	ON
CSIRT	AWS	None	ON
Logging Bucket	AWS	None	ON

The following table identifies various aspects of the page.

Summary	Description
All	Number of tags the Tag Sync background process fetched from the cloud provider.
Enabled	Number of tags that have been enabled for cost reporting.

Filter	Filter tags on cloud providers.
Search	Search for tags from the list.
Tag	Tag name.
Cloud	Cloud provider that the tag belongs to.
Cost Group Type	Cost group type the tag is assigned to. See: How Do I... > Associate a Tag .
Cost Reporting	<p>Toggle this option does the following:</p> <ul style="list-style-type: none">• Display tags in the Unassigned Tags area in the Cost Groups page (see Cost Groups Configuration). These tags can be associated with a cost group.• Display the cost report for this tag in the Cost by Tags report.• Lists the tag in the various filtering panel in Cost Optimizer.

Troubleshooting

Troubleshooting

- [Cost Optimizer Troubleshooting](#)
- [Scheduling MongoDB](#)

Cost Optimizer Troubleshooting

Cost Optimizer Troubleshooting

- [Adding a Cloud Account](#)
- [Costs for Private Clouds are not Displayed](#)
- [Cost by Organization Hierarchy Report is not Displayed](#)
- [Incorrect Numbers in Cost by Cost Group Type Report](#)
- [Inventory Types not Displayed](#)
- [No Rightsizing Recommendations are Displayed](#)
- [Kubernetes Troubleshooting](#)

If you are unable to add a cloud account, ensure that the credentials are valid and validate that the user or role assigned with the credentials has the correct permissions (see [Cloud Overview > Minimum Permissions for Public Clouds](#)). If the cloud account is a cloud master account, all child accounts must have AWS IAM role as *Optimizer*. This role must have the same permissions as described in the *Minimum Permissions for Public Clouds* section.

If the Cost Optimizer Dashboard does not display costs for private clouds (vCenter, OpenStack, and Kubernetes), verify the following:

- Price is specified in the **Price** field when adding instance types.
- Cost is entered in the **Cost** field when adding storage types.

See [Instance Types Settings](#) and [Storage Types Settings](#) for additional context.

If the Cost by Organization Hierarchy report (applies to MasterAWS and GCP accounts only) is not visible, ensure that the **Enable Reporting By Org Structure** is toggled to **On** when adding a cloud. See [Configure an AWS Cloud](#) for more details. You must set the toggle to **On** to cause Cost Optimizer to import the cost hierarchy created in the cloud provider portal.

If the Cost by Cost Group Type (Department) report displays incorrect costs for a specific cost group type, verify that the billing units are mapped correctly to the cost group type.

Inventory is only collected for regions that are explicitly added while setting up clouds. If you do not see expected inventory types (VMs, Kubernetes Workloads, Storage Volumes, and Services), verify that regions you added contain the inventory on the cloud.

Rightsizing recommendations are governed by the [Settings](#) tab in the Admin area. Review the values in this tab, in particular, review the value set for the **Min. Running Days** field.

Based on the error message that you see in the UI, you could perform basic troubleshooting steps if you have access to both the Kubernetes setup and to the CloudCenter Suite:

Issue	Error Reference Location
Errors returned by the Kubernetes cluster	Go to the Kubernetes dashboard and look for the event messages and login to the pod that you created for the CloudCenter Suite.
Kubernetes cluster API interaction issues	Login to Kibana (Monitor Modules > View Logs in Kibana) and look for error messages in logs with the text "cloudcenter-blade".
Orchestration or lifecycle issues	<p>Login to Kibana (Monitor Modules > View Logs in Kibana) and look for error messages in logs with the text "cloudcenter-cco".</p> <p>You may find the following warning message in the Kubernetes cloudcenter-cco logs – you can safely ignore this message as it does not impact product functionality.</p> <pre>WARNING!!! The linux bootstrap URL might be valid: http://build-rel.cliqr.com/.../bootstrap-cliqr-init.sh. If Workload Manager cannot access the file, all deployments would fail!</pre>
Model, manage, deploy issues	Login to Kibana (Monitor Modules > View Logs in Kibana) and look for error messages in logs with the text "cloudcenter-ccm-backend" or "cloudcenter-cloud-setup".

