MCP Deployment Guide

version q4-18

Copyright notice

Preface

This documentation provides information on how to use Mirantis products to deploy cloud environments. The information is for reference purposes and is subject to change.

Intended audience

This documentation is intended for deployment engineers, system administrators, and developers; it assumes that the reader is already familiar with network and cloud concepts.

Documentation history

The following table lists the released revisions of this documentation:

Revision date	Description
February 8, 2019	Q4`18 GA

Introduction

MCP enables you to deploy and manage cloud platforms and their dependencies. These include OpenStack and Kubernetes based clusters.

The deployment can be performed automatically through MCP DriveTrain or using the manual deployment procedures.

The MCP DriveTrain deployment approach is based on the bootstrap automation of the Salt Master node that contains MAAS hardware nodes provisioner as well as on the automation of an MCP cluster deployment using the Jenkins pipelines. This approach significantly reduces your time and eliminates possible human errors.

The manual deployment approach provides the ability to deploy all the components of the cloud solution in a very granular fashion.

The guide also covers the deployment procedures for additional MCP components including OpenContrail, Ceph, StackLight, NFV features.

Seealso

Minimum hardware requirements

Plan the deployment

The configuration of your MCP installation depends on the individual requirements that should be met by the cloud environments.

The detailed plan of any MCP deployment is determined on a per-cloud basis. For the MCP reference architecture and design overview, see: MCP Reference Architecture: Plan an OpenStack environment or MCP Reference Architecture: Plan a Kubernetes cluster depending on the type of your deployment.

> Caution!
>
> Kubernetes support termination notice
>
> Starting with the MCP 2019.2.5 update, the Kubernetes component is no longer supported as a part of the MCP product. This implies that Kubernetes is not tested and not shipped as an MCP component. Although the Kubernetes Salt formula is available in the community driven SaltStack formulas ecosystem, Mirantis takes no responsibility for its maintenance.
>
> Customers looking for a Kubernetes distribution and Kubernetes lifecycle management tools are encouraged to evaluate the Mirantis Kubernetes-as-a-Service (KaaS) and Docker Enterprise products.

At the same time, MCP provides a flexible reduced prebuilt mirror image that you can customize depending on the needs of your MCP deployment after the initial bootstrap is performed. The usage of the prebuilt mirror image is essential in case of an offline MCP deployment scenario. The prebuilt mirror image contains the Debian package mirror (Aptly or flat deb repositories), Docker images mirror (Registry), Git repositories mirror, and mirror of the Mirantis Ubuntu VM cloud images (VCP). This guide includes the steps required for the case with the additional prebuilt VM deployment on the Foundation node.

Prepare for the deployment

Create a project repository

An MCP cluster deployment configuration is stored in a Git repository created on a per-customer basis. This section instructs you on how to manually create and prepare your project repository for an MCP deployment.

Before you start this procedure, create a Git repository in your version control system, such as GitHub.

To create a project repository manually:

1. Log in to any computer.
2. Create an empty directory and change to that directory. In the example below, it is mcpdoc.
3. Initialize your project repository:

   ```
   git init
   ```

   Example of system response:

   ```
   Initialized empty Git repository in /Users/crh/Dev/mcpdoc/.git/
   ```

4. Add your repository to the directory you have created:

   ```
   git remote add origin <YOUR-GIT-REPO-URL>
   ```

5. Verify that Git and your local repository are set up correctly by creating and pushing a test file to your project repository. Run the following example commands:

   > Note
   >
   > The example commands below require the Git and GitHub credentials to be created and configured for your project repository.

   ```
   git remote add origin https://github.com/example_account/mcpdoc.git
   git config --local user.email "example@example.com"
   git config --local user.name "example_gituser"
   git config -l

   echo "#. mcpdoc" >> README.md
   git add README.md
   git commit -m "first commit"
   git push -u origin master
   ```

6. Create the following directories for your deployment metadata model:

```
mkdir -p classes/cluster
mkdir nodes
```

7. Add the Reclass variable to your bash profile by verifying your current directory using pwd and adding the string that exports the Reclass variable with the output value of the pwd command:

```
pwd
vim ~/.bash_profile
export RECLASS_REPO=<PATH_TO_YOUR_DEV_DIRECTORY>
```

   Example of system response:

```
/Users/crh/Dev/mcpdoc/

"~/.bash_profile" 13L, 450C
export RECLASS_REPO="/Users/crh/Dev/mcpdoc/"
```

8. Log out and log back in.
9. Verify that your ~/.bash_profile is sourced:

```
echo $RECLASS_REPO
```

   The command must show the value of your RECLASS_REPO variable.

   Example of system response:

```
/Users/crh/Dev/mcpdoc/
```

10. Add the Mirantis Reclass module to your repository as a submodule:

```
git submodule add https://github.com/Mirantis/reclass-system-salt-model ./classes/system/
```

    Example of system response:

```
Cloning into '<PATH_TO_YOUR_DEV_DIRECTORY>/classes/system'...
remote: Counting objects: 8923, done.
remote: Compressing objects: 100% (214/214), done.
remote: Total 8923 (delta 126), reused 229 (delta 82), pack-reused 8613
Receiving objects: 100% (8923/8923), 1.15 MiB | 826.00 KiB/s, done.
Resolving deltas: 100% (4482/4482), done.
Checking connectivity... done.
```

11 Update the submodule:

```
git submodule sync
git submodule update --init --recursive --remote
```

12 Add your changes to a new commit:

```
git add -A
```

13 Commit your changes:

```
git commit
```

14 Add your commit message.

Example of system response:

```
[master (root-commit) 9466ada] Initial Commit
 2 files changed, 4 insertions(+)
 create mode 100644 .gitmodules
 create mode 160000 classes/system
```

15 Push your changes:

```
git push
```

16 Proceed to Create a deployment metadata model.

Create a deployment metadata model

In a Reclass metadata infrastructural model, the data is stored as a set of several layers of objects, where objects of a higher layer are combined with objects of a lower layer, that allows for as flexible configuration as required.

The MCP metadata model has the following levels:

- Service level includes metadata fragments for individual services that are stored in Salt formulas and can be reused in multiple contexts.
- System level includes sets of services combined in a such way that the installation of these services results in a ready-to-use system.
- Cluster level is a set of models that combine already created system objects into different solutions. The cluster module settings override any settings of service and system levels and are specific for each deployment.

The model layers are firmly isolated from each other. They can be aggregated on a south-north direction using service interface agreements for objects on the same level. Such approach allows reusing of the already created objects both on service and system levels.

This section describes how to generate the cluster level metadata model for your MCP cluster deployment using the Model Designer web UI. The tool used to generate the model is Cookiecutter, a command-line utility that creates projects from templates.

While generating a metadata model, you can enable automated encryption of all secrets for the Salt Master node .iso file.

> Note
>
> The Model Designer web UI is only available within Mirantis. The Mirantis deployment engineers can access the Model Designer web UI using their Mirantis corporate username and password.

The workflow of a model creation includes the following stages:

1. Defining the model through the Model Designer web UI.
2. Optional. Tracking the execution of the model creation pipeline in the Jenkins web UI.
3. Obtaining the generated model to your email address or getting it published to the project repository directly.

   > Note
   >
   > If you prefer publishing to the project repository, verify that the dedicated repository is configured correctly and Jenkins can access it. See Create a project repository for details.

As a result, you get a generated deployment model and can customize it to fit specific use-cases. Otherwise, you can proceed with the base infrastructure deployment.

Enable all secrets encryption

The Model Designer UI supports passing a private key to enable automated encryption of secrets.yml during the Salt Master node .iso file generation.

To enable all secrets encryption in the Model Designer UI:

1. Generate a private PGP key locally. For example:

```
mkdir -p ~/mcp-temp-gpg-key ; cd ~/mcp-temp-gpg-key
cd cat <<EOF > gpg-batch.txt
Key-Type: 1
Key-Length: 4096
Expire-Date: 0
Name-Real: gpg-demo.com
Name-Email: saltmasterdemo@example.com
EOF
export GNUPGHOME="$(pwd)/gpghome" ; mkdir -p gpghome ; chmod 0700 gpghome
gpg --gen-key --batch < gpg-batch.txt
gpg --export-secret-key -a saltmasterdemo@example.com > gpgkey.asc
gpg --list-secret-keys
```

2. Copy the generated private PGP key:

```
cat gpgkey.asc
```

   Example of system response:

```
-----BEGIN PGP PRIVATE KEY BLOCK-----
Version: GnuPG v1

lQcYBFyKM7kBEADGU6P/Lp9YRMY/vLw7VOF5Sox1rnu2lz6YqnNQ2J+ZHVlPA9R
.....
```

3. Proceed with the metadata model generation as described in Define the deployment model. While generating the metadata model, enable the following parameters:
   - In General -> Services section, select Secrets Encryption Enabled
   - In Infra -> Salt Master section, paste the private key to the Secrets Encryption Private Key field
4. Proceed to the metadata model generation.

Seealso

MCP Operations Guide: Manage secrets in the Reclass model

Define the deployment model

This section instructs you on how to define the cluster level metadata model through the web UI using Cookiecutter. Eventually, you will obtain a generic deployment configuration that can be overriden afterwards.

> Note
>
> The Model Designer web UI is only available within Mirantis. The Mirantis deployment engineers can access the Model Designer web UI using their Mirantis corporate username and password.

> Note
>
> Currently, Cookiecutter can generate models with basic configurations. You may need to manually customize your model after generation to meet specific requirements of your deployment, for example, four interfaces bonding.

To define the deployment model:

1. Log in to the web UI.
2. Go to Integration dashboard > Models > Model Designer.
3. Click Create Model. The Create Model page opens.
4. Configure your model by selecting a corresponding tab and editing as required:
    1. Configure General deployment parameters. Click Next.
    2. Configure Infrastructure related parameters. Click Next.
    3. Configure Product related parameters. Click Next.
5. Verify the model on the Output summary tab. Edit if required.
6. Click Confirm to trigger the Generate reclass cluster separated-products-auto Jenkins pipeline. If required, you can track the success of the pipeline execution in the Jenkins web UI.

If you selected the Send to e-mail address publication option on the General parameters tab, you will receive the generated model to the e-mail address you specified in the Publication options > Email address field on the Infrastructure parameters tab. Otherwise, the model will automatically be pushed to your project repository.

> Seealso

- Create a project repository
- Publish the deployment model to a project repository

General deployment parameters

The tables in this section outline the general configuration parameters that you can define for your deployment model through the Model Designer web UI. Consult the Define the deployment model section for the complete procedure.

The General deployment parameters wizard includes the following sections:

- Basic deployment parameters cover basic deployment parameters
- Services deployment parameters define the platform you need to generate the model for
- Networking deployment parameters cover the generic networking setup for a dedicated management interface and two interfaces for the workload. The two interfaces for the workload are in bond and have tagged sub-interfaces for the Control plane (Control network/VLAN) and Data plane (Tenant network/VLAN) traffic. The PXE interface is not managed and is leaved to default DHCP from installation. Setups for the NFV scenarios are not covered and require manual configuration.

Basic deployment parameters

Parameter	Default JSON output	Description
Cluster name	cluster_name: deployment_name	The name of the cluster that will be used as cluster/<cluster_name>/ in the project directory structure
Cluster domain	cluster_domain: deploy-name.local	The name of the domain that will be used as part of the cluster FQDN
Public host	public_host: ${_param:openstack_proxy_address}	The name or IP address of the public endpoint for the deployment
Reclass repository	reclass_repository: https://github.com/Mirantis/mk-lab-salt-model.git	The URL to your project Git repository containing your models
Cookiecutter template URL	cookiecutter_template_url: git@github.com:Mirantis/mk2x-cookiecutter-reclass-model.git	The URL to the Cookiecutter template repository
Cookiecutter template branch	cookiecutter_template_branch: master	The branch of the Cookiecutter template repository to use, master by default. Use refs/tags/<mcp_version> to generate the model that corresponds to a specific MCP release version. For example, 2017.12. Other possible values include stable and testing.
Shared Reclass URL	shared_reclass_url: ssh://mcp-jenkins@gerrit.mcp.mirantis.net:29418/salt-models/reclass-system.git	The URL to the shared system model to be used as a Git submodule for the MCP cluster

MCP version	mcp_version: stable	Version of MCP to use, stable by default. Enter the release version number, for example, 2017.12. Other possible values are: nightly, testing. For nightly, use cookiecutter_template_branch: master.
Cookiecutter template credentials	cookiecutter_template_credentials: gerrit	Credentials to Gerrit to fetch the Cookiecutter templates repository. The parameter is used by Jenkins
Deployment type	deployment_type: physical	The supported deployment types include: • Physical for the OpenStack platform • Physical and Heat for the Kubernetes platform
Publication method	publication_method: email	The method to obtain the template. Available options include: • Send to the e-mail address • Commit to repository

Services deployment parameters

Parameter	Default JSON output	Description
Platform	• platform: openstack_enabled • platform: kubernetes_enabled	The platform to generate the model for: • The OpenStack platform supports OpenContrail, StackLight LMA, Ceph, CI/CD, and OSS sub-clusters enablement. If the OpenContrail is not enabled, the model will define OVS as a network engine. • The Kubernetes platform supports StackLight LMA and CI/CD sub-clusters enablement, OpenContrail networking, and presupposes Calico networking. To use the default Calico plugin, uncheck the OpenContrail enabled check box.

StackLight enabled	stacklight_enabled: 'True'	Enables a StackLight LMA sub-cluster.
Gainsight service enabled	gainsight_service_enabled: 'False'	Enables support for the Salesforce/Gainsight service
Salesforce notifications enabled	sf_notifications_enabled: 'False'	Enables sending of Alertmanager notifications to Salesforce
Ceph enabled	ceph_enabled: 'True'	Enables a Ceph sub-cluster.
CI/CD enabled	cicd_enabled: 'True'	Enables a CI/CD sub-cluster.
OSS enabled	oss_enabled: 'True'	Enables an OSS sub-cluster.
Benchmark node enabled	bmk_enabled: 'False'	Enables a benchmark node. False, by default.
Barbican enabled	barbican_enabled: 'False'	Enables the Barbican service
Backend for Barbican	barbican_backend: dogtag	The backend for Barbican

Networking deployment parameters

Parameter	Default JSON output	Description
DNS Server 01	dns_server01: 8.8.8.8	The IP address of the dns01 server
DNS Server 02	dns_server02: 1.1.1.1	The IP address of the dns02 server
Deploy network subnet	deploy_network_subnet: 10.0.0.0/24	The IP address of the deploy network with the network mask
Deploy network gateway	deploy_network_gateway: 10.0.0.1	The IP gateway address of the deploy network
Control network subnet	control_network_subnet: 10.0.1.0/24	The IP address of the control network with the network mask
Tenant network subnet	tenant_network_subnet: 10.0.2.0/24	The IP address of the tenant network with the network mask
Tenant network gateway	tenant_network_gateway: 10.0.2.1	The IP gateway address of the tenant network
Control VLAN	control_vlan: '10'	The Control plane VLAN ID
Tenant VLAN	tenant_vlan: '20'	The Data plane VLAN ID

NTP servers Added since 2019.2.6 update	0.pool.ntp.org,1.pool.ntp.org	The comma-separated list of Network Time Protocol (NTP) servers. You can also configure multiple NTP servers as required, for example, server1.ntp.org,server2.ntp.org,server3.ntp.org.

Infrastructure related parameters

The tables in this section outline the infrastructure configuration parameters you can define for your deployment model through the Model Designer web UI. Consult the Define the deployment model section for the complete procedure.

The Infrastructure deployment parameters wizard includes the following sections:

- Salt Master
- Ubuntu MAAS
- Publication options
- Kubernetes Storage
- Kubernetes Networking
- OpenStack cluster sizes
- OpenStack or Kuberbetes networking
- Ceph
- CI/CD
- Alertmanager email notifications
- Alertmanager Salesforce notifications
- OSS
- Repositories
- Nova

Salt Master

Parameter	Default JSON output	Description
Salt Master address	salt_master_address: 10.0.1.15	The IP address of the Salt Master node on the control network
Salt Master management address	salt_master_management_address: 10.0.1.15	The IP address of the Salt Master node on the management network
Salt Master hostname	salt_master_hostname: cfg01	The hostname of the Salt Master node
Secrets encryption enabled	secrets_encryption_enabled: 'False'	Encrypt sensitive data in the Reclass model
Secrets encryption private key	secrets_encryption_private_key: ''	PGP keypair for the sensitive data encryption. If not specified, the key will be generated automatically.

Ubuntu MAAS

Parameter	Default JSON output	Description
MAAS hostname	maas_hostname: cfg01	The hostname of the MAAS virtual server
MAAS deploy address	maas_deploy_address: 10.0.0.15	The IP address of the MAAS control on the deploy network
MAAS fabric name	deploy_fabric	The MAAS fabric name for the deploy network
MAAS deploy network name	deploy_network	The MAAS deploy network name
MAAS deploy range start	10.0.0.20	The first IP address of the deploy network range
MAAS deploy range end	10.0.0.230	The last IP address of the deploy network range

Publication options

Parameter	Default JSON output	Description
Email address	email_address: <your-email>	The email address where the generated Reclass model will be sent to

Kubernetes Storage

Parameter	Default JSON output	Description
Kubernetes rbd enabled	False	Enables a connection to an existing external Ceph RADOS Block Device (RBD) storage. Requires additional parameters to be configured in the Product parameters section. For details, see: Product related parameters.

Kubernetes Networking

Parameter	Default JSON output	Description
Kubernetes metallb enabled	False	Enables the MetalLB add-on that provides a network load balancer for bare metal Kubernetes clusters using standard routing protocols. For the deployment details, see: Enable the MetalLB support.

Kubernetes ingressnginx enabled	False	Enables the NGINX Ingress controller for Kubernetes. For the deployment details, see: Enable the NGINX Ingress controller.

OpenStack cluster sizes

Parameter	Default JSON output	Description
OpenStack cluster sizes	openstack_cluster_size: compact	A predefined number of compute nodes for an OpenStack cluster. Available options include: few for a minimal cloud, up to 50 for a compact cloud, up to 100 for a small cloud, up to 200 for a medium cloud, up to 500 for a large cloud.

OpenStack or Kuberbetes networking

Parameter	Default JSON output	Description
OpenStack network engine	openstack_network_engine: opencontrail	Available options include opencontrail and ovs. NFV feature generation is experimental. The OpenStack Nova compute NFV req enabled parameter is for enabling Hugepages and CPU pinning without DPDK.
Kubernetes network engine	kubernetes_network_engine: opencontrail	Available options include calico and opencontrail. This parameter is set automatically. If you uncheck the OpenContrail enabled field in the General parameters section, the default Calico plugin is set as the Kubernetes networking.

Ceph

Parameter	Default JSON output	Description
Ceph version	luminous	The Ceph version
Ceph OSD backend	bluestore	The OSD backend type

Backend network subnet	backend_network_subnet: 10.0.2.0/24	The IP address of Ceph backend network with the network mask. Used as cluster_network for OSD data replication
Backend VLAN	backend_vlan: 30	The Ceph backend VLAN ID used for OSD data replication on cluster_network

CI/CD

Parameter	Default JSON output	Description
OpenLDAP enabled	openldap_enabled: 'True'	Enables OpenLDAP authentication.
OpenLDAP name	openldap_domain: openldap-domain.local	OpenLDAP domain name. Must match the ^[a-z0-9.-]+$ regular expression and not contain any special symbols.

Alertmanager email notifications

Parameter	Default JSON output	Description
Alertmanager email notifications enabled	alertmanager_notification_email_enabled: 'False'	Enables email notifications using the Alertmanager service
Alertmanager notification email from	alertmanager_notification_email_from: john.doe@example.org	Alertmanager email notifications sender
Alertmanager notification email to	alertmanager_notification_email_to: jane.doe@example.org	Alertmanager email notifications receiver
Alertmanager email notifications SMTP host	alertmanager_notification_email_hostname: 127.0.0.1	The address of the SMTP host for alerts notifications
Alertmanager email notifications SMTP port	alertmanager_notification_email_port: 587	The address of the SMTP port for alerts notifications
Alertmanager email notifications with TLS	alertmanager_notification_email_require_tls: 'True'	Enable using of the SMTP server under TLS (for alerts notifications)

Alertmanager notification email password	alertmanager_notification_email_password: password	The sender-mail password for alerts notifications

Alertmanager Salesforce notifications

Parameter	Default JSON output	Description
Salesforce notifier SFDC authentication URL	sf_notifier_sfdc_auth_url: URL	The authentication URL for the Salesforce service
Salesforce notifier SFDC username	sf_notifier_sfdc_username: john.doe@example.org	The customer account user name for the Salesforce service
Salesforce notifier SFDC password	sf_notifier_sfdc_password: password	The customer account password for the Salesforce service
Salesforce notifier SFDC organization ID	sf_notifier_sfdc_organization_id: 0001	The organization ID for the Salesforce service
Salesforce notifier SFDC environment ID	sf_notifier_sfdc_environment_id: 0001	The cloud ID in Salesforce
Salesforce notifier SFDC sandbox enabled	sf_notifier_sfdc_sandbox_enabled: 'True'	Enable sandbox support for the Salesforce service

OSS

Parameter	Default JSON output	Description
OSS CIS enabled	cis_enabled: 'True'	Enables the Cloud Intelligence Service
OSS Security Audit enabled	oss_security_audit_enabled: 'True'	Enables the Security Audit service
OSS Cleanup Service enabled	oss_cleanup_service_enabled: 'True'	Enables the Cleanup Service
OSS SFDC support enabled	oss_sfdc_support_enabled: 'True'`	Enables synchronization of your SalesForce account with OSS

Repositories

Parameter	Default JSON output	Description
Local repositories	local_repositories: 'False'	If true, changes repositories URLs to local mirrors. The local_repo_url parameter should be added manually after model generation.

Nova

Parameter	Default JSON output	Description
Nova VNC TLS enabled	nova_vnc_tls_enabled: 'False'	If True, enables the TLS encryption for communications between the OpenStack compute nodes and VNC clients.

Product related parameters

The tables in this section outline the product configuration parameters including infrastructure, CI/CD, OpenContrail, OpenStack, Kubernetes, Stacklight LMA, and Ceph hosts details. You can configure your product infrastructure for the deployment model through the Model Designer web UI. Consult the Define the deployment model section for the complete procedure.

The Product deployment parameters wizard includes the following sections:

- Infrastructure product parameters
- CI/CD product parameters
- OSS parameters
- OpenContrail service parameters
- OpenStack product parameters
- Kubernetes product parameters
- StackLight LMA product parameters
- Ceph product parameters

Infrastructure product parameters

Section	Default JSON output	Description
Infra kvm01 hostname	infra_kvm01_hostname: kvm01	The hostname of the first KVM node
Infra kvm01 control address	infra_kvm01_control_address: 10.0.1.241	The IP address of the first KVM node on the control network
Infra kvm01 deploy address	infra_kvm01_deploy_address: 10.0.0.241	The IP address of the first KVM node on the management network
Infra kvm02 hostname	infra_kvm02_hostname: kvm02	The hostname of the second KVM node
Infra kvm02 control address	infra_kvm02_control_address: 10.0.1.242	The IP address of the second KVM node on the control network
Infra kvm02 deploy address	infra_kvm02_deploy_address: 10.0.0.242	The IP address of the second KVM node on the management network
Infra kvm03 hostname	infra_kvm03_hostname: kvm03	The hostname of the third KVM node
Infra kvm03 control address	infra_kvm03_control_address: 10.0.1.243	The IP address of the third KVM node on the control network

Infra kvm03 deploy address	infra_kvm03_deploy_address: 10.0.0.243	The IP address of the third KVM node on the management network
Infra KVM VIP address	infra_kvm_vip_address: 10.0.1.240	The virtual IP address of the KVM cluster
Infra deploy NIC	infra_deploy_nic: eth0	The NIC used for PXE of the KVM hosts
Infra primary first NIC	infra_primary_first_nic: eth1	The first NIC in the KVM bond
Infra primary second NIC	infra_primary_second_nic: eth2	The second NIC in the KVM bond
Infra bond mode	infra_bond_mode: active-backup	The bonding mode for the KVM nodes. Available options include: • active-backup • balance-xor • broadcast • 802.3ad • balance-ltb • balance-alb To decide which bonding mode best suits the needs of your deployment, you can consult the official Linux bonding documentation.
OpenStack compute count	openstack_compute_count: '100'	The number of compute nodes to be generated. The naming convention for compute nodes is cmp000 - cmp${openstack_compute_count}. If the value is 100, for example, the host names for the compute nodes expected by Salt include cmp000, cmp001, ..., cmp100.

CI/CD product parameters

Section	Default JSON output	Description
CI/CD control node01 address	cicd_control_node01_address: 10.0.1.91	The IP address of the first CI/CD control node

CI/CD control node01 hostname	cicd_control_node01_hostname: cid01	The hostname of the first CI/CD control node
CI/CD control node02 address	cicd_control_node02_address: 10.0.1.92	The IP address of the second CI/CD control nod
CI/CD control node02 hostname	cicd_control_node02_hostname: cid02	The hostname of the second CI/CD control node
CI/CD control node03 address	cicd_control_node03_address: 10.0.1.93	The IP address of the third CI/CD control node
CI/CD control node03 hostname	cicd_control_node03_hostname: cid03	The hostname of the third CI/CD control node
CI/CD control VIP address	cicd_control_vip_address: 10.0.1.90	The virtual IP address of the CI/CD control cluster
CI/CD control VIP hostname	cicd_control_vip_hostname: cid	The hostname of the CI/CD control cluster

OSS parameters

Section	Default JSON output	Description
OSS address	oss_address: ${_param:stacklight_monitor_address}	VIP address of the OSS cluster
OSS node01 address	oss_node01_addres: ${_param:stacklight_monitor01_address}	The IP address of the first OSS node
OSS node02 address	oss_node02_addres: ${_param:stacklight_monitor02_address}	The IP address of the second OSS node
OSS node03 address	oss_node03_addres: ${_param:stacklight_monitor03_address}	The IP address of the third OSS node
OSS OpenStack auth URL	oss_openstack_auth_url: http://172.17.16.190:5000/v3	OpenStack auth URL for OSS tools
OSS OpenStack username	oss_openstack_username: admin	Username for access to OpenStack
OSS OpenStack password	oss_openstack_password: nova	Password for access to OpenStack
OSS OpenStack project	oss_openstack_project: admin	OpenStack project name
OSS OpenStack domain ID	oss_openstack_domain_id: default	OpenStack domain ID
OSS OpenStack SSL verify	oss_openstack_ssl_verify: 'False'	OpenStack SSL verification mechanism

OSS OpenStack certificate	oss_openstack_cert: ''	OpenStack plain CA certificate
OSS OpenStack credentials path	oss_openstack_credentials_path: /srv/volumes/rundeck/storage	OpenStack credentials path
OSS OpenStack endpoint type	oss_openstack_endpoint_type: public	Interface type of OpenStack endpoint for service connections
OSS Rundeck external datasource enabled	oss_rundeck_external_datasource_enabled: False	Enabled external datasource (PostgreSQL) for Rundeck
OSS Rundeck forward iframe	rundeck_forward_iframe: False	Forward iframe of Rundeck through proxy
OSS Rundeck iframe host	rundeck_iframe_host: ${_param:openstack_proxy_address}	IP address for Rundeck configuration for proxy
OSS Rundeck iframe port	rundeck_iframe_port: ${_param:haproxy_rundeck_exposed_port}	Port for Rundeck through proxy
OSS Rundeck iframe ssl	rundeck_iframe_ssl: False	Secure Rundeck iframe with SSL
OSS webhook from	oss_webhook_from: TEXT	Required. Notification email sender.
OSS webhook recipients	oss_webhook_recipients: TEXT	Required. Notification email recipients.
OSS Pushkin SMTP host	oss_pushkin_smtp_host: 127.0.0.1	The address of SMTP host for alerts notifications
OSS Pushkin SMTP port	oss_pushkin_smtp_port: 587	The address of SMTP port for alerts notifications
OSS notification SMTP with TLS	oss_pushkin_smtp_use_tls: 'True'	Enable using of the SMTP server under TLS (for alert notifications)
OSS Pushkin email sender password	oss_pushkin_email_sender_password: password	The sender-mail password for alerts notifications
SFDC auth URL	N/A	Authentication URL for the Salesforce service. For example, sfdc_auth_url: https://login.salesforce.com/services/oauth2/token
SFDC username	N/A	Username for logging in to the Salesforce service. For example, sfdc_username: user@example.net

SFDC password	N/A	Password for logging in to the Salesforce service. For example, sfdc_password: secret
SFDC consumer key	N/A	Consumer Key in Salesforce required for Open Authorization (OAuth). For example, sfdc_consumer_key : example_consumer_key
SFDC consumer secret	N/A	Consumer Secret from Salesforce required for OAuth. For example, sfdc_consumer_secret: example_consumer_secret
SFDC organization ID	N/A	Salesforce Organization ID in Salesforce required for OAuth. For example, sfdc_organization_id: example_organization_id.
SFDC environment ID	sfdc_environment_id: 0	The cloud ID in Salesforce
SFDC Sandbox enabled	sfdc_sandbox_enabled: True	Sandbox environments are isolated from production Salesforce clouds. Enable sandbox to use it for testing and evaluation purposes. Verify that you specify the correct sandbox-url value in the sfdc_auth_url parameter. Otherwise, set the parameter to False.
OSS CIS username	oss_cis_username: ${_param:oss_openstack_username}	CIS username
OSS CIS password	oss_cis_password: ${_param:oss_openstack_password}	CIS password
OSS CIS OpenStack auth URL	oss_cis_os_auth_url: ${_param:oss_openstack_auth_url}	CIS OpenStack authentication URL
OSS CIS OpenStack endpoint type	oss_cis_endpoint_type: ${_param:oss_openstack_endpoint_type}	CIS OpenStack endpoint type
OSS CIS project	oss_cis_project: ${_param:oss_openstack_project}	CIS OpenStack project

OSS CIS domain ID	oss_cis_domain_id: ${_param:oss_openstack_domain_id}	CIS OpenStack domain ID
OSS CIS certificate	oss_cis_cacert: ${_param:oss_openstack_cert}	OSS CIS certificate
OSS CIS jobs repository	oss_cis_jobs_repository: https://github.com/Mirantis/rundeck-cis-jobs.git	CIS jobs repository
OSS CIS jobs repository branch	oss_cis_jobs_repository_branch: master	CIS jobs repository branch
OSS Security Audit username	oss_security_audit_username: ${_param:oss_openstack_username}	Security audit service username
OSS Security Audit password	oss_security_audit_password: ${_param:oss_openstack_password}	Security Audit service password
OSS Security Audit auth URL	name: oss_security_audit_os_auth_url: ${_param:oss_openstack_auth_url}	Security Audit service authentication URL
OSS Security Audit project	oss_security_audit_project: ${_param:oss_openstack_project}	Security Audit project name
OSS Security Audit user domain ID	oss_security_audit_user_domain_id: ${_param:oss_openstack_domain_id}	Security Audit user domain ID
OSS Security Audit project domain ID	oss_security_audit_project_domain_id: ${_param:oss_openstack_domain_id}	Security Audit project domain ID
OSS Security Audit OpenStack credentials path	oss_security_audit_os_credentials_path: ${_param:oss_openstack_credentials_path}	Path to credentials for OpenStack cloud for the Security Audit service
OSS Cleanup service Openstack credentials path	oss_cleanup_service_os_credentials_path: ${_param:oss_openstack_credentials_path}	Path to credentials for OpenStack cloud for the Cleanup service
OSS Cleanup service username	oss_cleanup_username: ${_param:oss_openstack_username}	Cleanup service username
OSS Cleanup service password	oss_cleanup_password: ${_param:oss_openstack_password}	Cleanup service password
OSS Cleanup service auth URL	oss_cleanup_service_os_auth_url: ${_param:oss_openstack_auth_url}	Cleanup service authentication URL
OSS Cleanup service project	oss_cleanup_project: ${_param:oss_openstack_project}	Cleanup service project name
OSS Cleanup service project domain ID	oss_cleanup_project_domain_id: ${_param:oss_openstack_domain_id}	Cleanup service project domain ID

OpenContrail service parameters

Section	Default JSON output	Description
OpenContrail analytics address	opencontrail_analytics_address: 10.0.1.30	The virtual IP address of the OpenContrail analytics cluster
OpenContrail analytics hostname	opencontrail_analytics_hostname: nal	The hostname of the OpenContrail analytics cluster
OpenContrail analytics node01 address	opencontrail_analytics_node01_address: 10.0.1.31	The virtual IP address of the first OpenContrail analytics node on the control network
OpenContrail analytics node01 hostname	opencontrail_analytics_node01_hostname: nal01	The hostname of the first OpenContrail analytics node on the control network
OpenContrail analytics node02 address	opencontrail_analytics_node02_address: 10.0.1.32	The virtual IP address of the second OpenContrail analytics node on the control network
OpenContrail analytics node02 hostname	opencontrail_analytics_node02_hostname: nal02	The hostname of the second OpenContrail analytics node on the control network
OpenContrail analytics node03 address	opencontrail_analytics_node03_address: 10.0.1.33	The virtual IP address of the third OpenContrail analytics node on the control network
OpenContrail analytics node03 hostname	opencontrail_analytics_node03_hostname: nal03	The hostname of the second OpenContrail analytics node on the control network
OpenContrail control address	opencontrail_control_address: 10.0.1.20	The virtual IP address of the OpenContrail control cluster
OpenContrail control hostname	opencontrail_control_hostname: ntw	The hostname of the OpenContrail control cluster
OpenContrail control node01 address	opencontrail_control_node01_address: 10.0.1.21	The virtual IP address of the first OpenContrail control node on the control network
OpenContrail control node01 hostname	opencontrail_control_node01_hostname: ntw01	The hostname of the first OpenContrail control node on the control network
OpenContrail control node02 address	opencontrail_control_node02_address: 10.0.1.22	The virtual IP address of the second OpenContrail control node on the control network

OpenContrail control node02 hostname	opencontrail_control_node02_hostname: ntw02	The hostname of the second OpenContrail control node on the control network
OpenContrail control node03 address	opencontrail_control_node03_address: 10.0.1.23	The virtual IP address of the third OpenContrail control node on the control network
OpenContrail control node03 hostname	opencontrail_control_node03_hostname: ntw03	The hostname of the third OpenContrail control node on the control network
OpenContrail router01 address	opencontrail_router01_address: 10.0.1.100	The IP address of the first OpenContrail gateway router for BGP
OpenContrail router01 hostname	opencontrail_router01_hostname: rtr01	The hostname of the first OpenContrail gateway router for BGP
OpenContrail router02 address	opencontrail_router02_address: 10.0.1.101	The IP address of the second OpenContrail gateway router for BGP
OpenContrail router02 hostname	opencontrail_router02_hostname: rtr02	The hostname of the second OpenContrail gateway router for BGP

OpenStack product parameters

Section	Default JSON output	Description
Compute primary first NIC	compute_primary_first_nic: eth1	The first NIC in the OpenStack compute bond
Compute primary second NIC	compute_primary_second_nic: eth2	The second NIC in the OpenStack compute bond
Compute bond mode	compute_bond_mode: active-backup	The bond mode for the compute nodes
OpenStack compute rack01 hostname	openstack_compute_rack01_hostname: cmp	The compute hostname prefix
OpenStack compute rack01 single subnet	openstack_compute_rack01_single_subnet: 10.0.0.1	The Control plane network prefix for compute nodes
OpenStack compute rack01 tenant subnet	openstack_compute_rack01_tenant_subnet: 10.0.2	The data plane netwrok prefix for compute nodes

OpenStack control address	openstack_control_address: 10.0.1.10	The virtual IP address of the control cluster on the control network
OpenStack control hostname	openstack_control_hostname: ctl	The hostname of the VIP control cluster
OpenStack control node01 address	openstack_control_node01_address: 10.0.1.11	The IP address of the first control node on the control network
OpenStack control node01 hostname	openstack_control_node01_hostname: ctl01	The hostname of the first control node
OpenStack control node02 address	openstack_control_node02_address: 10.0.1.12	The IP address of the second control node on the control network
OpenStack control node02 hostname	openstack_control_node02_hostname: ctl02	The hostname of the second control node
OpenStack control node03 address	openstack_control_node03_address: 10.0.1.13	The IP address of the third control node on the control network
OpenStack control node03 hostname	openstack_control_node03_hostname: ctl03	The hostname of the third control node
OpenStack database address	openstack_database_address: 10.0.1.50	The virtual IP address of the database cluster on the control network
OpenStack database hostname	openstack_database_hostname: dbs	The hostname of the VIP database cluster
OpenStack database node01 address	openstack_database_node01_address: 10.0.1.51	The IP address of the first database node on the control network
OpenStack database node01 hostname	openstack_database_node01_hostname: dbs01	The hostname of the first database node
OpenStack database node02 address	openstack_database_node02_address: 10.0.1.52	The IP address of the second database node on the control network
OpenStack database node02 hostname	openstack_database_node02_hostname: dbs02	The hostname of the second database node
OpenStack database node03 address	openstack_database_node03_address: 10.0.1.53	The IP address of the third database node on the control network

OpenStack database node03 hostname	openstack_database_node03_hostname: dbs03	The hostname of the third database node
OpenStack message queue address	openstack_message_queue_address: 10.0.1.40	The vitrual IP address of the message queue cluster on the control network
OpenStack message queue hostname	openstack_message_queue_hostname: msg	The hostname of the VIP message queue cluster
OpenStack message queue node01 address	openstack_message_queue_node01_address: 10.0.1.41	The IP address of the first message queue node on the control network
OpenStack message queue node01 hostname	openstack_message_queue_node01_hostname: msg01	The hostname of the first message queue node
OpenStack message queue node02 address	openstack_message_queue_node02_address: 10.0.1.42	The IP address of the second message queue node on the control network
OpenStack message queue node02 hostname	openstack_message_queue_node02_hostname: msg02	The hostname of the second message queue node
OpenStack message queue node03 address	openstack_message_queue_node03_address: 10.0.1.43	The IP address of the third message wueue node on the control network
OpenStack message queue node03 hostname	openstack_message_queue_node03_hostname: msg03	The hostname of the third message queue node
OpenStack benchmark node01 address	openstack_benchmark_node01_address: 10.0.1.95	The IP address of a benchmark node on the control network
OpenStack benchmark node01 hostname	openstack_benchmark_node01_hostname: bmk01	The hostname of a becnhmark node
Openstack octavia enabled	False	Enable the Octavia Load Balancing-as-a-Service for OpenStack. Requires OVS OpenStack to be enabled as a networking engine in Infrastructure related parameters.

OpenStack proxy address	openstack_proxy_address: 10.0.1.80	The virtual IP address of a proxy cluster on the control network
OpenStack proxy hostname	openstack_proxy_hostname: prx	The hostname of the VIP proxy cluster
OpenStack proxy node01 address	openstack_proxy_node01_address: 10.0.1.81	The IP address of the first proxy node on the control network
OpenStack proxy node01 hostname	openstack_proxy_node01_hostname: prx01	The hostname of the first proxy node
OpenStack proxy node02 address	openstack_proxy_node02_address: 10.0.1.82	The IP address of the second proxy node on the control network
OpenStack proxy node02 hostname	openstack_proxy_node02_hostname: prx02	The hostname of the second proxy node
OpenStack version	openstack_version: pike	The version of OpenStack to be deployed
Manila enabled	False	Enable the Manila OpenStack Shared File Systems service
Manila share backend	LVM	Enable the LVM Manila share backend
Manila lvm volume name	manila-volume	The Manila LVM volume name
Manila lvm devices	/dev/sdb,/dev/sdc	The comma-separated paths to the Manila LVM devices
Ironic enabled	false	Enable OpenStack Ironic. For the deployment details, see Deploy Ironic.
Tenant Telemetry enabled	false	Enable Tenant Telemetry based on Ceilometer, Aodh, Panko, and Gnocchi. Disabled by default. If enabled, you can select the Gnocchi aggregation storage type for metrics: ceph, file, or redis storage drivers. Tenant Telemetry does not support integration with StackLight LMA.
Gnocchi aggregation storage	gnocchi_aggregation_storage: file	Storage for aggregated metrics

Designate enabled	designate_enabled: 'False'	Enables OpenStack DNSaaS based on Designate
Designate backend	designate_backend: powerdns	The DNS backend for Designate
OpenStack internal protocol	openstack_internal_protocol: http	The protocol on internal OpenStack endpoints

Kubernetes product parameters

Section	Default JSON output	Description
Calico enable nat	calico_enable_nat: 'True'	If selected, NAT will be enabled for Calico
Calico netmask	16	The netmask of the Calico network
Calico network	192.168.0.0	The network that is used for the Kubernetes containers
etcd SSL	etcd_ssl: 'True'	If selected, the SSL for etcd will be enabled
Kubernetes virtlet enabled	False	Optional. Virtlet enables Kubernetes to run virtual machines. For the enablement details, see Enable Virtlet. Virtlet with OpenContrail is available as technical preview. Use such configuration for testing and evaluation purposes only.
Kubernetes externaldns enabled	False	If selected, ExternalDNS will be deployed. For details, see: Deploy ExternalDNS for Kubernetes.
Kubernetes metrics server enabled	False	If selected, the metrics-server add-on will be deployed to enable horizontal pod autoscaling. For details, see: Enable horizontal pod autoscaling.