For additional details, refer to the following documents:

- [Container Clouds](#)
- [Configure a Kubernetes Cloud](#)

Scheduling MongoDB

Scheduling MongoDB

- [Introduction](#)
- [Affinity and Tolerations](#)
- [Running the MongoDB on a New Node](#)

MongoDB is a shared component in Workload Manager and Cost Optimizer modules of CloudCenter Suite. Kubernetes schedules the MongoDB pod as any other pod to share resources (CPU, memory) with other pods. However, in a large setup and over a period of time, MongoDB might want to consume additional resources but could be limited by its peer pods.

This section provides guidance on how to configure the Kubernetes cloud environment to run the MongoDB pod on a new node.

The following values are defined on the MongoDB pod.

- **Tolerations**
 - Key: cloudcenter/dedicated
 - Value: cloudcenter-mongodb
- **Affinity**
 - nodeaffinity: preferredDuringSchedulingIgnoredDuringExecution
- **Node Label**
 - Key: cloudcenter/purpose
 - Value: cloudcenter-mongodb

Perform the following steps to run the MongoDB pod on a new node.

1. Add a new node and label it.

```
kubectl label node NAME cloudcenter/purpose=cloudcenter-mongodb
```

2. Apply a taint to assign the pod to MongoDB as shown in the below example.

```
kubectl taint node -l cloudcenter/purpose=cloudcenter-mongodb cloudcenter/dedicated=cloudcenter-mongodb:NoSchedule
```

3. Delete the pod to restart the MongoDB on this node.

```
kubectl delete po cloudcenter-shared-cloudcenter-mongodb-0
```



It is not recommended to run the above steps on Amazon EKS.

Refer to these links for additional context:

- [Assigning Pods to Nodes](#)
- [Taints and Tolerations](#)

Cost Optimizer API

Cost Optimizer API

- [API Overview](#)
- [API Authentication](#)
- [API Key](#)
- [Base URI Format](#)
- [HTTP Status Codes](#)
- [CSRF Token Protection](#)
- [API Permissions](#)
- [Synchronous and Asynchronous Calls](#)
- [Cost and Inventory Calls 5.1.0](#)
- [Recommendation Calls 5.1.0](#)
- [Cost Groups Calls 5.1.0](#)
- [Tags Collector Calls 5.1.0](#)

API Overview

CloudCenter Suite API Overview

- [Overview](#)
- [CloudCenter Suite API Version](#)
- [Date Format](#)
- [HTTPS Request Methods](#)
- [Response Schema](#)
- [Resource URL and ID](#)
- [Pagination](#)
 - [Pagination Request Attributes](#)
 - [Pagination Response Attributes](#)
- [Sorting](#)
- [Searching](#)
- [HTTP Location URL](#)
- [Who Can Use CloudCenter Suite APIs?](#)

The payloads for the CloudCenter Suite APIs are visible in the API documentation section for each module.

CloudCenter Suite APIs provide support for the CloudCenter Suite modules: [Suite Admin API](#), [Workload Manager API](#), [Action Orchestrator API](#), and [Cost Optimizer API](#).

The User, Groups, and Tenant APIs are part of the Suite Admin and each API using these services have an additional prefix in the URI. The payloads for the CloudCenter Suite APIs are visible the API documentation section for each module.

The v2 APIs, where available, provide structured responses with minimum details and provides links for nested resources as well as improved search, sort, and pagination filters.

The CloudCenter Suite API date and time values are formatted in [Unix time](#) to the millisecond level. The APIs are agnostic to dates and time zones.

CloudCenter Suite APIs support the following request methods:

- **GET**: To query or view the server information based on a CloudCenter Suite deployment
- **PUT**: To replace the entire object for update operations
- **POST**: To perform a CloudCenter Suite task or creating the resource
- **DELETE**: To remove specific aspects of the CloudCenter Suite deployment

CloudCenter APIs issue responses for all APIs using both JSON and XML formats. You can set the response format by sending the appropriate Content-Type request headers:

- JSON (Default)

```
Content-Type: application/json Accept: application/json
```

- XML

```
Content-Type: application/xml Accept: application/xml
```

- CSV (Only for Reports)



The CSV format only applies to report-based APIs

```
Content-Type: application/csv Accept: text/csv
```

For each API request, you see two common attributes displayed in the API response:

```
{
  "resource": "https://<HOST>:<PORT>/v1/users/",
  "size": 12,
  "pageNumber": 0,
  "totalElements": 12,
  "totalPages": 1,
  "users": [
    {
      "id": "2",
    }
  ]
  ...
}
```

- The **resource** URL: A unique URL that provides access to the requested *CloudCenter Suite Resource*.
- The POST and PUT API calls additionally provide an **id** attribute for each new *CloudCenter Suite Resource*.

The pagination information differs based on the API version:

- **v1 APIs:** The GET (view or list) APIs support pagination by default. CloudCenter Suite APIs use the following attributes to provide paginated results:


```
{
  "resource": "https://<HOST>:<PORT>/v1/users/",
  "size": 12,
  "pageNumber": 0,
  "totalElements": 12,
  "totalPages": 1,
  "users": [
    {
      "id": "2",
    }
  ]
  ...
}
```

- **v2 APIs:** Requires the *page* and *size* attributes for any request. The default size for v2 APIs now list 50 records by default.

Pagination Request Attributes

page

- **Description:** The total number of pages in for the API listing.
 - Default = 0
 - If **size=0**, then the *page* value is ignored.
 - If not specified (**page=0&size=20**), the default size (default = 20) value displays the first 20 elements, which is equal to one page
 - If you specify both the page and the size values, the following applies:

If you specify...	...then
size=21	Elements numbered 21 - 40 entities are displayed, which is equal to 2 pages
page=0 (or not specified)	The first set of 20 elements in the list, elements 1 to 20 are displayed
page=1	The second set of 20 elements in the list, elements 21 to 40 are displayed
page=2	The third set of 20 elements in the list (the third page). <div style="border: 1px solid green; border-radius: 10px; padding: 5px; display: inline-block;">  if the page does not have more than 10 elements, then only those 10 elements are displayed. </div>
page=1&&size=10	A set of 10 elements, Elements 11 to 20 are displayed
page=1&&size=20	A set of 20 elements, Elements 21 to 40 are displayed
page=2&&size=10	A set of 10 elements, Elements 21 to 30 are displayed

- **Type:** Integer

size

- **Description:** Total number of records that any list page should contain. The default is:
 - v1 APIs = 20 records
 - v2 APIs = 50 records
- **Type:** Integer

Pagination Response Attributes

- v1 APIs:
 - pageResource
 - **Description:** Identifies the pagination information for each resource
 - **Type:** Sequence of attributes for v1 APIs

size (see above)
pageNumber <ul style="list-style-type: none"> • Description: The page number that the client wants to fetch. Page numbers start with 0 (default). • Type: Integer
totalElements <ul style="list-style-type: none"> • Description: The number resources that an API call returns • Type: Long
totalPages <ul style="list-style-type: none"> • Description: The number of pages in a response • Type: Integer

- v2 APIs:
 - pageResource
 - **Description:** Identifies the pagination information for each resource
 - **Type:** Sequence of attributes for v2 APIs

resource <ul style="list-style-type: none"> • Description: Unique URL to access this resource. • Type: String
size (see above)
pageNumber <ul style="list-style-type: none"> • Description: The page number that the client wants to fetch. Page numbers start with 0 (default). • Type: Integer
totalPages <ul style="list-style-type: none"> • Description: The number of pages in a response • Type: Integer
jobs <ul style="list-style-type: none"> • Description: Array of JSON objects that use jobs as the key. • Type: Array of JSON objects
previousPage <ul style="list-style-type: none"> • Description: A resource link to the previous page. • Type: URI as a string
nextPage <ul style="list-style-type: none"> • Description: A resource link to the following page. • Type: URI as a string
lastPage <ul style="list-style-type: none"> • Description: A resource link to the last page. • Type: URI as a string

- **v1 APIs:** All list APIs support sorting by default and use the query-string parameters to provide sorted results with a comma-separated set of property names.
 - Sorting Order:
 - Ascending order: Default when you specify the property.
 - Descending order: Append a dash **↓** to the property.
 - Example:
 - **sort=id,name:** Sort by ID property in ascending order and then sort by name property in ascending order.
 - **sort=id,name,-description:** Sort by ID property in ascending order, then sort by name property in descending order, and finally sort by description in ascending order.

favoriteCreationTime

- **Description:** If the job was configured as a favorite job, then this attribute identifies the time when this configuration took place. See the *Favorite Deployments* section for the relevant release for additional context.
- **Type:** Epoch time as a String

This attribute is only available for v2 APIs.