Kubernetes rbd monitors	10.0.1.66:6789,10.0.1.67:6789,10.0.1.68:6789	A comma-separated list of the Ceph RADOS Block Device (RBD) monitors in a Ceph cluster that will be connected to Kubernetes. This parameter becomes available if you select the Kubernetes rbd enabled option in the Infrastructure parameters section.
Kubernetes rbd pool	kubernetes	A pool in a Ceph cluster that will be connected to Kubernetes. This parameter becomes available if you select the Kubernetes rbd enabled option in the Infrastructure parameters section.
Kubernetes rbd user id	kubernetes	A Ceph RBD user ID of a Ceph cluster that will be connected to Kubernetes. This parameter becomes available if you select the Kubernetes rbd enabled option in the Infrastructure parameters section.
Kubernetes rbd user key	kubernetes_key	A Ceph RBD user key of a Ceph cluster that will be connected to Kubernetes. This parameter becomes available if you select the Kubernetes rbd enabled option in the Infrastructure parameters section.
Kubernetes compute node01 hostname	cmp01	The hostname of the first Kubernetes compute node
Kubernetes compute node01 deploy address	10.0.0.101	The IP address of the first Kubernetes compute node
Kubernetes compute node01 single address	10.0.1.101	The IP address of the first Kubernetes compute node on the Control plane

Kubernetes compute node01 tenant address	10.0.2.101	The tenant IP address of the first Kubernetes compute node
Kubernetes compute node02 hostname	cmp02	The hostname of the second Kubernetes compute node
Kubernetes compute node02 deploy address	10.0.0.102	The IP address of the second Kubernetes compute node on the deploy network
Kubernetes compute node02 single address	10.0.1.102	The IP address of the second Kubernetes compute node on the control plane
Kubernetes control address	10.0.1.10	The Keepalived VIP of the Kubernetes control nodes
Kubernetes control node01 address	10.0.1.11	The IP address of the first Kubernetes controller node
Kubernetes control node01 deploy address	10.0.0.11	The IP address of the first Kubernetes control node on the deploy network
Kubernetes control node01 hostname	ctl01	The hostname of the first Kubernetes controller node
Kubernetes control node01 tenant address	10.0.2.11	The tenant IP address of the first Kubernetes controller node
Kubernetes control node02 address	10.0.1.12	The IP address of the second Kubernetes controller node
Kubernetes control node02 deploy address	10.0.0.12	The IP address of the second Kubernetes control node on the deploy network
Kubernetes control node02 hostname	ctl02	The hostname of the second Kubernetes controller node
Kubernetes control node02 tenant address	10.0.2.12	The tenant IP address of the second Kubernetes controller node
Kubernetes control node03 address	10.0.1.13	The IP address of the third Kubernetes controller node
Kubernetes control node03 tenant address	10.0.2.13	The tenant IP address of the third Kubernetes controller node

Kubernetes control node03 deploy address	10.0.0.13	The IP address of the third Kubernetes control node on the deploy network
Kubernetes control node03 hostname	ctl03	The hostname of the third Kubernetes controller node
OpenContrail public ip range	10.151.0.0/16	The public floating IP pool for OpenContrail
Opencontrail private ip range	10.150.0.0/16	The range of private OpenContrail IPs used for pods
Kubernetes keepalived vip interface	ens4	The Kubernetes interface used for the Keepalived VIP

StackLight LMA product parameters

Section	Default JSON output	Description
StackLight LMA log address	stacklight_log_address: 10.167.4.60	The virtual IP address of the StackLight LMA logging cluster
StackLight LMA log hostname	stacklight_log_hostname: log	The hostname of the StackLight LMA logging cluster
StackLight LMA log node01 address	stacklight_log_node01_address: 10.167.4.61	The IP address of the first StackLight LMA logging node
StackLight LMA log node01 hostname	stacklight_log_node01_hostname: log01	The hostname of the first StackLight LMA logging node
StackLight LMA log node02 address	stacklight_log_node02_address: 10.167.4.62	The IP address of the second StackLight LMA logging node
StackLight LMA log node02 hostname	stacklight_log_node02_hostname: log02	The hostname of the second StackLight LMA logging node
StackLight LMA log node03 address	stacklight_log_node03_address: 10.167.4.63	The IP address of the third StackLight LMA logging node
StackLight LMA log node03 hostname	stacklight_log_node03_hostname: log03	The hostname of the third StackLight LMA logging node
StackLight LMA monitor address	stacklight_monitor_address: 10.167.4.70	The virtual IP address of the StackLight LMA monitoring cluster
StackLight LMA monitor hostname	stacklight_monitor_hostname: mon	The hostname of the StackLight LMA monitoring cluster

StackLight LMA monitor node01 address	stacklight_monitor_node01_address: 10.167.4.71	The IP address of the first StackLight LMA monitoring node
StackLight LMA monitor node01 hostname	stacklight_monitor_node01_hostname: mon01	The hostname of the first StackLight LMA monitoring node
StackLight LMA monitor node02 address	stacklight_monitor_node02_address: 10.167.4.72	The IP address of the second StackLight LMA monitoring node
StackLight LMA monitor node02 hostname	stacklight_monitor_node02_hostname: mon02	The hostname of the second StackLight LMA monitoring node
StackLight LMA monitor node03 address	stacklight_monitor_node03_address: 10.167.4.73	The IP address of the third StackLight LMA monitoring node
StackLight LMA monitor node03 hostname	stacklight_monitor_node03_hostname: mon03	The hostname of the third StackLight LMA monitoring node
StackLight LMA telemetry address	stacklight_telemetry_address: 10.167.4.85	The virtual IP address of a StackLight LMA telemetry cluster
StackLight LMA telemetry hostname	stacklight_telemetry_hostname: mtr	The hostname of a StackLight LMA telemetry cluster
StackLight LMA telemetry node01 address	stacklight_telemetry_node01_address: 10.167.4.86	The IP address of the first StackLight LMA telemetry node
StackLight LMA telemetry node01 hostname	stacklight_telemetry_node01_hostname: mtr01	The hostname of the first StackLight LMA telemetry node
StackLight LMA telemetry node02 address	stacklight_telemetry_node02_address: 10.167.4.87	The IP address of the second StackLight LMA telemetry node
StackLight LMA telemetry node02 hostname	stacklight_telemetry_node02_hostname: mtr02	The hostname of the second StackLight LMA telemetry node
StackLight LMA telemetry node03 address	stacklight_telemetry_node03_address: 10.167.4.88	The IP address of the third StackLight LMA telemetry node
StackLight LMA telemetry node03 hostname	stacklight_telemetry_node03_hostname: mtr03	The hostname of the third StackLight LMA telemetry node

Long-term storage type	stacklight_long_term_storage_type: prometheus	The type of the long-term storage Warning InfluxDB, including InfluxDB Relay and remote storage adapter, is deprecated in the Q4`18 MCP release and will be removed in the next release.
OSS webhook login ID	oss_webhook_login_id: 13	The webhook login ID for alerts notifications
OSS webhook app ID	oss_webhook_app_id: 24	The webhook application ID for alerts notifications
Gainsight account ID	N/A	The customer account ID in Salesforce
Gainsight application organization ID	N/A	Mirantis organization ID in Salesforce
Gainsight access key	N/A	The access key for the Salesforce Gainsight service
Gainsight CSV upload URL	N/A	The URL to Gainsight API
Gainsight environment ID	N/A	The customer environment ID in Salesforce
Gainsight job ID	N/A	The job ID for the Salesforce Gainsight service
Gainsight login	N/A	The login for the Salesforce Gainsight service

Ceph product parameters

Section	Default JSON output	Description
Ceph RGW address	ceph_rgw_address: 172.16.47.75	The IP address of the Ceph RGW storage cluster
Ceph RGW hostname	ceph_rgw_hostname: rgw	The hostname of the Ceph RGW storage cluster

Ceph MON node01 address	ceph_mon_node01_address: 172.16.47.66	The IP address of the first Ceph MON storage node
Ceph MON node01 hostname	ceph_mon_node01_hostname: cmn01	The hostname of the first Ceph MON storage node
Ceph MON node02 address	ceph_mon_node02_address: 172.16.47.67	The IP address of the second Ceph MON storage node
Ceph MON node02 hostname	ceph_mon_node02_hostname: cmn02	The hostname of the second Ceph MON storage node
Ceph MON node03 address	ceph_mon_node03_address: 172.16.47.68	The IP address of the third Ceph MON storage node
Ceph MON node03 hostname	ceph_mon_node03_hostname: cmn03	The hostname of the third Ceph MON storage node
Ceph RGW node01 address	ceph_rgw_node01_address: 172.16.47.76	The IP address of the first Ceph RGW node
Ceph RGW node01 hostname	ceph_rgw_node01_hostname: rgw01	The hostname of the first Ceph RGW storage node
Ceph RGW node02 address	ceph_rgw_node02_address: 172.16.47.77	The IP address of the second Ceph RGW storage node
Ceph RGW node02 hostname	ceph_rgw_node02_hostname: rgw02	The hostname of the second Ceph RGW storage node
Ceph RGW node03 address	ceph_rgw_node03_address: 172.16.47.78	The IP address of the third Ceph RGW storage node
Ceph RGW node03 hostname	ceph_rgw_node03_hostname: rgw03	The hostname of the third Ceph RGW storage node
Ceph OSD node count	ceph_osd_node_count: 3	The number of OSD hosts
OSD padding with zeros	osd_padding_with_zeros: 'True'	Enables padding with zeros when generating Ceph OSD host names. For example, name the node as osd001 if enabled, otherwise, osd1
Ceph OSD count	ceph_osd_count: 10	The number of OSDs
Ceph OSD rack01 hostname	ceph_osd_rack01_hostname: osd	The OSD rack01 hostname
Ceph OSD single address ranges	ceph_osd_single_address_ranges	The control plane network ranges for Ceph OSDs. A comma-separated list of IP ranges, for example, 172.16.10.101-172.16.10.200,172.16.20.101-172.16.20.200

Ceph OSD backend address ranges	ceph_osd_backend_address_ranges	The cluster network ranges for Ceph OSDs, used to replicate the OSDs data. A comma-separated list of IP ranges, for example, 172.16.10.101-172.16.10.200,172.16.20.101-172.16.20.200
Ceph OSD deploy address ranges	ceph_osd_deploy_address_ranges	The deploy network ranges for Ceph OSDs. A comma-separated list of IP ranges, for example, 172.16.10.101-172.16.10.200,172.16.20.101-172.16.20.200
Ceph OSD rack01 single subnet	ceph_osd_rack01_single_subnet: 172.16.47	The control plane network prefix for Ceph OSDs
Ceph OSD rack01 backend subnet	ceph_osd_rack01_backend_subnet: 172.16.48	The deploy network prefix for Ceph OSDs
Ceph public network	ceph_public_network: 172.16.47.0/24	The IP address of Ceph public network with the network mask
Ceph cluster network	ceph_cluster_network: 172.16.48.70/24	The IP address of Ceph cluster network with the network mask
Ceph OSD block DB size	ceph_osd_block_db_size: 20	The Ceph OSD block DB size in GB
Ceph OSD primary first NIC	ceph_osd_primary_first_nic: eth1	The first NIC of Ceph OSD bond used for Ceph communication
Ceph OSD primary second NIC	ceph_osd_primary_second_nic: eth2	The second NIC of Ceph OSD bond used for Ceph communication
Ceph OSD bond mode	ceph_osd_bond_mode: active-backup	The bonding mode for Ceph OSD communication
Ceph OSD data disks	ceph_osd_data_disks: /dev/vdd,/dev/vde	The list of OSD data disks
Ceph OSD journal or block DB disks	ceph_osd_journal_or_block_db_disks: /dev/vdb,/dev/vdc	The list of journal or block disks

Publish the deployment model to a project repository

If you selected the option to receive the generated deployment model to your email address and customized it as required, you need to apply the model to the project repository.

To publish the metadata model, push the changes to the project Git repository:

```
git add *
git commit –m "Initial commit"

git pull -r
git push --set-upstream origin master
```

Seealso

Deployment automation

Deploy MCP DriveTrain

To reduce the deployment time and eliminate possible human errors, Mirantis recommends that you use the semi-automated approach to the MCP DriveTrain deployment as described in this section.

> Caution!
>
> The execution of the CLI commands used in the MCP Deployment Guide requires root privileges. Therefore, unless explicitly stated otherwise, run the commands as a root user or use sudo.

The deployment of MCP DriveTrain bases on the bootstrap automation of the Salt Master node. On a Reclass model creation, you receive the configuration drives by the email that you specified during the deployment model generation.

Depending on the deployment type, you receive the following configuration drives:

- For an online and offline deployment, the configuration drive for the cfg01 VM that is used in cloud-init to set up a virtual machine with Salt Master, MAAS provisioner, Jenkins server, and local Git server installed on it.
- For an offline deployment, the configuration drive for the APT VM that is used in cloud-init to set up a virtual machine with all required repositories mirrors.

The high-level workflow of the MCP DriveTrain deployment

#	Description
1	Manually deploy and configure the Foundation node as described in Prerequisites for MCP DriveTrain deployment.
2	Create the deployment model using the Model Designer web UI as described in Create a deployment metadata model.
3	Obtain the pre-built ISO configuration drive(s) with the Reclass deployment metadata model to you email. If required, customize and regenerate the configuration drives as described in Generate configuration drives manually.
4	Bootstrap the APT node. Optional, for an offline deployment only. For details, see: Deploy the APT node.
5	Bootstrap the Salt Master node that contains MAAS provisioner, Jenkins server, and local Git server. For details, see: Deploy the Salt Master node.
6	Deploy the remaining bare metal servers using the MAAS provisioner. For details, see: Provision physical nodes using MAAS and Deploy physical nodes.
7	Deploy MCP CI/CD using Jenkins as described in Deploy CI/CD.

Prerequisites for MCP DriveTrain deployment

Before you proceed with the actual deployment, verify that you have performed the following steps:

1. Deploy the Foundation physical node using one of the initial versions of Ubuntu Xenial, for example, 16.04.1.

   Use any standalone hardware node where you can run a KVM-based day01 virtual machine with an access to the deploy/control network. The Foundation node will host the Salt Master node that also includes the MAAS provisioner by default. For the offline case deployment, the Foundation node will also host the mirror VM.

2. Depending on your case, proceed with one of the following options:

   - If you do not have a deployment metadata model:

     1. Create a model using the Model Designer UI as described in Create a deployment metadata model.

        > Note
        >
        > For an offline deployment, select the Offline deployment and Local repositories options under the Repositories section on the Infrastructure parameters tab.

     2. Customize the obtained configuration drives as described in Generate configuration drives manually. For example, enable custom user access.

   - If you use an already existing model that does not have configuration drives, or you want to generate updated configuration drives, proceed with Generate configuration drives manually.

3. Configure the following bridges on the Foundation node: br-mgm for the management network and br-ctl for the control network.

   1. Log in to the Foundation node through IPMI.

      > Note
      >
      > If the IPMI network is not reachable from the management or control network, add the br-ipmi bridge for the IPMI network or any other network that is routed to the IPMI network.

   2. Create PXE bridges to provision network on the foundation node:

```
brctl addbr br-mgm
brctl addbr br-ctl
```

3. Install the br-ctl utility:

```
apt install bridge-utils
```

4. Add the bridges definition for br-mgm and br-ctl to /etc/network/interfaces. Use definitions from your deployment metadata model.

   Example:

```
auto br-mgm
iface br-mgm inet static
        address 172.17.17.200
        netmask 255.255.255.192
        bridge_ports bond0
```

5. Restart networking from the IPMI console to bring the bonds up.
6. Verify that the foundation node bridges are up by checking the output of the ip a show command:

```
ip a show br-ctl
```

   Example of system response:

```
8: br-ctl: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP group default qlen 1000
   link/ether 00:1b:21:93:c7:c8 brd ff:ff:ff:ff:ff:ff
   inet 172.17.45.241/24 brd 172.17.45.255 scope global br-ctl
      valid_lft forever preferred_lft forever
   inet6 fe80::21b:21ff:fe93:c7c8/64 scope link
      valid_lft forever preferred_lft forever
```

4. Depending on your case, proceed with one of the following options:

   - If you perform an online deployment, proceed to Deploy the Salt Master node.
   - If you perform the offline deployment or online deployment with local mirrors, proceed to Deploy the APT node.

Deploy the APT node

MCP enables you to deploy the whole MCP cluster without access to the Internet. On creating the metadata model, along with the configuration drive for the cfg01 VM, you will obtain a preconfigured QCOW2 image that will contain packages, Docker images, operating system images, Git repositories, and other software required specifically for the offline deployment.

This section describes how to deploy the apt01 VM using the prebuilt configuration drive.

> Warning
>
> Perform the procedure below only in case of an offline deployment or when using a local mirror from the prebuilt image.

To deploy the APT node:

1. Verify that you completed steps described in Prerequisites for MCP DriveTrain deployment.
2. Log in to the Foundation node.

   > Note
   >
   > Root privileges are required for following steps. Execute the commands as a root user or use sudo.

3. Download the latest version of the prebuilt http://images.mirantis.com/mcp-offline-image-<BUILD-ID>.qcow2 image for the apt node from http://images.mirantis.com.
4. In the /var/lib/libvirt/images/ directory, create an apt01/ subdirectory where the offline mirror image will be stored:

   > Note
   >
   > You can create and use a different subdirectory in /var/lib/libvirt/images/. If that is the case, verify that you specify the correct directory for the VM_*DISK variables described in next steps.

   ```
   mkdir -p /var/lib/libvirt/images/apt01/
   ```

5. Save the image on the Foundation node as /var/lib/libvirt/images/apt01/system.qcow2.

6. Copy the configuration ISO drive for the APT VM provided with the metadata model for the offline image to, for example, /var/lib/libvirt/images/apt01/.

   > **Caution!**
   >
   > By default, the prebuilt image does not have a possibility to log in to.

   > **Note**
   >
   > If you are using an already existing model that does not have configuration drives, or you want to generate updated configuration drives, for example, with an unlocked root login for debugging purposes, proceed with Generate configuration drives manually.

   ```
   cp /path/to/prepared-drive/apt01-config.iso /var/lib/libvirt/images/apt01/apt01-config.iso
   ```

7. Deploy the APT node:

   1. Download the shell script from GitHub:

      ```
      export MCP_VERSION="master"
      wget https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/predefine-vm/define-vm.sh
      ```

   2. Make the script executable, export the required variables:

      ```
      chmod +x define-vm.sh
      export VM_NAME="apt01.<CLUSTER_DOMAIN>"
      export VM_SOURCE_DISK="/var/lib/libvirt/images/apt01/system.qcow2"
      export VM_CONFIG_DISK="/var/lib/libvirt/images/apt01/apt01-config.iso"
      ```

      The CLUSTER_DOMAIN value is the cluster domain name used for the model. See Basic deployment parameters for details.

      > **Note**
      >
      > You may add other optional variables that have default values and change them depending on your deployment configuration. These variables include:
      >
      > - VM_MGM_BRIDGE_NAME="br-mgm"
      > - VM_CTL_BRIDGE_NAME="br-ctl"

- VM_MEM_KB="12589056"
- VM_CPUS="4"

The recommended VM_MEM_KB for the Salt Master node is 12589056 (or more depending on your cluster size) that is 12 GB of RAM. For large clusters, you should also increase VM_CPUS.

The recommended VM_MEM_KB for the local mirror node is 8388608 (or more) that is 8 GB of RAM.

The br-mgm and br-ctl values are the names of the Linux bridges. See Prerequisites for MCP DriveTrain deployment for details. Custom names can be passed to a VM definition using the VM_MGM_BRIDGE_NAME and VM_CTL_BRIDGE_NAME variables accordingly.

3. Run the shell script:

```
./define-vm.sh
```

8. Start the apt01 VM:

```
virsh start apt01.<CLUSTER_DOMAIN>
```

9. For MCP versions prior to the 2019.2.14 maintenance update, perform the following additional steps:

   1. SSH to the apt01 node.
   2. Verify the certificate:

   ```
   openssl x509 -checkend 1 -in /var/lib/docker/swarm/certificates/swarm-node.crt
   ```

   If the certificate has expired, restart Docker Swarm to regenerate it:

   ```
   systemctl stop docker || true
   rm -rf /var/lib/docker/swarm/*
   systemctl restart docker
   sleep 5
   docker ps
   docker swarm init --advertise-addr 127.0.0.1
   sleep 5
   cd /etc/docker/compose/docker/
   docker stack deploy --compose-file docker-compose.yml docker
   sleep 5
   ```

```
cd /etc/docker/compose/aptly/
docker stack deploy --compose-file docker-compose.yml aptly
sleep 5
docker ps
```

After completing the steps above, you obtain the apt01 node that contains only the pre-built content. Now, you can proceed with Deploy the Salt Master node. Once you deploy the Salt Master node, you will be able to customize the content of the local mirror, as described in Customize the prebuilt mirror node.

Seealso

- MCP Release Notes: Release artifacts
- Customize the prebuilt mirror node

Deploy the Salt Master node

The Salt Master node acts as a central control point for the clients that are called Salt minion nodes. The minions, in their turn, connect back to the Salt Master node.

This section describes how to set up a virtual machine with Salt Master, MAAS provisioner, Jenkins server, and local Git server. The procedure is applicable to both online and offline MCP deployments.

To deploy the Salt Master node:

1. Log in to the Foundation node.

   > Note
   >
   > Root privileges are required for following steps. Execute the commands as a root user or use sudo.

2. In case of an offline deployment, replace the content of the /etc/apt/sources.list file with the following lines:

   ```
   deb [arch=amd64] http://<local_mirror_url>/ubuntu xenial-security main universe restricted
   deb [arch=amd64] http://<local_mirror_url>/ubuntu xenial-updates main universe restricted
   deb [arch=amd64] http://<local_mirror_url>/ubuntu xenial main universe restricted
   ```

3. Create a directory for the VM system disk:

   > Note
   >
   > You can create and use a different subdirectory in /var/lib/libvirt/images/. If that is the case, verify that you specify the correct directory for the VM_*DISK variables described in next steps.

   ```
   mkdir -p /var/lib/libvirt/images/cfg01/
   ```

4. Download the day01 image for the cfg01 node:

   ```
   wget http://images.mirantis.com/cfg01-day01-<BUILD_ID>.qcow2 -O \
   /var/lib/libvirt/images/cfg01/system.qcow2
   ```

   Substitute <BUILD_ID> with the required MCP Build ID, for example, 2019.2.0.

5. Copy the configuration ISO drive for the cfg01 VM provided with the metadata model for the offline image to, for example, /var/lib/libvirt/images/cfg01/cfg01-config.iso.

Note

If you are using an already existing model that does not have configuration drives, or you want to generate updated configuration drives, for example, with an unlocked root login for debugging purposes, proceed with Generate configuration drives manually.

Caution!

Make sure to securely back up the configuration ISO drive image. This image contains critical information required to re-install your cfg01 node in case of storage failure, including master key for all encrypted secrets in the cluster metadata model.

Failure to back up the configuration ISO image may result in loss of ability to manage MCP in certain hardware failure scenarios.

```
cp /path/to/prepared-drive/cfg01-config.iso /var/lib/libvirt/images/cfg01/cfg01-config.iso
```

6. Create the Salt Master VM domain definition using the example script:
    1. Download the shell scripts from GitHub with the required MCP release version. For example:

    ```
    export MCP_VERSION="2019.2.0"
    git clone https://github.com/Mirantis/mcp-common-scripts -b release/${MCP_VERSION}
    ```

    2. Make the script executable and export the required variables:

    ```
    cd mcp-common-scripts/predefine-vm/
    export VM_NAME="cfg01.[CLUSTER_DOMAIN]"
    export VM_SOURCE_DISK="/var/lib/libvirt/images/cfg01/system.qcow2"
    export VM_CONFIG_DISK="/var/lib/libvirt/images/cfg01/cfg01-config.iso"
    ```

    The CLUSTER_DOMAIN value is the cluster domain name used for the model. See Basic deployment parameters for details.

    Note

    You may add other optional variables that have default values and change them depending on your deployment configuration. These variables include:

- VM_MGM_BRIDGE_NAME="br-mgm"
- VM_CTL_BRIDGE_NAME="br-ctl"
- VM_MEM_KB="12589056"
- VM_CPUS="4"

The recommended VM_MEM_KB for the Salt Master node is 12589056 (or more depending on your cluster size) that is 12 GB of RAM. For large clusters, you should also increase VM_CPUS.

The recommended VM_MEM_KB for the local mirror node is 8388608 (or more) that is 8 GB of RAM.

The br-mgm and br-ctl values are the names of the Linux bridges. See Prerequisites for MCP DriveTrain deployment for details. Custom names can be passed to a VM definition using the VM_MGM_BRIDGE_NAME and VM_CTL_BRIDGE_NAME variables accordingly.

3. Run the shell script:

```
./define-vm.sh
```

7. Start the Salt Master node VM:

```
virsh start cfg01.[CLUSTER_DOMAIN]
```

8. Log in to the Salt Master virsh console with the user name and password that you created in step 4 of the Generate configuration drives manually procedure:

```
virsh console cfg01.[CLUSTER_DOMAIN]
```

9. If you use local repositories, verify that mk-pipelines are present in /home/repo/mk and pipeline-library is present in /home/repo/mcp-ci after cloud-init finishes. If not, fix the connection to local repositories and run the /var/lib/cloud/instance/scripts/part-001 script.
10. Verify that the following states are successfully applied during the execution of cloud-init:

```
salt-call state.sls linux.system,linux,openssh,salt
salt-call state.sls maas.cluster,maas.region,reclass
```

Otherwise, fix the pillar and re-apply the above states.

11. In case of using kvm01 as the Foundation node, perform the following steps on it:

1. Depending on the deployment type, proceed with one of the options below:
   - For an online deployment, add the following deb repository to /etc/apt/sources.list.d/mcp_saltstack.list:

     ```
     deb [arch=amd64] https://mirror.mirantis.com/<MCP_VERSION>/saltstack-2017.7/xenial/ xenial main
     ```

   - For an offline deployment or local mirrors case, in /etc/apt/sources.list.d/mcp_saltstack.list, add the following deb repository:

     ```
     deb [arch=amd64] http://<local_mirror_url>/<MCP_VERSION>/saltstack-2017.7/xenial/ xenial main
     ```

2. Install the salt-minion package.
3. Modify /etc/salt/minion.d/minion.conf:

   ```
   id: <kvm01_FQDN>
   master: <Salt_Master_IP_or_FQDN>
   ```

4. Restart the salt-minion service:

   ```
   service salt-minion restart
   ```

5. Check the output of salt-key command on the Salt Master node to verify that the minion ID of kvm01 is present.

Verify the Salt infrastructure

Before you proceed with the deployment, validate the Reclass model and node pillars.

To verify the Salt infrastructure:

1. Log in to the Salt Master node.
2. Verify the Salt Master pillars:

   ```
   reclass -n cfg01.<cluster_domain>
   ```

   The cluster_domain value is the cluster domain name that you created while preparing your deployment metadata model. See Basic deployment parameters for details.
3. Verify that the Salt version for the Salt minions is the same as for the Salt Master node, that is currently 2017.7:

   ```
   salt-call --version
   salt '*' test.version
   ```
4. If required, enable management of the offline mirror VM (apt01) and customize the VM contents as described in Enable the management of the APT node through the Salt Master node.

Enable the management of the APT node through the Salt Master node

In compliance with the security best practices, MCP enables you to connect your offline mirror APT VM to the Salt Master node and manage it as any infrastructure VM on your MCP deployment.

> Note
>
> This section is only applicable for the offline deployments where all repositories are stored on a specific VM deployed using the MCP apt01 offline image, which is included in the MCP release artifacts.

For the deployments managed by the MCP 2018.8.0 Build ID or later, you should not manually enable the Salt minion on the offline image VM as it is configured automatically on boot during the APT VM provisioning.

Though, if your want to enable the management of the offline image VM through the Salt Master node on an existing deployment managed by the MCP version below the 2018.8.0 Build ID, you need to perform the procedure included in this section.

To enable the Salt minion on an existing offline mirror node:

1. Connect to the serial console of your offline image VM, which is included in the pre-built offline APT QCOW image:

   ```
   virsh console $(virsh list --all --name | grep ^apt01) --force
   ```

   Log in with the user name and password that you created in step 4 of the Generate configuration drives manually procedure.

   Example of system response:

   ```
   Connected to domain apt01.example.local
   Escape character is ^]
   ```

2. Press Enter to drop into the root shell.
3. Configure the Salt minion and start it:

   ```
   echo "" > /etc/salt/minion
   echo "master: <IP_address>" > /etc/salt/minion.d/minion.conf
   echo "id: <apt01.example.local>" >> /etc/salt/minion.d/minion.conf
   service salt-minion stop
   rm -f /etc/salt/pki/minion/*
   service salt-minion start
   ```

4. Quit the serial console by sending the Ctrl +] combination.
5. Log in to the Salt Master node.
6. Verify that you have the offline mirror VM Salt minion connected to your Salt Master node:

   ```
   salt-key -L | grep apt
   ```

   The system response should include your offline mirror VM domain name. For example:

   ```
   apt01.example.local
   ```

7. Verify that you can access the Salt minion from the Salt Master node:

   ```
   salt apt01\* test.ping
   ```

8. Verify the Salt states are mapped to the offline mirror VM:

   ```
   salt apt01\* state.show_top
   ```

Now, you can manage your offline mirror APT VM from the Salt Master node. At this point, the Salt Master node does not manage the offline mirror content. If you need to adjust the content of your offline mirror, refer to Customize the prebuilt mirror node.

Configure MAAS for bare metal provisioning

Before you proceed with provisioning of the remaining bare metal nodes, configure MAAS as described below.

To configure MAAS for bare metal provisioning:

1. Log in to the MAAS web UI through http://<infra_config_deploy_address>:5240/MAAS with the following credentials:
   - Username: mirantis
   - Password: r00tme
2. Go to the Subnets tab.
3. Select the fabric that is under the deploy network.
4. In the VLANs on this fabric area, click the VLAN under the VLAN column where the deploy network subnet is.
5. In the Take action drop-down menu, select Provide DHCP.
6. Adjust the IP range as required.

   > Note
   >
   > The number of IP addresses should not be less than the number of the planned VCP nodes.

7. Click Provide DHCP to submit.
8. If you use local package mirrors:

   > Note
   >
   > The following steps are required only to specify the local Ubuntu package repositories that are secured by a custom GPG key and used mainly for the offline mirror images prior the MCP version 2017.12.

   1. Go to Settings > Package repositories.
   2. Click Actions > Edit on the Ubuntu archive repository.
   3. Specify the GPG key of the repository in the Key field. The key can be obtained from the aptly_gpg_public_key parameter in the cluster level Reclass model.
   4. Click Save.

Provision physical nodes using MAAS

Physical nodes host the Virtualized Control Plane (VCP) of your Mirantis Cloud Platform deployment.

This section describes how to provision the physical nodes using the MAAS service that you have deployed on the Foundation node while deploying the Salt Master node.

The servers that you must deploy include at least:

- For OpenStack:
  - kvm02 and kvm03 infrastructure nodes
  - cmp0 compute node
- For Kubernetes:
  - kvm02 and kvm03 infrastructure nodes
  - ctl01, ctl02, ctl03 controller nodes
  - cmp01 and cmp02 compute nodes

You can provision physical nodes automatically or manually:

- An automated provisioning requires you to define IPMI and MAC addresses in your Reclass model. After you enforce all servers, the Salt Master node commissions and provisions them automatically.
- A manual provisioning enables commissioning nodes through the MAAS web UI.

Before you proceed with the physical nodes provisioning, you may want to customize the commissioning script, for example, to set custom NIC names. For details, see: Add custom commissioning scripts.

> Warning
>
> Before you proceed with the physical nodes provisioning, verify that BIOS settings enable PXE booting from NICs on each physical server.

Automatically commission and provision the physical nodes

This section describes how to define physical nodes in a Reclass model to automatically commission and then provision the nodes through Salt.

Automatically commission the physical nodes

You must define all IPMI credentials in your Reclass model to access physical servers for automated commissioning. Once you define the nodes, Salt enforces them into MAAS and starts commissioning.

To automatically commission physical nodes:

1. Define all physical nodes under classes/cluster/<cluster>/infra/maas.yml using the following structure.

   For example, to define the kvm02 node:

```
maas:
  region:
    machines:
      kvm02:
        interface:
          mac: 00:25:90:eb:92:4a
        power_parameters:
          power_address: kvm02.ipmi.net
          power_password: password
          power_type: ipmi
          power_user: ipmi_user
```

   Note

   To get MAC addresses from IPMI, you can use the ipmi tool. Usage example for Supermicro:

```
ipmitool -U ipmi_user-P passowrd -H kvm02.ipmi.net raw 0x30 0x21 1| tail -c 18
```

2. (Optional) Define the IP address on the first (PXE) interface. By default, it is assigned automatically and can be used as is.

   For example, to define the kvm02 node:

```
maas:
  region:
    machines:
      kvm02:
        interface:
          mac: 00:25:90:eb:92:4a
          mode: "static"
          ip: "2.2.3.15"
```

```
      subnet: "subnet1"
      gateway: "2.2.3.2"
```

3. (Optional) Define a custom disk layout or partitioning per server in MAAS. For more information and examples on how to define it in the model, see: Add a custom disk layout per node in the MCP model.
4. (Optional) Modify the commissioning process as required. For more information and examples, see: Add custom commissioning scripts.
5. Once you have defined all physical servers in your Reclass model, enforce the nodes:

> **Caution!**
>
> For an offline deployment, remove the deb-src repositories from commissioning before enforcing the nodes, since these repositories are not present on the reduced offline apt image node. To remove these repositories, you can enforce MAAS to rebuild sources.list. For example:
>
> ```
> export PROFILE="mirantis"
> export API_KEY=$(cat /var/lib/maas/.maas_credentials)
> maas login ${PROFILE} http://localhost:5240/MAAS/api/2.0/ ${API_KEY}
> REPO_ID=$(maas $PROFILE package-repositories read | jq '.[]| select(.name=="main_archive") | .id ')
> maas $PROFILE package-repository update ${REPO_ID} disabled_components=multiverse
> maas $PROFILE package-repository update ${REPO_ID} "disabled_pockets=backports"
> ```
>
> The default PROFILE variable is mirantis. You can find your deployment-specific value for this parameter in parameters:maas:region:admin:username of your Reclass model.
>
> For details on building a custom list of repositories, see: MAAS GitHub project.

```
salt-call maas.process_machines
```

All nodes are automatically commissioned.

6. Verify the status of servers either through the MAAS web UI or using the salt call command:

```
salt-call maas.machines_status
```

The successfully commissioned servers appear in the ready status.

7. Enforce the interfaces configuration defined in the model for servers:

```
salt-call state.sls maas.machines.assign_ip
```

8. To protect any static IP assignment defined, for example, in the model, configure a reserved IP range in MAAS on the management subnet.
9. (Optional) Enforce the disk custom configuration defined in the model for servers:

   ```
   salt-call state.sls maas.machines.storage
   ```

10. Verify that all servers have correct NIC names and configurations.
11. Proceed to Provision the automatically commissioned physical nodes.

Provision the automatically commissioned physical nodes

Once you successfully commission your physical nodes, you can start the provisioning.

To provision the automatically commissioned physical nodes through MAAS:

1. Log in to the Salt Master node.
2. Run the following command:

```
salt-call maas.deploy_machines
```

3. Check the status of the nodes:

```
salt-call maas.machines_status
local:
    ----------
    machines:
        - hostname:kvm02,system_id:anc6a4,status:Deploying
    summary:
        ----------
        Deploying:
            1
```

4. When all servers have been provisioned, perform the verification of the servers` automatic registration by running the salt-key command on the Salt Master node. All nodes should be registered. For example:

```
salt-key
Accepted Keys:
cfg01.bud.mirantis.net
cmp001.bud.mirantis.net
cmp002.bud.mirantis.net
kvm02.bud.mirantis.net
kvm03.bud.mirantis.net
```

Now, proceed to Deploy physical nodes.

Manually commission and provision the physical nodes

This section describes how to discover, commission, and provision the physical nodes using the MAAS web UI.

Manually discover and commission the physical nodes

You can discover and commission your physical nodes manually using the MAAS web UI.

To discover and commission physical nodes manually:

1. Power on a physical node.
2. In the MAAS UI, verify that the server has been discovered.
3. On the Nodes tab, rename the discovered host accordingly. Click Save after each renaming.
4. In the Settings tab, configure the Commissioning release and the Default Minimum Kernel Version to Ubuntu 16.04 TLS ‘Xenial Xerus’ and Xenial (hwe-16.04), respectively.

   > Note
   >
   > The above step ensures that the NIC naming convention uses the predictable schemas, for example, enp130s0f0 rather than eth0.

5. In the Deploy area, configure the Default operating system used for deployment and Default OS release used for deployment to Ubuntu and Ubuntu 16.04 LTS ‘Xenial Xerus’, respectively.
6. Leave the remaining parameters as defaults.
7. (Optional) Modify the commissioning process as required. For more information and examples, see: Add custom commissioning scripts.
8. Commission the node:
   1. From the Take Action drop-down list, select Commission.
   2. Define a storage schema for each node.
   3. On the Nodes tab, click the required node link from the list.
   4. Scroll down to the Available disks and partitions section.
   5. Select two SSDs using check marks in the left column.
   6. Click the radio button to make one of the disks the boot target.
   7. Click Create RAID to create an MD raid1 volume.
   8. In RAID type, select RAID 1.
   9. In File system, select ext4.
   10. Set / as Mount point.
   11. Click Create RAID.

   The Used disks and partitions section should now look as follows:

9. Repeat the above steps for each physical node.
10 Proceed to Manually provision the physical nodes.
.

Manually provision the physical nodes

Start the manual provisioning of the physical nodes with the control plane kvm02 and kvm03 physical nodes, and then proceed with the compute cmp01 node deployment.

To manually provision the physical nodes through MAAS:

1. Verify that the boot order in the physical nodes' BIOS is set in the following order:
    1. PXE
    2. The physical disk that was chosen as the boot target in the Maas UI.
2. Log in to the MAAS web UI.
3. Click on a node.
4. Click the Take Action drop-down menu and select Deploy.
5. In the Choose your image area, verify that Ubuntu 16.04 LTS 'Xenial Xerus' with the Xenial(hwe-16.04) kernel is selected.
6. Click Go to deploy the node.
7. Repeat the above steps for each node.

Now, proceed to Deploy physical nodes.

Seealso

- Configure PXE booting over UEFI

Deploy physical nodes

After you provision physical nodes as described in Provision physical nodes using MAAS, follow the instruction below to deploy physical nodes intended for an OpenStack-based MCP cluster. If you plan to deploy a Kubernetes-based MCP cluster, proceed with steps 1-2 of the Kubernetes Prerequisites procedure.

Caution!

To avoid the lack of memory for the network driver and ensure its proper operation, specify the minimum reserved kernel memory in your Reclass model on the cluster level for a particular hardware node. For example, use /cluster/<cluster_name>/openstack/compute/init.yml for the OpenStack compute nodes and /cluster/<cluster_name>/infra/kvm.yml for the KVM nodes.

```
linux:
  system:
    kernel:
      sysctl:
        vm.min_free_kbytes: <min_reserved_memory>
```

Set the vm.min_free_kbytes value to 4194304 for a node with more than 96 GB of RAM. Otherwise, set not more than 5% of the total RAM on the node.

Note

To change the default kernel version, perform the steps described in Manage kernel version.

To deploy physical servers:

1. Log in to the Salt Master node.
2. Verify that the cfg01 key has been added to Salt and your host FQDN is shown properly in the Accepted Keys field in the output of the following command:

   ```
   salt-key
   ```

3. Verify that all pillars and Salt data are refreshed:

   ```
   salt "*" saltutil.refresh_pillar
   salt "*" saltutil.sync_all
   ```

4. Verify that the Reclass model is configured correctly. The following command output should show top states for all nodes:

```
python -m reclass.cli --inventory
```

5. To verify that the rebooting of the nodes, which will be performed further, is successful, create the trigger file:

```
salt -C 'I@salt:control or I@nova:compute or I@neutron:gateway or I@ceph:osd' \
cmd.run "touch /run/is_rebooted"
```

6. To prepare physical nodes for VCP deployment, apply the basic Salt states for setting up network interfaces and SSH access. Nodes will be rebooted.

> Warning
>
> If you use kvm01 as a Foundation node, the execution of the commands below will also reboot the Salt Master node.