search

- **Description:** Searches API responses based on the format specified.
- **Type:** String
 - **Format:** search=[field, searchType, *SearchExpression1*, *SearchExpression2*]
 - **Example:** search =[startTime, gt, 01/01/2016]
 - **Search Expressions:**
 - *pattern:* Provide a pattern using the format provided in the *searchTypes* table below.
 - *searchTypes*

searchType	Format
eq	==
ne	!=
el	LIKE <i>pattern</i> %
fl	LIKE % <i>pattern</i>
eln	NOT LIKE <i>pattern</i> %
fln	NOT LIKE % <i>pattern</i>
file	LIKE % <i>pattern</i> %"
gt	> <i>searchValue</i>
lt	< <i>searchValue</i>
ge	>= <i>searchValue</i>
le	<= <i>searchValue</i>
gtlt	> <i>searchValue</i> && <i>searchValue</i>
gtelt	>= <i>searchValue</i> && < <i>searchValue</i>
gtlte	> <i>searchValue</i> && <= <i>searchValue</i>
gtelte	>= <i>searchValue</i> && <= <i>searchValue</i>
emp	Empty string
noemp	Not Empty string
nu	Null value
nn	Not Null Value

- **searchValue:**

searchValue	SearchType Availability
id	eq
startTime	eq, nu, gtlt
endTime	eq, nu, nn, gtlt
totalCost	eq, gt, ge, le, gtlt, gtlte, gtelte, gtelt
favoriteCreationTime	eq, nu, ,nn gtlt
jobStatusMessage	el, eln, fl, fln, file, nn, emp, noemp
nodeHours	eq, gt, ge, le, gtlt, gtlte, gtelte, gtelt
name	eq, nn, eln, file, fln, el, emp, noemp, fl
description	eq, nn, eln, file, fln, el, emp, noemp, fl

deploymentEntity.name	eq, nn, eln, fle, fln, el, emp, noemp, fl
ownerEmailAddress	eq
cloudFamily	eq, nu
status	eq, nu

The HTTP Status code and the Location URL (highlighted in blue in the following example) is provided in the Response Header when Create *resource* API calls are successful:

```
curl -k -X POST -H "Content-Type: application/json" -H "Accept: application/json"
cliqradmin:D3DD6F7874E6B26B https://test.cliqr.com/v1/users -d '{
  "firstName": "User 02",
  "lastName": "Cliqr",
  "password": "cliqr",
  "emailAddr": "user.02@cliqr.com",
  "companyName": "Cliqr, Inc",
  "phoneNumber": "14085467899",
  "externalId": "",
  "tenantId": 1
}'
> POST /v1/users HTTP/1.1
> Authorization: Basic Y2xpcXJhZG1pbjpmEM0RENky3ODc0RTZCMjZC
> User-Agent: curl/7.37.1
> Host: test.cliqr.com
> Content-Type: application/json
> Accept: application/json
> Content-Length: 217
>
< HTTP/1.1 201 Created
< Server: Apache-Coyote/1.1
< Set-Cookie: JSESSIONID=0E85227543C66D55E06449582091C2B4; Path=/; Secure; HttpOnly
< osmosix_content: true
< X-Frame-Options: SAMEORIGIN
< Pragma: no-cache
< Expires: Thu, 01 Jan 1970 00:00:00 GMT
< Cache-Control: no-cache
< Cache-Control: no-store
< Location: https://test.cliqr.com/v1/users/12
< Content-Type: application/json; charset=UTF-8
< Transfer-Encoding: chunked
< Vary: Accept-Encoding
< Date: Fri, 07 Aug 2015 20:59:18 GMT
```

Both admins and users can use CloudCenter Suite REST APIs.

Your login credentials determine if you are an admin (platform (root), tenant admin, or co-admin) or a user. If you do not have the required Permission Control level to access any *resource*, you receive the HTTP 403 status error mentioned in the [HTTP Status Codes](#) section.

Back to:

- [Suite Admin API](#)
- [Workload Manager API](#)
- [Action Orchestrator API](#)
- [Cost Optimizer API](#)

API Authentication

API Authentication

- [Overview](#)
- [Authentication Format in CURL Requests](#)
- [Successful Authentication](#)
- [Session Timeout Length](#)

CloudCenter Suite APIs require the following authentication details for each API call:

- Username
- API access key



The authentication HTTP header is not required when making standalone REST API calls using the username/API Key credentials.

Standalone CURL Request Example:

```
curl -H "Accept:application/json" -H "Content-Type:application/json" -u writer:BED74F4D9BFE0DA0 -X GET https://<HOST>:<PORT>/v1/users/27
```

In this CURL request example:

- **writer1** is the username
- **BED74F4D9BFE0DA0** is the API accessKey

Your tenant administrator can retrieve the username and API access key from the UI. See [API Key](#) for additional details.

On successful authentication, CloudCenter Suite sends a browser cookie to maintain the authentication session. The cookie forwards the information to the server for each API call so you do not need to authenticate each time you make an API call. If you do not want to maintain cookies in your browser, you can send the authentication information for each API request. Once authenticated, you can begin making API calls.

The CloudCenter Suite authentication session times out after 15 minutes. If you use a REST client to make API calls by authenticating through the UI's, this session timeout applies to the REST client as well.

However, if you add and save the REST client authentication headers or if you issue CURL commands with the authentication details, you can circumvent the session timeout restriction.

Back to:

- [Suite Admin API](#)
- [Workload Manager API](#)
- [Action Orchestrator API](#)
- [Cost Optimizer API](#)

API Key

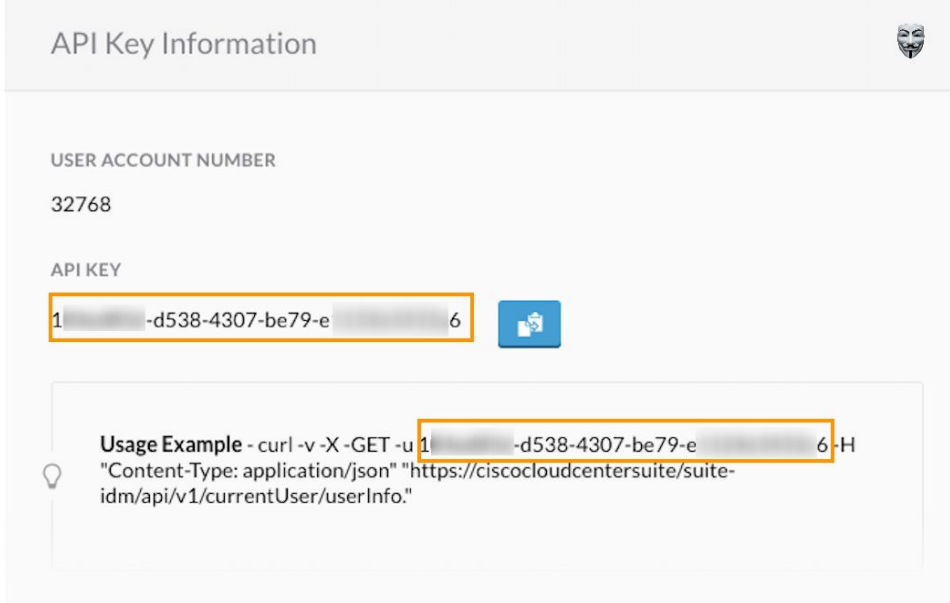
Generate API Key

- [Overview](#)
- [UI Process to Generate Your Own API Key](#)
- [UI Process to Generate API Key for Another User](#)
- [API Process to Generate a New API Key](#)

You need an **API key** to use CloudCenter Suite APIs. Suite administrators or tenant administrator (for their respective tenants) can generate/regenerate an API key by using the Suite Admin UI or the `user_api_key` API call.

To generate the API key from the UI for yourself, follow this procedure:

1. Navigate to the [Suite Admin Dashboard](#) and click your account profile dropdown.
2. Click the **Generate API Key** link to generate a new API key.
3. Click **Yes** to replace the API key. You can now use this key to make REST API calls as listed in the Usage Example in the following screenshot.



API Key Information

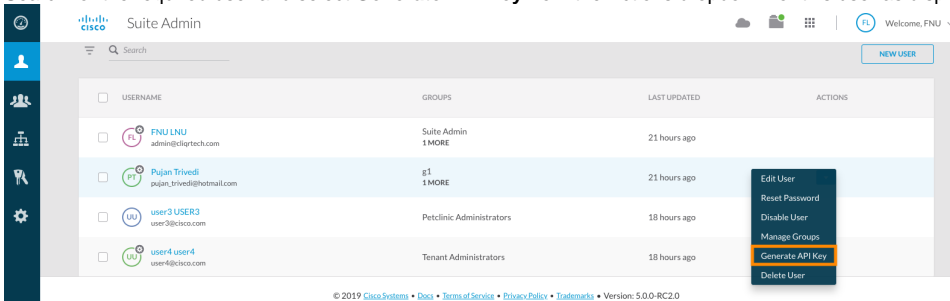
USER ACCOUNT NUMBER
32768

API KEY
1 [redacted] -d538-4307-be79-e 6

Usage Example - curl -v -X GET -u 1 [redacted] -d538-4307-be79-e 6 -H "Content-Type: application/json" "https://ciscloudcentersuite/suite-idm/api/v1/currentUser/userInfo."