> Caution!
>
> All hardware nodes must be rebooted after executing the commands below. If the nodes do not reboot for a long time, execute the below commands again or reboot the nodes manually.
>
> Verify that you have a possibility to log in to nodes through IPMI in case of emergency.

1. For KVM nodes:

```
salt --async -C 'I@salt:control' cmd.run 'salt-call state.sls \
linux.system.repo,linux.system.user,openssh,linux.network;reboot'
```

2. For compute nodes:

```
salt --async -C 'I@nova:compute' pkg.install bridge-utils,vlan
```

```
salt --async -C 'I@nova:compute' cmd.run 'salt-call state.sls \
linux.system.repo,linux.system.user,openssh,linux.network;reboot'
```

3. For gateway nodes, execute the following command only for the deployments with OVS setup with physical gateway nodes:

   ```
   salt --async -C 'I@neutron:gateway' cmd.run 'salt-call state.sls \
   linux.system.repo,linux.system.user,openssh,linux.network;reboot'
   ```

   The targeted KVM, compute, and gateway nodes will stop responding after a couple of minutes. Wait until all of the nodes reboot.

7. Verify that the targeted nodes are up and running:

   ```
   salt -C 'I@salt:control or I@nova:compute or I@neutron:gateway or I@ceph:osd' \
   test.ping
   ```

8. Check the previously created trigger file to verify that the targeted nodes are actually rebooted:

   ```
   salt -C 'I@salt:control or I@nova:compute or I@neutron:gateway' \
   cmd.run 'if [ -f "/run/is_rebooted" ];then echo "Has not been rebooted!";else echo "Rebooted";fi'
   ```

   All nodes should be in the Rebooted state.

9. Verify that the hardware nodes have the required network configuration. For example, verify the output of the ip a command:

   ```
   salt -C 'I@salt:control or I@nova:compute or I@neutron:gateway or I@ceph:osd' \
   cmd.run "ip a"
   ```

Deploy VCP

The virtualized control plane (VCP) is hosted by KVM nodes deployed by MAAS. Depending on the cluster type, the VCP runs Kubernetes or OpenStack services, database (MySQL), message queue (RabbitMQ), Contrail, and support services, such as monitoring, log aggregation, and a time-series metric database. VMs can be added to or removed from the VCP allowing for easy scaling of your MCP cluster.

After the KVM nodes are deployed, Salt is used to configure Linux networking, appropriate repositories, host name, and so on by running the linux Salt state against these nodes. The libvirt packages configuration, in its turn, is managed by running the libvirt Salt state.

Prepare KVM nodes to run the VCP nodes

To prepare physical nodes to run the VCP nodes:

1. On the Salt Master node, prepare the node operating system by running the Salt linux state:

   ```
   salt-call state.sls linux -l info
   ```

   > Warning
   >
   > Some formulas may not correctly deploy on the first run of this command. This could be due to a race condition in running the deployment of nodes and services in parallel while some services are dependent on others. Repeat the command execution. If an immediate subsequent run of the command fails again, reboot the affected physical node and re-run the command.

2. Prepare physical nodes operating system to run the controller node:
   1. Verify the salt-common and salt-minion versions
   2. If necessary, Install the correct versions of salt-common and salt-minion.
3. Proceed to Create and provision the control plane VMs.

Verify the salt-common and salt-minion versions

To verify the version deployed with the state:

1. Log in to the physical node console.
2. To verify the salt-common version, run:

   ```
   apt-cache policy salt-common
   ```

3. To verify the salt-minion version, run:

   ```
   apt-cache policy salt-minion
   ```

The output for the commands above must show the 2017.7 version. If you have different versions installed, proceed with Install the correct versions of salt-common and salt-minion.

Install the correct versions of salt-common and salt-minion

This section describes the workaround for salt.virt to properly inject minion.conf.

To manually install the required version of salt-common and salt-minion:

1. Log in to the physical node console
2. Change the version to 2017.7 in /etc/apt/sources.list.d/salt.list:

   ```
   deb [arch=amd64] http://repo.saltstack.com/apt/ubuntu/16.04/amd64/2017.7/dists/ xenial main
   ```

3. Sync the packages index files:

   ```
   apt-get update
   ```

4. Verify the versions:

   ```
   apt-cache policy salt-common
   apt-cache policy salt-minion
   ```

5. If the wrong versions are installed, remove them:

   ```
   apt-get remove salt-minion
   apt-get remove salt-common
   ```

6. Install the required versions of salt-common and salt-minion:

   ```
   apt-get install salt-common=2017.7
   apt-get install salt-minion=2017.7
   ```

7. Restart the salt-minion service to ensure connectivity with the Salt Master node:

   ```
   service salt-minion stop && service salt-minion start
   ```

8. Verify that the required version is installed:

   ```
   apt-cache policy salt-common
   apt-cache policy salt-minion
   ```

9. Repeat the procedure on each physical node.

Partitioning of a VCP node

Starting from the Q4`18 MCP release, the VCP images contain the prebuilt partitioning table. The main VM disk, which is vda, has the following partitions:

- vda1 - 1 MB partition required for GPT
- vda2 - 1 GB boot partition
- vda3 - Partition with LVM

The mountpoints selection is based on the recommendations from Center for Internet Security (CIS) and inlcude the following:

- root
- home
- /var/log
- /var/log/audit
- /tmp
- /var/tmp

Example of a partition table for a proxy node:

```
root@prx01:# lsblk /dev/vda
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
vda                 252:0    0   20G  0 disk
├─vda2              252:2    0 1002M  0 part /boot
├─vda3              252:3    0   19G  0 part
│ ├─vg0-home        253:1    0  100M  0 lvm  /home
│ ├─vg0-var_tmp     253:4    0  500M  0 lvm  /var/tmp
│ ├─vg0-tmp         253:2    0  500M  0 lvm  /tmp
│ ├─vg0-root        253:0    0  9.5G  0 lvm  /
│ ├─vg0-var_log_audit 253:5    0  500M  0 lvm  /var/log/audit
│ └─vg0-var_log     253:3    0  2.9G  0 lvm  /var/log
└─vda1              252:1    0    1M  0 part
```

Specifying the VCP network/disk metadata

Each VCP node has the size parameter associated with it. The size parameter is represented by the salt:control:cluster:internal:node:<VCP_NAME>:size path in Reclass, where <VCP_NAME> is the name of your VCP node. For example, for prx01:

```
root@cfg01:~# salt kvm01* pillar.items salt:control:cluster:internal:node:prx01:size --out json
{
    "kvm01.<CLUSTER_NAME>.local": {
        "salt:control:cluster:internal:node:prx01:size": "openstack.proxy"
    }
}
```

The size parameter defines disk, network, RAM, and CPU metadata per a VCP node class. For example:

```
root@cfg01:~# salt kvm01* pillar.items salt:control:size:openstack.control --out json
{
    "kvm01.<CLUSTER_NAME>.local": {
        "salt:control:size:openstack.control": {
            "net_profile": "default",
            "ram": 32768,
            "cpu": 8,
            "disk_profile": "small"
        }
    }
}
```

The disk_profile parameter is the profile that describes the disk configuration for a VCP node. You can extend a VCP image and connect it to a VM. For example:

```
root@cfg01:~# salt kvm01* pillar.items virt:disk --out json
{
    "kvm01.<CLUSTER_NAME>.local": {
        "virt:disk": {
            "small": [
                {
                    "system": {
                        "size": 8000
                    }
                }
            ]
        }
    }
}
```

Passing the cloud-init data to a VCP node

By default, a VCP node is bootstrapped through cloud-init. You can set the cloud-init user_data either on the cluster or node levels. The node level configuration overrides the cloud_init data passed on the cluster level.

The user_data configuration example on the cluster level:

```
salt:
  control:
    enabled: true
    virt_enabled: true
    cluster:
      mycluster:
        domain: neco.virt.domain.com
        engine: virt
        # Cluster global settings
        seed: cloud-init
        cloud_init:
          user_data:
            disable_ec2_metadata: true
            resize_rootfs: True
            timezone: UTC
            ssh_deletekeys: True
            ssh_genkeytypes: ['rsa', 'dsa', 'ecdsa']
            ssh_svcname: ssh
            locale: en_US.UTF-8
            disable_root: true
            apt_preserve_sources_list: false
            apt:
              sources_list: ""
              sources:
                ubuntu.list:
                  source: ${linux:system:repo:ubuntu:source}
                mcp_saltstack.list:
                  source: ${linux:system:repo:mcp_saltstack:source}
```

The user_data configuration example on the node level:

```
salt:
 control:
   cluster:
     mycluster:
       node:
         ubuntu1:
           provider: node01.domain.com
           image: ubuntu.qcow
           size: medium
```

```
      cloud_init:
        network_data:
          networks:
          - <<: *private-ipv4
            ip_address: 192.168.0.161
```

Specifying the cloud-init data to grow an LVM-based VCP node

When a VM is spawned, the cloud-init growroot module extends the physical disk to consume all free space. The stages of the partition growth for a VCP node with Logical Volume Management (LVM) include:

1. The growth of a physical disk, which is performed by the growroot module.

   To grow a particular physical drive and not the / mounpoint as it is pointed to LVM, you need to pass the following cloud_init data to the cluster level:

   ```
   _param:
     salt_control_cluster_vcp_lvm_device: '/dev/vda3'
   salt:
     control:
       cluster:
         internal:
           seed: cloud-init
           cloud_init:
             user_data:
               growpart:
                 mode: auto
                 devices:
                 - '/'
                 - ${_param:salt_control_cluster_vcp_lvm_device}
                 ignore_growroot_disabled: false
   ```

   > Note
   >
   > The name of the disk can differ depending on the VCP disk driver. By default, vda as virtio is used.

2. The extension of the LVM physical volume to consume all free disk space.

   Configuration example:

   ```
   _param:
     salt_control_cluster_vcp_lvm_device: '/dev/vda3'
   salt:
   ```

```
control:
  cluster:
    internal:
      seed: cloud-init
      cloud_init:
        user_data:
          runcmd:
            - 'if lvs vg0; then pvresize ${_param:salt_control_cluster_vcp_lvm_device}; fi'
            - 'if lvs vg0; then /usr/bin/growlvm.py --image-layout-file /usr/share/growlvm/image-layout.yml; fi'
```

3. The application of the partitioning layout.

   The partitioning layout is stored in salt:control:size:openstack.control:image_layout, which is a dictionary with the following schema:

```
{"$schema": "http://json-schema.org/draft-04/schema#",
 "title": "Image partition layout",
 "type": "object",
 "patternProperties": {
    ".*": {"$ref": "#/definitions/logical_volume_layout"}
 },
 "definitions": {
    "logical_volume_layout": {
       "type": "object",
       "properties": {
          "name": {
             "description": "Logical Volume Name",
             "type": "string"
          },
          "size": {
             "description": (
                "Size of Logical volume in units of logical extents. "
                "The number might be volume size in units of "
                "megabytes. A size suffix of M for megabytes, G for "
                "gigabytes, T for terabytes, P for petabytes or E for "
                "exabytes is optional. The number can also be "
                "expressed as a percentage of the total space in the "
                "Volume Group with the suffix %VG. Percentage of the "
                "changeble values like free space is not supported."
                ),
          },
          "resizefs": {
             "description": (
                "Resize underlying filesystem together with the "
                "logical volume using fsadm(8)."
             ),
             "type": "boolean"
          },
          "vg": {
             "description": ("Volume group name to resize logical "
```

```
                        "volume on."),
            "type": "string"
        }
    },
    "additionalProperties": False,
    "required": ["size"]
  }
}}
```

The default partitioning layout is specified in the /srv/salt/reclass/classes/system/defaults/salt/init.yml file.

Configuration example:

```
parameters:
  _param:
    salt_control_size_image_layout_default:
      root:
        size: '30%VG'
      home:
        size: '1G'
      var_log:
        size: '11%VG'
      var_log_audit:
        size: '5G'
      var_tmp:
        size: '11%VG'
      tmp:
        size: '5G'
    salt_control_size_image_layout_ceph_mon: ${_param:salt_control_size_image_layout_default}
    salt_control_size_image_layout_ceph_rgw: ${_param:salt_control_size_image_layout_default}
```

You can adjust the partitioning layout for a particular size through a soft type parameter. For example, you can describe the partitioning layout for ceph.mon as follows:

```
parameters:
  _param:
    salt_control_size_image_layout_ceph_mon:
      root:
        size: '70%VG'
      home:
        size: '500M'
      var_log:
        size: '5%VG'
      var_log_audit:
        size: '1G'
      var_tmp:
        size: '1G'
```

```
    tmp:
      size: '1G'
```

Create and provision the control plane VMs

The control plane VMs are created on each node by running the salt state. This state leverages the salt virt module along with some customizations defined in a Mirantis formula called salt-formula-salt. Similarly to how MAAS manages bare metal, the salt virt module creates VMs based on profiles that are defined in the metadata and mounts the virtual disk to add the appropriate parameters to the minion configuration file.

After the salt state successfully runs against a KVM node where metadata specifies the VMs placement, these VMs will be started and automatically added to the Salt Master node.

To create control plane VMs:

1. Log in to the KVM nodes that do not host the Salt Master node. The correct physical node names used in the installation described in this guide to perform the next step are kvm02 and kvm03.

   > Warning
   >
   > Otherwise, on running the command in the step below, you will delete the cfg Salt Master.

2. Verify whether virtual machines are not yet present:

   ```
   virsh list --name --all | grep -Ev '^(mas|cfg|apt)' | xargs -n 1 virsh destroy
   virsh list --name --all | grep -Ev '^(mas|cfg|apt)' | xargs -n 1 virsh undefine
   ```

3. Log in to the Salt Master node console.
4. Verify that the Salt Minion nodes are synchronized by running the following command on the Salt Master node:

   ```
   salt '*' saltutil.sync_all
   ```

5. Perform the initial Salt configuration:

   ```
   salt 'kvm*' state.sls salt.minion
   ```

6. Set up the network interfaces and the SSH access:

   ```
   salt -C 'I@salt:control' cmd.run 'salt-call state.sls \
     linux.system.user,openssh,linux.network;reboot'
   ```

> Warning
>
> This will also reboot the Salt Master node because it is running on top of kvm01.

7. Log in back to the Salt Master node console.
8. Run the libvirt state:

```
salt 'kvm*' state.sls libvirt
```

9. For the OpenStack-based MCP clusters, add system.salt.control.cluster.openstack_gateway_single to infra/kvm.yml to enable a gateway VM for your OpenStack environment. Skip this step for the Kubernetes-based MCP clusters.
10. Run salt.control to create virtual machines. This command also inserts minion.conf files from KVM hosts:

```
salt 'kvm*' state.sls salt.control
```

11. Verify that all your Salt Minion nodes are registered on the Salt Master node. This may take a few minutes.

```
salt-key
```

Example of system response:

```
mon03.bud.mirantis.net
msg01.bud.mirantis.net
msg02.bud.mirantis.net
msg03.bud.mirantis.net
mtr01.bud.mirantis.net
mtr02.bud.mirantis.net
mtr03.bud.mirantis.net
nal01.bud.mirantis.net
nal02.bud.mirantis.net
nal03.bud.mirantis.net
ntw01.bud.mirantis.net
ntw02.bud.mirantis.net
ntw03.bud.mirantis.net
prx01.bud.mirantis.net
prx02.bud.mirantis.net
...
```

Seealso

Manage kernel version

Deploy CI/CD

The automated deployment of the MCP components is performed through CI/CD that is a part of MCP DriveTrain along with SaltStack and Reclass. CI/CD, in its turn, includes Jenkins, Gerrit, and MCP Registry components. This section explains how to deploy a CI/CD infrastructure.

To deploy CI/CD automatically:

1. Deploy a customer-specific CI/CD using Jenkins as part of, for example, an OpenStack cloud environment deployment:
    1. Log in to the Jenkins web UI available at salt_master_management_address:8081 with the following credentials:
        - Username: admin
        - Password: r00tme
    2. Use the Deploy - OpenStack pipeline to deploy cicd cluster nodes as described in Deploy an OpenStack environment. Start with Step 7 in case of the online deployment and with Step 8 in case of the offline deployment.
2. Once the cloud environment is deployed, verify that the cicd cluster is up and running.
3. Disable the Jenkins service on the Salt Master node:
    - For the MCP versions 2018.11.0 and below:

      ```
      systemctl stop jenkins
      systemctl disable jenkins
      ```

    - For the MCP versions 2019.2.0 and newer, add following pillars to infra/config/jenkins.yml:

      ```
      parameters:
        docker:
          client:
            stack:
              jenkins:
                service:
                  master:
                    deploy:
                      replicas: 0
                  slave01:
                    deploy:
                      replicas: 0
      ```

4. Skip the jenkins.client state on the Salt Master node by adding the following pillars to infra/config/jenkins.yml:

   ```
   parameters:
     jenkins:
   ```

```
  client:
    enabled: false
```

5. Refresh pillars on the Salt Master node:

```
salt-call saltutil.clear_cache && salt-call saltutil.refresh_pillar
```

6. For the MCP versions 2019.2.0 and newer, update the Jenkins service configuration in Docker on the Salt Master node:

```
salt-call state.apply docker.client
```

Seealso

- Enable a watchdog
- Manage kernel version

Deploy an MCP cluster using DriveTrain

After you have installed the MCP CI/CD infrastructure as descibed in Deploy CI/CD, you can reach the Jenkins web UI through the Jenkins master IP address. This section contains procedures explaining how to deploy OpenStack environments and Kubernetes clusters using CI/CD pipelines.

> Note
>
> For production environments, CI/CD should be deployed on a per-customer basis.
>
> For testing purposes, you can use the central Jenkins lab that is available for Mirantis employees only. To be able to configure and execute Jenkins pipelines using the lab, you need to log in to the Jenkins web UI with your Launchpad credentials.

Deploy an OpenStack environment

This section explains how to configure and launch the OpenStack environment deployment pipeline. This job is run by Jenkins through the Salt API on the functioning Salt Master node and deployed hardware servers to set up your MCP OpenStack environment.

Run this Jenkins pipeline after you configure the basic infrastructure as described in Deploy MCP DriveTrain. Also, verify that you have successfully applied the linux and salt states to all physical and virtual nodes for them not to be disconnected during network and Salt Minion setup.

> Note
>
> For production environments, CI/CD should be deployed on a per-customer basis.
>
> For testing purposes, you can use the central Jenkins lab that is available for Mirantis employees only. To be able to configure and execute Jenkins pipelines using the lab, you need to log in to the Jenkins web UI with your Launchpad credentials.

To automatically deploy an OpenStack environment:

1. Log in to the Salt Master node.
2. For the OpenContrail setup, add the version-specific parameters to the <cluster_name>/opencontrail/init.yml file of your Reclass model. For example:

   ```
   parameters:
     _param:
       opencontrail_version: 4.1
       linux_repo_contrail_component: oc41
   ```

3. Set up network interfaces and the SSH access on all compute nodes:

   ```
   salt -C 'I@nova:compute' cmd.run 'salt-call state.sls \
     linux.system.user,openssh,linux.network;reboot'
   ```

4. If you run OVS, run the same command on physical gateway nodes as well:

   ```
   salt -C 'I@neutron:gateway' cmd.run 'salt-call state.sls \
     linux.system.user,openssh,linux.network;reboot'
   ```

5. Verify that all nodes are ready for deployment:

   ```
   salt '*' state.sls linux,ntp,openssh,salt.minion
   ```

> **Caution!**
>
> If any of these states fails, fix the issue provided in the output and re-apply the state before you proceed to the next step. Otherwise, the Jenkins pipeline will fail.

6. In a web browser, open http://<ip address>:8081 to access the Jenkins web UI.

> Note
>
> The IP address is defined in the classes/cluster/<cluster_name>/cicd/init.yml file of the Reclass model under the cicd_control_address parameter variable.

7. Log in to the Jenkins web UI as admin.

> Note
>
> To obtain the password for the admin user, run the salt "cid*" pillar.data _param:jenkins_admin_password command from the Salt Master node.

8. In the global view, verify that the git-mirror-downstream-mk-pipelines and git-mirror-downstream-pipeline-library pipelines have successfully mirrored all content.
9. Find the Deploy - OpenStack job in the global view.
10. Select the Build with Parameters option from the drop-down menu of the Deploy - OpenStack job.
11. Specify the following parameters:

Deploy - OpenStack environment parameters

Parameter	Description and values
ASK_ON_ERROR	If checked, Jenkins will ask either to stop a pipeline or continue execution in case of Salt state fails on any task

STACK_INSTALL	Specifies the components you need to install. The available values include: • core • kvm • cicd • openstack • ovs or contrail depending on the network plugin. • ceph • stacklight • oss **Note** For the details regarding StackLight LMA (stacklight) with the DevOps Portal (oss) deployment, see Deploy StackLight LMA with the DevOps Portal.
BATCH_SIZE Added since 2019.2.6 update	The batch size for Salt commands targeted for a large amount of nodes. Disabled by default. Set to an absolute number of nodes (integer) or percentage, for example, 20 or 20%. For details, see Configure Salt Master threads and batching.
DIST_UPGRADE_NODES Added since 2019.2.8 update	Select to run apt-get dist-upgrade on all cluster nodes before deployment. Disabled by default.
SALT_MASTER_CREDENTIALS	Specifies credentials to Salt API stored in Jenkins, included by default. See View credentials details used in Jenkins pipelines for details.
SALT_MASTER_URL	Specifies the reachable IP address of the Salt Master node and port on which Salt API listens. For example, http://172.18.170.28:6969 To find out on which port Salt API listens: 1. Log in to the Salt Master node. 2. Search for the port in the /etc/salt/master.d/_api.conf file. 3. Verify that the Salt Master node is listening on that port: `netstat -tunelp | grep <PORT>`
STACK_TYPE	Specifies the environment type. Use physical for a bare metal deployment

12 Click Build.
.

13 Once done, configure the Salt Master node password expiration as described in Modify Salt
. Master password expiration.

Seealso

- View the deployment details
- Enable a watchdog
- MCP 2019.2.3 Maintenance Update: Known issues

Deploy a multi-site OpenStack environment

MCP DriveTrain enables you to deploy several OpenStack environments at the same time.

> Note
>
> For production environments, CI/CD should be deployed on a per-customer basis.
>
> For testing purposes, you can use the central Jenkins lab that is available for Mirantis employees only. To be able to configure and execute Jenkins pipelines using the lab, you need to log in to the Jenkins web UI with your Launchpad credentials.

To deploy a multi-site OpenStack environment, repeat the Deploy an OpenStack environment procedure as many times as you need specifying different values for the SALT_MASTER_URL parameter.

> Seealso
>
> View the deployment details

Deploy a Kubernetes cluster

> Caution!
>
> Kubernetes support termination notice
>
> Starting with the MCP 2019.2.5 update, the Kubernetes component is no longer supported as a part of the MCP product. This implies that Kubernetes is not tested and not shipped as an MCP component. Although the Kubernetes Salt formula is available in the community driven SaltStack formulas ecosystem, Mirantis takes no responsibility for its maintenance.
>
> Customers looking for a Kubernetes distribution and Kubernetes lifecycle management tools are encouraged to evaluate the Mirantis Kubernetes-as-a-Service (KaaS) and Docker Enterprise products.

The MCP Containers as a Service architecture enables you to easily deploy a Kubernetes cluster on bare metal with Calico plugin set for Kubernetes networking.

> Caution!
>
> OpenContrail 4.x for Kubernetes 1.12 or later is not supported.

This section explains how to configure and launch the Kubernetes cluster deployment pipeline using DriveTrain.

You can enable an external Ceph RBD storage in your Kubernetes cluster as required. For new deployments, enable the corresponding parameters while creating your deployment metadata model as described in Create a deployment metadata model. For existing deployments, follow the Enable an external Ceph RBD storage procedure.

You can also deploy ExternalDNS to set up a DNS management server in order to control DNS records dynamically through Kubernetes resources and make Kubernetes resources discoverable through public DNS servers.

If you have a predeployed OpenStack environment, you can deploy a Kubernetes cluster on top of OpenStack and enable the OpenStack cloud provider functionality. It allows you to leverage Cinder volumes and Neutron LBaaS (Octavia) that enhance the Kubernetes cluster functionality.

Added in 2019.2.3 If you want to enable Helm for managing Kubernetes charts, configure your deployment model as described in Enable Helm support. Once configured, Helm will be deployed on the Kubernetes cluster using the corresponding DriveTrain pipeline.

Depending on your cluster configuration, proceed with one of the sections listed below.

Note

For production environments, CI/CD should be deployed on a per-customer basis.

For testing purposes, you can use the central Jenkins lab that is available for Mirantis employees only. To be able to configure and execute Jenkins pipelines using the lab, you need to log in to the Jenkins web UI with your Launchpad credentials.

Prerequisites

Before you proceed with an automated deployment of a Kubernetes cluster, follow the steps below:

1. If you have swap enabled on the ctl and cmp nodes, modify your Kubernetes deployment model as described in Add swap configuration to a Kubernetes deployment model.
2. Deploy DriveTrain as described in Deploy MCP DriveTrain.

Now, proceed to deploying Kubernetes as described in Deploy a Kubernetes cluster on bare metal.

Deploy a Kubernetes cluster on bare metal

This section provides the steps to deploy a Kubernetes cluster on bare metal nodes configured using MAAS with Calico as a Kubernetes networking plugin.

> ### Caution!
>
> OpenContrail 4.x for Kubernetes 1.12 or later is not supported.

To automatically deploy a Kubernetes cluster on bare metal nodes:

1. Verify that you have completed the steps described in Prerequisites.
2. Log in to the Jenkins web UI as Administrator.

   > Note
   >
   > To obtain the password for the admin user, run the salt "cid*" pillar.data _param:jenkins_admin_password command from the Salt Master node.

3. Find the k8s_ha_calico heat pipeline job in the global view.
4. Select the Build with Parameters option from the drop-down menu of the selected job.
5. Configure the deployment by setting the following parameters as required:

Deployment parameters

Parameter	Defualt value	Description
ASK_ON_ERROR	False	If True, Jenkins will stop on any failure and ask either you want to cancel the pipeline or proceed with the execution ignoring the error.

SALT_MASTER_CREDENTIALS	<YOUR_SALT_MASTER_CREDENTIALS_ID>	The Jenkins ID of credentials for logging in to the Salt API. For example, salt-credentials. See View credentials details used in Jenkins pipelines for details.
SALT_MASTER_URL	<YOUR_SALT_MASTER_URL>	The URL to access the Salt Master node.
STACK_INSTALL	Select core,k8s,calico	Components to install.
STACK_TEST	Empty	The names of the cluster components to test. By default, nothing is tested.
STACK_TYPE	physical	The type of the cluster.

6. Click Build to launch the pipeline.
7. Click Full stage view to track the deployment process.

   The following table contains the stages details for the deployment with Calico as a Kubernetes networking plugin:

The deploy pipeline workflow

#	Title	Details
1	Create infrastructure	Creates a base infrastructure using MAAS.
2	Install core infrastructure	1. Prepares and validates the Salt Master node and Salt Minion nodes. For example, refreshes pillars and synchronizes custom modules. 2. Applies the linux,openssh,salt.minion,ntp states to all nodes.

3	Install Kubernetes infrastructure	1. Reads the control plane load-balancer address and applies it to the model. 2. Generates the Kubernetes certificates. 3. Installs the Kubernetes support packages that include Keepalived, HAProxy, containerd, and etcd.
4	Install the Kubernetes control plane and networking plugins	1. Installs Calico. 2. Sets up etcd. 3. Installs the control plane nodes.

8. When the pipeline has successfully executed, log in to any Kubernetes ctl node and verify that all nodes have been registered successfully:

```
kubectl get nodes
```

Seealso

View the deployment details

Deploy ExternalDNS for Kubernetes

ExternalDNS deployed on Mirantis Cloud Platform (MCP) allows you to set up a DNS management server for Kubernetes starting with version 1.7. ExternalDNS enables you to control DNS records dynamically through Kubernetes resources and make Kubernetes resources discoverable through public DNS servers. ExternalDNS synchronizes exposed Kubernetes Services and Ingresses with DNS cloud providers, such as Designate, AWS Route 53, Google CloudDNS, and CoreDNS.

ExternalDNS retrieves a list of resources from the Kubernetes API to determine the desired list of DNS records. It synchronizes the DNS service according to the current Kubernetes status.

ExternalDNS can use the following DNS backend providers:

- AWS Route 53 is a highly available and scalable cloud DNS web service. Amazon Route 53 is fully compliant with IPv6.
- Google CloudDNS is a highly available, scalable, cost-effective, and programmable DNS service running on the same infrastructure as Google.
- OpenStack Designate can use different DNS servers including Bind9 and PowerDNS that are supported by MCP.
- CoreDNS is the next generation of SkyDNS that can use etcd to accept updates to DNS entries. It functions as an on-premises open-source alternative to cloud DNS services (DNSaaS). You can deploy CoreDNS with ExternalDNS if you do not have an active DNS backend provider yet.

This section describes how to configure and set up ExternalDNS on a new or existing MCP Kubernetes-based cluster.

Prepare a DNS backend for ExternalDNS

Depending on your DNS backend provider, prepare your backend and the metadata model of your MCP cluster before setting up ExternalDNS. If you do not have an active DNS backend provider yet, you can use CoreDNS that functions as an on-premises open-source alternative to cloud DNS services.

To prepare a DNS backend

Select from the following options depending on your DNS backend:

- For AWS Route 53:

  1. Log in to your AWS Route 53 console.
  2. Navigate to the AWS Services page.
  3. In the search field, type “Route 53” to find the corresponding service page.
  4. On the Route 53 page, find the DNS management icon and click Get started now.
  5. On the DNS management page, click Create hosted zone.
  6. On the right side of the Create hosted zone window:

     1. Add <your_mcp_domain.>.local name.
     2. Select the Public Hosted Zone type.
     3. Click Create.

     You will be redirected to the previous page with two records of NS and SOA type. Keep the link of this page for verification after the ExernalDNS deployment.
  7. Click Back to Hosted zones.
  8. Locate and copy the Hosted Zone ID in the corresponding column of your recently created hosted zone.
  9. Add this ID to the following template:

```
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Action": [
        "route53:ChangeResourceRecordSets",
        "route53:ListResourceRecordSets",
        "route53:GetHostedZone
      ],
      "Resource": [
        "arn:aws:route53:::hostedzone/<YOUR_ZONE_ID>"
      ]
    },
    {
```

```
        "Effect" : "Allow",
        "Action" : [
          "route53:GetChange"
        ],
        "Resource" : [
          "arn:aws:route53:::change/*"
        ]
      },
      {
        "Effect" : "Allow",
        "Action" " [
          "route53:ListHostedZones"
        ],
        "Resource" : [
          "*"
        ]
       }
   ]
}
```

10 Navigate to Services > IAM > Customer Managed Policies.
.

11 Click Create Policy > Create your own policy.
.

12 Fill in the required fields:
.

- Policy Name field: externaldns
- Policy Document field: use the JSON template provided in step 9

13 Click Validate Policy.
.

14 Click Create Policy. You will be redirected to the policy view page.
.

15 Navigate to Users.
.

16 Click Add user:
.

1. Add a user name: extenaldns.
2. Select the Programmatic access check box.
3. Click Next: Permissions.
4. Select the Attach existing policy directly option.
5. Select the Customer managed policy type in the Filter drop-down menu.
6. Select the externaldns check box.

7. Click Next: Review.
8. Click Create user.
9. Copy the Access key ID and Secret access key.

- For Google CloudDNS:

  1. Log in to your Google Cloud Platform web console.
  2. Navigate to IAM & Admin > Service accounts > Create service account.
  3. In the Create service account window, configure your new ExernalDNS service account:
     1. Add a service account name.
     2. Assign the DNS Administrator role to the account.
     3. Select the Furnish a new private key check box and the JSON key type radio button.

        The private key is automatically saved on your computer.
  4. Navigate to NETWORKING > Network services > Cloud DNS.
  5. Click CREATE ZONE to create a DNS zone that will be managed by ExternalDNS.
  6. In the Create a DNS zone window, fill in the following fields:
     - Zone name
     - DNS name that must contain your MCP domain address in the <your_mcp_domain>.local format.
  7. Click Create.

     You will be redirected to the Zone details page with two DNS names of the NS and SOA type. Keep this page for verification after the ExernalDNS deployment.

- For Designate:

  1. Log in to the Horizon web UI of your OpenStack environment with Designate.
  2. Create a project with the required admin role as well as generate the access credentials for the project.
  3. Create a hosted DNS zone in this project.

- For CoreDNS, proceed to Configure cluster model for ExternalDNS.

Now, proceed to Configure cluster model for ExternalDNS.

Configure cluster model for ExternalDNS

After you prepare your DNS backend as described in Prepare a DNS backend for ExternalDNS, prepare your cluster model as described below.

To configure the cluster model:

1. Select from the following options:
   - If you are performing the initial deployment of your MCP Kubernetes cluster:
     1. Use the ModelDesigner UI to create the Kubernetes cluster model. For details, see: Create a deployment metadata model.
     2. While creating the model, select the Kubernetes externaldns enabled check box in the Kubernetes product parameters section.
   - If you are making changes to an existing MCP Kubernetes cluster, proceed to the next step.
2. Open your Git project repository.
3. In classes/cluster/<cluster_name>/kubernetes/control.yml:
   1. If you are performing the initial deployment of your MCP Kubernetes cluster, configure the provider parameter in the snippet below depending on your DNS provider: coredns|aws|google|designate. If you are making changes to an existing cluster, add and configure the snippet below. For example:

```
parameters:
  kubernetes:
    common:
      addons:
        externaldns:
        enabled: True
        namespace: kube-system
        image: mirantis/external-dns:latest
        domain: domain
        provider: coredns
```

   2. Set up the pillar data for your DNS provider to configure it as an add-on. Use the credentials generated while preparing your DNS provider.
      - For Designate:

```
parameters:
  kubernetes:
    common:
      addons:
        externaldns:
          externaldns:
            enabled: True
```

```
        domain: company.mydomain
        provider: designate
        designate_os_options:
          OS_AUTH_URL: https://keystone_auth_endpoint:5000
          OS_PROJECT_DOMAIN_NAME: default
          OS_USER_DOMAIN_NAME: default
          OS_PROJECT_NAME: admin
          OS_USERNAME: admin
          OS_PASSWORD: password
          OS_REGION_NAME: RegionOne
```

- For AWS Route 53:

```
parameters:
  kubernetes:
    common:
      addons:
        externaldns:
          externaldns:
            enabled: True
            domain: company.mydomain
            provider: aws
            aws_options:
              AWS_ACCESS_KEY_ID: XXXXXXXXXXXXXXXXXXX
              AWS_SECRET_ACCESS_KEY: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

- For Google CloudDNS:

```
parameters:
  kubernetes:
    common:
      addons:
        externaldns:
          externaldns:
            enabled: True
            domain: company.mydomain
            provider: google
            google_options:
              key: ''
              project: default-123
```

> Note
>
> You can export the credentials from the Google console and process them using the cat key.json | tr -d 'n' command.

- For CoreDNS:

```
parameters:
  kubernetes:
    common:
      addons:
        coredns:
          enabled: True
          namespace: kube-system
          image: coredns/coredns:latest
          etcd:
            operator_image: quay.io/coreos/etcd-operator:v0.5.2
            version: 3.1.8
            base_image: quay.io/coreos/etcd
```

4. Commit and push the changes to the project Git repository.
5. Log in to the Salt Master node.
6. Update your Salt formulas and the system level of your repository:
    1. Change the directory to /srv/salt/reclass.
    2. Run the git pull origin master command.
    3. Run the salt-call state.sls salt.master command.
    4. Run the salt-call state.sls reclass command.

Now, proceed to Deploy ExternalDNS.

Deploy ExternalDNS

Before you deploy ExternalDNS, complete the steps described in Configure cluster model for ExternalDNS.

To deploy ExternalDNS

Select from the following options:

- If you are performing the initial deployment of your MCP Kubernetes cluster, deploy a Kubernetes cluster as described in Deploy a Kubernetes cluster on bare metal. The ExternalDNS will be deployed automatically by the MCP DriveTrain pipeline job during the Kubernetes cluster deployment.
- If you are making changes to an existing MCP Kubernetes cluster, apply the following state:

  ```
  salt --hard-crash --state-output=mixed --state-verbose=False -C \
  'I@kubernetes:master' state.sls kubernetes.master.kube-addons
  ```

  Once the state is applied, the kube-addons.sh script applies the Kubernetes resources and they will shortly appear in the Kubernetes resources list.

Verify ExternalDNS after deployment

After you complete the steps described in Deploy ExternalDNS, verify that ExternalDNS is up and running using the procedures below depending on your DNS backend.

Verify ExternalDNS with Designate backend after deployment

After you complete the steps described in Deploy ExternalDNS, verify that ExternalDNS is successfully deployed with Designate backend using the procedure below.

To verify ExternalDNS with Designate backend:

1. Log in to any Kubernetes Master node.
2. Source the openrc file of your OpenStack environment:

   ```
   source keystonerc
   ```

   > Note
   >
   > If you use Keystone v3, use the source keystonercv3 command instead.

3. Open the Designate shell using the designate command.
4. Create a domain:

   ```
   domain-create --name nginx.<your_mcp_domain>.local. --email <your_email>
   ```

   Example of system response:

   ```
   +-------------+---------------------------------------+
   | Field       | Value                                 |
   +-------------+---------------------------------------+
   | description | None                                  |
   | created_at  | 2017-10-13T16:23:26.533547            |
   | updated_at  | None                                  |
   | email       | designate@example.org                 |
   | ttl         | 3600                                  |
   | serial      | 1423844606                            |
   | id          | ae59d62b-d655-49a0-ab4b-ea536d845a32  |
   | name        | nginx.virtual-mcp11-k8s-calico.local. |
   +-------------+---------------------------------------+
   ```

5. Verify that the domain was successfully created. Use the id parameter value from the output of the command described in the previous step. Keep this value for further verification steps.

   For example:

   ```
   record-list ae59d62b-d655-49a0-ab4b-ea536d845a32
   ```

   Example of system response:

```
+----+------+---------------------------------------+-----------------------+
|id  | type | name                                  | data                  |
+----+------+---------------------------------------+-----------------------+
|... | NS   | nginx.virtual-mcp11-k8s-calico.local. | dns01.bud.mirantis.net.|
+----+------+---------------------------------------+-----------------------+
```

6. Start my-nginx:

```
kubectl run my-nginx --image=nginx --port=80
```

Example of system response:

```
deployment "my-nginx" created
```

7. Expose my-nginx:

```
kubectl expose deployment my-nginx --port=80 --type=ClusterIP
```

Example of system response:

```
service "my-nginx" exposed
```

8. Annotate my-nginx:

```
kubectl annotate service my-nginx \
"external-dns.alpha.kubernetes.io/hostname=nginx.<your_domain>.local."
```

Example of system response:

```
service "my-nginx" annotated
```

9. Verify that the domain was associated with the IP inside a Designate record by running the record-list [id] command. Use the id parameter value from the output of the command described in step 4. For example:

```
record-list ae59d62b-d655-49a0-ab4b-ea536d845a32
```

Example of system response:

```
+-----+------+---------------------------------------+-----------------------------------------------------+
| id  | type | name                                  | data                                                |
+-----+------+---------------------------------------+-----------------------------------------------------+
| ... | NS   | nginx.virtual-mcp11-k8s-calico.local.| dns01.bud.mirantis.net.                              |
```

```
+-----+------+--------------------------------------+-----------------------------------------------------------+
| ... | A    | nginx.virtual-mcp11-k8s-calico.local.| 10.254.70.16                                              |
+-----+------+--------------------------------------+-----------------------------------------------------------+
| ... | TXT  | nginx.virtual-mcp11-k8s-calico.local.| "heritage=external-dns,external-dns/owner=my-identifier"|
+-----+------+--------------------------------------+-----------------------------------------------------------+
```

Verify ExternalDNS with CoreDNS backend after deployment

After you complete the steps described in Deploy ExternalDNS, verify that ExternalDNS is successfully deployed with CoreDNS backend using the procedure below.

To verify ExternalDNS with CoreDNS backend:

1. Log in to any Kubernetes Master node.
2. Start my-nginx:

   ```
   kubectl run my-nginx --image=nginx --port=80
   ```

   Example of system response:

   ```
   deployment "my-nginx" created
   ```

3. Expose my-nginx:

   ```
   kubectl expose deployment my-nginx --port=80 --type=ClusterIP
   ```

   Example of system response:

   ```
   service "my-nginx" exposed
   ```

4. Annotate my-nginx:

   ```
   kubectl annotate service my-nginx \
   "external-dns.alpha.kubernetes.io/hostname=nginx.<your_domain>.local."
   ```

   Example of system response:

   ```
   service "my-nginx" annotated
   ```

5. Get the IP of DNS service:

   ```
   kubectl get svc coredns -n kube-system | awk '{print $2}' | tail -1
   ```

   Example of system response:

   ```
   10.254.203.8
   ```

6. Select from the following options:

   - If your Kubernetes networking is Calico, run the following command from any Kubernetes Master node.

- If your Kubernetes networking is OpenContrail, run the following command from any Kubernetes pod.