To generate the API key from the UI for another user, follow this procedure:

1. Navigate to the [Suite Admin Dashboard](#) > **Users**.
2. Search for the required user and select **Generate API Key** from the Actions dropdown for this user as displayed in the following screenshot.



USERNAME	GROUPS	LAST UPDATED	ACTIONS
FNU LNU admin@clirttech.com	Suite Admin 1 MORE	21 hours ago	Edit User Reset Password Disable User Manage Groups Generate API Key Delete User
Pujan Trivedi pujan_trivedi@hotmail.com	g1 1 MORE	21 hours ago	
user3 USER3 user3@ciscc.com	Petclinic Administrators	18 hours ago	
user4 user4 user4@ciscc.com	Tenant Administrators	18 hours ago	

3. Click the **Generate API Key** link to generate a new API key. This user can now make REST API calls using new API key.

To generate the API key using the Suite Admin API call, follow this procedure:

1. Issue the [Password Service API Calls](#) > `/api/v1/users/{userId}/user_api_key` API POST call to generate/regenerate the API key for yourself or for any other user.

```
POST https://host-port/suite-password/api/v1/users/1/user_api_key
```

2. Retrieve the `apiKey` from the response for this API.

```
{
  "userId":1,
  "apiKey":"1.....-d538-4307-be79-e.....6",
  "accountNumber":"32768"
}
```

3. Use this *apiKey* to make REST API calls.

Back to:

- [Suite Admin API](#)
- [Workload Manager API](#)
- [Action Orchestrator API](#)
- [Cost Optimizer API](#)

Base URI Format

Base URI Format

- [Overview](#)
- [Host Name](#)
- [Port Usage](#)
- [API Version](#)
- [Parameters](#)
- [Parameter Types](#)

The base URI format is **https:// <host>:<port>/...**

The host is generally represented as <HOST> in all CloudCenter APIs. It represents the IP address or the DNS name.

The host differs based on your DNS or IP address and port usage.

The port is generally represented at <PORT> in all CloudCenter APIs. It represents the port used to connect to the CCO server for the API connection. The <PORT> in the REST endpoint is *optional*. You can decide if you want to use the port for each API call. All CloudCenter API requests and responses display <PORT> in all examples.

```
curl -H "Accept:application/json" -H "Content-Type:application/json" -u \
cloudcenteradmin:40E45DBE57E35ECB -X GET https://<HOST>:<PORT>/...
```



If you do not specify the port, **then API requests default to Port 443 for a HTTPS connection** when accessing CloudCenter Suite REST APIs.

The CloudCenter Suite 5.0.0 API version can be v1 or v2 as applicable. The version is identified for each API, where applicable.

Parameters used to make the API call are displayed after the APIs and are called out after the description.

Attribute Type	Description
String	Any combination of characters. Maximum of 255 characters.
Integer	A whole number value. Restricted to 32-bit values.
Long	A whole number value. Restricted to 64-bit values.
Float	A number with or without a decimal point. Displayed as a string in the response.
Boolean	A logical true or false value. May be passed to API requests as true or false or 1 or 0.
Enumeration	A predefined list of values, for example STANDARD or TENANT describes the possible values for each type. Only listed values are permitted, other values result in an error.
JSON Object	A method to parse JavaScript Object Notation (JSON) and return the object value to which a specified name is mapped.
Name-Value Pair	A name–value pair where each element is an attribute–value pair.
Array	A sequential collection of like elements corresponding to the element's data type. The type of the array is determined by the types of the elements (can be String, Integer, Name-Value Pair Type)
Perms List	Lists the permissions for specific user if the user is logged in. An empty response is <i>also</i> indicative of the resource not being currently supported.
Metadata	Metadata information associated with the cloud provider.

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- [Suite Admin API](#)
- [Workload Manager API](#)
- [Action Orchestrator API](#)
- [Cost Optimizer API](#)

HTTP Status Codes

HTTP Status Codes

CloudCenter APIs return one or more of the following HTTPS status codes for all (synchronous and asynchronous) API requests:

HTTP Response Code	Status	Description
200	Success	Successful GET and PUT
201		Successful POST (when a resource is created)
202		Request accepted for a time-consuming task (asynchronous update and created requests). See Shared 5.1 Synchronous and Asynchronous APIs for more details You can issue GET calls until the request completes.
204		Successful DELETE
30x	Redirection	Only displays if a client calls an API using HTTP instead of HTTPS
400	Client failure	Validation error. This category has additional error codes in the response body for each API (as applicable).
401		Not authenticated
403		Forbidden. You do not have the required permission level to access the <i>CloudCenter Resource</i>
404		Resource not found
500	Server failure	Server error: The server failed to respond to this request due to an internal error

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CSRF Token Protection

CSRF Token Protection

- [Overview](#)
- [The 403 Forbidden Error for Some APIs](#)
- [Setting the CSRF Token](#)
- [Retrieving the CSRF Token](#)
- [Using the CSRF Token](#)

Cisco provides CSRF protection for all API calls. When an API call is made by you or the CloudCenter Suite, be aware that a CSRF token is required for the following scenarios:

- If the request method is **POST**, **PUT**, or **DELETE** and
- If the request **Content-Type** is not **application/json**

For example, the following functions require the CSRF token:

- Suite Admin Resource Management Service API Calls that use the following functions:
 - Company logo upload
 - User avatar upload
- Workload Manager API Calls that use the following functions
 - Application profiles
 - Logo upload
 - Services logo upload
 - Import applications
 - Cloud account management API calls
 - DELETE calls that change the database contents

If the CSRF token is missing or incorrect, you will see a 403 error due to the CSRF token protection.

If you see this error, you must first set the CSRF token in the request header for the affected API.

To set a CSRF token, add **X-CSRF-TOKEN** to the header name (case sensitive, all uppercase).

To obtain the CSRF token, follow this procedure.

1. You must first pass authentication. See [API Authentication](#) for details.
2. Once authenticated, use one of the following APIs to retrieve the CSRF token from the response body (**csrfToken** attribute). See [Authentication Service API Calls](#) for details.
 - a. Login API (/suite-auth/login)
 - b. Token Refresh API (/suite-auth/api/v1/token)
 - c. CSRF Token API (/suite-auth/api/v1/csrfToken)

See the following request for examples of using a CSRF Token.

Java Rest Client Example

```
WebResource.Builder builder = webResource.type(MediaType.APPLICATION_JSON).header("X-CSRF-TOKEN", "<TOKEN>");
```

Python Example

```
headers = {'content-type': 'application/json', 'X-CSRF-TOKEN': '<TOKEN>'}
requests.delete(url, headers = headers, verify=False)

requests.post(url, json=jobJson, headers = headers, verify=False)
```

Where **<TOKEN>** is retrieved as specified in the *Retrieving the CSRF Token* section above.

Back to:

- [Suite Admin API](#)

- [Workload Manager API](#)
- [Action Orchestrator API](#)
- [Cost Optimizer API](#)

API Permissions

API Permissions – Allowed Roles

- [Overview](#)
- [Current User Permissions](#)
- [Suite Level Permissions](#)
- [Workload Manager Roles](#)
- [Action Orchestrator Roles](#)
- [Cost Optimizer Roles](#)

Each API identifies the permissions and roles required to execute that API call. Permissions for each API are governed by Role Based Access Control (RBAC) as explained in [Understand Roles](#) and user level as explained in [Understand User Levels](#).

Users can find their permission level by executing the **GET /suite-idm/api/v1/currentUser/userInfo** API listed in the [IDM Service API Calls > User Controller](#) section.

Based on the current user's permissions the Suite Admin APIs display enumerations for the **Allowed Role(s)** described in the following table.