```
nslookup nginx.<your_domain>.local. <coredns_ip>
```

Example of system response:

```
Server: 10.254.203.8 Address: 10.254.203.8#53
Name: test.my_domain.local Address: 10.254.42.128
```

Verify ExternalDNS with Google CloudDNS backend after deployment

After you complete the steps described in Deploy ExternalDNS, verify that ExternalDNS is successfully deployed with Google CloudDNS backend using the procedure below.

To verify ExternalDNS with Google CloudDNS backend:

1. Log in to any Kubernetes Master node.
2. Start my-nginx:

   ```
   kubectl run my-nginx --image=nginx --port=80
   ```

   Example of system response:

   ```
   deployment "my-nginx" created
   ```

3. Expose my-nginx:

   ```
   kubectl expose deployment my-nginx --port=80 --type=ClusterIP
   ```

   Example of system response:

   ```
   service "my-nginx" exposed
   ```

4. Annotate my-nginx:

   ```
   kubectl annotate service my-nginx \
   "external-dns.alpha.kubernetes.io/hostname=nginx.<your_domain>.local."
   ```

   Example of system response:

   ```
   service "my-nginx" annotated
   ```

5. Log in to your Google Cloud Platform web console.
6. Navigate to the Cloud DNS > Zone details page.
7. Verify that your DNS zone now has two more records of the A and TXT type. Both records must point to nginx.<your_domain>.local.

Verify ExternalDNS with AWS Route 53 backend after deployment

After you complete the steps described in Deploy ExternalDNS, verify that ExternalDNS is successfully deployed with AWS Route 53 backend using the procedure below.

To verify ExternalDNS with AWS Route 53 backend:

1. Log in to any Kubernetes Master node.
2. Start my-nginx:

   ```
   kubectl run my-nginx --image=nginx --port=80
   ```

   Example of system response:

   ```
   deployment "my-nginx" created
   ```

3. Expose my-nginx:

   ```
   kubectl expose deployment my-nginx --port=80 --type=ClusterIP
   ```

   Example of system response:

   ```
   service "my-nginx" exposed
   ```

4. Annotate my-nginx:

   ```
   kubectl annotate service my-nginx \
   "external-dns.alpha.kubernetes.io/hostname=nginx.<your_domain>.local."
   ```

   Example of system response:

   ```
   service "my-nginx" annotated
   ```

5. Log in to your AWS Route 53 console.
6. Navigate to the Services > Route 53 > Hosted zones > YOUR_ZONE_NAME page.
7. Verify that your DNS zone now has two more records of the A and TXT type. Both records must point to nginx.<your_domain>.local.

Deploy OpenStack cloud provider for Kubernetes

> Note
>
> This feature is available as technical preview in the MCP Build ID 2019.2.0. Starting from the MCP 2019.2.2 update, the feature is fully supported.

If you have a predeployed OpenStack environment, you can deploy a Kubernetes cluster on VMs on top of OpenStack and enable the OpenStack cloud provider functionality.

The OpenStack cloud provider allows you to leverage Cinder volumes and Neutron LBaaS (Octavia) that enhance the Kubernetes cluster functionality.

The two main functions provided by the OpenStack cloud provider are PersistentVolume for pods and LoadBalancer for services.

Considerations when using the OpenStack cloud provider

The OpenStack cloud provider for Kubernetes has several requirements in OpenStack, which are outlined in the OpenStack cloud provider Overview section.

In addition to component requirements, there are operational requirements:

- Instance names must have a proper DNS label, consisting of letters, numbers, and dashes, ending with an alphanumeric character. Underscores and other symbols are invalid.
- All Kubernetes nodes must be Nova instances in the same project/tenant. Bare metal hosts or OpenStack instances from another tenant cannot be joined to the cluster with the OpenStack cloud provider.
- All Kubernetes nodes must be on the same Neutron subnet.
- OpenStack public APIs (such as Keystone API) must be accessible from all Kubernetes nodes.

In addition to operational requirements, the OpenStack cloud provider introduces a significant security concern. As a result, a non-privileged user should be created in the project/tenant where the instances reside specifically for this purpose. The reason behind this is that every single Kubernetes node (both Master node and Node) must contain the entire credentials in cleartext in the /etc/kubernetes/cloud-config.conf file. These credentials are put into pillar as well, so this is also a security vector to be aware of.

Enable the OpenStack cloud provider

Before you deploy a new Kubernetes cluster on VMs on top of OpenStack, enable the OpenStack cloud provider by making corresponding changes in you deployment metadata model.

> ### Caution!
>
> Mirantis recommends that you enable the OpenStack cloud provider on new Kubernetes clusters only. Enabling the OpenStack cloud provider on existing Kubernetes clusters may impact your workloads. The Kubernetes nodes will be re-registered with FQDN-based names identical to the corresponding instances names on your OpenStack environment. This may impact your workloads pinned to particular nodes and requires a manual clean up of stalled nodes.

To enable the OpenStack cloud provider:

1. Verify that you have an existing OpenStack environment to be used to deploy a Kubernetes cluster on top of OpenStack. For the requirements details, see: Considerations when using the OpenStack cloud provider.
2. Prepare six VMs that will include the Salt Master node and corresponding network configuration to be used for deploying a new Kubernetes cluster. For details, see: Prerequisites.
3. Open your Git project repository with Reclass model on the cluster level.
4. In classes/cluster/<cluster_name>/kubernetes/init.yml, add the following parameters, replacing the credentials to reflect your OpenStack environment:

```
_param:

  kubernetes_cloudprovider_enabled: True
  kubernetes_cloudprovider_type: 'openstack'

  kubernetes_openstack_provider_cloud_user: admin
  kubernetes_openstack_provider_cloud_password: secret
  kubernetes_openstack_provider_cloud_auth_url: <public_keystone_endpoint>
  kubernetes_openstack_provider_cloud_tenant_id: <tenant_id>
  kubernetes_openstack_provider_cloud_domain_id: default
  kubernetes_openstack_provider_cloud_region: RegionOne
  kubernetes_openstack_provider_lbaas_subnet_id: <subnet_id>
  kubernetes_openstack_provider_floating_net_id: <floating_net_id>
```

> Note
>
> The subnet_id parameter is the UUID of the subnet from which you can access internal addresses of the Kubernetes nodes, or external addresses if internal ones are not present on a cluster. Do not use the network ID.

5. Commit and push the changes to the project Git repository.
6. Proceed with further cluster configuration as required. OpenStack cloud provider will be automatically deployed with the Kubernetes cluster.

After you deploy the OpenStack cloud provider, proceed to Verify the OpenStack cloud provider after deployment.

Verify the OpenStack cloud provider after deployment

After you enable the OpenStack cloud provider as described in Enable the OpenStack cloud provider and deploy it together with your Kubernetes cluster, verify that it has been successfully deployed using the procedure below.

To verify the OpenStack cloud provider:

1. Log in to any Kubernetes Master node.
2. Create a claim1.yaml file with the following content:

```
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: claim1
spec:
  storageClassName: cinder
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
```

3. Run the following command:

```
kubectl apply -f claim1.yaml
```

4. Create a cinder-test-rc.yaml file with the following content:

```
apiVersion: v1
kind: ReplicationController
metadata:
  name: server
  labels:
    name: nginx
spec:
  replicas: 1
  template:
    metadata:
      labels:
        name: nginx
    spec:
      containers:
      - name: server
        image: nginx
        volumeMounts:
          - mountPath: /var/lib/www/html
            name: cinderpvc
      volumes:
```

```
    - name: cinderpvc
      persistentVolumeClaim:
        claimName: claim1
```

5. Run the following command:

```
kubectl apply -f cinder-test-rc.yaml
```

6. Verify that the volume was created:

```
openstack volume list
```

7. Verify that Neutron LBaaS can create the LoadBalancer objects:

    1. Create an nginx-rs.yml file with the following content:

```
apiVersion: extensions/v1beta1
kind: ReplicaSet
metadata:
  name: nginx
spec:
  replicas: 4
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
        - name: nginx
          image: nginx:1.10
          resources:
            requests:
              cpu: 100m
              memory: 100Mi
```

    2. Run the following commands:

```
kubectl create -f nginx-rs.yml
kubectl expose rs nginx --port 80 --type=LoadBalancer
```

8. Verify that the service has an external IP:

```
kubectl get services -owide
```

Example of system response:

```
NAME       CLUSTER-IP    EXTERNAL-IP              PORT(S)      AGE  SELECTOR
kubernetes 10.254.0.1    <none>                   443/TCP      40m  <none>
nginx      10.254.18.214 192.168.10.96,172.17.48.159  80:31710/TCP  1m   app=nginx
```

9. Verify that LoadBalancer was created in OpenStack:

   ```
   neutron lbaas-loadbalancer-list
   ```

   In the output, the vip_address should match the first external IP for the service created.

Seealso

Troubleshoot the OpenStack cloud provider

Troubleshoot the OpenStack cloud provider

The table in this section lists solutions for issues related to the OpenStack cloud provider operations after deployment.

Issue	Solution
Cinder volume cannot be mounted	1. Verify logs for the pod that failed and the kubelet logs on the Kubernetes Nodes. Identify and fix permission issues, if any.

Cinder volume is not created	1. Verify that your user has privileges to create Cinder volumes:
	    1. Source the openrc file of your environment. For details, see: Create OpenStack client environment scripts.
	    2. Run the openstack volume create test --size 1.
	2. Verify logs for openstack-cloud-controller-manager on each Kubernetes Master node.

The kubelet agent does not register with apiserver	1. Verify that the instance name does not contain invalid characters. An instance name must be a RFC-953 compliant, which states that a DNS name must consist of characters drawn from the alphabet (A-Z), digits (0-9), minus sign (-), and period (.). It is best to destroy and recreate the instance because the configdrive metadata located in /dev/vdb cannot be updated automatically even after renaming an instance. 2. Verify that your cloud credentials are valid. The kubelet agent will not start if the credentials are wrong.

Heat stack cannot be deleted because of LoadBalancer services	1. Delete all service resources before deleting the Heat stack using the kubectl delete svc --all command. 2. If the stack was already deleted and is now in the DELETE_FAILED state, purge all LBaaS objects visible to your OpenStack user with the following commands: `for pool in `neutron lbaas-pool-list -c id -f value`; do while read member; do neutron lbaas-member-delete $member $pool done < <(neutron lbaas-member-list $pool -c id -f value) neutron lbaas-pool-delete $pool done for listener in `neutron lbaas-listener-list -c id -f value`; do neutron lbaas-listener-delete $listener done for lb in `neutron lbaas-loadbalancer-list -c id -f value`; do neutron lbaas-loadbalancer-delete $lb done` 3. Delete the stack safely with the openstack stack delete STACKNAME command.
LBaaS is stuck in Pending state	1. Verify the subnet ID used for deployment. The subnet should match the network attached to the first interface on the instances (such as net01). Use the openstack subnet list command to get a list of subnets. 2. Verify that the public net ID is correct. Use the neutron net-external-list command to find the public net. 3. Verify that Octavia is deployed and configured. The neutron lbaas-loadbalancer-list command must return either 0 or some entries, but not an error. For the Octavia deployment details, see Configure load balancing with OpenStack Octavia.

Seealso

OpenStack cloud provider overview

Seealso

MCP Operations Guide: Kubernetes operations

Deploy StackLight LMA with the DevOps Portal

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

This section explains how to deploy StackLight LMA with the DevOps Portal (OSS) using Jenkins.

Before you proceed with the deployment, verify that your cluster level model contains configuration to deploy StackLight LMA as well as OSS. More specifically, check whether you enabled StackLight LMA and OSS as described in Services deployment parameters, and specified all the required parameters for these MCP components as described in StackLight LMA product parameters and OSS parameters.

> Note
>
> For production environments, CI/CD should be deployed on a per-customer basis.
>
> For testing purposes, you can use the central Jenkins lab that is available for Mirantis employees only. To be able to configure and execute Jenkins pipelines using the lab, you need to log in to the Jenkins web UI with your Launchpad credentials.

To deploy StackLight LMA with the DevOps Portal:

1. In a web browser, open http://<ip_address>:8081 to access the Jenkins web UI.

   > Note
   >
   > The IP address is defined in the classes/cluster/<cluster_name>/cicd/init.yml file of the Reclass model under the cicd_control_address parameter variable.

2. Log in to the Jenkins web UI as admin.

   > Note
   >
   > To obtain the password for the admin user, run the salt "cid*" pillar.data _param:jenkins_admin_password command from the Salt Master node.

3. Find the Deploy - OpenStack job in the global view.

4. Select the Build with Parameters option from the drop-down menu of the Deploy - OpenStack job.
5. For the STACK_INSTALL parameter, specify the stacklight and oss values.

   Warning

   If you enabled Stacklight LMA and OSS in the Reclass model, you should specify both stacklight and oss to deploy them together. Otherwise, the Runbooks Automation service (Rundeck) will not start due to Salt and Rundeck behavior.

   Note

   For the details regarding other parameters for this pipeline, see Deploy - OpenStack environment parameters.

6. Click Build.
7. Once the cluster is deployed, you can access the DevOps Portal at the the IP address specified in the stacklight_monitor_address parameter on port 8800.
8. Customize the alerts as described in MCP Operations Guide: Alerts that require tuning.
9. Once StackLight LMA is deployed, customize the alerts as described in MCP Operations Guide: Alerts that require tuning.

Seealso

- Deploy an OpenStack environment
- View the deployment details

View credentials details used in Jenkins pipelines

MCP uses the Jenkins Credentials Plugin that enables users to store credentials in Jenkins globally. Each Jenkins pipeline can operate only the credential ID defined in the pipeline's parameters and does not share any security data.

To view the detailed information about all available credentials in the Jenkins UI:

1. Log in to your Jenkins master located at http://<jenkins_master_ip_address>:8081.

   > Note
   >
   > The Jenkins master IP address is defined in the classes/cluster/<cluster_name>/cicd/init.yml file of the Reclass model under the cicd_control_address parameter variable.

2. Navigate to the Credentials page from the left navigation menu.

   All credentials listed on the Credentials page are defined in the Reclass model. For example, on the system level in the ../../system/jenkins/client/credential/gerrit.yml file.

   Examples of users definitions in the Reclass model:

   - With the RSA key definition:

     ```
     jenkins:
       client:
         credential:
           gerrit:
             username: ${_param:gerrit_admin_user}
             key: ${_param:gerrit_admin_private_key}
     ```

   - With the open password:

     ```
     jenkins:
       client:
         credential:
           salt:
             username: salt
             password: ${_param:salt_api_password}
     ```

View the deployment details

Once you have enforced a pipeline in CI/CD, you can monitor the progress of its execution on the job progress bar that appears on your screen. Moreover, Jenkins enables you to analyze the details of the deployments process.

To view the deployment details:

1. Log in to the Jenkins web UI.
2. Under Build History on the left, click the number of the build you are interested in.
3. Go to Console Output from the navigation menu to view the deployment progress.
4. When the deployment succeeds, verify the deployment result in Horizon.

> Note
>
> The IP address for Horizon is defined in the classes/cluster/<name>/openstack/init.yml file of the Reclass model under the openstack_proxy_address parameter variable.

To troubleshoot an OpenStack deployment:

1. Log in to the Jenkins web UI.
2. Under Build History on the left, click the number of the build you are interested in.
3. Verify Full log to determine the cause of the error.
4. Rerun the deployment with the failed component only. For example, if StackLight LMA fails, run the deployment with only StackLight selected for deployment. Use steps 6-10 of the Deploy an OpenStack environment instruction.

Deploy an MCP cluster manually

This section explains how to manually configure and install the software required for your MCP cluster. For an easier deployment process, use the automated DriveTrain deployment procedure described in Deploy an MCP cluster using DriveTrain.

> Note
>
> The modifications to the metadata deployment model described in this section provide only component-specific parameters and presuppose the networking-specific parameters related to each OpenStack component, since the networking model may differ depending on a per-customer basis.

Deploy an OpenStack environment manually

This section explains how to manually configure and install software required by your MCP OpenStack environment, such as support services, OpenStack services, and others.

Prepare VMs to install OpenStack

This section instructs you on how to prepare the virtual machines for the OpenStack services installation.

To prepare VMs for a manual installation of an OpenStack environment:

1. Log in to the Salt Master node.
2. Verify that the Salt Minion nodes are synchronized:

   ```
   salt '*' saltutil.sync_all
   ```

3. Configure basic operating system settings on all nodes:

   ```
   salt '*' state.sls salt.minion,linux,ntp,openssh
   ```

Enable TLS support

To assure the confidentiality and integrity of network traffic inside your OpenStack deployment, you should use cryptographic protective measures, such as the Transport Layer Security (TLS) protocol.

By default, only the traffic that is transmitted over public networks is encrypted. If you have specific security requirements, you may want to configure internal communications to connect through encrypted channels. This section explains how to enable the TLS support for your MCP cluster.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

Encrypt internal API HTTP transport with TLS

This section explains how to encrypt the internal OpenStack API HTTP with TLS.

To encrypt the internal API HTTP transport with TLS:

1. Verify that the Keystone, Nova Placement, Cinder, Barbican, Gnocchi, Panko, and Manila API services, whose formulas support using Web Server Gateway Interface (WSGI) templates from Apache, are running under Apache by adding the following classes to your deployment model:

   - In openstack/control.yml:

     ```
     classes:
     ...
     - system.apache.server.site.barbican
     - system.apache.server.site.cinder
     - system.apache.server.site.gnocchi
     - system.apache.server.site.manila
     - system.apache.server.site.nova-placement
     - system.apache.server.site.panko
     ```

   - In openstack/telemetry.yml:

     ```
     classes:
     ...
     - system.apache.server.site.gnocchi
     - system.apache.server.site.panko
     ```

2. Add SSL configuration for each WSGI template by specifying the following parameters:

   - In openstack/control.yml:

     ```
     parameters:
       _param:
       ...
         apache_proxy_ssl:
           enabled: true
           engine: salt
           authority: "${_param:salt_minion_ca_authority}"
           key_file: "/etc/ssl/private/internal_proxy.key"
            cert_file: "/etc/ssl/certs/internal_proxy.crt"
            chain_file: "/etc/ssl/certs/internal_proxy-with-chain.crt"

         apache_cinder_ssl: ${_param:apache_proxy_ssl}
         apache_keystone_ssl: ${_param:apache_proxy_ssl}
         apache_barbican_ssl: ${_param:apache_proxy_ssl}
         apache_manila_ssl: ${_param:apache_proxy_ssl}
         apache_nova_placement: ${_param:apache_proxy_ssl}
     ```

- In openstack/telemetry.yml:

```
parameters:
  _param:
  ...
  apache_gnocchi_api_address: ${_param:single_address}
  apache_panko_api_address: ${_param:single_address}
  apache_gnocchi_ssl: ${_param:nginx_proxy_ssl}
  apache_panko_ssl: ${_param:nginx_proxy_ssl}
```

3. For services that are still running under Eventlet, configure TLS termination proxy. Such services include Nova, Neutron, Ironic, Glance, Heat, Aodh, and Designate.

   Depending on your use case, configure proxy on top of either Apache or NGINX by defining the following classes and parameters:

   - In openstack/control.yml:

     - To configure proxy on Apache:

```
classes:
...
- system.apache.server.proxy.openstack.designate
- system.apache.server.proxy.openstack.glance
- system.apache.server.proxy.openstack.heat
- system.apache.server.proxy.openstack.ironic
- system.apache.server.proxy.openstack.neutron
- system.apache.server.proxy.openstack.nova

parameters:
  _param:
  ...
    # Configure proxy to redirect request to locahost:
    apache_proxy_openstack_api_address: ${_param:cluster_local_host}
    apache_proxy_openstack_designate_host: 127.0.0.1
    apache_proxy_openstack_glance_host: 127.0.0.1
    apache_proxy_openstack_heat_host: 127.0.0.1
    apache_proxy_openstack_ironic_host: 127.0.0.1
    apache_proxy_openstack_neutron_host: 127.0.0.1
    apache_proxy_openstack_nova_host: 127.0.0.1

  ...
  apache:
    server:
      site:
        apache_proxy_openstack_api_glance_registry:
          enabled: true
          type: proxy
```

```
      name: openstack_api_glance_registry
      proxy:
        host: ${_param:apache_proxy_openstack_glance_registry_host}
        port: 9191
        protocol: http
      host:
        name: ${_param:apache_proxy_openstack_api_host}
        port: 9191
        address: ${_param:apache_proxy_openstack_api_address}
        ssl: ${_param:apache_proxy_ssl}
```

- To configure proxy on NGINX:

```
classes:
...
- system.nginx.server.single
- system.nginx.server.proxy.openstack_api
- system.nginx.server.proxy.openstack.designate
- system.nginx.server.proxy.openstack.ironic
- system.nginx.server.proxy.openstack.placement

# Delete proxy sites that are running under Apache:
_param:
...
nginx:
  server:
    site:
      nginx_proxy_openstack_api_keystone:
        enabled: false
      nginx_proxy_openstack_api_keystone_private:
        enabled: false
      ...

# Configure proxy to redirect request to locahost
_param:
...
nginx_proxy_openstack_api_address: ${_param:cluster_local_address}
nginx_proxy_openstack_cinder_host: 127.0.0.1
nginx_proxy_openstack_designate_host: 127.0.0.1
nginx_proxy_openstack_glance_host: 127.0.0.1
nginx_proxy_openstack_heat_host: 127.0.0.1
nginx_proxy_openstack_ironic_host: 127.0.0.1
nginx_proxy_openstack_neutron_host: 127.0.0.1
nginx_proxy_openstack_nova_host: 127.0.0.1

# Add nginx SSL settings:
```

```
_param:
...
nginx_proxy_ssl:
  enabled: true
  engine: salt
  authority: "${_param:salt_minion_ca_authority}"
  key_file: "/etc/ssl/private/internal_proxy.key"
  cert_file: "/etc/ssl/certs/internal_proxy.crt"
  chain_file: "/etc/ssl/certs/internal_proxy-with-chain.crt"
```

- In openstack/telemetry.yml:

```
classes:
...
- system.nginx.server.proxy.openstack_aodh
...
parameters:
  _param:
  ...
    nginx_proxy_openstack_aodh_host: 127.0.0.1
```

4. Edit the openstack/init.yml file:

    1. Add the following parameters to the cluster model:

```
parameters:
  _param:
  ...
    cluster_public_protocol: https
    cluster_internal_protocol: https
    aodh_service_protocol: ${_param:cluster_internal_protocol}
    barbican_service_protocol: ${_param:cluster_internal_protocol}
    cinder_service_protocol: ${_param:cluster_internal_protocol}
    designate_service_protocol: ${_param:cluster_internal_protocol}
    glance_service_protocol: ${_param:cluster_internal_protocol}
    gnocchi_service_protocol: ${_param:cluster_internal_protocol}
    heat_service_protocol: ${_param:cluster_internal_protocol}
    ironic_service_protocol: ${_param:cluster_internal_protocol}
    keystone_service_protocol: ${_param:cluster_internal_protocol}
    manila_service_protocol: ${_param:cluster_internal_protocol}
    neutron_service_protocol: ${_param:cluster_internal_protocol}
    nova_service_protocol: ${_param:cluster_internal_protocol}
    panko_service_protocol: ${_param:cluster_internal_protocol}
```

    2. Depending on your use case, define the following parameters for the OpenStack services to verify that the services running behind TLS proxy are binded to the localhost:

- In openstack/control.yml:

OpenStack service	Required configuration

Barbican	**bind**:
	  address: 127.0.0.1
	identity:
	  protocol: https

Cinder	**identity**:
	  protocol: https
	osapi:
	  host: 127.0.0.1
	glance:
	  protocol: https

Designate	**identity**:
	  protocol: https
	bind:
	  api:
	  address: 127.0.0.1

Glance	**bind**:
	  address: 127.0.0.1
	identity:
	  protocol: https
	registry:
	  protocol: https

Heat	**bind**:
	  api:
	  address: 127.0.0.1
	  api_cfn:
	  address: 127.0.0.1
	  api_cloudwatch:
	  address: 127.0.0.1
	identity:
	  protocol: https

Horizon	**identity**: **encryption**: ssl

Ironic	**ironic**:
	  bind:
	  api:
	  address: 127.0.0.1

Neutron	**bind**:
	  address: 127.0.0.1
	identity:
	  protocol: https

Nova	**controller**:
	  bind:
	  private_address: 127.0.0.1
	  identity:
	  protocol: https
	  network:
	  protocol: https
	  glance:
	  protocol: https
	  metadata:
	  bind:
	  address: ${_param:nova_service_host}

Panko	**panko**:
	  server:
	  bind:
	  host: 127.0.0.1

- In openstack/telemetry.yml:

```
parameters:
  _param:
  ...
  aodh:
    server:
      bind:
        host: 127.0.0.1
      identity:
        protocol: http

  gnocchi:
    server:
      identity:
        protocol: http
```

```
panko:
  server:
    identity:
      protocol: https
```

5. For StackLight LMA, in stacklight/client.yml, enable Telegraf to correctly resolve the CA of the identity endpoint:

```
docker:
  client:
    stack:
      monitoring:
        service:
          remote_agent:
            volumes:
              - /etc/ssl/certs/:/etc/ssl/certs/
```

6. For RADOS Gateway, specify the following pillar in ceph/rgw.yml:

```
ceph:
  radosgw:
    identity:
      keystone_verify_ssl: True
      host: ${_param:cluster_internal_protocol}://${_param:ceph_radosgw_keystone_host}
```

7. For the existing deployments, add the following pillar to openstack/control/init.yml to update Nova cells. Otherwise, nova-conductor will use a wrong port for AMQP connections.

```
nova:
  controller:
    update_cells: true
```

8. Select one of the following options:

   - If you are performing an initial deployment of your cluster, proceed with further configuration as required.
   - If you are making changes to an existing cluster:

     1. Log in to the Salt Master node.
     2. Refresh pillars:

        ```
        salt '*' saltutil.refresh_pillar
        ```

     3. Apply the Salt states depending on your use case. For example:

```
salt -C 'I@haproxy' state.apply haproxy
salt -C 'I@apache' state.apply apache
salt 'ctl0*' state.apply keystone,nova,neutron,heat,glance,cinder,designate,manila,ironic
salt 'mdb0*' state.apply aodh,ceilometer,panko,gnocchi
salt -C 'I@ceph' state.apply ceph
salt -C "I@docker:client" state.sls docker.client
salt -C "I@nova:controller" state.sls nova.controller
```

Enable TLS for RabbitMQ and MySQL backends

Using TLS protects the communications within your cloud environment from tampering and eavesdropping. This section explains how to configure the OpenStack databases backends to require TLS.

> **Caution!**
>
> TLS for MySQL is supported starting from the Pike OpenStack release.

> **Note**
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To encrypt RabbitMQ and MySQL communications:

1. Add the following classes to the cluster model of the nodes where the server is located:
   - For the RabbitMQ server:

     ```
     classes:
       ### Enable tls, contains paths to certs/keys
       - service.rabbitmq.server.ssl
       ### Definition of cert/key
       - system.salt.minion.cert.rabbitmq_server
     ```

   - For the MySQL server (Galera cluster):

     ```
     classes:
       ### Enable tls, contains paths to certs/keys
       - service.galera.ssl
       ### Definition of cert/key
       - system.salt.minion.cert.mysql.server
     ```

2. Verify that each node trusts the CA certificates that come from the Salt Master node:

   ```
   _param:
     salt_minion_ca_host: cfg01.${_param:cluster_domain}
   salt:
     minion:
       trusted_ca_minions:
         -  cfg01.${_param:cluster_domain}
   ```

3. Deploy RabbitMQ and MySQL as described in Install support services.
4. Apply the changes by executing the salt.minion state:

```
salt -I salt:minion:enabled state.apply salt.minion
```

Seealso

- Database transport security in the OpenStack Security Guide
- Messaging security in the OpenStack Security Guide

Enable TLS for client-server communications

This section explains how to encrypt the communication paths between the OpenStack services and the message queue service (RabbitMQ) as well as the MySQL database.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To enable TLS for client-server communications:

1. For each of the OpenStack services, enable the TLS protocol usage for messaging and database communications by changing the cluster model as shown in the examples below:
   - For a controller node:
     - The database server configuration example:

```
classes:
- system.salt.minion.cert.mysql.server
- service.galera.ssl

parameters:
  barbican:
    server:
      database:
        ssl:
          enabled: True
  heat:
    server:
      database:
        ssl:
          enabled: True
  designate:
    server:
      database:
        ssl:
          enabled: True
  glance:
    server:
      database:
        ssl:
          enabled: True
  neutron:
    server:
      database:
```

```
      ssl:
        enabled: True
  nova:
    controller:
      database:
        ssl:
          enabled: True
  cinder:
    controller:
      database:
        ssl:
          enabled: True
    volume:
      database:
        ssl:
          enabled: True
  keystone:
    server:
      database:
        ssl:
          enabled: True
```

- The messaging server configuration example:

```
classes:
- service.rabbitmq.server.ssl
- system.salt.minion.cert.rabbitmq_server

parameters:

  designate:
    server:
      message_queue:
        port: 5671
        ssl:
          enabled: True

  barbican:
    server:
      message_queue:
        port: 5671
        ssl:
          enabled: True

  heat:
    server:
```

```
    message_queue:
      port: 5671
      ssl:
        enabled: True

glance:
  server:
    message_queue:
      port: 5671
      ssl:
        enabled: True

neutron:
  server:
    message_queue:
      port: 5671
      ssl:
        enabled: True
nova:
  controller:
    message_queue:
      port: 5671
      ssl:
        enabled: True


cinder:
  controller:
    message_queue:
      port: 5671
      ssl:
        enabled: True
  volume:
    message_queue:
      port: 5671
      ssl:
        enabled: True

keystone:
  server:
    message_queue:
      port: 5671
      ssl:
        enabled: True
```

- For a compute node, the messaging server configuration example:

```
parameters:
  neutron:
    compute:
      message_queue:
        port: 5671
        ssl:
          enabled: True
  nova:
    compute:
      message_queue:
        port: 5671
        ssl:
          enabled: True
```

- For a gateway node, the messaging configuration example:

```
parameters:
  neutron:
    gateway:
      message_queue:
        port: 5671
        ssl:
          enabled: True
```

2. Refresh the pillar data to synchronize the model update at all nodes:

```
salt '*' saltutil.refresh_pillar
salt '*' saltutil.sync_all
```

3. Proceed to Install OpenStack services.

Enable libvirt control channel and live migration over TLS

This section explains how to enable TLS encryption for libvirt. By protecting libvirt with TLS, you prevent your cloud workloads from security compromise. The attacker without an appropriate TLS certificate will not be able to connect to libvirtd and affect its operation. Even if the user does not define custom certificates in their Reclass configuration, the certificates are created automatically.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To enable libvirt control channel and live migration over TLS:

1. Log in to the Salt Master node.
2. Select from the following options:
   - To use dynamically generated pillars from the Salt minion with the automatically generated certificates, add the following class in the classes/cluster/cluster_name/openstack/compute/init.yml of your Recalss model:

     ```
     classes:
     ...
     - system.nova.compute.libvirt.ssl
     ```

   - To install the pre-created certificates, define them as follows in the pillar:

     ```
     nova:
       compute:
         libvirt:
           tls:
             enabled: True
             key: certificate_content
             cert: certificate_content
             cacert: certificate_content
             client:
               key: certificate_content
               cert: certificate_content
     ```

3. Optional. In classes/cluster/cluster_name/openstack/compute/init.yml, modify the following default configuration for SSL ciphers as required:

> Warning
>
> The default SSL ciphers configuration below contains only the TLS v1.2 FIPS-approved cipher suites. Using weak or medium strengh encryption suites can potentially lead to security or compliance issues in your cluster. Therefore, Mirantis highly recommends keeping the default configuration for this parameter.

```
nova:
  complute:
    libvirt:
      tls:
        ...
        priority: "SECURE256:-VERS-ALL:+VERS-TLS1.2:-KX-ALL:+ECDHE-RSA:+ECDHE-ECDSA:\
          -CIPHER-ALL:+AES-256-GCM:+AES-256-CBC:-MAC-ALL:+AEAD:+SHA384"
```

4. Apply the changes by running the nova state for all compute nodes:

```
salt 'cmp*' state.apply nova
```

Enable TLS encryption between the OpenStack compute nodes and VNC clients

The Virtual Network Computing (VNC) provides a remote console or remote desktop access to guest virtual machines through either the OpenStack dashboard or the command-line interface. The OpenStack Compute service users can access their instances using the VNC clients through the VNC proxy. MCP enables you to encrypt the communication between the VNC clients and OpenStack compute nodes with TLS.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To enable TLS encryption for VNC:

1. Open your Reclass model Git repository on the cluster level.
2. Enable the TLS encryption of communications between the OpenStack compute nodes and VNC proxy:

   > Note
   >
   > The data encryption over TLS between the OpenStack compute nodes and VNC proxy is supported starting with the OpenStack Pike release.

   1. In openstack/compute/init.yml, enable the TLS encryption on the OpenStack compute nodes:

      ```
      - system.nova.compute.libvirt.ssl.vnc

      parameters:
        _param:
          ...
          nova_vncproxy_url: https://${_param:cluster_public_host}:6080
      ```

   2. In openstack/control.yml, enable the TLS encryption on the VNC proxy:

      ```
      - system.nova.control.novncproxy.tls

      parameters:
        _param:
          ...
          nova_vncproxy_url: https://${_param:cluster_public_host}:6080
      ```

3. In openstack/proxy.yml, define the HTTPS protocol for the nginx_proxy_novnc site:

```
nginx:
  server:
    site:
      nginx_proxy_novnc:
        proxy:
          protocol: https
```

3. Enable the TLS encryption of communications between VNC proxy and VNC clients in openstack/control.yml:

> Note
>
> The data encryption over TLS between VNC proxy and VNC clients is supported starting with the OpenStack Queens release.

```
nova:
  controller:
    novncproxy:
      tls:
        enabled: True
```

4. Available from 2019.2.4 Optional. Specify a required TLS version and allowed SSL ciphers to use by the Nova console proxy server:

```
nova:
  controller:
    novncproxy:
      tls:
        enabled: True
        version: <tls version>
        ciphers: <ciphers>
```

   - The <tls_version> value is one of default, tlsv1_1, tlsv1_2, or tlsv1_3. Depending on your Python version, not all TLS versions may be available, in which case a graceful fallback to the newest possible version will be performed.
   - The <ciphers> value is a coma-separated list of allowed SSL ciphers, depending on your system and OpenSSL version. To obtain the list of available ciphers, run openssl ciphers on an OpenStack controller node.

5. Apply the changes:

```
salt 'cmp*' state.apply nova
salt 'ctl*' state.apply nova
salt 'prx*' state.apply nginx
```

Configure OpenStack APIs to use X.509 certificates for MySQL

MCP enables you to enhance the security of your OpenStack cloud by requiring X.509 certificates for authentication. Configuring OpenStack APIs to use X.509 certificates for communicating with the MySQL database provides greater identity assurance of OpenStack clients making the connection to the database and ensures that the communications are encrypted.

When configuring X.509 for your MCP cloud, you enable the TLS support for the communications between MySQL and the OpenStack services.

The OpenStack services that support X.509 certificates include: Aodh, Barbican, Cinder, Designate, Glance, Gnocchi, Heat, Ironic, Keystone, Manila Neutron, Nova, and Panko.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To enable the X.509 and SSL support:

1. Configure the X.509 support on the Galera side:
    1. Include the following class to cluster_name/openstack/database.yml of your deployment model:

        ```
        system.galera.server.database.x509.<openstack_service_name>
        ```

    2. Apply the changes by running the galera state:

        > Note
        >
        > On an existing environment, the already existing database users and their privileges will not be replaced automatically. If you want to replace the existing users, you need to remove them manually before applying the galera state.

        ```
        salt -C 'I@galera:master' state.sls galera
        ```

2. Configure the X.509 support on the service side:
    1. Configure all OpenStack APIs that support X.509 to use X.509 certificates by setting openstack_mysql_x509_enabled: True on the cluster level of your deployment model:

```
parameters:
  _param:
    openstack_mysql_x509_enabled: True
```

2. Define the certificates:

    1. Generate certificates automatically using Salt:

        ```
        salt '*' state.sls salt.minion
        ```

    2. Optional. Define pre-created certificates for particular services in pillars as described in the table below.

        Note

        The table illustrates how to define pre-created certificates through paths. Though, you can include a certificate content to a pillar instead. For example, for the Aodh, use the following structure:

        ```
        aodh:
          server:
            database:
              x509:
                cacert: (certificate content)
                cert: (certificate content)
                key: (certificate content)
        ```

OpenStack service	Define custom certificates in pillar	Apply the change

Aodh	`aodh:`
	`  server:`
	`  database:`
	`  x509:`
	`  ca_cert: <path/to/cert/file>`
	`  cert_file: <path/to/cert/file>`
	`  key_file: <path/to/cert/file>`
		`salt -C 'I@aodh:server' state.sls aodh`

Barbican	**barbican**:
	  server:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@barbican:server' state.sls barbican.server

Cinder	**cinder**:
	  controller:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
	  volume:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@cinder:controller' state.sls cinder

Designate	**designate**:
	  server:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@designate:server' state.sls designate

Glance	**glance**:
	  server:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@glance:server' state.sls glance.server

Gnocchi	**gnocchi**:
	  common:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@gnocchi:server' state.sls gnocchi.server

Heat	**heat**:
	  server:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@heat:server' state.sls heat

Ironic	**ironic**:
	  api:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
	  conductor:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@ironic:api' state.sls ironic.api
		salt -C 'I@ironic:conductor' state.sls ironic.conductor

Keystone	**keystone**:
	  server:
	  database:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@keystone:server' state.sls keystone.server

Manila	**manila**: **common**: **database**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@manila:common' state.sls manila
Neutron	**neutron**: **server**: **database**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@neutron:server' state.sls neutron.server
Nova	**nova**: **controller**: **database**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@nova:controller' state.sls nova.controller
Panko	**panko**: **server**: **database**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@panko:server' state.sls panko

3. To verify that a particular client is able to authorize with X.509, verify the output of the mysql --user-name=<component_name> on any controller node. For example:

```
mysql --user-name=nova --host=10.11.0.50 --password=<password> --silent \
  --ssl-ca=/etc/nova/ssl/mysql/ca-cert.pem \
  --ssl-cert=/etc/nova/ssl/mysql/client-cert.pem \
  --ssl-key=/etc/nova/ssl/mysql/client-key.pem
```

Seealso

MCP Operations Guide: Enable SSL certificates monitoring

Configure OpenStack APIs to use X.509 certificates for RabbitMQ

MCP enables you to enhance the security of your OpenStack environment by requiring X.509 certificates for authentication. Configuring the OpenStack services to use X.509 certificates for communicating with the RabbitMQ server provides greater identity assurance of OpenStack clients making the connection to message_queue and ensures that the communications are encrypted.

When configuring X.509 for your MCP cloud, you enable the TLS support for the communications between RabbitMQ and the OpenStack services.

The OpenStack services that support X.509 certificates for communicating with the RabbitMQ server include Aodh, Barbican, Cinder, Designate, Glance, Heat, Ironic, Keystone, Manila, Neutron, and Nova.

> Note
>
> The procedures included in this section apply to new MCP OpenStack deployments only, unless specified otherwise.

To enable the X.509 and SSL support for communications between the OpenStack services and RabbitMQ:

1. Configure the X.509 support on the RabbitMQ server side:
    1. Include the following class to <cluster_name>/openstack/message_queue.yml of your deployment model:

        ```
        - system.rabbitmq.server.ssl
        ```

    2. Refresh the pillars:

        ```
        salt -C 'I@rabbitmq:server' saltutil.refresh_pillar
        ```

    3. Verify the pillars:

        > Note
        >
        > X.509 remains disabled until you enable it on the cluster level as described further in this procedure.

        ```
        salt -C 'I@rabbitmq:server' pillar.get rabbitmq:server:x509
        ```

2. Configure the X.509 support on the service side:

1. Configure all OpenStack services that support X.509 to use X.509 certificates for RabbitMQ by setting the following parameters on the cluster level of your deployment model in <cluster_name>/openstack/init.yml:

```
parameters:
  _param:
    rabbitmq_ssl_enabled: True
    openstack_rabbitmq_x509_enabled: True
    openstack_rabbitmq_port: 5671
```

2. Refresh the pillars:

```
salt '*' saltutil.refresh_pillar
```

3. Verify that the pillars for the OpenStack services are updated. For example, for the Nova controller:

```
salt -C 'I@nova:controller' pillar.get nova:controller:message_queue:x509
```

   Example of system response:

```
ctl03.example-cookiecutter-model.local:
  ----------
  ca_file:
      /etc/nova/ssl/rabbitmq/ca-cert.pem
  cert_file:
      /etc/nova/ssl/rabbitmq/client-cert.pem
  enabled:
      True
  key_file:
      /etc/nova/ssl/rabbitmq/client-key.pem
ctl02.example-cookiecutter-model.local:
  ----------
  ca_file:
      /etc/nova/ssl/rabbitmq/ca-cert.pem
  cert_file:
      /etc/nova/ssl/rabbitmq/client-cert.pem
  enabled:
      True
  key_file:
      /etc/nova/ssl/rabbitmq/client-key.pem
ctl01.example-cookiecutter-model.local:
  ----------
  ca_file:
      /etc/nova/ssl/rabbitmq/ca-cert.pem
  cert_file:
      /etc/nova/ssl/rabbitmq/client-cert.pem
```

```
enabled:
  True
key_file:
  /etc/nova/ssl/rabbitmq/client-key.pem
```

3. Generate certificates automatically using Salt:
   1. For the OpenStack services:

      ```
      salt '*' state.sls salt.minion
      ```

   2. For the RabbitMQ server:

      ```
      salt -C 'I@rabbitmq:server' state.sls salt.minion.cert
      ```

4. Verify that the RabbitmMQ cluster is healthy:

   ```
   salt -C 'I@rabbitmq:server' cmd.run 'rabbitmqctl cluster_status'
   ```

5. Apply the changes on the server side:

   ```
   salt -C 'I@rabbitmq:server' state.sls rabbitmq
   ```

6. Apply the changes for the OpenStack services by running the appropriate service states listed in the Apply the change column of the Definition of custom X.509 certificates for RabbitMQ table in the next step.
7. Optional. Define pre-created certificates for particular services in pillars as described in the table below.

   Note

   The table illustrates how to define pre-created certificates through paths. Though, you can include a certificate content to a pillar instead. For example, for the Aodh, use the following structure:

   ```
   aodh:
     server:
       message_queue:
         x509:
           cacert: <certificate_content>
           cert: <certificate_content>
           key: <certificate_content>
   ```

Definition of custom X.509 certificates for RabbitMQ

OpenStack service	Define custom certificates in pillar	Apply the change

Aodh	**aodh**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@aodh:server' state.sls aodh

Barbican	**barbican**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@barbican:server' state.sls barbican.server

Cinder	**cinder**:
	  controller:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
	  volume:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@cinder:controller or I@cinder:volume' state.sls cinder

Designate	**designate**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@designate:server' state.sls designate

Glance	**glance**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@glance:server' state.sls glance.server

Heat	**heat**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@heat:server' state.sls heat

Ironic	**ironic**:
	  api:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
	  conductor:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@ironic:api' state.sls ironic.api
		salt -C 'I@ironic:conductor' state.sls ironic.conductor

Keystone	**keystone**:
	  server:
	  message_queue:
	  x509:
	  ca_cert: <path/to/cert/file>
	  cert_file: <path/to/cert/file>
	  key_file: <path/to/cert/file>
		salt -C 'I@keystone:server' state.sls keystone.server

Manila	**manila**: **common**: **message_queue**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file	salt -C 'I@manila:common' state.sls manila
Neutron	**neutron**: **server**: **message_queue**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file> **neutron**: **gateway**: **message_queue**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@neutron:server or I@neutron:gateway or I@neutron:compute' state.sls neutron
Nova	**nova**: **controller**: **message_queue**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file> **nova**: **compute**: **message_queue**: **x509**: **ca_cert**: <path/to/cert/file> **cert_file**: <path/to/cert/file> **key_file**: <path/to/cert/file>	salt -C 'I@nova:controller or I@nova:compute' state.sls nova

8. To verify that a particular client can authorize to RabbitMQ with an X.509 certificate, verify the output of the rabbitmqctl list_connections command on any RabbitMQ node. For example:

```
salt msg01* cmd.run 'rabbitmqctl list_connections peer_host peer_port peer_cert_subject ssl'
```

Seealso

MCP Operations Guide: Enable SSL certificates monitoring

Install support services

Your installation should include a number of support services such as RabbitMQ for messaging; HAProxy for load balancing, proxying, and HA; GlusterFS for storage; and others. This section provides the procedures to install the services and verify they are up and running.

Warning

The HAProxy state should not be deployed prior to Galera. Otherwise, the Galera deployment will fail because of the ports/IP are not available due to HAProxy is already listening on them attempting to bind to 0.0.0.0.

Therefore, verify that your deployment workflow is correct:

1. Keepalived
2. Galera
3. HAProxy

Deploy Keepalived

Keepalived is a framework that provides high availability and load balancing to Linux systems. Keepalived provides a virtual IP address that network clients use as a main entry point to access the CI/CD services distributed between nodes. Therefore, in MCP, Keepalived is used in HA (multiple-node warm-standby) configuration to keep track of services availability and manage failovers.

> Warning
>
> The HAProxy state should not be deployed prior to Galera. Otherwise, the Galera deployment will fail because of the ports/IP are not available due to HAProxy is already listening on them attempting to bind to 0.0.0.0.
>
> Therefore, verify that your deployment workflow is correct:
>
> 1. Keepalived
> 2. Galera
> 3. HAProxy

To deploy Keepalived:

```
salt -C 'I@keepalived:cluster' state.sls keepalived -b 1
```

To verify the VIP address:

1. Determine the VIP address for the current environment:

   ```
   salt -C 'I@keepalived:cluster' pillar.get keepalived:cluster:instance:VIP:address
   ```

   Example of system output:

   ```
   ctl03.mk22-lab-basic.local:
   172.16.10.254
   ctl02.mk22-lab-basic.local:
   172.16.10.254
   ctl01.mk22-lab-basic.local:
   172.16.10.254
   ```

   > Note
   >
   > You can also find the Keepalived VIP address in the following files of the Reclass model:

- /usr/share/salt-formulas/reclass/service/keepalived/cluster/single.yml, parameter keepalived.cluster.instance.VIP.address
- /srv/salt/reclass/classes/cluster/<ENV_NAME>/openstack/control.yml, parameter cluster_vip_address

2. Verify if the obtained VIP address is assigned to any network interface on one of the controller nodes:

```
salt -C 'I@keepalived:cluster' cmd.run "ip a | grep <ENV_VIP_ADDRESS>"
```

Note

Remember that multiple clusters are defined. Therefore, verify that all of them are up and running.

Deploy NTP

The Network Time Protocol (NTP) is used to properly synchronize services among your OpenStack nodes.

To deploy NTP:

```
salt '*' state.sls ntp
```

Seealso

Enable NTP authentication

Deploy GlusterFS

GlusterFS is a highly-scalable distributed network file system that enables you to create a reliable and redundant data storage. GlusterFS keeps all important data for Database, Artifactory, and Gerrit in shared storage on separate volumes that makes MCP CI infrastructure fully tolerant to failovers.

To deploy GlusterFS:

```
salt -C 'I@glusterfs:server' state.sls glusterfs.server.service
salt -C 'I@glusterfs:server' state.sls glusterfs.server.setup -b 1
```

To verify GlusterFS:

```
salt -C 'I@glusterfs:server' cmd.run "gluster peer status; gluster volume status" -b 1
```

Deploy RabbitMQ

RabbitMQ is an intermediary for messaging. It provides a platform to send and receive messages for applications and a safe place for messages to live until they are received. All OpenStack services depend on RabbitMQ message queues to communicate and distribute the workload across workers.

To deploy RabbitMQ:

1. Log in to the Salt Master node.
2. Apply the rabbitmq state:

   ```
   salt -C 'I@rabbitmq:server' state.sls rabbitmq
   ```

3. Verify the RabbitMQ status:

   ```
   salt -C 'I@rabbitmq:server' cmd.run "rabbitmqctl cluster_status"
   ```

Deploy Galera (MySQL)

Galera cluster is a synchronous multi-master database cluster based on the MySQL storage engine. Galera is an HA service that provides scalability and high system uptime.

> Warning
>
> The HAProxy state should not be deployed prior to Galera. Otherwise, the Galera deployment will fail because of the ports/IP are not available due to HAProxy is already listening on them attempting to bind to 0.0.0.0.
>
> Therefore, verify that your deployment workflow is correct:
>
> 1. Keepalived
> 2. Galera
> 3. HAProxy

> Note
>
> For details on the Galera service configurations, see Configure Galera parameters.

To deploy Galera:

1. Log in to the Salt Master node.
2. Apply the galera state:

```
salt -C 'I@galera:master' state.sls galera
salt -C 'I@galera:slave' state.sls galera -b 1
```

3. Verify that Galera is up and running:

```
salt -C 'I@galera:master' mysql.status | grep -A1 wsrep_cluster_size
salt -C 'I@galera:slave' mysql.status | grep -A1 wsrep_cluster_size
```

Deploy HAProxy

HAProxy is a software that provides load balancing for network connections while Keepalived is used for configuring the IP address of the VIP.

> Warning
>
> The HAProxy state should not be deployed prior to Galera. Otherwise, the Galera deployment will fail because of the ports/IP are not available due to HAProxy is already listening on them attempting to bind to 0.0.0.0.
>
> Therefore, verify that your deployment workflow is correct:
>
> 1. Keepalived
> 2. Galera
> 3. HAProxy

> Note
>
> For details on HAProxy configurations, see Configure HAProxy parameters.

To deploy HAProxy:

```
salt -C 'I@haproxy:proxy' state.sls haproxy
salt -C 'I@haproxy:proxy' service.status haproxy
salt -I 'haproxy:proxy' service.restart rsyslog
```

Deploy Memcached

Memcached is used for caching data for different OpenStack services such as Keystone. The Memcached service is running on the controller nodes for the control plane services and on proxy nodes for Horizon.

To deploy Memcached:

```
salt -C 'I@memcached:server' state.sls memcached
```

Seealso

MCP Operations guide: Disable the Memcached listener on the UDP port

Deploy a DNS backend for Designate

Berkely Internet Name Domain (BIND9) and PowerDNS are the two underlying Domain Name system (DNS) servers that Designate supports out of the box. You can use either new or existing DNS server as a backend for Designate.

Deploy BIND9 for Designate

Berkely Internet Name Domain (BIND9) server can be used by Designate as its underlying backend. This section describes how to configure an existing or deploy a new BIND9 server for Designate.

Configure an existing BIND9 server for Designate

If you already have a running BIND9 server, you can configure and use it for the Designate deployment.

The example configuration below has three predeployed BIND9 servers.

To configure an existing BIND9 server for Designate:

1. Open your BIND9 server UI.
2. Verify that the BIND9 configuration files contain rdnc.key for Designate.

   The following text is an example of /etc/bind/named.conf.local on the managed BIND9 server with the IPs allowed for Designate and rdnc.key:

```
key "designate" {
  algorithm hmac-sha512;
  secret "4pc+X4PDqb2q+5o72dISm72LM1Ds9X2EYZjqg+nmsS7F/C8H+z0fLLBunoitw==";
};
controls {
  inet 10.0.0.3 port 953
  allow {
    172.16.10.101;
    172.16.10.102;
    172.16.10.103;
  }
  keys {
    designate;
  };
};
```

3. Open classes/cluster/cluster_name/openstack in your Git project repository.
4. In init.yml, add the following parameters:

```
bind9_node01_address: 10.0.0.1
bind9_node02_address: 10.0.0.2
bind9_node03_address: 10.0.0.3
mysql_designate_password: password
keystone_designate_password: password
designate_service_host: ${_param:openstack_control_address}
designate_bind9_rndc_algorithm: hmac-sha512
designate_bind9_rndc_key: >
  4pc+X4PDqb2q+5o72dISm72LM1Ds9X2EYZjqg+nmsS7F/C8H+z0fLLBunoitw==
designate_domain_id: 5186883b-91fb-4891-bd49-e6769234a8fc
designate_pool_ns_records:
  - hostname: 'ns1.example.org.'
    priority: 10
designate_pool_nameservers:
  - host: ${_param:bind9_node01_address}
    port: 53
```

```
  - host: ${_param:bind9_node02_address}
    port: 53
  - host: ${_param:bind9_node03_address}
    port: 53
designate_pool_target_type: bind9
designate_pool_target_masters:
  - host: ${_param:openstack_control_node01_address}
    port: 5354
  - host: ${_param:openstack_control_node02_address}
    port: 5354
  - host: ${_param:openstack_control_node03_address}
    port: 5354
designate_pool_target_options:
  host: ${_param:bind9_node01_address}
  port: 53
  rndc_host: ${_param:bind9_node01_address}
  rndc_port: 953
  rndc_key_file: /etc/designate/rndc.key
designate_version: ${_param:openstack_version}
```

5. In control.yml, modify the parameters section. Add targets according to the number of BIND9 severs that will be managed, three in our case.

   Example:

```
designate:
   server:
     backend:
       bind9:
         rndc_key: ${_param:designate_bind9_rndc_key}
         rndc_algorithm: ${_param:designate_bind9_rndc_algorithm}
     pools:
       default:
         description: 'test pool'
         targets:
           default:
             description: 'test target1'
           default1:
             type: ${_param:designate_pool_target_type}
             description: 'test target2'
              masters: ${_param:designate_pool_target_masters}
             options:
               host: ${_param:bind9_node02_address}
               port: 53
               rndc_host: ${_param:bind9_node02_address}
               rndc_port: 953
               rndc_key_file: /etc/designate/rndc.key
           default2:
```

```
      type: ${_param:designate_pool_target_type}
      description: 'test target3'
       masters: ${_param:designate_pool_target_masters}
      options:
        host: ${_param:bind9_node03_address}
        port: 53
        rndc_host: ${_param:bind9_node03_address}
        rndc_port: 953
        rndc_key_file: /etc/designate/rndc.key
```

6. Add your changes to a new commit.
7. Commit and push the changes.

Once done, proceed to deploy Designate as described in Deploy Designate.

Prepare a deployment model for a new BIND9 server

Before you deploy a BIND9 server as a backend for Designate, prepare your cluster deployment model as described below.

The example provided in this section describes the configuration of the deployment model with two BIND9 servers deployed on separate VMs of the infrastructure nodes.

To prepare a deployment model for a new BIND9 server:

1. Open the classes/cluster/cluster_name/openstack directory in your Git project repository.
2. Create a dns.yml file with the following parameters:

```
classes:
- system.linux.system.repo.mcp.extra
- system.linux.system.repo.mcp.apt_mirantis.ubuntu
- system.linux.system.repo.mcp.apt_mirantis.saltstack
- system.bind.server.single
- cluster.cluster_name.infra
parameters:
  linux:
    network:
      interface:
        ens3: ${_param:linux_single_interface}
  bind:
    server:
      key:
        designate:
          secret: "${_param:designate_bind9_rndc_key}"
          algorithm: "${_param:designate_bind9_rndc_algorithm}"
      allow_new_zones: true
      query: true
      control:
        mgmt:
          enabled: true
          bind:
            address: ${_param:single_address}
            port: 953
          allow:
            - ${_param:openstack_control_node01_address}
            - ${_param:openstack_control_node02_address}
            - ${_param:openstack_control_node03_address}
            - ${_param:single_address}
            - 127.0.0.1
          keys:
            - designate
    client:
      enabled: true
      option:
        default:
```

```
      server: 127.0.0.1
      port: 953
      key: designate
    key:
      designate:
        secret: "${_param:designate_bind9_rndc_key}"
        algorithm: "${_param:designate_bind9_rndc_algorithm}"
```

> Note
>
> In the parameters above, substitute cluster_name with the appropriate value.

3. In control.yml, modify the parameters section as follows. Add targets according to the number of the BIND9 servers that will be managed.

```
designate:
  server:
    backend:
      bind9:
        rndc_key: ${_param:designate_bind9_rndc_key}
        rndc_algorithm: ${_param:designate_bind9_rndc_algorithm}
    pools:
      default:
        description: 'test pool'
        targets:
          default:
            description: 'test target1'
          default1:
            type: ${_param:designate_pool_target_type}
            description: 'test target2'
            masters: ${_param:designate_pool_target_masters}
            options:
              host: ${_param:openstack_dns_node02_address}
              port: 53
              rndc_host: ${_param:openstack_dns_node02_address}
              rndc_port: 953
              rndc_key_file: /etc/designate/rndc.key
```

> Note
>
> In the example above, the first target that contains default parameters is defined in openstack/init.yml. The second target is defined explicitly. You can add more targets in this section as required.

4. In init.yml, modify the parameters section.

   Example:

```
openstack_dns_node01_hostname: dns01
openstack_dns_node02_hostname: dns02
openstack_dns_node01_deploy_address: 10.0.0.8
openstack_dns_node02_deploy_address: 10.0.0.9
openstack_dns_node01_address: 10.0.0.1
openstack_dns_node02_address: 10.0.0.2
mysql_designate_password: password
keystone_designate_password: password
designate_service_host: ${_param:openstack_control_address}
designate_bind9_rndc_key: >
  4pc+X4PDqb2q+5o72dISm72LM1Ds9X2EYZjqg+nmsS7F/C8H+z0fLLBunoitw==
designate_bind9_rndc_algorithm: hmac-sha512
designate_domain_id: 5186883b-91fb-4891-bd49-e6769234a8fc
designate_pool_ns_records:
  - hostname: 'ns1.example.org.'
    priority: 10
designate_pool_nameservers:
  - host: ${_param:openstack_dns_node01_address}
    port: 53
  - host: ${_param:openstack_dns_node02_address}
    port: 53
designate_pool_target_type: bind9
designate_pool_target_masters:
  - host: ${_param:openstack_control_node01_address}
    port: 5354
  - host: ${_param:openstack_control_node02_address}
    port: 5354
  - host: ${_param:openstack_control_node03_address}
    port: 5354
designate_pool_target_options:
    host: ${_param:openstack_dns_node01_address}
    port: 53
    rndc_host: ${_param:openstack_dns_node01_address}
    rndc_port: 953
    rndc_key_file: /etc/designate/rndc.key
designate_version: ${_param:openstack_version}
```

```
linux:
  network:
    host:
    dns01:
      address: ${_param:openstack_dns_node01_address}
      names:
      - ${_param:openstack_dns_node01_hostname}
      - ${_param:openstack_dns_node01_hostname}.${_param:cluster_domain}
    dns02:
      address: ${_param:openstack_dns_node02_address}
      names:
      - ${_param:openstack_dns_node02_hostname}
      - ${_param:openstack_dns_node02_hostname}.${_param:cluster_domain}
```

5. In classes/cluster/cluster_name/infra/kvm.yml, add the following class:

```
classes:
- system.salt.control.cluster.openstack_dns_cluster
```

6. In classes/cluster/cluster_name/infra/config.yml, modify the classes and parameters sections.

   Example:

   - In the classes section:

     ```
     classes:
     - system.reclass.storage.system.openstack_dns_cluster
     ```

   - In the parameters section, add the DNS VMs.

     ```
     reclass:
       storage:
         node:
           openstack_dns_node01:
             params:
               linux_system_codename: xenial
               deploy_address: ${_param:openstack_database_node03_deploy_address}
           openstack_dns_node01:
             params:
               linux_system_codename: xenial
               deploy_address: ${_param:openstack_dns_node01_deploy_address}
           openstack_dns_node02:
             params:
               linux_system_codename: xenial
               deploy_address: ${_param:openstack_dns_node02_deploy_address}
     ```

```
    openstack_message_queue_node01:
      params:
        linux_system_codename: xenial
```

7. Commit and push the changes.

Once done, proceed to deploy the BIND9 server service as described in Deploy a new BIND9 server for Designate.

Deploy a new BIND9 server for Designate

After you configure the Reclass model for a BIND9 server as the backend for Designate, proceed to deploying the BIND9 server service as described below.

To deploy a BIND9 server service:

1. Log in to the Salt Master node.
2. Configure basic operating system settings on the DNS nodes:

```
salt -C 'I@bind:server' state.sls linux,ntp,openssh
```

3. Apply the following state:

```
salt -C 'I@bind:server' state.sls bind
```

Once done, proceed to deploy Designate as described in Deploy Designate.

Deploy PowerDNS for Designate

PowerDNS server can be used by Designate as its underlying backend. This section describes how to configure an existing or deploy a new PowerDNS server for Designate.

The default PowerDNS configuration for Designate uses the Designate worker role. If you need live synchronization of DNS zones between Designate and PowerDNS servers, you can configure Designate with the pool_manager role. The Designate Pool Manager keeps records consistent across the Designate database and the PowerDNS servers. For example, if a record was removed from the PowerDNS server due to a hard disk failure, this record will be automatically restored from the Designate database.

Configure an existing PowerDNS server for Designate

If you already have a running PowerDNS server, you can configure and use it for the Designate deployment.

The example configuration below has three predeployed PowerDNS servers.

To configure an existing PowerDNS server for Designate:

1. Open your PowerDNS server UI.
2. In etc/powerdns/pdns.conf, modify the following parameters:
   - allow-axfr-ips - must list the IPs of the Designate nodes, which will be located on the OpenStack API nodes
   - api-key - must coincide with the designate_pdns_api_key parameter for Designate in the Reclass model
   - webserver - must have the value yes
   - webserver-port - must coincide with the powerdns_webserver_port parameter for Designate in the Reclass model
   - api - must have the value yes to enable management through API
   - disable-axfr - must have the value no to enable the axfr zone updates from the Designate nodes

   Example:

```
allow-axfr-ips=172.16.10.101,172.16.10.102,172.16.10.103,127.0.0.1
allow-recursion=127.0.0.1
api-key=VxK9cMlFL5Ae
api=yes
config-dir=/etc/powerdns
daemon=yes
default-soa-name=a.very.best.power.dns.server
disable-axfr=no
guardian=yes
include-dir=/etc/powerdns/pdns.d
launch=
local-address=10.0.0.1
local-port=53
master=no
setgid=pdns
setuid=pdns
slave=yes
soa-minimum-ttl=3600
socket-dir=/var/run
version-string=powerdns
webserver=yes
webserver-address=10.0.0.1
```

```
webserver-password=gJ6n3gVaYP8eS
webserver-port=8081
```

3. Open the classes/cluster/cluster_name/openstack directory in your Git project repository.
4. In init.yml, add the following parameters:

```
powerdns_node01_address: 10.0.0.1
powerdns_node02_address: 10.0.0.2
powerdns_node03_address: 10.0.0.3
powerdns_webserver_password: gJ6n3gVaYP8eS
powerdns_webserver_port: 8081
mysql_designate_password: password
keystone_designate_password: password
designate_service_host: ${_param:openstack_control_address}
designate_domain_id: 5186883b-91fb-4891-bd49-e6769234a8fc
designate_pdns_api_key: VxK9cMlFL5Ae
designate_pdns_api_endpoint: >
  "http://${_param:powerdns_node01_address}:${_param:powerdns_webserver_port}"
designate_pool_ns_records:
  - hostname: 'ns1.example.org.'
    priority: 10
designate_pool_nameservers:
  - host: ${_param:powerdns_node01_address}
    port: 53
  - host: ${_param:powerdns_node02_address}
    port: 53
  - host: ${_param:powerdns_node03_address}
    port: 53
designate_pool_target_type: pdns4
designate_pool_target_masters:
  - host: ${_param:openstack_control_node01_address}
    port: 5354
  - host: ${_param:openstack_control_node02_address}
    port: 5354
  - host: ${_param:openstack_control_node03_address}
    port: 5354
designate_pool_target_options:
  host: ${_param:powerdns_node01_address}
  port: 53
  api_token: ${_param:designate_pdns_api_key}
  api_endpoint: ${_param:designate_pdns_api_endpoint}
designate_version: ${_param:openstack_version}
```

5. In control.yml, modify the parameters section. Add targets according to the number of PowerDNS severs that will be managed, three in our case.

   Example:

```
designate:
  server:
    backend:
      pdns4:
        api_token: ${_param:designate_pdns_api_key}
        api_endpoint: ${_param:designate_pdns_api_endpoint}
    pools:
      default:
        description: 'test pool'
        targets:
          default:
            description: 'test target1'
          default1:
            type: ${_param:designate_pool_target_type}
            description: 'test target2'
            masters: ${_param:designate_pool_target_masters}
            options:
              host: ${_param:powerdns_node02_address}
              port: 53
              api_endpoint: >
                "http://${_param:${_param:powerdns_node02_address}}:
                ${_param:powerdns_webserver_port}"
              api_token: ${_param:designate_pdns_api_key}
          default2:
            type: ${_param:designate_pool_target_type}
            description: 'test target3'
            masters: ${_param:designate_pool_target_masters}
            options:
              host: ${_param:powerdns_node03_address}
              port: 53
              api_endpoint: >
                "http://${_param:powerdns_node03_address}:
                ${_param:powerdns_webserver_port}"
              api_token: ${_param:designate_pdns_api_key}
```

Once done, proceed to deploy Designate as described in Deploy Designate.

Prepare a deployment model for a new PowerDNS server with the worker role

Before you deploy a PowerDNS server as a backend for Designate, prepare your deployment model with the default Designate worker role as described below.

If you need live synchronization of DNS zones between Designate and PowerDNS servers, configure Designate with the pool_manager role as described in Prepare a deployment model for a new PowerDNS server with the pool_manager role.

The examples provided in this section describe the configuration of the deployment model with two PowerDNS servers deployed on separate VMs of the infrastructure nodes.

To prepare a deployment model for a new PowerDNS server:

1. Open the classes/cluster/cluster_name/openstack directory of your Git project repository.
2. Create a dns.yml file with the following parameters:

```
classes:
- system.powerdns.server.single
- cluster.cluster_name.infra
parameters:
  linux:
    network:
      interface:
        ens3: ${_param:linux_single_interface}
    host:
      dns01:
        address: ${_param:openstack_dns_node01_address}
        names:
        - dns01
        - dns01.${_param:cluster_domain}
      dns02:
        address: ${_param:openstack_dns_node02_address}
        names:
        - dns02
        - dns02.${_param:cluster_domain}
  powerdns:
    server:
      enabled: true
      bind:
        address: ${_param:single_address}
        port: 53
      backend:
        engine: sqlite
        dbname: pdns.sqlite3
        dbpath: /var/lib/powerdns
      api:
        enabled: true
        key: ${_param:designate_pdns_api_key}
      webserver:
```

```
      enabled: true
      address: ${_param:single_address}
      port: ${_param:powerdns_webserver_port}
      password: ${_param:powerdns_webserver_password}
    axfr_ips:
      - ${_param:openstack_control_node01_address}
      - ${_param:openstack_control_node02_address}
      - ${_param:openstack_control_node03_address}
      - 127.0.0.1
```

> Note
>
> If you want to use the MySQL backend instead of the default SQLite one, modify the backend section parameters accordingly and configure your metadata model as described in Enable the MySQL backend for PowerDNS.

3. In init.yml, define the following parameters:

   Example:

```
openstack_dns_node01_address: 10.0.0.1
openstack_dns_node02_address: 10.0.0.2
powerdns_webserver_password: gJ6n3gVaYP8eS
powerdns_webserver_port: 8081
mysql_designate_password: password
keystone_designate_password: password
designate_service_host: ${_param:openstack_control_address}
designate_domain_id: 5186883b-91fb-4891-bd49-e6769234a8fc
designate_pdns_api_key: VxK9cMlFL5Ae
designate_pdns_api_endpoint: >
  "http://${_param:openstack_dns_node01_address}:${_param:powerdns_webserver_port}"
designate_pool_ns_records:
  - hostname: 'ns1.example.org.'
    priority: 10
designate_pool_nameservers:
  - host: ${_param:openstack_dns_node01_address}
    port: 53
  - host: ${_param:openstack_dns_node02_address}
    port: 53
designate_pool_target_type: pdns4
designate_pool_target_masters:
  - host: ${_param:openstack_control_node01_address}
    port: 5354
  - host: ${_param:openstack_control_node02_address}
    port: 5354
```

```
  - host: ${_param:openstack_control_node03_address}
    port: 5354
designate_pool_target_options:
  host: ${_param:openstack_dns_node01_address}
  port: 53
  api_token: ${_param:designate_pdns_api_key}
  api_endpoint: ${_param:designate_pdns_api_endpoint}
designate_version: ${_param:openstack_version}
designate_worker_enabled: true
```

4. In control.yml, define the following parameters in the parameters section:

   Example:

```
designate:
  worker:
    enabled: ${_param:designate_worker_enabled}
  server:
    backend:
      pdns4:
        api_token: ${_param:designate_pdns_api_key}
        api_endpoint: ${_param:designate_pdns_api_endpoint}
    pools:
      default:
        description: 'test pool'
        targets:
          default:
            description: 'test target1'
          default1:
            type: ${_param:designate_pool_target_type}
            description: 'test target2'
            masters: ${_param:designate_pool_target_masters}
            options:
              host: ${_param:openstack_dns_node02_address}
              port: 53
              api_endpoint: >
                "http://${_param:openstack_dns_node02_address}:
                ${_param:powerdns_webserver_port}"
              api_token: ${_param:designate_pdns_api_key}
```

5. In classes/cluster/cluster_name/infra/kvm.yml, modify the classes and parameters sections.

   Example:

   - In the classes section:

```
classes:
- system.salt.control.cluster.openstack_dns_cluster
```

- In the parameters section, add the DNS parameters for VMs with the required location of DNS VMs on kvm nodes and the planned resource usage for them.

```
salt:
  control:
    openstack.dns:
      cpu: 2
      ram: 2048
      disk_profile: small
      net_profile: default
  cluster:
    internal:
      node:
        dns01:
          provider: kvm01.${_param:cluster_domain}
        dns02:
          provider: kvm02.${_param:cluster_domain}
```

6. In classes/cluster/cluster_name/infra/config.yml, modify the classes and parameters sections.

   Example:

   - In the classes section:

```
classes:
- system.reclass.storage.system.openstack_dns_cluster
```

   - In the parameters section, add the DNS VMs. For example:

```
reclass:
  storage:
    node:
      openstack_dns_node01:
        params:
          linux_system_codename: xenial
      openstack_dns_node02:
        params:
          linux_system_codename: xenial
```

7. Commit and push the changes.

Once done, proceed to deploy the PowerDNS server service as described in Deploy a new PowerDNS server for Designate.

Prepare a deployment model for a new PowerDNS server with the pool_manager role

If you need live synchronization of DNS zones between Designate and PowerDNS servers, you can configure Designate with the pool_manager role as described below. The Designate Pool Manager keeps records consistent across the Designate database and the PowerDNS servers. For example, if a record was removed from the PowerDNS server due to a hard disk failure, this record will be automatically restored from the Designate database.

To configure a PowerDNS server with the default Designate worker role, see Prepare a deployment model for a new PowerDNS server with the worker role.

The examples provided in this section describe the configuration of the deployment model with two PowerDNS servers deployed on separate VMs of the infrastructure nodes.

To prepare a model for a new PowerDNS server with the pool_manager role:

1. Open the classes/cluster/cluster_name/openstack directory of your Git project repository.
2. Create a dns.yml file with the following parameters:

```
classes:
- system.powerdns.server.single
- cluster.cluster_name.infra
parameters:
  linux:
    network:
      interface:
        ens3: ${_param:linux_single_interface}
    host:
      dns01:
        address: ${_param:openstack_dns_node01_address}
        names:
        - dns01
        - dns01.${_param:cluster_domain}
      dns02:
        address: ${_param:openstack_dns_node02_address}
        names:
        - dns02
        - dns02.${_param:cluster_domain}
  powerdns:
    server:
      enabled: true
      bind:
        address: ${_param:single_address}
        port: 53
      backend:
        engine: sqlite
        dbname: pdns.sqlite3
        dbpath: /var/lib/powerdns
      api:
        enabled: true
```

```
      key: ${_param:designate_pdns_api_key}
    overwrite_supermasters: ${_param:powerdns_supermasters}
    supermasters:
      ${_param:powerdns_supermasters}
    webserver:
      enabled: true
      address: ${_param:single_address}
      port: ${_param:powerdns_webserver_port}
      password: ${_param:powerdns_webserver_password}
    axfr_ips:
      - ${_param:openstack_control_node01_address}
      - ${_param:openstack_control_node02_address}
      - ${_param:openstack_control_node03_address}
      - 127.0.0.1
```

> Note
>
> If you want to use the MySQL backend instead of the default SQLite one, modify the backend section parameters accordingly and configure your metadata model as described in Enable the MySQL backend for PowerDNS.

3. In init.yml, define the following parameters:

   Example:

```
openstack_dns_node01_address: 10.0.0.1
openstack_dns_node02_address: 10.0.0.2
powerdns_axfr_ips:
  - ${_param:openstack_control_node01_address}
  - ${_param:openstack_control_node02_address}
  - ${_param:openstack_control_node03_address}
  - 127.0.0.1
powerdns_supermasters:
  - ip: ${_param:openstack_control_node01_address}
    nameserver: ns1.example.org
    account: master
  - ip: ${_param:openstack_control_node02_address}
    nameserver: ns2.example.org
    account: master
  - ip: ${_param:openstack_control_node03_address}
    nameserver: ns3.example.org
    account: master
powerdns_overwrite_supermasters: True
powerdns_webserver_password: gJ6n3gVaYP8eS
powerdns_webserver_port: 8081
```

```
mysql_designate_password: password
keystone_designate_password: password
designate_service_host: ${_param:openstack_control_address}
designate_domain_id: 5186883b-91fb-4891-bd49-e6769234a8fc
designate_mdns_address: 0.0.0.0
designate_mdns_port: 53
designate_pdns_api_key: VxK9cMlFL5Ae
designate_pdns_api_endpoint: >
  "http://${_param:openstack_dns_node01_address}:${_param:powerdns_webserver_port}"
designate_pool_manager_enabled: True
designate_pool_manager_periodic_sync_interval: '120'
designate_pool_ns_records:
  - hostname: 'ns1.example.org.'
    priority: 10
  - hostname: 'ns2.example.org.'
    priority: 20
  - hostname: 'ns3.example.org.'
    priority: 30
designate_pool_nameservers:
  - host: ${_param:openstack_dns_node01_address}
    port: 53
  - host: ${_param:openstack_dns_node02_address}
    port: 53
designate_pool_target_type: pdns4
designate_pool_target_masters:
  - host: ${_param:openstack_control_node01_address}
    port: ${_param:designate_mdns_port}
  - host: ${_param:openstack_control_node02_address}
    port: ${_param:designate_mdns_port}
  - host: ${_param:openstack_control_node03_address}
    port: ${_param:designate_mdns_port}
designate_pool_target_options:
  host: ${_param:openstack_dns_node01_address}
  port: 53
  api_token: ${_param:designate_pdns_api_key}
  api_endpoint: ${_param:designate_pdns_api_endpoint}
designate_version: ${_param:openstack_version}
```

4. In control.yml, define the following parameters in the parameters section:

   Example:

```
designate:
  pool_manager:
    enabled: ${_param:designate_pool_manager_enabled}
    periodic_sync_interval: ${_param:designate_pool_manager_periodic_sync_interval}
  server:
    backend:
      pdns4:
```

```
    api_token: ${_param:designate_pdns_api_key}
    api_endpoint: ${_param:designate_pdns_api_endpoint}
mdns:
  address: ${_param:designate_mdns_address}
  port: ${_param:designate_mdns_port}
pools:
  default:
    description: 'test pool'
    targets:
      default:
        description: 'test target1'
      default1:
        type: ${_param:designate_pool_target_type}
        description: 'test target2'
        masters: ${_param:designate_pool_target_masters}
        options:
          host: ${_param:openstack_dns_node02_address}
          port: 53
          api_endpoint: >
            "http://${_param:openstack_dns_node02_address}:
            ${_param:powerdns_webserver_port}"
          api_token: ${_param:designate_pdns_api_key}
```

5. In classes/cluster/cluster_name/infra/kvm.yml, modify the classes and parameters sections.

   Example:

   - In the classes section:

     ```
     classes:
     - system.salt.control.cluster.openstack_dns_cluster
     ```

   - In the parameters section, add the DNS parameters for VMs with the required location of DNS VMs on the kvm nodes and the planned resource usage for them.

     ```
     salt:
       control:
         openstack.dns:
           cpu: 2
           ram: 2048
           disk_profile: small
           net_profile: default
       cluster:
         internal:
           node:
             dns01:
               provider: kvm01.${_param:cluster_domain}
     ```

```
      dns02:
        provider: kvm02.${_param:cluster_domain}
```

6. In classes/cluster/cluster_name/infra/config.yml, modify the classes and parameters sections.

   Example:

   - In the classes section:

   ```
   classes:
   - system.reclass.storage.system.openstack_dns_cluster
   ```

   - In the parameters section, add the DNS VMs. For example:

   ```
   reclass:
     storage:
       node:
         openstack_dns_node01:
           params:
             linux_system_codename: xenial
         openstack_dns_node02:
           params:
             linux_system_codename: xenial
   ```

7. Commit and push the changes.

Once done, proceed to deploy the PowerDNS server service as described in Deploy a new PowerDNS server for Designate.

Enable the MySQL backend for PowerDNS

You can use PowerDNS with the MySQL backend instead of the default SQLite one if required.

> Warning
>
> If you use PowerDNS in the slave mode, you must run MySQL with a storage engine that supports transactions, for example, InnoDB that is the default storage engine for MySQL in MCP.
>
> Using a non-transaction storage engine may negatively affect your database after some actions, such as failures in an incoming zone transfer.
>
> For more information, see: PowerDNS documentation.

> Note
>
> While following the procedure below, replace ${node} with a short name of the required node where applicable.

To enable the MySQL backend for PowerDNS:

1. Open your Reclass model Git repository.
2. Modify nodes/_generated/${full_host_name}.yml, where ${full_host_name} is the FQDN of the particular node. Add the following classes and parameters:

```
classes:
...
- cluster.<cluster_name>
- system.powerdns.server.single
...
parameters:
  ...
  powerdns:
    ...
    server:
      ...
      backend:
        engine: mysql
        host: ${_param:cluster_vip_address}
        port: 3306
        dbname: ${_param:mysql_powerdns_db_name}
        user: ${_param:mysql_powerdns_db_name}
        password: ${_param:mysql_powerdns_password}
```

Substitute <cluster_name> with the appropriate value.

> Warning
>
> Do not override the cluster_vip_address parameter.

3. Create a classes/system/galera/server/database/powerdns_${node}.yml file and add the databases to use with the MySQL backend:

```
parameters:
  mysql:
    server:
      database:
        powerdns_${node}:
          encoding: utf8
          users:
          - name: ${_param:mysql_powerdns_user_name_${node}}
            password: ${_param:mysql_powerdns_user_password_${node}}
            host: '%'
            rights: all
          - name: ${_param:mysql_powerdns_user_name_${node}}
            password: ${_param:mysql_powerdns_user_password_${node}}
            host: ${_param:cluster_local_address}
            rights: all
```

4. Add the following class to classes/cluster/<cluster_name>/openstack/control.yml:

```
classes:
...
- system.galera.server.database.powerdns_${node}
```

5. Add the MySQL parameters for Galera to classes/cluster/<cluster_name>/openstack/init.yml. For example:

```
parameters:
  _param:
    ...
    mysql_powerdns_db_name_${node}: powerdns_${node}
    mysql_powerdns_user_name_${node}: pdns_slave_${node}
    mysql_powerdns_user_password_${node}: ni1iX1wuf]ongiVu
```

6. Log in to the Salt Master node.
7. Refresh pillar information:

```
salt '*' saltutil.refresh_pillar
```

8. Apply the Galera states:

```
salt -C 'I@galera:master' state.sls galera
```

9. Proceed to deploying PowerDNS as described in Deploy a new PowerDNS server for Designate.
10. Optional. After you deploy PowerDNS:

    - If you use MySQL InnoDB, add foreign key constraints to the tables. For details, see: PowerDNS documentation.
    - If you use MySQL replication, to support the NATIVE domains, set binlog_format to MIXED or ROW to prevent differences in data between replicated servers. For details, see: MySQL documentation.

Deploy a new PowerDNS server for Designate

After you configure the Reclass model for PowerDNS server as a backend for Designate, proceed to deploying the PowerDNS server service as described below.

To deploy a PowerDNS server service:

1. Log in to the Salt Master node.
2. Configure basic operating system settings on the DNS nodes:

   ```
   salt -C 'I@powerdns:server' state.sls linux,ntp,openssh
   ```

3. Apply the following state:

   ```
   salt -C 'I@powerdns:server' state.sls powerdns
   ```

Once done, you can proceed to deploy Designate as described in Deploy Designate.

Seealso

- Deploy Designate
- BIND9 documentation
- PowerDNS documentation
- Plan the Domain Name System

Install OpenStack services

Many of the OpenStack service states make changes to the databases upon deployment. To ensure proper deployment and to prevent multiple simultaneous attempts to make these changes, deploy a service states on a single node of the environment first. Then, you can deploy the remaining nodes of this environment.

Keystone must be deployed before other services. Following the order of installation is important, because many of the services have dependencies of the others being in place.

Deploy Keystone

To deploy Keystone:

1. Log in to the Salt Master node.
2. Set up the Keystone service:

```
salt -C 'I@keystone:server and *01*' state.sls keystone.server
salt -C 'I@keystone:server' state.sls keystone.server
```

3. Populate keystone services/tenants/admins:

```
salt -C 'I@keystone:client' state.sls keystone.client
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; openstack service list"
```

> Note
>
> By default, the latest MCP deployments use rsync for fernet and credential keys rotation. To configure rsync on the environments that use GlusterFS as a default rotation driver and credential keys rotation driver, see MCP Operations Guide: Migrate from GlusterFS to rsync for fernet and credential keys rotation.

Deploy Glance

The OpenStack Image service (Glance) provides a REST API for storing and managing virtual machine images and snapshots.

To deploy Glance:

1. Install Glance and verify that GlusterFS clusters exist:

   ```
   salt -C 'I@glance:server and *01*' state.sls glance.server
   salt -C 'I@glance:server' state.sls glance.server
   salt -C 'I@glance:client' state.sls glance.client
   salt -C 'I@glusterfs:client' state.sls glusterfs.client
   ```

2. Update Fernet tokens before doing request on the Keystone server. Otherwise, you will get the following error: No encryption keys found; run keystone-manage fernet_setup to bootstrap one:

   ```
   salt -C 'I@keystone:server' state.sls keystone.server
   salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; glance image-list"
   ```

Deploy Nova

To deploy the Nova:

1. Install Nova:

```
salt -C 'I@nova:controller and *01*' state.sls nova.controller
salt -C 'I@nova:controller' state.sls nova.controller
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; nova --debug service-list"
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; nova --debug list"
salt -C 'I@nova:client' state.sls nova.client
```

2. On one of the controller nodes, verify that the Nova services are enabled and running:

```
root@cfg01:~# ssh ctl01 "source keystonercv3; nova service-list"
```

Deploy Cinder

To deploy Cinder:

1. Install Cinder:

```
salt -C 'I@cinder:controller and *01*' state.sls cinder
salt -C 'I@cinder:controller' state.sls cinder
```

2. On one of the controller nodes, verify that the Cinder service is enabled and running:

```
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; cinder list"
```

Deploy Neutron

To install Neutron:

```
salt -C 'I@neutron:server and *01*' state.sls neutron.server
salt -C 'I@neutron:server' state.sls neutron.server
salt -C 'I@neutron:gateway' state.sls neutron
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; neutron agent-list"
```

> Note
>
> For installations with the OpenContrail setup, see Deploy OpenContrail manually.

> Seealso
>
> MCP Operations Guide: Configure Neutron OVS

Deploy Horizon

To install Horizon:

```
salt -C 'I@horizon:server' state.sls horizon
salt -C 'I@nginx:server' state.sls nginx
```

Deploy Heat

To deploy Heat:

1. Apply the following states:

```
salt -C 'I@heat:server and *01*' state.sls heat
salt -C 'I@heat:server' state.sls heat
```

2. On one of the controller nodes, verify that the Heat service is enabled and running:

```
salt -C 'I@keystone:server' cmd.run ". /root/keystonercv3; openstack stack list"
```

Deploy Tenant Telemetry

Tenant Telemetry collects metrics about the OpenStack resources and provides this data through the APIs. This section describes how to deploy the Tenant Telemetry, which uses its own backends, such as Gnocchi and Panko, on a new or existing MCP cluster.

Caution!

The deployment of Tenant Telemetry based on Ceilometer, Aodh, Panko, and Gnocchi is supported starting from the Pike OpenStack release and does not support integration with StackLight LMA. However, you can add the Gnocchi data source to Grafana to view the Tenant Telemetry data.

Note

If you select Ceph as an aggregation metrics storage, a Ceph health warning 1 pools have many more objects per pg than average may appear due to Telemetry writing a number of small files to Ceph. The possible solutions are as follows:

- Increase the amount of PGs per pool. This option is suitable only if concurrent access is required together with request low latency.
- Suppress the warning by modifying mon pg warn max object skew depending on the number of objects. For details, see Ceph documentation.

Deploy Tenant Telemetry on a new cluster

> **Caution!**
>
> The deployment of Tenant Telemetry based on Ceilometer, Aodh, Panko, and Gnocchi is supported starting from the Pike OpenStack release and does not support integration with StackLight LMA. However, you can add the Gnocchi data source to Grafana to view the Tenant Telemetry data.

Follow the procedure below to deploy Tenant Telemetry that uses its own back ends, such as Gnocchi and Panko.

To deploy Tenant Telemetry on a new cluster:

1. Log in to the Salt Master node.
2. Set up the aggregation metrics storage for Gnocchi:
   - For Ceph, verify that you have deployed Ceph as described in Deploy a Ceph cluster and run the following commands:

     ```
     salt -C "I@ceph:osd or I@ceph:osd or I@ceph:radosgw" saltutil.refresh_pillar
     salt -C "I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin" state.sls ceph.mon
     salt -C "I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin" mine.update
     salt -C "I@ceph:mon" state.sls 'ceph.mon'
     salt -C "I@ceph:setup" state.sls ceph.setup
     salt -C "I@ceph:osd or I@ceph:osd or I@ceph:radosgw" state.sls ceph.setup.keyring
     ```

   - For the file backend based on GlusterFS, run the following commands:

     ```
     salt -C "I@glusterfs:server" saltutil.refresh_pillar
     salt -C "I@glusterfs:server" state.sls glusterfs.server.service
     salt -C "I@glusterfs:server:role:primary" state.sls glusterfs.server.setup
     salt -C "I@glusterfs:server" state.sls glusterfs
     salt -C "I@glusterfs:client" saltutil.refresh_pillar
     salt -C "I@glusterfs:client" state.sls glusterfs.client
     ```

3. Create users and databases for Panko and Gnocchi:

   ```
   salt-call state.sls reclass.storage
   salt -C 'I@salt:control' state.sls salt.control
   salt -C 'I@keystone:client' state.sls keystone.client
   salt -C 'I@keystone:server state.sls linux.system.package
   salt -C 'I@galera:master' state.sls galera
   salt -C 'I@galera:slave' state.sls galera
   salt prx\* state.sls nginx
   ```

4. Provision the mdb nodes:

    1. Apply basic states:

    ```
    salt mdb\* saltutil.refresh_pillar
    salt mdb\* saltutil.sync_all
    salt mdb\* state.sls linux.system
    salt mdb\* state.sls linux,ntp,openssh,salt.minion
    salt mdb\* system.reboot --async
    ```

    2. Deploy basic services on mdb nodes:

    ```
    salt mdb01\* state.sls keepalived
    salt mdb\* state.sls keepalived
    salt mdb\* state.sls haproxy
    salt mdb\* state.sls memcached
    salt mdb\* state.sls nginx
    salt mdb\* state.sls apache
    ```

    3. Install packages:

        - For Ceph:

        ```
        salt mdb\* state.sls ceph.common,ceph.setup.keyring
        ```

        - For GlusterFS:

        ```
        salt mdb\* state.sls glusterfs
        ```

5. Update the cluster nodes:

    ```
    salt '*' saltutil.refresh_pillar
    salt '*' state.sls linux.network.host
    ```

6. To use the Redis cluster as coordination backend and storage for Gnocchi, deploy Redis master:

    ```
    salt -C 'I@redis:cluster:role:master' state.sls redis
    ```

7. Deploy Redis on all servers:

    ```
    salt -C 'I@redis:server' state.sls redis
    ```

8. Deploy Gnocchi:

    ```
    salt -C 'I@gnocchi:server and *01*' state.sls gnocchi.server
    salt -C 'I@gnocchi:server' state.sls gnocchi.server
    ```

9. Deploy Panko:

```
salt -C 'I@panko:server and *01*' state.sls panko
salt -C 'I@panko:server' state.sls panko
```

10. Deploy Ceilometer:

```
salt -C 'I@ceilometer:server and *01*' state.sls ceilometer
salt -C 'I@ceilometer:server' state.sls ceilometer
salt -C 'I@ceilometer:agent' state.sls ceilometer -b 1
```

11. Deploy Aodh:

```
salt -C 'I@aodh:server and *01*' state.sls aodh
salt -C 'I@aodh:server' state.sls aodh
```

Deploy Tenant Telemetry on an existing cluster

> **Caution!**
>
> The deployment of Tenant Telemetry based on Ceilometer, Aodh, Panko, and Gnocchi is supported starting from the Pike OpenStack release and does not support integration with StackLight LMA. However, you can add the Gnocchi data source to Grafana to view the Tenant Telemetry data.

If you have already deployed an MCP cluster with OpenStack Pike, StackLight LMA, and Ceph (optionally), you can add the Tenant Telemetry as required.

Prepare the cluster deployment model

Before you deploy Tenant Telemetry on an existing MCP cluster, prepare your cluster deployment model by making the corresponding changes in your Git project repository.

To prepare the deployment model:

1. Open your Git project repository.
2. Set up the aggregation metrics storage for Gnocchi:
   - For the Ceph backend, define the Ceph users and pools:
     1. In the classes/cluster/<cluster_name>/ceph/setup.yml file, add the pools:

```
parameters:
  ceph:
    setup:
      pool:
        telemetry_pool:
          pg_num: 512
          pgp_num: 512
          type: replicated
          application: rgw
#           crush_rule: sata
```

     2. In the classes/cluster/<cluster_name>/openstack/init.yml file, specify the Telemetry user and pool:

```
parameters:
 _param:
   gnocchi_storage_user: gnocchi_user
   gnocchi_storage_pool: telemetry_pool
```

     3. In the classes/cluster/<cluster_name>/ceph/common.yml file, define the Telemetry user permissions:

```
parameters:
  ceph:
    common:
      keyring:
        gnocchi:
          name: ${_param:gnocchi_storage_user}
          caps:
            mon: "allow r"
            osd: "allow rwx pool=telemetry_pool"
```

   - For the file backend with GlusterFS, define the GlusterFS volume in the classes/cluster/<cluster_name>/infra/glusterfs.yml file:

```
classes:
- system.glusterfs.server.volume.gnocchi
```

> Note
>
> Mirantis recommends creating a separate LVM for the Gnocchi GlusterFS volume. The LVM must contain a file system with a large number of inodes. Four million of inodes allow keeping the metrics of 1000 Gnocchi resources with a medium Gnocchi archive policy for two days maximum.

3. In the classes/cluster/<cluster_name>/infra/config/init.yml file, add the class with Telemetry nodes definition:

```
classes:
- system.reclass.storage.system.openstack_telemetry_cluster
```

4. In the classes/cluster/<cluster_name>/infra/config/nodes.yml file, add the Telemetry node parameters:

```
parameters:
  salt:
    reclass:
      storage:
        node:
          openstack_telemetry_node01:
            params:
              linux_system_codename: xenial
              deploy_address: ${_param:openstack_telemetry_node01_deploy_address}
              redis_cluster_role: 'master'
              ceilometer_create_gnocchi_resources: true
          openstack_telemetry_node02:
            params:
              linux_system_codename: xenial
              deploy_address: ${_param:openstack_telemetry_node02_deploy_address}
              redis_cluster_role: 'slave'
          openstack_telemetry_node03:
            params:
              linux_system_codename: xenial
              deploy_address: ${_param:openstack_telemetry_node03_deploy_address}
              redis_cluster_role: 'slave'
```

5. In the classes/cluster/<cluster_name>/infra/kvm.yml file, add the Telemetry VM definition:

```
classes:
- system.salt.control.cluster.openstack_telemetry_cluster
parameters:
  salt:
    control:
      cluster:
        internal:
          node:
            mdb01:
              image: ${_param:salt_control_xenial_image}
            mdb02:
              image: ${_param:salt_control_xenial_image}
            mdb03:
              image: ${_param:salt_control_xenial_image}
    virt:
      nic:
  ##Telemetry
        mdb:
          eth1:
            bridge: br-mgm
          eth0:
            bridge: br-ctl
```

6. Define the Panko, Gnocchi, Ceilometer, and Aodh secrets in classes/cluster/<cluster_name>/infra/secrets.yml:

```
parameters:
  _param:
    mysql_gnocchi_password_generated: <GNOCCHI MYSQL SECRET>
    mysql_panko_password_generated: <PANKO MYSQL SECRET>
    mysql_aodh_password_generated: <AODH MYSQL SECRET>
    keystone_gnocchi_password_generated: <GNOCCHI KEYSTONE SECRET>
    keystone_panko_password_generated: <PANKO KEYSTONE SECRET>
    keystone_aodh_password_generated: <AODH KEYSTONE SECRET>
    keystone_ceilometer_password_generated: <CEILOMETER KEYSTONE SECRET>
    openstack_telemetry_redis_password_generated: <TELEMETRY REDIS SECRET>
    aodh_memcache_secret_key_generated: <AODH MEMCACHE SECRET>
    ceilometer_memcache_secret_key_generated: <CEILOMETER MEMCACHE SECRET>
    panko_memcache_secret_key_generated: <PANKO MEMCACHE SECRET>
    gnocchi_memcache_secret_key_generated: <GNOCCHI MEMCACHE SECRET>
    tenant_telemetry_keepalived_vip_password: <TENANT TELEMETRY KEEPALIVED SECRET>
```

7. In the classes/cluster/<cluster_name>/openstack/init.yml file, define the global parameters and linux:network:host:

```
parameters:
  _param:
    aodh_service_host: ${_param:openstack_telemetry_address}
```

```
    ceilometer_service_host: ${_param:openstack_telemetry_address}
    panko_service_host: ${_param:openstack_telemetry_address}
    gnocchi_service_host: ${_param:openstack_telemetry_address}
    # For Queens openstack set gnocchi version to 4.2, for Pike to 4.0
    gnocchi_version: 4.2
    panko_version: ${_param:openstack_version}
    mysql_gnocchi_password: ${_param:mysql_gnocchi_password_generated}
    mysql_panko_password: ${_param:mysql_panko_password_generated}
    mysql_aodh_password: ${_param:mysql_aodh_password_generated}
    keystone_gnocchi_password: ${_param:keystone_gnocchi_password_generated}
    keystone_panko_password: ${_param:keystone_panko_password_generated}
    keystone_aodh_password: ${_param:keystone_aodh_password_generated}
    keystone_ceilometer_password: ${_param:keystone_ceilometer_password_generated}
    ceilometer_agent_default_polling_interval: 15
    ceilometer_agent_default_polling_meters:
    - "*"
    openstack_telemetry_redis_password: ${_param:openstack_telemetry_redis_password_generated}
    aodh_memcache_secret_key: ${_param:aodh_memcache_secret_key_generated}
    ceilometer_memcache_secret_key: ${_param:ceilometer_memcache_secret_key_generated}
    panko_memcache_secret_key: ${_param:panko_memcache_secret_key_generated}
    gnocchi_memcache_secret_key: ${_param:gnocchi_memcache_secret_key_generated}

    # openstack telemetry
    openstack_telemetry_address: 172.30.121.65
    openstack_telemetry_node01_deploy_address: 10.160.252.66
    openstack_telemetry_node02_deploy_address: 10.160.252.67
    openstack_telemetry_node03_deploy_address: 10.160.252.68
    openstack_telemetry_node01_address: 172.30.121.66
    openstack_telemetry_node02_address: 172.30.121.67
    openstack_telemetry_node03_address: 172.30.121.68


    openstack_telemetry_hostname: mdb
    openstack_telemetry_node01_hostname: mdb01
    openstack_telemetry_node02_hostname: mdb02
    openstack_telemetry_node03_hostname: mdb03

  linux:
    network:
      host:
        mdb:
          address: ${_param:openstack_telemetry_address}
          names:
          - ${_param:openstack_telemetry_hostname}
          - ${_param:openstack_telemetry_hostname}.${_param:cluster_domain}
        mdb01:
          address: ${_param:openstack_telemetry_node01_address}
```

```
    names:
    - ${_param:openstack_telemetry_node01_hostname}
    - ${_param:openstack_telemetry_node01_hostname}.${_param:cluster_domain}
  mdb02:
    address: ${_param:openstack_telemetry_node02_address}
    names:
    - ${_param:openstack_telemetry_node02_hostname}
    - ${_param:openstack_telemetry_node02_hostname}.${_param:cluster_domain}
  mdb03:
    address: ${_param:openstack_telemetry_node03_address}
    names:
    - ${_param:openstack_telemetry_node03_hostname}
    - ${_param:openstack_telemetry_node03_hostname}.${_param:cluster_domain}
```

8. Add endpoints:

    1. In the classes/cluster/<cluster_name>/openstack/control/init.yml file, verify that the Panko, Gnocchi, and Aodh endpoints are present:

    ```
    classes:
    - system.keystone.client.service.panko
    - system.keystone.client.service.aodh
    - system.keystone.client.service.gnocchi
    - system.keystone.client.service.ceilometer

    parameters:
      _param:
        aodh_service_protocol: ${_param:cluster_internal_protocol}
        gnocchi_service_protocol: ${_param:cluster_internal_protocol}
        panko_service_protocol: ${_param:cluster_internal_protocol}
    ```

    2. In the classes/cluster/<cluster_name>/openstack/proxy.yml file, add the Gnocchi, Aodh, and Panko public endpoints:

    ```
    classes:
    - system.nginx.server.proxy.openstack.gnocchi
    - system.nginx.server.proxy.openstack.aodh
    - system.nginx.server.proxy.openstack.panko
    ```

    3. If HTTPS is enabled on the OpenStack internal endpoints, add the following parameters to classes/cluster/<cluster_name>/openstack/proxy.yml:

    ```
    parameters:
      _param:
        nginx_proxy_openstack_aodh_protocol: 'https'
        nginx_proxy_openstack_panko_protocol: 'https'
        nginx_proxy_openstack_gnocchi_protocol: 'https'
    ```

9. In the classes/cluster/<cluster_name>/openstack/database/master.yml file, verify that the classes for the Panko, Gnocchi, Aodh databases are present:

```
classes:
- system.galera.server.database.panko
- system.galera.server.database.aodh
- system.galera.server.database.gnocchi
```

10 Change the configuration of the OpenStack controller nodes:
.

1. In the classes/cluster/<cluster_name>/openstack/control.yml file, add the Panko client package to test the OpenStack event CLI command. Additionally, verify that the file includes the ceilometer.client class.

```
classes:
#- system.ceilometer.server.backend.influxdb
#- system.heka.ceilometer_collector.single
#- system.aodh.server.cluster
#- system.ceilometer.server.cluster
- system.keystone.server.notification.messagingv2
- system.glance.control.notification.messagingv2
- system.nova.control.notification.messagingv2
- system.neutron.control.notification.messagingv2
- system.ceilometer.client.nova_control
- system.cinder.control.notification.messagingv2
- system.cinder.volume.notification.messagingv2
- system.heat.server.notification.messagingv2

parameters:
  linux:
    system:
      package:
        python-pankoclient:
```

2. In the classes/cluster/<cluster_name>/openstack/control/init.yml file, add the following classes:

```
classes:
- system.gnocchi.client
- system.gnocchi.client.v1.archive_policy.default
```

3. In the classes/cluster/<cluster_name>/stacklight/telemetry.yml file, remove InfluxDB from the mdb* node definition:

```
classes:
#- system.haproxy.proxy.listen.stacklight.influxdb_relay
#- system.influxdb.relay.cluster
```

```
#- system.influxdb.server.single
#- system.influxdb.database.ceilometer
```

11 Change the configuration of compute nodes:

1. Open the classes/cluster/<cluster_name>/openstack/compute/init.yml file for editing.
2. Verify that ceilometer.agent classes are present on the compute nodes:

```
classes:
- system.ceilometer.agent.telemetry.cluster
- system.ceilometer.agent.polling.default
- system.nova.compute.notification.messagingv2
```

3. If SSL in libvirt is enabled, set the following parameter:

```
parameters:
  _param:
    ceilometer_agent_ssl_enabled: True
```

12 In the classes/cluster/<cluster_name>/openstack/networking/telemetry.yml file, define the networking schema for the mdb VMs:

```
# Networking template for Telemetry nodes
parameters:
  linux:
    network:
      interface:
        ens2: ${_param:linux_deploy_interface}
        ens3: ${_param:linux_single_interface}
```

13 Define the Telemetry node YAML file:

1. Open the classes/cluster/<cluster_name>/openstack/telemetry.yml file for editing.
2. Specify the classes and parameters depending on the aggregation metrics storage:
   - For Ceph, specify:

```
classes:
- system.ceph.common.cluster
- system.gnocchi.common.storage.ceph
- cluster.<cluster_name>.ceph.common
parameters:
  _param:
    gnocchi_storage_ceph_pool: ${_param:gnocchi_storage_pool}
    gnocchi_storage_ceph_user: ${_param:gnocchi_storage_user}
```

- For the file backend with GlusterFS, specify:

```
classes:
- system.linux.system.repo.mcp.apt_mirantis.glusterfs
- system.glusterfs.client.cluster
- system.glusterfs.client.volume.gnocchi
parameters:
  _param:
    gnocchi_glusterfs_service_host: ${_param:glusterfs_service_host}
```

3. Specify the following classes and parameters:

```
classes:
- system.keepalived.cluster.instance.openstack_telemetry_vip
- system.memcached.server.single
- system.apache.server.single
- system.apache.server.site.aodh
- system.apache.server.site.gnocchi
- system.apache.server.site.panko
- service.redis.server.single
- system.gnocchi.common.cluster
- system.gnocchi.server.cluster
- system.gnocchi.common.storage.incoming.redis
- system.gnocchi.common.coordination.redis
- system.ceilometer.server.telemetry.cluster
- system.ceilometer.server.coordination.redis
- system.aodh.server.cluster
- system.aodh.server.coordination.redis
- system.panko.server.cluster
- system.ceilometer.server.backend.gnocchi
- cluster.<cluster_name>.infra
- cluster.<cluster_name>.openstack.networking.telemetry
parameters:
  _param:
    cluster_vip_address: ${_param:openstack_telemetry_address}
    keepalived_vip_interface: ens3
    keepalived_vip_address: ${_param:cluster_vip_address}
    keepalived_vip_password: ${_param:tenant_telemetry_keepalived_vip_password}
    cluster_local_address: ${_param:single_address}
    cluster_node01_hostname: ${_param:openstack_telemetry_node01_hostname}
    cluster_node01_address: ${_param:openstack_telemetry_node01_address}
    cluster_node02_hostname: ${_param:openstack_telemetry_node02_hostname}
    cluster_node02_address: ${_param:openstack_telemetry_node02_address}
    cluster_node03_hostname: ${_param:openstack_telemetry_node03_hostname}
    cluster_node03_address: ${_param:openstack_telemetry_node03_address}
    redis_sentinel_node01_address: ${_param:openstack_telemetry_node01_address}
    redis_sentinel_node02_address: ${_param:openstack_telemetry_node02_address}
    redis_sentinel_node03_address: ${_param:openstack_telemetry_node03_address}
    # Redis doesn't support multi-user authentication so, any username can be used in url
    openstack_telemetry_redis_url: redis://openstack:${_param:openstack_telemetry_redis_password}@${_param:redis_sentinel_node01_address}:26379?db=0&sentinel=master_1&sentinel_fallback=${_param:redis_sentinel_node02_address}:26379&sentinel_fallback=${_param:redis_sentinel_node03_address}:26379
    gnocchi_coordination_url: ${_param:openstack_telemetry_redis_url}
    gnocchi_storage_incoming_redis_url: ${_param:openstack_telemetry_redis_url}
    haproxy_https_check_options:
    - httpchk GET /
    - httpclose
    - tcplog
    haproxy_panko_api_check_params: check-ssl verify none
    haproxy_gnocchi_api_check_params: check-ssl verify none
    haproxy_aodh-api_check_params: check inter 10s fastinter 2s downinter 3s rise 3 fall 3 check-ssl verify none
    apache_ssl:
      enabled: true
      authority: "${_param:salt_minion_ca_authority}"
      key_file: ${_param:openstack_api_cert_key_file}
      cert_file: ${_param:openstack_api_cert_cert_file}
      chain_file: ${_param:openstack_api_cert_all_file}
  redis:
    server:
      version: 5.0
      bind:
        address: ${_param:single_address}
    cluster:
      enabled: True
      mode: sentinel
      role: ${_param:redis_cluster_role}
      quorum: 2
      master:
        host: ${_param:cluster_node01_address}
        port: 6379
      sentinel:
        address: ${_param:single_address}
  apache:
    server:
      modules:
        - wsgi
  gnocchi:
    common:
      database:
        host: ${_param:openstack_database_address}
        ssl:
          enabled: true
    server:
      identity:
        protocol: ${_param:cluster_internal_protocol}
      pkgs:
      # TODO: move python-memcache installation to formula
      - gnocchi-api
      - gnocchi-metricd
      - python-memcache
  panko:
    server:
      identity:
        protocol: ${_param:cluster_internal_protocol}
      database:
        ssl:
          enabled: true
  aodh:
    server:
      coordination_backend:
        url: ${_param:openstack_telemetry_redis_url}
      identity:
        host: ${_param:openstack_control_address}
  ceilometer:
    server:
      coordination_backend:
        url: ${_param:openstack_telemetry_redis_url}
      identity:
        host: ${_param:openstack_control_address}
  haproxy:
    proxy:
      listen:
        panko_api:
          type: None
          options: ${_param:haproxy_https_check_options}
        gnocchi_api:
          type: None
          options: ${_param:haproxy_https_check_options}
        aodh-api:
          type: None
          options: ${_param:haproxy_https_check_options}
```

Once done, proceed to Deploy Tenant Telemetry.

Deploy Tenant Telemetry

Once you have performed the steps described in Prepare the cluster deployment model, deploy Tenant Telemetry on an existing MCP cluster as described below.

To deploy Tenant Telemetry on an existing MCP cluster:

1. Log in to the Salt Master node.
2. Depending on the type of the aggregation metrics storage, select from the following options:
   - For Ceph, deploy the newly created users and pools:

     ```
     salt -C "I@ceph:osd or I@ceph:osd or I@ceph:radosgw" saltutil.refresh_pillar
     salt -C "I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin" state.sls ceph.mon
     salt -C "I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin" mine.update
     salt -C "I@ceph:mon" state.sls 'ceph.mon'
     salt -C "I@ceph:setup" state.sls ceph.setup
     salt -C "I@ceph:osd or I@ceph:osd or I@ceph:radosgw" state.sls ceph.setup.keyring
     ```

   - For the file backend with GlusterFS, deploy the Gnocchi GlusterFS configuration:

     ```
     salt -C "I@glusterfs:server" saltutil.refresh_pillar
     salt -C "I@glusterfs:server" state.sls glusterfs
     ```

3. Run the following commands to generate definitions under /srv/salt/reclass/nodes/_generated:

   ```
   salt-call saltutil.refresh_pillar
   salt-call state.sls reclass.storage
   ```

4. Verify that the following files were created:

   ```
   ls -1 /srv/salt/reclass/nodes/_generated | grep mdb
   mdb01.domain.name
   mdb02.domain.name
   mdb03.domain.name
   ```

5. Create the mdb VMs:

   ```
   salt -C 'I@salt:control' saltutil.refresh_pillar
   salt -C 'I@salt:control' state.sls salt.control
   ```

6. Verify that the mdb nodes were successfully registered on the Salt Master node:

   ```
   salt-key -L | grep mdb
   mdb01.domain.name
   mdb02.domain.name
   mdb03.domain.name
   ```

7. Create endpoints:

    1. Create additional endpoints for Panko and Gnocchi and update the existing Ceilometer and Aodh endpoints, if any:

        ```
        salt -C 'I@keystone:client' saltutil.refresh_pillar
        salt -C 'I@keystone:client' state.sls keystone.client
        ```

    2. Verify the created endpoints:

        ```
        salt -C 'I@keystone:client' cmd.run '. /root/keystonercv3 ; openstack endpoint list --service ceilometer'
        salt -C 'I@keystone:client' cmd.run '. /root/keystonercv3 ; openstack endpoint list --service aodh'
        salt -C 'I@keystone:client' cmd.run '. /root/keystonercv3 ; openstack endpoint list --service panko'
        salt -C 'I@keystone:client' cmd.run '. /root/keystonercv3 ; openstack endpoint list --service gnocchi'
        ```

    3. Optional. Install the Panko client if you have defined it in the cluster model:

        ```
        salt -C 'I@keystone:server' saltutil.refresh_pillar
        salt -C 'I@keystone:server' state.sls linux.system.package
        ```

8. Create databases:

    1. Create databases for Panko and Gnocchi:

        ```
        salt -C 'I@galera:master or I@galera:slave' saltutil.refresh_pillar
        salt -C 'I@galera:master' state.sls galera
        salt -C 'I@galera:slave' state.sls galera
        ```

    2. Verify that the databases were successfully created:

        ```
        salt -C 'I@galera:master' cmd.run 'mysql --defaults-extra-file=/etc/mysql/debian.cnf -e "show databases;"'
        salt -C 'I@galera:master' cmd.run 'mysql --defaults-extra-file=/etc/mysql/debian.cnf -e "select User from mysql.user;"'
        ```

9. Update the NGINX configuration on the prx nodes:

    ```
    salt prx\* saltutil.refresh_pillar
    salt prx\* state.sls nginx
    ```

10. Disable the Ceilometer and Aodh services deployed on the ctl nodes:

    ```
    for service in aodh-evaluator aodh-listener aodh-notifier \
      ceilometer-agent-central ceilometer-agent-notification \
      ceilometer_collector
    do
    salt ctl\* service.stop $service
    salt ctl\* service.disable $service
    done
    ```

11 Provision the mdb nodes:

1. Apply the basic states for the mdb nodes:

```
salt mdb\* saltutil.refresh_pillar
salt mdb\* saltutil.sync_all
salt mdb\* state.sls linux.system
salt-call state.sls salt.minion.ca
salt mdb\* state.sls linux,ntp,openssh,salt.minion
salt mdb\* system.reboot --async
```

2. Install basic services on the mdb nodes:

```
salt mdb01\* state.sls keepalived
salt mdb\* state.sls keepalived
salt mdb\* state.sls haproxy
salt mdb\* state.sls memcached
salt mdb\* state.sls apache
```

3. Install packages depending on the aggregation metrics storage:

   - For Ceph:

     ```
     salt mdb\* state.sls ceph.common,ceph.setup.keyring
     ```

   - For the file backend with GlusterFS:

     ```
     salt mdb\* state.sls glusterfs
     ```

4. Install the Redis, Gnocchi, Panko, Ceilometer, and Aodh services on mdb nodes:

```
salt -C 'I@redis:cluster:role:master' state.sls redis
salt -C 'I@redis:server' state.sls redis
salt -C 'I@gnocchi:server:role:primary' state.sls gnocchi
salt -C 'I@gnocchi:server' state.sls gnocchi
salt -C 'I@gnocchi:client' state.sls gnocchi.client -b 1
salt -C 'I@panko:server:role:primary' state.sls panko
salt -C 'I@panko:server' state.sls panko
salt -C 'I@ceilometer:server:role:primary' state.sls ceilometer
salt -C 'I@ceilometer:server' state.sls ceilometer
salt -C 'I@aodh:server:role:primary' state.sls aodh
salt -C 'I@aodh:server' state.sls aodh
```

5. Update the cluster nodes:

   1. Verify that the mdb nodes were added to /etc/hosts on every node:

```
salt '*' saltutil.refresh_pillar
salt '*' state.sls linux.network.host
```

2. For Ceph, run:

```
salt -C 'I@ceph:common and not mon*' state.sls ceph.setup.keyring
```

6. Verify that the Ceilometer agent is deployed and up to date:

```
salt -C 'I@ceilometer:agent' state.sls salt.minion
salt -C 'I@ceilometer:agent' state.sls ceilometer
```

7. Apply the configuration for Nova messaging notifications on the OpenStack controller nodes:

```
salt -C 'I@nova:controller' state.sls nova.controller -b 1
```

8. Update the StackLight LMA configuration:

```
salt mdb\* state.sls telegraf
salt mdb\* state.sls fluentd
salt '*' state.sls salt.minion.grains
salt '*' saltutil.refresh_modules
salt '*' mine.update
salt -C 'I@docker:swarm and I@prometheus:server' state.sls prometheus
salt -C 'I@sphinx:server' state.sls sphinx
```

12 Verify Tenant Telemetry:

.

> **Note**
>
> Metrics will be collected for the newly created resources. Therefore, launch an instance or create a volume before executing the commands below.

1. Verify that metrics are available:

```
salt ctl01\* cmd.run '. /root/keystonercv3 ; openstack metric list --limit 50'
```

2. If you have installed the Panko client on the ctl nodes, verify that events are available:

```
salt ctl01\* cmd.run '. /root/keystonercv3 ; openstack event list --limit 20'
```

3. Verify that the Aodh endpoint is available:

```
salt ctl01\* cmd.run '. /root/keystonercv3 ; openstack --debug alarm list'
```

The output will not contain any alarm because no alarm was created yet.

4. For Ceph, verify that metrics are saved to the Ceph pool (telemtry_pool for the cloud):

```
salt cmn01\* cmd.run 'rados df'
```

Seealso

- MCP Reference Architecture: Tenant Telemetry
- MCP Operations Guide: Enable the Gnocchi archive policies in Tenant Telemetry
- MCP Operations Guide: Add the Gnocchi data source to Grafana

Deploy Designate

Designate supports underlying DNS servers, such as BIND9 and PowerDNS. You can use either a new or an existing DNS server as a backend for Designate. By default, Designate is deployed on three OpenStack API VMs of the VCP nodes.

Prepare a deployment model for the Designate deployment

Before you deploy Designate with a new or existing BIND9 or PowerDNS server as a backend, prepare your cluster deployment model by making corresponding changes in your Git project repository.

To prepare a deployment model for the Designate deployment:

1. Verify that you have configured and deployed a DNS server as a backend for Designate as described in Deploy a DNS backend for Designate.
2. Open the classes/cluster/<cluster_name>/openstack/ directory in your Git project repository.
3. In control_init.yml, add the following parameter in the classes section:

   ```
   classes:
   - system.keystone.client.service.designate
   ```

4. In control.yml, add the following parameter in the classes section:

   ```
   classes:
   - system.designate.server.cluster
   ```

5. In database.yml, add the following parameter in the classes section:

   ```
   classes:
   - system.galera.server.database.designate
   ```

6. Add your changes to a new commit.
7. Commit and push the changes.

Once done, proceed to Install Designate.

Install Designate

This section describes how to install Designate on a new or existing MCP cluster.

Before you proceed to installing Designate:

1. Configure and deploy a DNS backend for Designate as described in Deploy a DNS backend for Designate.
2. Prepare your cluster model for the Designate deployment as described in Prepare a deployment model for the Designate deployment.

To install Designate on a new MCP cluster:

1. Log in to the Salt Master node.
2. Apply the following states:

```
salt -C 'I@designate:server and *01*' state.sls designate.server
salt -C 'I@designate:server' state.sls designate
```

To install Designate on an already deployed MCP cluster:

1. Log in to the Salt Master node.
2. Refresh Salt pillars:

```
salt '*' saltutil.refresh_pillar
```

3. Create databases for Designate by applying the mysql state:

```
salt -C 'I@galera:master' state.sls galera
```

4. Create the HAProxy configuration for Designate:

```
salt -C 'I@haproxy:proxy' state.sls haproxy
```

5. Create endpoints for Designate in Keystone:

```
salt -C 'I@keystone:client' state.sls keystone.client
```

6. Apply the designate states:

```
salt -C 'I@designate:server and *01*' state.sls designate.server
salt -C 'I@designate:server' state.sls designate
```

7. Verify that the Designate services are up and running:

```
salt -C 'I@designate:server' cmd.run ". /root/keystonercv3; openstack dns service list"
```

   Example of the system response extract:

```
ctl02.virtual-mcp-ocata-ovs.local:
+------------------+---------+-------------+-------+------+-------------+
| id               |hostname |service_name |status |stats |capabilities |
+------------------+---------+-------------+-------+------+-------------+
| 72df3c63-ed26-... | ctl03   | worker      | UP    | -    | -           |
| c3d425bb-131f-... | ctl03   | central     | UP    | -    | -           |
| 1af4c4ef-57fb-... | ctl03   | producer    | UP    | -    | -           |
| 75ac49bc-112c-... | ctl03   | api         | UP    | -    | -           |
| ee0f24cd-0d7a-... | ctl03   | mdns        | UP    | -    | -           |
| 680902ef-380a-... | ctl02   | worker      | UP    | -    | -           |
| f09dca51-c4ab-... | ctl02   | producer    | UP    | -    | -           |
| 26e09523-0140-... | ctl01   | producer    | UP    | -    | -           |
| 18ae9e1f-7248-... | ctl01   | worker      | UP    | -    | -           |
| e96dffc1-dab2-... | ctl01   | central     | UP    | -    | -           |
| 3859f1e7-24c0-... | ctl01   | api         | UP    | -    | -           |
| 18ee47a4-8e38-... | ctl01   | mdns        | UP    | -    | -           |
| 4c807478-f545-... | ctl02   | api         | UP    | -    | -           |
| b66305e3-a75f-... | ctl02   | central     | UP    | -    | -           |
| 3c0d2310-d852-... | ctl02   | mdns        | UP    | -    | -           |
+------------------+---------+-------------+-------+------+-------------+
```

Seealso

Designate operations

Seealso

- Deploy a DNS backend for Designate
- Plan the Domain Name System
- Designate operations

Deploy Barbican

Barbican is an OpenStack service that provides a REST API for secured storage as well as for provisioning and managing of secrets such as passwords, encryption keys, and X.509 certificates.

Barbican requires a backend to store secret data in its database. If you have an existing Dogtag backend, deploy and configure Barbican with it as described in Deploy Barbican with the Dogtag backend. Otherwise, deploy a new Dogtag backend as described in Deploy Dogtag. For testing purposes, you can use the simple_crypto backend.

> Note
>
> Due to a limitation, unshelving of an instance and booting from a snapshot require manual intervention when integration between Nova and Barbican is enabled and instances are only allowed to boot from signed Glance images. Both shelve and snapshot operations in Nova create an image in Glance. You must manually sign this image to enable Nova to boot an instance from this snapshot or to unshelve an instance. Nova does not automatically sign the snapshot images it creates.

Deploy Dogtag

Dogtag is one of the Barbican plugins that represents a backend for storing symmetric keys, for example, for volume encryption, as well as passwords, and X.509 certificates.

To deploy the Dogtag backend for Barbican:

1. Open the classes/cluster/<cluster_name>/ directory of your Git project repository.
2. In openstack/control.yml, add the Dogtag class and specify the required parameters. For example:

```
classes:
- system.dogtag.server.cluster

...

parameters:
  _param:
    dogtag_master_host: ${_param:openstack_control_node01_hostname}.${_param:cluster_domain}
    haproxy_dogtag_bind_port: 8444
    cluster_dogtag_port: 8443
    # Dogtag listens on 8443 but there is no way to bind it to a
    # Specific IP, as in this setup Dogtag is installed on ctl nodes
    # Change port on haproxy side to avoid binding conflict.
    haproxy_dogtag_bind_port: 8444
    cluster_dogtag_port: 8443
    dogtag_master_host: ctl01.${linux:system:domain}
    dogtag_pki_admin_password: workshop
    dogtag_pki_client_database_password: workshop
    dogtag_pki_client_pkcs12_password: workshop
    dogtag_pki_ds_password: workshop
    dogtag_pki_token_password: workshop
    dogtag_pki_security_domain_password: workshop
    dogtag_pki_clone_pkcs12_password: workshop
  dogtag:
    server:
      ldap_hostname: ${linux:network:fqdn}
      ldap_dn_password: workshop
      ldap_admin_password: workshop
      export_pem_file_path: /etc/dogtag/kra_admin_cert.pem
```

3. In classes/cluster/<cluster_name>/infra/config/init.yml, add the - system.salt.master.formula.pkg.dogtag class to the classes section.

   For example:

```
classes:
- system.salt.master.formula.pkg.dogtag
...
```

4. In classes/cluster/<cluster_name>/infra/config/nodes.yml, specify the dogtag_cluster_role: master parameter in the openstack_control_node01 section, and the

dogtag_cluster_role: slave parameter in the openstack_control_node02 and openstack_control_node03 sections.

For example:

```
node:
  openstack_control_node01:
    classes:
    - service.galera.master.cluster
    - service.dogtag.server.cluster.master
    params:
      mysql_cluster_role: master
      linux_system_codename: xenial
      dogtag_cluster_role: master
  openstack_control_node02:
    classes:
    - service.galera.slave.cluster
    - service.dogtag.server.cluster.slave
    params:
      mysql_cluster_role: slave
      linux_system_codename: xenial
      dogtag_cluster_role: slave
  openstack_control_node03:
    classes:
    - service.galera.slave.cluster
    - service.dogtag.server.cluster.slave
    params:
      mysql_cluster_role: slave
      linux_system_codename: xenial
      dogtag_cluster_role: slave
```

5. Commit and push the changes to the project Git repository.
6. Log in to the Salt Master node.
7. Update your Salt formulas at the system level:
    1. Change the directory to /srv/salt/reclass.
    2. Run the git pull origin master command.
    3. Run the salt-call state.sls salt.master command.
8. Apply the following states:

```
salt -C 'I@salt:master' state.sls salt,reclass
salt -C 'I@dogtag:server and *01*' state.sls dogtag.server
salt -C 'I@dogtag:server' state.sls dogtag.server
salt -C 'I@haproxy:proxy' state.sls haproxy
```

9. Proceed to Deploy Barbican with the Dogtag backend.

Note

If the dogtag:export_pem_file_path variable is defined, the system imports kra admin certificate to the defined .pem file and to the Salt Mine dogtag_admin_cert variable. After that, Barbican and other components can use kra admin certificate.

Seealso

Dogtag OpenStack documentation

Deploy Barbican with the Dogtag backend

You can deploy and configure Barbican to work with the private Key Recovery Agent (KRA) Dogtag backend.

Before you proceed with the deployment, make sure that you have a running Dogtag backend. If you do not have a Dogtag backend yet, deploy it as described in Deploy Dogtag.

To deploy Barbican with the Dogtag backend:

1. Open the classes/cluster/<cluster_name>/ directory of your Git project repository.
2. In infra/config/init.yml, add the following class:

```
classes:
- system.keystone.client.service.barbican
```

3. In openstack/control.yml, modify the classes and parameters sections:

```
classes:
- system.apache.server.site.barbican
- system.galera.server.database.barbican
- system.barbican.server.cluster
- service.barbican.server.plugin.dogtag
...
parameters:
  _param:
    apache_barbican_api_address: ${_param:cluster_local_address}
    apache_barbican_api_host: ${_param:single_address}
    apache_barbican_ssl: ${_param:nginx_proxy_ssl}
    barbican_dogtag_nss_password: workshop
    barbican_dogtag_host: ${_param:cluster_vip_address}
  ...
    barbican:
      server:
        enabled: true
        dogtag_admin_cert:
          engine: mine
          minion: ${_param:dogtag_master_host}
        ks_notifications_enable: True
        store:
          software:
            store_plugin: dogtag_crypto
            global_default: True
        plugin:
          dogtag:
            port: ${_param:haproxy_dogtag_bind_port}
    nova:
      controller:
        barbican:
```

```
      enabled: ${_param:barbican_integration_enabled}
  cinder:
    controller:
      barbican:
        enabled: ${_param:barbican_integration_enabled}
  glance:
    server:
      barbican:
        enabled: ${_param:barbican_integration_enabled}
```

4. In openstack/init.yml, modify the parameters section. For example:

```
parameters:
  _param:
    ...
    barbican_service_protocol: ${_param:cluster_internal_protocol}
    barbican_service_host: ${_param:openstack_control_address}
    barbican_version: ${_param:openstack_version}
    mysql_barbican_password: workshop
    keystone_barbican_password: workshop
    barbican_dogtag_host: "dogtag.example.com"
    barbican_dogtag_nss_password: workshop
    barbican_integration_enabled: true
```

5. In openstack/proxy.yml, add the following class:

```
classes:
- system.nginx.server.proxy.openstack.barbican
```

6. Optional. Enable image verification:

    1. In openstack/compute/init.yml, add the following parameters:

    ```
    parameters:
      _param:
        nova:
          compute:
            barbican:
              enabled: ${_param:barbican_integration_enabled}
    ```

    2. In openstack/control.yml, add the following parameters:

    ```
    parameters:
      _param:
        nova:
          controller:
    ```

```
      barbican:
        enabled: ${_param:barbican_integration_enabled}
```

> Note
>
> This configuration changes the requirement to the Glance image upload procedure. All glance images will have to be updated with signature information. For details, see: OpenStack Nova and OpenStack Glance documentation.

7. Optional. In openstack/control.yml, enable volume encryption supported by the key manager:

```
parameters:
  _param:
    cinder:
      volume:
        barbican:
          enabled: ${_param:barbican_integration_enabled}
```

8. Optional. In init.yml, add the following parameters if you plan to use a self-signed certificate managed by Salt:

```
parameters:
  _param:
    salt:
      minion:
        trusted_ca_minions:
          - cfg01
```

9. Distribute the Dogtag KRA certificate from the Dogtag node to the Barbican nodes. Select from the following options (engines):

   - Define the KRA admin certificate manually in pillar by editing the infra/openstack/control.yml file:

```
barbican:
  server:
    dogtag_admin_cert:
      engine: manual
      key: |
      <key_data>
```

- Receive the Dogtag certificate from Salt Mine. The Dogtag formula sends the KRA certificate to the dogtag_admin_cert Mine function. Add the following to infra/openstack/control.yml:

```
barbican:
  server:
    dogtag_admin_cert:
      engine: mine
      minion: <dogtag_minion_node_name>
```

- If some additional steps were applied to install the KRA certificate and these steps are out of scope of the Barbican formula, the formula has the noop engine to perform no operations. If the noop engine is defined in infra/openstack/control.yml, the Barbican formula does nothing to install the KRA admin certificate.