Allowed Role(s) Enumeration	Description
SUITE_ADMIN	The initial administrator described in Initial Administrator Setup . This user can perform the following tasks: <ul style="list-style-type: none"> • Module Lifecycle Management • Manage Clusters
SUITE_TENANT_ADMIN	The tenant administrator set up as part of the root tenant configuration described in Manage Tenants . This user can perform the following tasks: <ul style="list-style-type: none"> • Manage sub-tenants • Create, update, and delete sub-tenant users (including createTenantWithAdmin atomic operation) • Tenant resource management including Email Settings, Branding Information, and so forth
SUITE_USER	Any user added to the CloudCenter Suite. A newly-added user can only view the Suite Admin Dashboard , if not assigned to a group.
SUITE_USER_ADMIN	A SUITE_ADMIN can promote any SUITE_USER to the Suite Administrator group as described in Create and Assign Groups . This user can perform the following tasks: <ul style="list-style-type: none"> • Manage users and groups • Create, update, delete users and groups • Assign roles to users and groups • Manage passwords for users
SUITE_OUTOFBOX_USER	A SUITE_ADMIN can promote any SUITE_USER to be a SUITE_OUTOFBOX_USER, which basically implies that this user has been added to one or more OOB Suite Admin Groups .
SUITE_RESET_PASSWORD	Users with SUITE_ADMIN permissions and/or SUITE_TENANT_ADMIN for this tenant as described in Create and Manage Users > User Actions . This user can perform the following tasks: <ul style="list-style-type: none"> • Edit any user's profile by changing the first/middle/last name and email • Configure metadata details • Configure groups • Reset password • Disable a user

See [OOB Groups, Roles, and Permissions](#) for details.

See [Action Orchestrator Roles](#) for details.

See [Access and Roles](#) for details.

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Synchronous and Asynchronous Calls

Synchronous and Asynchronous Calls

- Overview
- Synchronous
- Asynchronous
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CloudCenter Suite APIs support both synchronous and asynchronous calls. Some APIs return data in the response body and others will only return an HTTP status. For example, CloudCenter DELETE calls return a **Status 204 No Content** after deleting the *resource* in the background.

Synchronous APIs indicate that the program execution waits for a response to be returned by the API. The execution does not proceed until the call is completed. The real state of the API request is available in the response.

Asynchronous APIs do not wait for the API call to complete. Program execution continues, and until the call completes, you can issue GET requests to review the state after the submission, during the execution, and after the call completion. Use the **Get Operation Status** API to retrieve the status of an asynchronous operation.

As asynchronous calls may take some time to complete, they return HTTP Status Codes responses containing information with an HTTP Status Code, which allows you to retrieve the progress, status, response, and other information for the call.

After submitting an asynchronous API call:

1. Retrieve the resource URL from the HTTP Status Codes.
2. Use this location URL and query the system using GET calls. While the call is in progress and you issue the GET request, you get additional details of the operation being performed. These details are only available while the operation is in various states of execution (RUNNING, SUCCESS, FAILED).
3. When the asynchronous API call completes successfully, issue a GET request to view the SUCCESS state and the resource URL for this operation.

Call States

In the following example of a [Create Cloud Account](#) API:

- The various states of execution (RUNNING, SUCCESS, FAILED) are highlighted in corresponding colors
- The first and last GET requests are in bold to show the sequence of events

```
Location: https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78

{ "operationId": "f503c52a-d13b-4b62-840d-0faa22ccbb78", "status": "RUNNING", "msg": "Updating Image permissions...", "progress": 50, "timestamp": 1438850245522, "additionalParameters": null, "operationHistory": [ ], "subtaskResults": null, "resourceUrl": "https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78" }
curl 'https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78' -H 'Accept: application/json'

{ "status": "RUNNING", "msg": "Updating Image permissions...", "resource": "https://test.cliqr.com", "additionalParameters": [ ] }
...
curl 'https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78' -H 'Accept: application/json'

{ "status": "RUNNING", "msg": "Saving cloud account...", "resource": "https://test.cliqr.com/https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78", "additionalParameters": [ ] }
curl 'https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78' -H 'Accept: application/json'

{ "status": "SUCCESS", "msg": "Cloud Account is saved successfully.", "resource": "https://test.cliqr.com/https://test.cliqr.com/v1/operationStatus/f503c52a-d13b-4b62-840d-0faa22ccbb78", "additionalParameters": [ ] }
```

Operation ID Availability

Operation IDs (displayed below the Location URL in the above image) allow you to query the status of asynchronous APIs and are only available for a brief period as identified in the following table:

Operation ID Availability	Description
5 minutes	The Operation ID is available for five minutes if the operation completes (regardless of success or failure).
1 hour	The Operation ID is available for one hour if the operation times out and does not complete.

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Cost Optimizer API Calls 5.1.0

Refer to the Cost Optimizer 5.1 JSON files.