```
barbican:
  server:
    dogtag_admin_cert:
      engine: noop
```

  In this case, manually populate the Dogtag KRA certificate in /etc/barbican/kra_admin_cert.pem on the Barbican nodes.

10 Commit and push the changes to the project Git repository.
.

11 Log in to the Salt Master node.
.

12 Update your Salt formulas at the system level:
.

1. Change the directory to /srv/salt/reclass.
2. Run the git pull origin master command.
3. Run the salt-call state.sls salt.master command.

13 If you enabled the usage of a self-signed certificate managed by Salt, apply the following
. state:

```
salt -C 'I@salt:minion' state.apply salt.minion
```

14 Apply the following states:
.

```
salt -C 'I@keystone:client' state.sls keystone.client
salt -C 'I@galera:master' state.sls galera.server
salt -C 'I@galera:slave' state.apply galera
salt -C 'I@nginx:server' state.sls nginx
salt -C 'I@barbican:server and *01*' state.sls barbican.server
```

```
salt -C 'I@barbican:server' state.sls barbican.server
salt -C 'I@barbican:client' state.sls barbican.client
```

15 If you enabled image verification by Nova, apply the following states:

```
salt -C 'I@nova:controller' state.sls nova -b 1
salt -C 'I@nova:compute' state.sls nova
```

16 If you enabled volume encryption supported by the key manager, apply the following state:

```
salt -C 'I@cinder:controller' state.sls cinder -b 1
```

17 If you have async workers enabled, restart the Barbican worker service:

```
salt -C 'I@barbican:server' service.restart barbican-worker
```

18 Restart the Barbican API server:

```
salt -C 'I@barbican:server' service.restart apache2
```

19 Verify that Barbican works correctly. For example:

```
openstack secret store --name mysecret --payload j4=]d21
```

Deploy Barbican with the simple_crypto backend

> Warning
>
> The deployment of Barbican with the simple_crypto backend described in this section is intended for testing and evaluation purposes only. For production deployments, use the Dogtag backend. For details, see: Deploy Dogtag.

You can configure and deploy Barbican with the simple_crypto backend.

To deploy Barbican with the simple_crypto backend:

1. Open the classes/cluster/<cluster_name>/ directory of your Git project repository.
2. In openstack/database/init.yml, add the following class:

```
classes:
- system.mysql.client.database.barbican
```

3. In openstack/control/init.yml, add the following class:

```
classes:
- system.keystone.client.service.barbican
```

4. In infra/openstack/control.yml, modify the parameters section. For example:

```
classes:
- system.apache.server.site.barbican
- system.barbican.server.cluster
- service.barbican.server.plugin.simple_crypto

parameters:
  _param:
    barbican:
      server:
        store:
          software:
            crypto_plugin: simple_crypto
            store_plugin: store_crypto
            global_default: True
```

5. In infra/secret.yml, modify the parameters section. For example:

```
parameters:
  _param:
    barbican_version: ${_param:openstack_version}
```

```
  barbican_service_host: ${_param:openstack_control_address}
  mysql_barbican_password: password123
  keystone_barbican_password: password123
  barbican_simple_crypto_kek: "base64 encoded 32 bytes as secret key"
```

6. In openstack/proxy.yml, add the following class:

```
classes:
- system.nginx.server.proxy.openstack.barbican
```

7. Optional. Enable image verification:

   1. In openstack/compute/init.yml, add the following parameters:

```
parameters:
  _param:
    nova:
      compute:
        barbican:
          enabled: ${_param:barbican_integration_enabled}
```

   2. In openstack/control.yml, add the following parameters:

```
parameters:
  _param:
    nova:
      controller:
        barbican:
          enabled: ${_param:barbican_integration_enabled}
```

> Note
>
> This configuration changes the requirement for the Glance image upload procedure. All glance images will have to be updated with signature information. For details, see: OpenStack Nova and OpenStack Glance documentation.

8. Optional. In openstack/control.yml, enable volume encryption supported by the key manager:

```
parameters:
  _param:
    cinder:
      volume:
        barbican:
          enabled: ${_param:barbican_integration_enabled}
```

9. Optional. In init.yml, add the following parameters if you plan to use a self-signed certificate managed by Salt:

```
parameters:
  _param:
    salt:
      minion:
        trusted_ca_minions:
          - cfg01
```

10. Commit and push the changes to the project Git repository.

11. Log in to the Salt Master node.

12. Update your Salt formulas at the system level:

    1. Change the directory to /srv/salt/reclass.
    2. Run the git pull origin master command.
    3. Run the salt-call state.sls salt.master command.

13. If you enabled the usage of a self-signed certificate managed by Salt, apply the following state:

```
salt -C 'I@salt:minion' state.apply salt.minion
```

14. If you enabled image verification by Nova, apply the following states:

```
salt -C 'I@nova:controller' state.sls nova -b 1
salt -C 'I@nova:compute' state.sls nova
```

15. If you enabled volume encryption supported by the key manager, apply the following state:

```
salt -C 'I@cinder:controller' state.sls cinder -b 1
```

16. Apply the following states:

```
salt -C 'I@keystone:client' state.apply keystone.client
salt -C 'I@galera:master' state.apply galera.server
salt -C 'I@galera:slave' state.apply galera
salt -C 'I@nginx:server' state.apply nginx
salt -C 'I@haproxy:proxy' state.apply haproxy.proxy
salt -C 'I@barbican:server and *01*' state.sls barbican.server
salt -C 'I@barbican:server' state.sls barbican.server
salt -C 'I@barbican:client' state.sls barbican.client
```

Seealso

Barbican OpenStack documentation

Deploy Ironic

While virtualization provides outstanding benefits in server management, cost efficiency, and resource consolidation, some cloud environments with particularly high I/O rate may require physical servers as opposed to virtual.

MCP supports bare-metal provisioning for OpenStack environments using the OpenStack Bare Metal service (Ironic). Ironic enables system administrators to provision physical machines in the same fashion as they provision virtual machines.

> Note
>
> Starting from the 2019.2.6 maintenance update, Ironic is officially supported and integrated into MCP. Before the 2019.2.6 maintenance update, Ironic is available as technical preview and can be used for testing and evaluation purposes only.

Limitations

When you plan on using the OpenStack Bare Metal provisioning service (Ironic), consider the following limitations:

Specific hardware limitations

When choosing hardware (switch) to be used by Ironic, consider hardware limitations of a specific vendor.

Only iSCSI deploy drivers are enabled

Ironic is deployed with only iSCSI deploy drivers enabled which may pose performance limitations for deploying multiple nodes concurrently. You can enable agent-based Ironic drivers manually after deployment if the deployed cloud has a working Swift-compatible object-store service with support for temporary URLs, with Glance configured to use the object store service to store images. For more information on how to configure Glance for temporary URLs, see OpenStack documentation.

Seealso

MCP Ironic supported features and known limitations

Modify the deployment model

To use the OpenStack Bare Metal service, you need to modify your Reclass model before deploying a new OpenStack environment. You can also deploy the OpenStack Bare Metal service in the existing OpenStack environment.

As bare-metal configurations vary, this section provides examples of deployment model modifications. You may need to tailor them for your specific use case.

The configuration examples in this section presuppose the following:

- The OpenStack Bare Metal API service runs on the OpenStack Controller node
- The Bare Metal service for ironic-conductor and other services per the bare-metal role reside on the bmt01, bmt02, and bmt03 nodes
- Separate flat network is used between the bmt* and gtw* nodes
- The network configuration:
  - Control network: 10.11.0.0/16
  - Bare-metal network: 10.13.0.0/16
  - Bare-metal interface: ens6

To modify the deployment model:

1. Select from the following options:
   - For the MCP versions prior to the 2019.2.6 maintenance update, Create a deployment metadata model.
   - For the MCP versions 2019.2.6 and later, when creating a deployment model as described in Create a deployment metadata model, set the ironic_enabled parameter to True that will automatically add most of the Ironic parameters and classes described in the following steps.
2. Open the cluster level of your Reclass model.
3. In the ./openstack/init.yml file, add or update the following parameters to match your specific bare metal configuration:

> Caution!
>
> The openstack_baremetal_neutron_subnet_ parameters must match your bare metal network settings. The bare metal nodes must be connected to the network before the deployment. During the deployment, MCP automatically registers this network in the OpenStack Networking service.

```
parameters:
  _param:
    openstack_baremetal_address: 10.11.0.5
```

```
  openstack_baremetal_node01_address: 10.11.0.6
  openstack_baremetal_node02_address: 10.11.0.7
  openstack_baremetal_node03_address: 10.11.0.8
  openstack_baremetal_node01_hostname: bmt01
  openstack_baremetal_node02_hostname: bmt02
  openstack_baremetal_node03_hostname: bmt03
  openstack_baremetal_address_baremetal: 10.13.0.10
  openstack_baremetal_node01_baremetal_address: 10.13.0.11
  openstack_baremetal_node02_baremetal_address: 10.13.0.12
  openstack_baremetal_node03_baremetal_address: 10.13.0.13
  openstack_baremetal_neutron_subnet_cidr: 10.13.0.0/16
  openstack_baremetal_neutron_subnet_allocation_start: 10.13.90.1
  openstack_baremetal_neutron_subnet_allocation_end: 10.13.199.255
  mysql_ironic_password: ${_param:mysql_ironic_password_generated}
  keystone_ironic_password: ${_param:keystone_ironic_password_generated}
  ironic_version: ${_param:openstack_version}
```

4. Verify that the following pillars are defined in ./openstack/init.yml:

```
parameters:
  linux:
    network:
      host:
        bmt01:
          address: ${_param:openstack_baremetal_node01_address}
          names:
            - ${_param:openstack_baremetal_node01_hostname}
            - ${_param:openstack_baremetal_node01_hostname}.${_param:cluster_domain}
        bmt02:
          address: ${_param:openstack_baremetal_node02_address}
          names:
            - ${_param:openstack_baremetal_node02_hostname}
            - ${_param:openstack_baremetal_node02_hostname}.${_param:cluster_domain}
        bmt03:
          address: ${_param:openstack_baremetal_node03_address}
          names:
            - ${_param:openstack_baremetal_node03_hostname}
            - ${_param:openstack_baremetal_node03_hostname}.${_param:cluster_domain}
```

5. Verify that the following classes are included into infra/config/init.yml:

```
- system.reclass.storage.system.openstack_baremetal_cluster
- system.salt.master.formula.pkg.baremetal
```

6. Verify that the following classes are included into openstack/database.yml:

```
- system.galera.server.database.ironic
```

7. Verify that the following parameters are defined in infra/secrets.yml:

```
mysql_ironic_password: some_password
keystone_ironic_password: some_password
keepalived_openstack_baremetal_password_generated: some_password
```

8. Verify that the following pillars and classes are added to openstack/control.yml:

```
- system.haproxy.proxy.listen.openstack.ironic
- system.ironic.api.cluster
parameters:
  _param:
    ironic_service_host: ${_param:cluster_vip_address}
    cluster_baremetal_local_address: ${_param:cluster_local_address}
    ironic_api_type: 'public'

  neutron:
    server:
      ironic_enabled: True
      backend:
        ironic_vlan_range: 100:1000
```

9. Verify that the following classes are included into openstack/control/init.yml:

```
- service.ironic.client
- system.neutron.client.service.ironic
- system.keystone.client.service.ironic
```

10. Verify that the openstack/baremetal.yml file is present in the model with the following exemplary content:

```
classes:
- system.linux.system.repo.mcp.apt_mirantis.extra
- system.linux.system.repo.mcp.apt_mirantis.openstack
- cluster.${CLUSTER_NAME}.infra
- system.ironic.api.cluster
- system.ironic.conductor.cluster
- system.ironic.tftpd_hpa
- system.nova.compute_ironic.cluster
- system.apache.server.single
- system.apache.server.site.ironic
- system.keepalived.cluster.instance.openstack_baremetal_vip
- system.haproxy.proxy.listen.openstack.ironic_deploy
- system.haproxy.proxy.single

parameters:
  _param:
```

```
ironic_api_type: 'deploy'
cluster_vip_address: ${_param:openstack_control_address}
ironic_service_host: ${_param:cluster_vip_address}
cluster_local_address: ${_param:single_address}
cluster_baremetal_vip_address: ${_param:openstack_baremetal_address_baremetal}
cluster_baremetal_local_address: ${_param:baremetal_address}
keepalived_openstack_baremetal_vip_interface: ens6
cluster_node01_hostname: ${_param:openstack_baremetal_node01_hostname}
cluster_node01_address: ${_param:openstack_baremetal_node01_address}
cluster_node02_hostname: ${_param:openstack_baremetal_node02_hostname}
cluster_node02_address: ${_param:openstack_baremetal_node02_address}
cluster_node03_hostname: ${_param:openstack_baremetal_node03_hostname}
cluster_node03_address: ${_param:openstack_baremetal_node03_address}
keepalived_openstack_baremetal_password: ${_param:keepalived_openstack_baremetal_password_generated}
```

11 Verify that the following pillars and classes are added into openstack/proxy.yml:

```
classes:
- system.nginx.server.proxy.openstack.ironic
parameters:
  _param:
    ironic_service_host: ${_param:openstack_control_address}
```

12 Verify that the following pillars are added into openstack/gateway.yml:

```
neutron:
  gateway:
    ironic_enabled: True
linux:
  network:
    interface:
      br-baremetal:
        enabled: true
        type: ovs_bridge
        mtu: ${_param:interface_mtu}
      ens6:
        enabled: true
        name: ens6
        type: eth
        proto: manual
        ovs_bridge: br-baremetal
        ovs_type: OVSPort
        ipflush_onchange: true
        restart_on_ipflush: true
```

13 In openstack/control.yml, enroll the bare metal nodes dedicated for Ironic:

```
parameters:
  ironic:
    client:
      enabled: true
```

```
    nodes:
      admin_identity:
        - name: <node name>
          driver: pxe_ipmitool
          properties:
            local_gb: <size of node's disk in GiB>
            cpus: <Number of CPUs on the node>
            memory_mb: <RAM size of the node in MiB>
            cpu_arch: <architecture of node's CPU>
          driver_info:
            ipmi_username: <username for IPMI>
            ipmi_password: <password for the IPMI user>
            ipmi_address: <IPMI address of the node>
          ports:
            - address: <MAC address of the node port1>
            - address: <MAC address of the node port2>
```

14 Proceed to Install the Bare Metal service components.
.

Install the Bare Metal service components

> **Caution!**
>
> The procedure below applies to existing MCP clusters and to new MCP clusters prior to the 2019.2.6 maintenance update.
>
> Starting from 2019.2.6, you can skip the procedure below for new MCP clusters and deploy Ironic automatically using the OpenStack deployment pipeline as described in Deploy an OpenStack environment.

After you have configured the deployment model as described in Modify the deployment model, install the Bare Metal service components, including Ironic API, Ironic Conductor, Ironic Client, and others.

To install the Bare Metal service components:

1. Install Ironic API:

   ```
   salt -C 'I@ironic:api and *01*' state.sls ironic.api
   salt -C 'I@ironic:api' state.sls ironic.api
   ```

2. Install Ironic Conductor:

   ```
   salt -C 'I@ironic:conductor' state.sls ironic.conductor
   ```

3. Install Ironic Client:

   ```
   salt -C 'I@ironic:client and *01*' state.sls ironic.client
   salt -C 'I@ironic:client' state.sls ironic.client
   ```

4. Install software required by Ironic, such as Apache and TFTP server:

   ```
   salt -C 'I@ironic:conductor' state.sls apache
   salt -C 'I@tftpd_hpa:server' state.sls tftpd_hpa
   ```

5. Install nova-compute with ironic virt-driver:

   ```
   salt -C 'I@nova:compute' state.sls nova.compute
   salt -C 'I@nova:compute' cmd.run 'systemctl restart nova-compute'
   ```

6. Log in to an OpenStack Controller node.

7. Verify that the Ironic services are enabled and running:

   ```
   salt -C 'I@ironic:client' cmd.run '. /root/keystonercv3; ironic driver-list'
   ```

Deploy Manila

> ## Caution!
>
> Manila deprecation notice
>
> In the MCP 2019.2.7 update, the OpenStack Manila component is being considered for deprecation. The corresponding capabilities are still available, although not further enhanced.
>
> Starting with the 2019.2.11 maintenance update, the OpenStack Manila component will no longer be supported by Mirantis. For those existing customers who have the Manila functionality explicitly included in the scope of their contracts, Mirantis will continue to fulfill the corresponding support obligations.

Manila, also known as the OpenStack Shared File Systems service, provides coordinated access to shared or distributed file systems that a compute instance can consume.

Modify the deployment model

> **Caution!**
>
> Manila deprecation notice
>
> In the MCP 2019.2.7 update, the OpenStack Manila component is being considered for deprecation. The corresponding capabilities are still available, although not further enhanced.
>
> Starting with the 2019.2.11 maintenance update, the OpenStack Manila component will no longer be supported by Mirantis. For those existing customers who have the Manila functionality explicitly included in the scope of their contracts, Mirantis will continue to fulfill the corresponding support obligations.

You can enable Manila while generating you deployment metadata model using the Model Designer UI before deploying a new OpenStack environment. You can also deploy Manila on an existing OpenStack environment.

The manila-share service may use different backends. This section provides examples of deployment model modifications for the LVM backend. You may need to tailor these examples depending on the needs of your deployment. Basically, the examples provided in this section describe the following configuration:

- The OpenStack Manila API and Scheduler services run on the OpenStack share nodes.
- The manila-share service and other services per share role may reside on the share or cmp nodes depending on the backend type. The default LVM-based shares reside on the cmp nodes.

To modify the deployment model:

1. While generating a deployment metadata model for your new MCP cluster as described in Create a deployment metadata model, select Manila enabled and modify its parameters as required in the Product parameters section of the Model Designer UI.
2. If you have already generated a deployment metadata model without the Manila service or to enable this feature on an existing MCP cluster:
    1. Open your Reclass model Git project repository on the cluster level.
    2. Modify the ./infra/config.yml file:

        ```
        classes:
        ...
        - system.reclass.storage.system.openstack_share_multi
        - system.salt.master.formula.pkg.manila
        ```

    3. Modify the ./infra/secrets.yml file:

```
parameters:
  _param:
    ...
    keystone_manila_password_generated: some_password
    mysql_manila_password_generated: some_password
    manila_keepalived_vip_password_generated: some_password
```

4. Modify the ./openstack/compute/init.yml file:

```
classes:
...
- system.manila.share
- system.manila.share.backend.lvm

parameters:
  _param:
    ...
    manila_lvm_volume_name: <lvm_volume_name>
    manila_lvm_devices: <list_of_lvm_devices>
```

5. Modify the ./openstack/control/init.yml file:

```
classes:
...
- system.keystone.client.service.manila
- system.keystone.client.service.manila2
- system.manila.client

parameters:
  _param:
    ...
    manila_share_type_default_extra_specs:
      driver_handles_share_servers: False
      snapshot_support: True
      create_share_from_snapshot_support : True
      mount_snapshot_support : True
      revert_to_snapshot_support : True
```

6. Modify the ./openstack/database.yml file:

```
classes:
...
- system.galera.server.database.manila
```

7. Modify the ./openstack/init.yml file:

```
parameters:
  _param:
    ...
    manila_service_host: ${_param:openstack_share_address}
    keystone_manila_password: ${_param:keystone_manila_password_generated}
    mysql_manila_password: ${_param:mysql_manila_password_generated}
    openstack_share_address: <share_address>
    openstack_share_node01_address: <share_node01_address>
    openstack_share_node02_address: <share_node02_address>
    openstack_share_node03_address: <share_node03_address>
    openstack_share_node01_share_address: ${_param:openstack_share_node01_address}
    openstack_share_node02_share_address: ${_param:openstack_share_node02_address}
    openstack_share_node03_share_address: ${_param:openstack_share_node03_address}
    openstack_share_node01_deploy_address: <share_node01_deploy_address>
    openstack_share_node02_deploy_address: <share_node02_deploy_address>
    openstack_share_node03_deploy_address: <share_node03_deploy_address>
    openstack_share_hostname: <share_hostname>
    openstack_share_node01_hostname: <share_node01_hostname>
    openstack_share_node02_hostname: <share_node02_hostname>
    openstack_share_node03_hostname: <share_node03_hostname>

  linux:
    network:
      host:
        ...
        share01:
          address: ${_param:openstack_share_node01_address}
          names:
            - ${_param:openstack_share_node01_hostname}
            - ${_param:openstack_share_node01_hostname}.${_param:cluster_domain}
        share02:
          address: ${_param:openstack_share_node02_address}
          names:
          - ${_param:openstack_share_node02_hostname}
          - ${_param:openstack_share_node02_hostname}.${_param:cluster_domain}
        share03:
          address: ${_param:openstack_share_node03_address}
          names:
          - ${_param:openstack_share_node03_hostname}
          - ${_param:openstack_share_node03_hostname}.${_param:cluster_domain}
```

8. Modify the ./openstack/proxy.yml file:

```
classes:
...
- system.nginx.server.proxy.openstack.manila
```

9. Modify the ./openstack/share.yml file:

```
classes:
...
```

```
- system.linux.system.repo.mcp.extra
- system.linux.system.repo.mcp.apt_mirantis.openstack
- system.apache.server.single
- system.manila.control.cluster
- system.keepalived.cluster.instance.openstack_manila_vip

parameters:
  _param:
    ...
    manila_cluster_vip_address: ${_param:openstack_control_address}
    cluster_vip_address: ${_param:openstack_share_address}
    cluster_local_address: ${_param:single_address}
    cluster_node01_hostname: ${_param:openstack_share_node01_hostname}
    cluster_node01_address: ${_param:openstack_share_node01_address}
    cluster_node02_hostname: ${_param:openstack_share_node02_hostname}
    cluster_node02_address: ${_param:openstack_share_node02_address}
    cluster_node03_hostname: ${_param:openstack_share_node03_hostname}
    cluster_node03_address: ${_param:openstack_share_node03_address}
    keepalived_vip_interface: ens3
    keepalived_vip_address: ${_param:cluster_vip_address}
    keepalived_vip_password: ${_param:manila_keepalived_vip_password_generated}
    apache_manila_api_address: ${_param:cluster_local_address}

  manila:
    common:
      default_share_type: default
```

3. If you plan a separate storage network for Manila, define the manila_share_address parameter on the cluster level of your Reclass model in the file that contains the configuration for the Manila share backend. For example, for the LVM backend, modify the ./openstack/compute/init.yml file:

```
parameters:
  _param:
    manila_share_address: <ip_address>
```

4. Proceed to Install the Manila components.

Seealso

MCP Reference Architecture: Manila storage networking planning

Install the Manila components

> **Caution!**
>
> Manila deprecation notice
>
> In the MCP 2019.2.7 update, the OpenStack Manila component is being considered for deprecation. The corresponding capabilities are still available, although not further enhanced.
>
> Starting with the 2019.2.11 maintenance update, the OpenStack Manila component will no longer be supported by Mirantis. For those existing customers who have the Manila functionality explicitly included in the scope of their contracts, Mirantis will continue to fulfill the corresponding support obligations.

After you have configured the deployment model as described in Modify the deployment model, install the Manila components that include the manila-api, manila-scheduler, manila-share, manila-data, and other services.

To install the Manila components:

1. Log in to the Salt Master node.
2. Refresh your Reclass storage data:

   ```
   salt-call state.sls reclass.storage
   ```

3. Install manila-api:

   ```
   salt -C 'I@manila:api and *01*' state.sls manila.api
   salt -C 'I@manila:api' state.sls manila.api
   ```

4. Install manila-scheduler:

   ```
   salt -C 'I@manila:scheduler' state.sls manila.scheduler
   ```

5. Install manila-share:

   ```
   salt -C 'I@manila:share' state.sls manila.share
   ```

6. Install manila-data:

   ```
   salt -C 'I@manila:data' state.sls manila.data
   ```

7. Install the Manila client:

```
salt -C 'I@manila:client' state.sls manila.client
```

8. Log in to any OpenStack controller node.
9. Verify that the Manila services are enabled and running:

```
salt 'cfg01*' cmd.run 'source keystonercv3; manila list'
salt 'cfg01*' cmd.run 'source keystonercv3; manila service-list'
```

Secure memcached for the OpenStack services

This section provides the instruction on how to enable the memcached protection in the OpenStack Pike deployments.

The OpenStack services that support the memcached protection include Aodh, Barbican, Cinder, Glance, Gnocchi, Heat, Ironic, Neutron, Nova, and Panko.

When using Memcached, tokens and authentication responses are stored in the cache as raw data. If the cache is compromised, tokens and authentication responses become readable. To mitigate this risk, MCP uses the auth_token middleware that provides for the authentication and encryption of the token data stored in the cache by means of the following configuration parameters:

- memcache_security_strategy

  Indicates whether the token data should be authenticated or authenticated and encrypted. Acceptable values include:

  - MAC to authenticate (with HMAC) the token data in cache
  - ENCRYPT to encrypt and authenticate the token data in cache

  If the value is not set or empty, auth_token raises an exception on initialization.

- memcache_secret_key

  Mandatory if memcache_security_strategy is defined. Used for key derivation. If memcache_security_strategy is defined and memcache_secret_key is not set, auth_token raises an exception on initialization.

MCP OpenStack supports the memcached protection since the Pike release. By default, this functionality is disabled in the Pike deployments. For Queens and newer releases, the memcached protection is enabled by default with the ENCRYPT security strategy.

To enable the memcached protection:

1. Log in to the Salt Master node.
2. Update your Reclass metadata model.
3. Verify the pillars. For example, for nova:controller:

```
salt -C 'I@nova:controller' pillar.get nova:controller:cache:security
```

   Example of system response:

```
---Output---
ctl02.node.local:
    ----------
    enabled:
      False
    secret_key:
    strategy:
        ENCRYPT
ctl03.node.local:
    ----------
    enabled:
        False
    secret_key:
    strategy:
        ENCRYPT
ctl01.node.local:
    ----------
    enabled:
        False
    secret_key:
    strategy:
        ENCRYPT
---End output---
```

4. Select from the following options:

   - Enable the memcache security and specify the secret keys globally by modifying the cluster level of your deployment model:

     1. In the <cluster_name>/openstack/init.yml file, enable the cache security, set the security strategy, and define the secret keys for the required OpenStack services. For example:

        ```
        parameters:
          _param:
            openstack_memcache_security_enabled: True
            openstack_memcache_security_strategy: ENCRYPT
            nova_memcache_secret_key: <SECRET_KEY>
            neutron_memcache_secret_key: <SECRET_KEY>
            ...
        ```

     2. Refresh pillars:

        ```
        salt '*' saltutil.refresh_pillar
        ```

     3. Verify pillars for the OpenStack services. For example, for the Nova controller:

```
salt -C 'I@nova:controller' pillar.get nova:controller:cache:security
```

Example of system response:

```
---Output---
ctl02.node.local:
    ----------
    enabled:
        True
    secret_key:
        ez6D6unod2PB4Aqp
    strategy:
        ENCRYPT
ctl03.node.local:
    ----------
    enabled:
        True
    secret_key:
        ez6D6unod2PB4Aqp
    strategy:
        ENCRYPT
ctl01.node.local:
    ----------
    enabled:
        True
    secret_key:
        ez6D6unod2PB4Aqp
    strategy:
        ENCRYPT
---End Output---
```

4. Apply the changes for all required OpenStack services by running the appropriate service states listed in the table below.

- Define the memcache security parameters through the pillars in a granular way, which allows for particular services configuration if required.

Memcache protection configuration for the OpenStack services

OpenStack service	Define custom pillar	Apply the change

Aodh	**aodh**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@aodh:server' state.sls aodh

Barbican	**barbican**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@barbican:server' state.sls barbican.server

Cinder	**cinder**:
	  controller:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
	
	cinder:
	  volume:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@cinder:controller or I@cinder:volume' state.sls cinder

Glance	**glance**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@glance:server' state.sls glance.server

Gnocchi	**gnocchi**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@gnocchi:server' state.sls gnocchi.server

Heat	**heat**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@heat:server' state.sls heat.server

Ironic	**ironic**:
	  api:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
	  conductor:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@ironic:api' state.sls ironic.api
		salt -C 'I@ironic:conductor' state.sls ironic.conductor

Neutron	**neutron**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
		salt -C 'I@neutron:server' state.sls neutron.server

Nova	<pre>**nova**:
	  controller:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT
	
	nova:
	  compute:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT</pre>
		salt -C 'I@nova:controller or I@nova:compute' state.sls nova

Panko	<pre>**panko**:
	  server:
	  cache:
	  security:
	  enabled: True
	  secret_key: secret-key
	  strategy: ENCRYPT</pre>
		salt -C 'I@panko:server' state.sls panko.server

Deploy a Ceph cluster

Ceph is a storage backend for cloud environments. This section guides you through the manual deployment of a Ceph cluster. To deploy a Ceph cluster with nodes in different L3 compartments, first perform the prerequisite steps as described in Prerequisites for a Ceph cluster distributed over L3 domains. Otherwise, proceed with Deploy a Ceph cluster.

Prerequisites for a Ceph cluster distributed over L3 domains

> Note
>
> This feature is available starting from the MCP 2019.2.5 maintenance update. Before enabling the feature, follow the steps described in Apply maintenance updates.

Before deploying a Ceph cluster with nodes in different L3 compartments, consider the following prerequisite steps. Otherwise, proceed to Deploy a Ceph cluster right away.

This document uses the terms failure domain and L3 compartment. Failure domains are a logical representation of a physical cluster structure. For example, one L3 segment spans two racks and another one spans a single rack. In this case, failure domains reside along the rack boundary, instead of the L3 segmentation.

1. Verify your networking configuration:

   > Note
   >
   > Networking verification may vary depending on the hardware used for the deployment. Use the following steps as a reference only.

   1. To ensure the best level of high availability, verify that the Ceph Monitor and RADOS Gateway nodes are distributed as evenly as possible over the failure domains.
   2. Verify that the same number and weight of OSD nodes and OSDs are defined in each L3 compartment for the best data distribution:
      1. In classes/cluster/cluster_name/ceph/osd.yml, verify the Ceph OSDs weight. For example:

         ```
         backend:
           bluestore:
             disks:
               - dev: /dev/vdc
                 block_db: /dev/vdd
                 class: hdd
                 weight: 1.5
         ```

      2. In classes/cluster/cluster_name/infra/config/nodes.yml, verify the number of OSDs.
   3. Verify the connection between the nodes from different compartments through public or cluster VLANs. To use different subnets for the Ceph nodes in different compartments, specify all subnets in classes/cluster/cluster_name/ceph/common.yml. For example:

```
parameters:
  ceph:
    common:
      public_network: 10.10.0.0/24, 10.10.1.0/24
      cluster_network: 10.11.0.0/24, 10.11.1.0/24
```

2. Prepare the CRUSHMAP:

    1. To ensure at least one data replica in every failure domain, group the Ceph OSD nodes from each compartment by defining the ceph_crush_parent parameter in classes/cluster/cluster_name/infra/config/nodes.yml for each Ceph OSD node. For example, for three Ceph OSDs in rack01:

    ```
    ceph_osd_rack01:
      name: ${_param:ceph_osd_rack01_hostname}<<count>>
      domain: ${_param:cluster_domain}
      classes:
        - cluster.${_param:cluster_name}.ceph.osd
      repeat:
        count: 3
        ip_ranges:
          single_address: 10.11.11.1-10.11.20.255
          backend_address: 10.12.11.1-10.12.20.255
          ceph_public_address: 10.13.11.1-10.13.20.255
        start: 1
        digits: 0
        params:
          single_address:
            value: <<single_address>>
          backend_address:
            value: <<backend_address>>
          ceph_public_address:
            value: <<ceph_public_address>>
      params:
        salt_master_host: ${_param:reclass_config_master}
        ceph_crush_parent: rack01
        linux_system_codename: xenial
    ```

    2. In /classes/cluster/cluster_name/ceph/setup.yml, create a new CRUSHMAP and define the failure domains. For example, to have three copies of each object distributed over rack01, rack02, rack03:

    ```
    parameters:
      ceph:
        setup:
          crush:
            enforce: false # uncomment this line and set it to true only if
    ```

```
                # you want to enforce CRUSHMAP with ceph.setup
                # state !
        type:  # define any non-standard bucket type here
          - root
          - region
          - rack
          - host
          - osd
        root:
          - name: default
        room:
          - name: room1
            parent: default
          - name: room2
            parent: default
          - name: room3
            parent: default
        rack:
          - name: rack01 # OSD nodes defined in previous section
                  # will be added to this rack
            parent: room1
          - name: rack02
            parent: room2
          - name: rack03
            parent: room3
        rule:
          default:
            ruleset: 0
            type: replicated
            min_size: 2
            max_size: 10
            steps:
              - take take default
              - chooseleaf firstn 0 type region
              - emit
```

Once done, proceed to Deploy a Ceph cluster.

Deploy a Ceph cluster

This section guides you through the manual deployment of a Ceph cluster. If you are deploying a Ceph cluster distributed over L3 domains, verify that you have performed the steps described in Prerequisites for a Ceph cluster distributed over L3 domains.

> Warning
>
> Converged storage is not supported.

> Note
>
> Prior to deploying a Ceph cluster:
>
> 1. Verify that you have selected Ceph enabled while generating a deployment model as described in Define the deployment model.
> 2. If you require Tenant Telemetry, verify that you have set the gnocchi_aggregation_storage option to Ceph while generating the deployment model.
> 3. Verify that OpenStack services, such as Cinder, Glance, and Nova are up and running.
> 4. Verify and, if required, adjust the Ceph setup for disks in the classes/cluster/<CLUSTER_NAME>/ceph/osd.yml file.

To deploy a Ceph cluster:

1. Log in to the Salt Master node.
2. Update modules and states on all Minions:

   ```
   salt '*' saltutil.sync_all
   ```

3. Run basic states on all Ceph nodes:

   ```
   salt "*" state.sls linux,openssh,salt,ntp,rsyslog
   ```

4. Generate admin and mon keyrings:

   ```
   salt -C 'I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin' state.sls ceph.mon
   salt -C 'I@ceph:mon' saltutil.sync_grains
   salt -C 'I@ceph:mon:keyring:mon or I@ceph:common:keyring:admin' mine.update
   ```

5. Deploy Ceph mon nodes:

   - If your Ceph version is older than Luminous:

```
salt -C 'I@ceph:mon' state.sls ceph.mon
```

- If your Ceph version is Luminous or newer:

```
salt -C 'I@ceph:mon' state.sls ceph.mon
salt -C 'I@ceph:mgr' state.sls ceph.mgr
```

6. (Optional) To modify the Ceph CRUSH map:

   1. Uncomment the example pillar in the classes/cluster/<CLUSTER_NAME>/ceph/setup.yml file and modify it as required.
   2. Verify the ceph_crush_parent parameters in the classes/cluster/<CLUSTER_NAME>/infra.config.yml file and modify them if required.
   3. If you have modified the ceph_crush_parent parameters, also update the grains:

```
salt -C 'I@salt:master' state.sls reclass.storage
salt '*' saltutil.refresh_pillar
salt -C 'I@ceph:common' state.sls salt.minion.grains
salt -C 'I@ceph:common' mine.flush
salt -C 'I@ceph:common' mine.update
```

7. Technical preview Optional. For testing and evaluation purposes, you can enable the ceph-volume tool instead of ceph-disk to deploy the Ceph OSD nodes:

   1. In classes/cluster/<cluster_name>/ceph/osd.yml, specify:

```
parameters:
  ceph:
    osd:
      backend:
        bluestore:
          create_partitions: True
      lvm_enabled: True
```

   2. Apply the changes:

```
salt -C 'I@ceph:osd' saltutil.refresh_pillar
```

8. Deploy Ceph osd nodes:

```
salt -C 'I@ceph:osd' state.sls ceph.osd
salt -C 'I@ceph:osd' saltutil.sync_grains
salt -C 'I@ceph:osd' state.sls ceph.osd.custom
salt -C 'I@ceph:osd' saltutil.sync_grains
salt -C 'I@ceph:osd' mine.update
salt -C 'I@ceph:setup' state.sls ceph.setup
```

9. Deploy RADOS Gateway:

```
salt -C 'I@ceph:radosgw' saltutil.sync_grains
salt -C 'I@ceph:radosgw' state.sls ceph.radosgw
```

10. Set up the Keystone service and endpoints for Swift or S3:

```
salt -C 'I@keystone:client' state.sls keystone.client
```

11. Connect Ceph to your MCP cluster:

```
salt -C 'I@ceph:common and I@glance:server' state.sls ceph.common,ceph.setup.keyring,glance
salt -C 'I@ceph:common and I@glance:server' service.restart glance-api
salt -C 'I@ceph:common and I@glance:server' service.restart glance-glare
salt -C 'I@ceph:common and I@glance:server' service.restart glance-registry
salt -C 'I@ceph:common and I@cinder:controller' state.sls ceph.common,ceph.setup.keyring,cinder
salt -C 'I@ceph:common and I@nova:compute' state.sls ceph.common,ceph.setup.keyring
salt -C 'I@ceph:common and I@nova:compute' saltutil.sync_grains
salt -C 'I@ceph:common and I@nova:compute' state.sls nova
```

12. If you have deployed StackLight LMA, configure Ceph monitoring:

    1. Clean up the /srv/volumes/ceph/etc/ceph directory.
    2. Connect Telegraf to Ceph:

    ```
    salt -C 'I@ceph:common and I@telegraf:remote_agent' state.sls ceph.common
    ```

13. If you have deployed Tenant Telemetry, connect Gnocchi to Ceph:

```
salt -C 'I@ceph:common and I@gnocchi:server' state.sls ceph.common,ceph.setup.keyring
salt -C 'I@ceph:common and I@gnocchi:server' saltutil.sync_grains
salt -C 'I@ceph:common and I@gnocchi:server:role:primary' state.sls gnocchi.server
salt -C 'I@ceph:common and I@gnocchi:server' state.sls gnocchi.server
```

14. (Optional) If you have modified the CRUSH map as described in the step 6:

    1. View the CRUSH map generated in the /etc/ceph/crushmap file and modify it as required. Before applying the CRUSH map, verify that the settings are correct.
    2. Apply the following state:

    ```
    salt -C 'I@ceph:setup:crush' state.sls ceph.setup.crush
    ```

    3. Once the CRUSH map is set up correctly, add the following snippet to the classes/cluster/<CLUSTER_NAME>/ceph/osd.yml file to make the settings persist even after a Ceph OSD reboots:

```
ceph:
  osd:
    crush_update: false
```

4. Apply the following state:

```
salt -C 'I@ceph:osd' state.sls ceph.osd
```

Once done, if your Ceph version is Luminous or newer, you can access the Ceph dashboard through http://<active_mgr_node_IP>:7000/. Run ceph -s on a cmn node to obtain the active mgr node.

Deploy Xtrabackup for MySQL

MCP uses the Xtrabackup utility to back up MySQL databases.

To deploy Xtrabackup for MySQL:

1. Apply the xtrabackup server state:

```
salt -C 'I@xtrabackup:server' state.sls xtrabackup
```

2. Apply the xtrabackup client state:

```
salt -C 'I@xtrabackup:client' state.sls openssh.client,xtrabackup
```

Post-deployment procedures

After your OpenStack environment deployment has been successfully completed, perform a number of steps to verify all the components are working and your OpenStack installation is stable and performs correctly at scale.

Run non-destructive Rally tests

Rally is a benchmarking tool that enables you to test the performance and stability of your OpenStack environment at scale.

The Tempest and Rally tests are integrated into the MCP CI/CD pipeline and can be managed through the DriveTrain web UI.

For debugging purposes, you can manually start Rally tests from the deployed Benchmark Rally Server (bmk01) with the installed Rally benchmark service or run the appropriate Docker container.

To manually run a Rally test on a deployed environment:

1. Validate the input parameters of the Rally scenarios in the task_arguments.yaml file.
2. Create the Cirros image:

   Note

   If you need to run Glance scenarios with an image that is stored locally, download it from https://download.cirros-cloud.net/0.3.5/cirros-0.3.5-i386-disk.img:

   ```
   wget https://download.cirros-cloud.net/0.3.5/cirros-0.3.5-i386-disk.img
   ```

   ```
   openstack image create --disk-format qcow2 --container-format bare --public --file ./cirros-0.3.5-i386-disk.img cirros
   ```

3. Run the Rally scenarios:

   ```
   rally task start <name_of_file_with_scenarios> --task-args-file task_arguments.yaml
   ```

   or

   ```
   rally task start combined_scenario.yaml --task-args-file task_arguments.yaml
   ```

Modify Salt Master password expiration

Due to CIS 5.4.1.1, the Salt Master node password expiration is set to maximum 90 days with a subsequent access lock if the password is not updated. As a result, if the user does not update the password, even if PasswordAuthentication is disabled, access to the Salt Master node may be lost. Perform the following steps to either disable CIS 5.4.1.1 or update the time stamp of the last password change.

To modify the Salt Master node password expiration:

- For MCP versions before the 2019.2.6 maintenance update, disable CIS 5.4.1.1:
  1. Log in to the Salt Master node.
  2. Choose from the following options:
     - Disable CIS 5.4.1.1 on all nodes for all users:

       ```
       salt '*' cmd.run "getent passwd|awk -F':' '{print \$1}'|xargs -I{} chage -M 99999 -m 7 {}"
       ```

     - Disable CIS 5.4.1.1 for a particular user:

       ```
       salt '*' cmd.run "chage -M 99999 -m 7 <account>"
       ```

  3. Run chage -l <account> to verify that Password expires is set to never and Maximum number of days between password change is set to 99999. For example:

     ```
     chage -l <account>
     Last password change                    : Jan 29, 2020
     Password expires                        : never
     Password inactive                       : never
     Account expires                         : never
     Minimum number of days between password change      : 7
     Maximum number of days between password change      : 99999
     Number of days of warning before password expires   : 7
     ```

- For MCP versions starting from the 2019.2.6 maintenance update, update the time stamp of the last password change using the helper function. The helper does not update the password itself. Update the time stamp using the helper function every 30 days or set a cron job to update the time stamp automatically.
  1. Log in to the Salt Master node.
  2. Choose from the following options:
     - Update the time stamp of the last password change for all users:

       ```
       salt '*' sharedlib.call cis.fix_last_password_change
       ```

     - Update the time stamp of the last password change for particular users:

```
salt '*' sharedlib.call cis.fix_last_password_change <account1> [<account2>]
```

3. Run chage -l <account> to verify that Last password change is set to the current date and Password expires is set to the date 90 days after the current one. For example:

```
chage -l <account>
Last password change                    : Jan 29, 2020
Password expires                        : Apr 28, 2020
Password inactive                       : never
Account expires                         : never
Minimum number of days between password change      : 7
Maximum number of days between password change      : 90
Number of days of warning before password expires   : 7
```

4. Optional. Set a cron job to automatically update the time stamp every 30 days:

    1. Run crontab -e.
    2. Schedule the cron job:

```
0 1 1 * * salt '*' sharedlib.call cis.fix_last_password_change <account1>
```

Troubleshoot

This section provides solutions to the issues that may occur while installing Mirantis Cloud Platform.

Troubleshooting of an MCP installation usually requires the salt command usage. The following options may be helpful if you run into an error:

- -l LOG_LEVEL, --log-level=LOG_LEVEL

  Console logging log level. One of all, garbage, trace, debug, info, warning, error, or quiet. Default is warning

- --state-output=STATE_OUTPUT

  Override the configured STATE_OUTPUT value for minion output. One of full, terse, mixed, changes, or filter. Default is full.

To synchronize all of the dynamic modules from the file server for a specific environment, use the saltutil.sync_all module. For example:

```
salt '*' saltutil.sync_all
```

Troubleshooting the server provisioning

This section includes the workarounds for the following issues:

Virtual machine node stops responding

If one of the control plane VM nodes stops responding, you may need to redeploy it.

Workaround:

1. From the physical node where the target VM is located, get a list of the VM domain IDs and VM names:

   ```
   virsh list
   ```

2. Destroy the target VM (ungraceful powering off of the VM):

   ```
   virsh destroy DOMAIN_ID
   ```

3. Undefine the VM (removes the VM configuration from KVM):

   ```
   virsh undefine VM_NAME
   ```

4. Verify that your physical KVM node has the correct salt-common and salt-minion version:

   ```
   apt-cache policy salt-common
   apt-cache policy salt-minion
   ```

   > Note
   >
   > If the salt-common and salt-minion versions are not 2015.8, proceed with Install the correct versions of salt-common and salt-minion.

5. Redeploy the VM from the physical node meant to host the VM:

   ```
   salt-call state.sls salt.control
   ```

6. Verify the newly deployed VM is listed in the Salt keys:

   ```
   salt-key
   ```

7. Deploy the Salt states to the node:

   ```
   salt 'OST_NAME*' state.sls linux,ntp,openssh,salt
   ```

8. Deploy service states to the node:

   ```
   salt 'HOST_NAME*' state.sls keepalived,haproxy,SPECIFIC_SERVICES
   ```

Note

You may need to log in to the node itself and run the states locally for higher success rates.

Troubleshoot Ceph

This section includes workarounds for the Ceph-related issues that may occur during the deployment of a Ceph cluster.

Troubleshoot an encrypted Ceph OSD

During the deployment of a Ceph cluster, an encrypted OSD may fail to be prepared or activated and thus fail to join the Ceph cluster. In such case, remove all the disk partitions as described below.

Workaround:

1. From the Ceph OSD node where the failed encrypted OSD disk resides, erase its partition table:

   ```
   dd if=/dev/zero of=/dev/<<ADD>> bs=512 count=1 conv=notrunc
   ```

2. Reboot the server:

   ```
   reboot
   ```

3. Run the following command twice to create a partition table for the disk and to remove the disk data:

   ```
   ceph-disk zap /dev/<<ADD>>;
   ```

4. Remove all disk signatures using wipefs:

   ```
   wipefs --all --force /dev/<<ADD>>*;
   ```

Deploy a Kubernetes cluster manually

> Caution!
>
> Kubernetes support termination notice
>
> Starting with the MCP 2019.2.5 update, the Kubernetes component is no longer supported as a part of the MCP product. This implies that Kubernetes is not tested and not shipped as an MCP component. Although the Kubernetes Salt formula is available in the community driven SaltStack formulas ecosystem, Mirantis takes no responsibility for its maintenance.
>
> Customers looking for a Kubernetes distribution and Kubernetes lifecycle management tools are encouraged to evaluate the Mirantis Kubernetes-as-a-Service (KaaS) and Docker Enterprise products.

Kubernetes is the system for containerized applications automated deployment, scaling, and management. This section guides you through the manual deployment of a Kubernetes cluster on bare metal with Calico plugin set for Kubernetes networking. For an easier deployment process, use the automated DriveTrain deployment procedure described in Deploy a Kubernetes cluster.

> Caution!
>
> OpenContrail 4.x for Kubernetes 1.12 or later is not supported.

Prerequisites

The following are the prerequisite steps for a manual MCP Kubernetes deployment:

1. Prepare six nodes:
    - 1 x configuration node - a host for the Salt Master node. Can be a virtual machine.
    - 3 x Kubernetes Master nodes (ctl) - hosts for the Kubernetes control plane components and etcd.
    - 2 x Kubernetes Nodes (cmp) - hosts for the Kubernetes pods, groups of containers that are deployed together on the same host.
2. For an easier deployment and testing, the following usage of three NICs is recommended:
    - 1 x NIC as a PXE/DHCP/Salt network (PXE and DHCP is are third-party services in a data center, unmanaged by SaltStack)
    - 2 x NICs as bond active-passive or active-active with two 10 Gbit slave interfaces
3. Create a project repository.
4. Create a deployment metadata model.
5. Optional. Add additional options to the deployment model as required:
    - Enable horizontal pod autoscaling
    - Enable Virtlet
    - Enable the MetalLB support
    - Enable an external Ceph RBD storage
    - Enable Helm support
6. If you have swap enabled on the ctl and cmp nodes, modify the deployment model as described in Add swap configuration to a Kubernetes deployment model.
7. Define interfaces.
8. Deploy the Salt Master node.

Now, proceed to Deploy a Kubernetes cluster.

Salt formulas used in the Kubernetes cluster deployment

MCP Kubernetes cluster standard deployment uses the following Salt formulas to deploy and configure a Kubernetes cluster:

salt-formula-kubernetes

Handles Kubernetes hyperkube binaries, CNI plugins, Calico manifests, containerd

salt-formula-etcd

Provisions etcd clusters

salt-formula-bird

Customizes BIRD templates used by Calico to provide advanced networking scenarios for route distribution through BGP

Add swap configuration to a Kubernetes deployment model

If you have swap enabled on the ctl and cmp nodes, configure your Kubernetes model to make kubelet work correctly with swapping.

To add swap configuration to a Kubernetes deployment model:

1. Open your Git project repository.
2. In classes/cluster/<cluster-name>/kubernetes/control.yml, add the following snippet:

```
...
parameters:
  kubernetes:
    master:
      kubelet:
        fail_on_swap: False
```

3. In classes/cluster/<cluster-name>/kubernetes/compute.yml, add the following snippet:

```
...
parameters:
  kubernetes:
    pool:
      kubelet:
        fail_on_swap: False
```

Now, proceed with further MCP Kubernetes cluster configuration as required.

Define interfaces

Since Cookiecutter is simply a tool to generate projects from templates, it cannot handle all networking use-cases. Your cluster may include a single interface, two interfaces in bond, bond and management interfaces, and so on.

This section explains how to handle 3 interfaces configuration:

- eth0 interface for pxe
- eth1 and eth2 as bond0 slave interfaces

To configure network interfaces:

1. Open your MCP Git project repository.
2. Open the {{ cookiecutter.cluster_name }}/kubernetes/init.yml file for editing.
3. Add the following example definition to this file:

```
parameters:
...
 _param:
   deploy_nic: eth0
   primary_first_nic: eth1
   primary_second_nic: eth2
 linux:
   ...
   network:
   ...
     interface:
       deploy_nic:
         name: ${_param:deploy_nic}
         enabled: true
         type: eth
         proto: static
         address: ${_param:deploy_address}
         netmask: 255.255.255.0
       primary_first_nic:
         name: ${_param:primary_first_nic}
         enabled: true
         type: slave
         master: bond0
         mtu: 9000
         pre_up_cmds:
         - /sbin/ethtool --offload eth6 rx off tx off tso off gro off
       primary_second_nic:
         name: ${_param:primary_second_nic}
         type: slave
         master: bond0
         mtu: 9000
         pre_up_cmds:
```

```
      - /sbin/ethtool --offload eth7 rx off tx off tso off gro off
    bond0:
      enabled: true
      proto: static
      type: bond
      use_interfaces:
      - ${_param:primary_first_nic}
      - ${_param:primary_second_nic}
      slaves: ${_param:primary_first_nic} ${_param:primary_second_nic}
      mode: active-backup
      mtu: 9000
      address: ${_param:single_address}
      netmask: 255.255.255.0
      name_servers:
       - {{ cookiecutter.dns_server01 }}
       - {{ cookiecutter.dns_server02 }}
```

Deploy a Kubernetes cluster

After you complete the prerequisite steps described in Prerequisites, deploy your MCP Kubernetes cluster manually using the procedure below.

To deploy the Kubernetes cluster:

1. Log in to the Salt Master node.
2. Update modules and states on all Minions:

   ```
   salt '*' saltutil.sync_all
   ```

3. If you use autoregistration for the compute nodes, register all discovered compute nodes. Run the following command on every compute node:

   ```
   salt-call event.send "reclass/minion/classify" \
    "{\"node_master_ip\": \"<config_host>\", \
   \"node_os\": \"<os_codename>\", \
   \"node_deploy_ip\": \"<node_deploy_network_ip>\", \
   \"node_deploy_iface\": \"<node_deploy_network_iface>\", \
   \"node_control_ip\": \"<node_control_network_ip>\", \
   \"node_control_iface\": \"<node_control_network_iface>\", \
   \"node_sriov_ip\": \"<node_sriov_ip>\", \
   \"node_sriov_iface\": \"<node_sriov_iface>\", \
   \"node_tenant_ip\": \"<node_tenant_network_ip>\", \
   \"node_tenant_iface\": \"<node_tenant_network_iface>\", \
   \"node_external_ip\": \"<node_external_network_ip>\", \
   \"node_external_iface\": \"<node_external_network_iface>\", \
   \"node_baremetal_ip\": \"<node_baremetal_network_ip>\", \
   \"node_baremetal_iface\": \"<node_baremetal_network_iface>\", \
   \"node_domain\": \"<node_domain>\", \
   \"node_cluster\": \"<cluster_name>\", \
   \"node_hostname\": \"<node_hostname>\"}"
   ```

   Modify the parameters passed with the command above as required. The table below provides the description of the parameters required for a compute node registration.

Parameter	Description
config_host	IP of the Salt Master node
os_codename	Operating system code name. Check the system response of lsb_release -c for it
node_deploy_network_ip	Minion deploy network IP address
node_deploy_network_iface	Minion deploy network interface

node_control_network_ip	Minion control network IP address
node_control_network_iface	Minion control network interface
node_sriov_ip	Minion SR-IOV IP address
node_sriov_iface	Minion SR-IOV interface
node_tenant_network_ip	Minion tenant network IP address
node_tenant_network_iface	Minion tenant network interface
node_external_network_ip	Minion external network IP address
node_external_network_iface	Minion external network interface
node_baremetal_network_ip	Minion baremetal network IP address
node_baremetal_network_iface	Minion baremetal network interface
node_domain	Domain of a minion. Check the system response of hostname -d for it
cluster_name	Value of the cluster_name variable specified in the Reclass model. See Basic deployment parameters for details
node_hostname	Short hostname without a domain part. Check the system response of hostname -s for it

4. Log in to the Salt Master node.
5. Perform Linux system configuration to synchronize repositories and execute outstanding system maintenance tasks:

```
salt '*' state.sls linux.system
```

6. Install the Kubernetes control plane:
    1. Bootstrap the Kubernetes Master nodes:

```
salt -C 'I@kubernetes:master' state.sls  linux
salt -C 'I@kubernetes:master' state.sls  salt.minion
salt -C 'I@kubernetes:master' state.sls openssh,ntp
```

    2. Create and distribute SSL certificates for services using the salt state and install etcd with the SSL support:

```
salt -C 'I@kubernetes:master' state.sls salt.minion.cert,etcd.server.service
salt -C 'I@etcd:server' cmd.run '. /var/lib/etcd/configenv && etcdctl cluster-health'
```

3. Install Keepalived:

```
salt -C 'I@keepalived:cluster' state.sls keepalived -b 1
```

4. Install HAProxy:

```
salt -C 'I@haproxy:proxy' state.sls haproxy
salt -C 'I@haproxy:proxy' service.status haproxy
```

5. Install Kubernetes:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
salt -C 'I@kubernetes:master' state.sls kubernetes.pool
```

6. For the Calico setup:

    1. Verify the Calico nodes status:

    ```
    salt -C 'I@kubernetes:pool' cmd.run "calicoctl node status"
    ```

    2. Set up NAT for Calico:

    ```
    salt -C 'I@kubernetes:master' state.sls etcd.server.setup
    ```

7. Apply the following state to simplify namespaces creation:

```
salt -C 'I@kubernetes:master and *01*' state.sls kubernetes.master \
exclude=kubernetes.master.setup
```

8. Apply the following state:

```
salt -C 'I@kubernetes:master' state.sls kubernetes exclude=kubernetes.master.setup
```

9. Run the Kubernetes Master nodes setup:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.setup
```

10. Restart kubelet:

```
salt -C 'I@kubernetes:master' service.restart kubelet
```

7. Log in to any Kubernetes Master node and verify that all nodes have been registered successfully:

```
kubectl get nodes
```

8. Deploy the Kubernetes Nodes:

    1. Log in to the Salt Master node.
    2. Bootstrap all compute nodes:

        ```
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls linux
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls  salt.minion
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls openssh,ntp
        ```

    3. Create and distribute SSL certificates for services and install etcd with the SSL support:

        ```
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls salt.minion.cert,etcd.server.service
        salt -C 'I@etcd:server' cmd.run '. /var/lib/etcd/configenv && etcdctl cluster-health'
        ```

    4. Install Kubernetes:

        ```
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls kubernetes.pool
        ```

    5. Restart kubelet:

        ```
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' service.restart kubelet
        ```

After you deploy Kubernetes, deploy StackLight LMA to your cluster as described in Deploy StackLight LMA.

Enable horizontal pod autoscaling

Using MCP, you can adjust the number of pod replicas without using an external orchestrator by enabling the horizontal pod autoscaling feature in your MCP Kubernetes deployment. The feature is based on observed CPU and/or memory utilization and can be enabled using the metrics-server add-on.

To enable horizontal pod autoscaling:

1. While generating a deployment metadata model for your new MCP Kubernetes cluster as described in Create a deployment metadata model, select the Kubernetes metrics server enabled option in the Kubernetes Product parameters section of the Model Designer UI.
2. If you have already generated a deployment metadata model without the metrics-server parameter or to enable this feature on an existing Kubernetes cluster:
    1. Open your Reclass model Git project repository on the cluster level.
    2. In /kubernetes/control.yml, add the metrics-server parameters:

```
parameters:
  kubernetes:
    common:
      addons:
        ...
        metrics-server:
          enabled: true
```

3. Select from the following options:
    - If you are performing an initial deployment of your cluster, proceed with further configuration as required. Pod autoscaling will be enabled during your Kubernetes cluster deployment.
    - If you are making changes to an existing cluster:
        1. Log in to the Salt Master node.
        2. Refresh your Reclass storage data:

```
salt-call state.sls reclass.storage
```

        3. Apply the kube-addons state:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
```

4. On a running Kubernetes cluster, verify that autoscaling works successfully using the Official Kubernetes documentation.

Enable Virtlet

You can enable Kubernetes to run virtual machines using Virtlet. Virtlet enables you to run unmodified QEMU/KVM virtual machines that do not include an additional containerd layer as in similar solutions in Kubernetes.

Virtlet requires the --feature-gates=MountPropagation=true feature gate to be enabled in the Kubernetes API server and on all kubelet instances. This feature is enabled by default in MCP. Using this feature, Virtlet can create or delete network namespaces assigned to VM pods.

Caution!

Virtlet with OpenContrail is available as technical preview. Use such configuration for testing and evaluation purposes only.

Deploy Virtlet

You can deploy Virtlet on either new or existing MCP cluster using the procedure below. By default, Virtlet is deployed on all Kubernetes Nodes (cmp).

To deploy Virtlet on a new MCP cluster:

1. When generating a deployment metadata model using the ModelDesigner UI, select the Virtlet enabled check box in the Kubernetes Product parameters section.
2. Open your Git project repository.
3. In classes/cluster/<cluster-name>/kubernetes/init.yml, verify that Virtlet is enabled:

```
parameters:
  _param:
    kubernetes_virtlet_enabled: True
```

4. Optional. In classes/cluster/<cluster-name>/kubernetes/compute.yml, modify the kubernetes:common:addons:virtlet: parameters as required to define the Virtlet namespace and image path as well as the number of compute nodes on which you want to enable Virtlet. For example:

```
parameters:
  kubernetes:
    common:
      addons:
        virtlet:
          enabled: true
          namespace: kube-system
          image: mirantis/virtlet:latest
```

5. If your networking system is OpenContrail, add the following snippet to classes/cluster/<cluster-name>/opencontrail/compute.yml:

```
kubernetes:
  pool:
    network:
      hash: 77169cdadb80a5e33e9d9fe093ed0d99
```

Proceed with further MCP cluster configuration. Virtlet will be automatically deployed during the Kubernetes cluster deployment.

To deploy Virtlet on an existing MCP cluster:

1. Open your Git project repository.
2. In classes/cluster/<cluster-name>/kubernetes/compute.yml, add the following snippet:

```
parameters:
  kubernetes:
```

```
common:
  addons:
    virtlet:
      enabled: true
      namespace: kube-system
      image: mirantis/virtlet:latest
```

Modify the kubernetes:common:addons:virtlet: parameters as required to define the Virtlet namespace and image path as well as the number of compute nodes on which you want to enable Virtlet.

3. If your networking system is OpenContrail, add the following snippet to classes/cluster/<cluster-name>/opencontrail/compute.yml:

```
kubernetes:
  pool:
    network:
      hash: 77169cdadb80a5e33e9d9fe093ed0d99
```

4. Commit and push the changes to the project Git repository.
5. Log in to the Salt Master node.
6. Update your Salt formulas and the system level of your repository:
    1. Change the directory to /srv/salt/reclass.
    2. Run the git pull origin master command.
    3. Run the salt-call state.sls salt.master command.
    4. Run the salt-call state.sls reclass command.
7. Apply the following states:

```
salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls kubernetes.pool
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
salt -C 'I@kubernetes:master' state.sls kubernetes.master.setup
```

Seealso

Verify Virtlet after deployment

Verify Virtlet after deployment

After you enable Virtlet as described in Deploy Virtlet, proceed with the verification procedure described in this section.

To verify Virtlet after deployment:

1. Verify a basic pod startup:
    1. Start a sample VM:

    ```
    kubectl create -f https://raw.githubusercontent.com/Mirantis/virtlet/v1.4.4/examples/cirros-vm.yaml
    kubectl get pods --all-namespaces -o wide -w
    ```

    2. Connect to the VM console:

    ```
    kubectl attach -it cirros-vm
    ```

    If you do not see a command prompt, press Enter.

    Example of system response:

    ```
    login as 'cirros' user. default password: 'gosubsgo'. use 'sudo' for root.
    cirros-vm login: cirros
    Password:
    $
    ```

    To quit the console, use the ^] key combination.
2. Verify SSH access to the VM pod:
    1. Download the vmssh.sh script with the test SSH key:

    ```
    wget https://raw.githubusercontent.com/Mirantis/virtlet/v1.4.4/examples/{vmssh.sh,vmkey}
    chmod +x vmssh.sh
    chmod 600 vmkey
    ```

    > Note
    >
    > The vmssh.sh script requires kubectl to access a cluster.

    2. Access the VM pod using the vmssh.sh script:

```
./vmssh.sh cirros@cirros-vm
```

3. Verify whether the VM can access the Kubernetes cluster services:
    1. Verify the DNS resolution of the cluster services:

    ```
    nslookup kubernetes.default.svc.cluster.local
    ```

    2. Verify the service connectivity:

    ```
    curl -k https://kubernetes.default.svc.cluster.local
    ```

    > Note
    > The above command will raise an authentication error. Ignore this error.

    3. Verify Internet access from the VM. For example:

    ```
    curl -k https://google.com
    ping -c 1 8.8.8.8
    ```

Enable the MetalLB support

MetalLB is a Kubernetes add-on that provides a network load balancer for bare metal Kubernetes clusters using standard routing protocols. It provides external IP addresses to the workloads services, for example, NGINX, from the pool of addresses defined in the MetalLB configuration.

To enable MetalLB support on a bare metal Kubernetes cluster:

1. While generating a deployment metadata model for your new MCP Kubernetes cluster as described in Create a deployment metadata model, select the Kubernetes metallb enabled option in the Infrastructure parameters section of the Model Designer UI.
2. If you have already generated a deployment metadata model without the MetalLB parameter or to enable this feature on an existing Kubernetes cluster:
    1. Open your Reclass model Git project repository on the cluster level.
    2. In /kubernetes/control.yml, add the MetalLB parameters. For example:

```
parameters:
  kubernetes:
    common:
      addons:
        ...
        metallb:
          enabled: true
            addresses:
            - 172.16.10.150-172.16.10.180
            - 172.16.10.192/26
```

    For the addresses parameter, define the required pool of IP addresses.
3. Select from the following options:
    - If you are performing an initial deployment of your cluster, proceed with further configuration as required. MetalLB will be installed during your Kubernetes cluster deployment.
    - If you are making changes to an existing cluster:
        1. Log in to the Salt Master node.
        2. Refresh your Reclass storage data:

```
salt-call state.sls reclass.storage
```

        3. Apply the kube-addons state:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
```

To verify MetalLB after deployment:

1. Log in to any Kubernetes Master node.

2. Verify that the MetalLB pods are created:

```
kubectl get pods --namespace metallb-system
```

   Example of system response:

```
NAME                          READY    STATUS    RESTARTS   AGE
controller-79876bc7cc-8z2bh   1/1      Running   0          20h
speaker-ckn49                 1/1      Running   0          21h
speaker-dr65f                 1/1      Running   0          21h
```

3. Create two NGINX pods that listen on port 80:

```
kubectl run my-nginx --image=nginx --replicas=2 --port=80
```

4. Expose the NGINX pods to the Internet:

```
kubectl expose deployment my-nginx --port=80 --type=LoadBalancer
```

5. Verify that NGINX obtained an EXTERNAL-IP address from the pool of addresses defined in the MetalLB configuration.

```
kubectl get svc
```

   Example of system response:

```
NAME         TYPE          CLUSTER-IP      EXTERNAL-IP   PORT(S)       AGE
kubernetes   ClusterIP     10.254.0.1      <none>        443/TCP       23h
my-nginx     LoadBalancer  10.254.96.233   172.16.10.150 80:31983/TCP  7m
```

Seealso

- MCP Reference Architecture: MetalLB support
- Enable the NGINX Ingress controller

Enable the NGINX Ingress controller

The NGINX Ingress controller provides load balancing, SSL termination, and name-based virtual hosting. You can enable the NGINX Ingress controller if you use MetalLB in your MCP Kubernetes-based cluster.

To enable the NGINX Ingress controller on a Kubernetes cluster:

1. While generating a deployment metadata model for your new MCP Kubernetes cluster as described in Create a deployment metadata model, select the following options in the Infrastructure parameters section of the Model Designer UI:
   - Kubernetes ingressnginx enabled
   - Kubernetes metallb enabled as the Kubernetes network engine
2. If you have already generated a deployment metadata model without the NGINX Ingress controller parameter or to enable this feature on an existing Kubernetes cluster:
   1. Enable MetalLB as described in Enable the MetalLB support.
   2. Open your Reclass model Git project repository on the cluster level.
   3. In /kubernetes/control.yml, enable the NGINX Ingress controller:

```
parameters:
  kubernetes:
    common:
      addons:
        ...
        ingress-nginx:
          enabled: true
```

> Note
>
> If required, you can change the default number of replicas for the NGINX Ingress controller by adding the kubernetes_ingressnginx_controller_replicas parameter to /kubernetes/control.yml. The default value is 1.

3. Select from the following options:
   - If you are performing an initial deployment of your cluster, proceed with further configuration as required. The NGINX Ingress controller will be installed during your Kubernetes cluster deployment.
   - If you are making changes to an existing cluster:
     1. Log in to the Salt Master node.
     2. Refresh your Reclass storage data:

```
salt-call state.sls reclass.storage
```

3. Apply the kube-addons state:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
```

Enable an external Ceph RBD storage

You can connect your Kubernetes cluster to an existing external Ceph RADOS Block Device (RBD) storage by enabling the corresponding feature in your new or existing Kubernetes cluster.

To enable an external Ceph RBD storage on a Kubernetes cluster:

1. While generating a deployment metadata model for your new MCP Kubernetes cluster as described in Create a deployment metadata model, select the Kubernetes rbd enabled option in the Infrastructure parameters section and define the Kubernetes RBD parameters in the Product parameters section of the Model Designer UI.
2. If you have already generated a deployment metadata model without the Ceph RBD storage parameters or to enable this feature on an existing Kubernetes cluster:
    1. Open your Reclass model Git project repository on the cluster level.
    2. In /kubernetes/control.yml, add the Ceph RBD cluster parameters. For example:

```
parameters:
  ...
  kubernetes:
  common:
    addons:
      storageclass:
        rbd:
          enabled: True
          default: True
          provisioner: rbd
          name: rbd
          user_id: kubernetes
          user_key: AQAOoo5bGqtPExAABGSPtThpt5s+iq97KAE+WQ==
          monitors: cmn01:6789,cmn02:6789,cmn03:6789
          pool: kubernetes
          fstype: ext4
```

3. Select from the following options:
    - On a new Kubernetes cluster, proceed to further cluster configuration. The external Ceph RBD storage will be enabled during the Kubernetes cluster deployment. For the deployment details, see: Deploy a Kubernetes cluster.
    - On an existing Kubernetes cluster:
        1. Log in to the Salt Master node.
        2. Update your Salt formulas and the system level of your repository:
            1. Change the directory to /srv/salt/reclass.
            2. Run the following commands:

```
git pull origin master
salt-call state.sls salt.master
salt-call state.sls reclass
```

3. Apply the following state:

```
salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
```

Enable Helm support

> Warning
>
> This feature is available starting from the MCP 2019.2.3 maintenance update. Before enabling the feature, follow the steps described in Apply maintenance updates.

Helm is a package manager for Kubernetes that allows you to configure, package, and deploy applications on a Kubernetes cluster.

The Helm packaging format is called charts. Charts are packages of the pre-configured Kubernetes resources.

To enable Helm support on a bare metal Kubernetes cluster:

1. While generating a deployment metadata model for your new MCP Kubernetes cluster as described in Create a deployment metadata model, select the Kubernetes helm enabled option in the Infrastructure parameters section of the Model Designer UI.
2. If you have already generated a deployment metadata model without the Helm parameter or to enable this feature on an existing Kubernetes cluster:
    1. Open your Git project repository with the Reclass model on the cluster level.
    2. In /kubernetes/common/init.yml, add the Helm parameters:

```
parameters:
  kubernetes:
    common:
      addons:
        ...
        helm:
          enabled: true
```

3. Select from the following options:
    - If you are performing an initial deployment of your cluster, proceed with further configuration as required. Helm will be installed during your Kubernetes cluster deployment.

- If you are making changes to an existing cluster:
  1. Log in to the Salt Master node.
  2. Refresh your Reclass storage data:

     ```
     salt-call state.sls reclass.storage
     ```

  3. Apply the kube-addons state:

     ```
     salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
     ```

To verify Helm after deployment:

1. Log in to any Kubernetes Master node.
2. Verify that the Tiller pod is created:

   ```
   kubectl get pods --namespace kube-system
   ```

   Example of system response:

   ```
   NAME                            READY    STATUS    RESTARTS   AGE
   tiller-deploy-79876bc7dd-7z2bh  1/1      Running   0          10h
   ```

3. Once the Tiller pod is running, run the following command:

   ```
   helm version
   ```

   The output must contain both the Helm client and server versions:

   Example of system response:

   ```
   Client: &version.Version{SemVer:"v2.12.2", GitCommit:"7d2b0c73d734f6586ed222a567c5d103fed435be", GitTreeState:"clean"}
   Server: &version.Version{SemVer:"v2.12.2", GitCommit:"7d2b0c73d734f6586ed222a567c5d103fed435be", GitTreeState:"clean"}
   ```

Seealso

- Helm Git project
- Helm official documentation

Deploy OpenContrail manually

OpenContrail is a component of MCP that provides overlay networking built on top of physical IP-based underlay network for cloud environments. OpenContrail provides more flexibility in terms of network hardware used in cloud environments comparing to other enterprise-class networking solutions.

> Caution!
>
> OpenContrail 4.x for Kubernetes 1.12 or later is not supported.

Deploy OpenContrail

This section instructs you on how to manually deploy OpenContrail 4.1 on your OpenStack-based MCP cluster.

Caution!

The OpenContrail versions support status:

- OpenContrail 4.1 is fully supported.
- OpenContrail 4.0 is deprecated and not supported for new deployments since MCP maintenance update 2019.2.4.
- OpenContrail 3.2 is not supported for new deployments.

Deploy OpenContrail 4.1 for OpenStack

This section provides instructions on how to manually deploy OpenContrail 4.1 on your OpenStack-based MCP cluster.

To deploy OpenContrail 4.1 on an OpenStack-based MCP cluster:

1. Log in to the Salt Master node.
2. Run the following basic states to prepare the OpenContrail nodes:

```
salt -C 'ntw* or nal*' saltutil.refresh_pillar
salt -C 'I@opencontrail:database' saltutil.sync_all
salt -C 'I@opencontrail:database' state.sls salt.minion,linux,ntp,openssh
```

3. Deploy and configure Keepalived and HAProxy:

```
salt -C 'I@opencontrail:database' state.sls keepalived,haproxy
```

4. Deploy and configure Docker:

```
salt -C 'I@opencontrail:database' state.sls docker.host
```

5. Create configuration files for OpenContrail:

```
salt -C 'I@opencontrail:database' state.sls opencontrail exclude=opencontrail.client
```

6. Start the OpenContrail Docker containers:

```
salt -C 'I@opencontrail:database' state.sls docker.client
```

7. Verify the status of the OpenContrail service:

```
salt -C 'I@opencontrail:database' cmd.run 'doctrail all contrail-status'
```

   In the output, the services status should be active or backup.

   > Note
   >
   > It may take some time for all services to finish initializing.

8. Configure the OpenContrail resources:

```
salt -C 'I@opencontrail:client and not I@opencontrail:compute' state.sls opencontrail.client
```

9. Apply the following states to deploy the OpenContrail vRouters:

```
salt -C 'cmp*' saltutil.refresh_pillar
salt -C 'I@opencontrail:compute' saltutil.sync_all
salt -C 'I@opencontrail:compute' state.highstate exclude=opencontrail.client
salt -C 'I@opencontrail:compute' cmd.run 'reboot'
salt -C 'I@opencontrail:compute' state.sls opencontrail.client
```

10 After you deploy an OpenContrail-based MCP cluster:

.

1. Navigate to the OpenContrail web UI as described in MCP Operations Guide: Access the OpenContrail web UI.
2. Verify that Monitor > Infrastructure > Dashboard displays actual information about all OpenContrail nodes configured and deployed on your MCP cluster.

Seealso

MCP 2019.2.3 Maintenance Update: Known issues

Seealso

OpenContrail limitations

Seealso

- OpenContrail limitations
- Troubleshoot OpenContrail
- OpenContrail operations
- Plan OpenContrail networking

Deploy compute nodes

Provisioning and deploying of the OpenStack or Kubernetes compute nodes (cmp00X) is relatively straightforward and should be performed after the bare-metal provisioning through MAAS is done. You can run all states at once. Though, this has to be done multiple times with a reboot involved for changes to network configuration to take effect. The ordering of dependencies is not yet orchestrated.

To deploy a compute node:

1. Log in to the Salt Master node.
2. Verify that the new machines have connectivity with the Salt Master node:

   ```
   salt 'cmp*' test.ping
   ```

3. Refresh the deployed pillar data:

   ```
   salt 'cfg*' state.sls reclass.storage
   ```

4. Apply the Salt data sync and base states for Linux, NTP, OpenSSH, and Salt for the target nodes:

   ```
   salt 'cmp*' saltutil.sync_all
   salt 'cmp*' saltutil.refresh_pillar
   salt 'cmp*' state.sls linux,ntp,openssh,salt
   ```

   > Note
   >
   > Refreshing the pillar data must be done every time you apply the reclass state on the Salt Master node.

5. Apply all states for the target nodes:

   ```
   salt 'cmp*' state.highstate
   ```

   > Note
   >
   > You may need to apply the states multiple times to get a successful deployment. If after two runs you still have errors, reboot the target nodes and apply the states again.

> Note
>
> You may have an error stating that iptables is down. Ignore this error.

6. Reboot the target nodes.
7. Discover compute hosts:

```
salt 'ctl01*' state.sls nova.controller
```

After you deploy compute nodes, proceed with Deploy StackLight LMA if required.

Deploy the DevOps Portal manually

The DevOps Portal collects a comprehensive set of data about the cloud, offers visualization dashboards, and enables the operator to interact with a variety of tools.

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

This section instructs you on how to manually deploy the DevOps Portal with the Operations Support System (OSS) services available. Eventually, you will be able to access the DevOps Portal at the VIP address of the deployment on port 8800 with the following services installed:

- Push Notification service
- Runbook Automation service
- Security Audit service
- Cleanup service
- PostgreSQL database management system
- Elasticsearch back end
- Gerrit and Jenkins as part of the CI/CD deployment, will be available from the DevOps Portal web UI
- OpenLDAP and aptly as part of the CI/CD deployment

> Caution!
>
> Before you can deploy the DevOps Portal, you must complete the steps described in Deploy CI/CD.

MCP enables you to configure the OSS services metadata in a Reclass model using Cookiecutter. Therefore, if you are performing the initial deployment of your MCP environment, you should have already configured your deployment model with the OSS parameters during the create-deployment-model-ui stage considering the dependencies described in MCP Reference Architecture: Dependencies between services. If so, skip the procedure described in Configure services in the Reclass model and proceed to Deploy OSS services manually.

Configure services in the Reclass model

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

If the Reclass model of your deployment does not include metadata for OSS services, you must define it in the Reclass model before proceeding with the deployment of the DevOps portal.

To configure OSS services in the Reclass model:

1. In the init.yml file in the /srv/salt/reclass/classes/cluster/${_param:cluster_name}/cicd/control/ directory, define the required classes.

   The following code snippet contains all services currently available. To configure your deployment for a specific use case, comment out the services that are not required:

```
classes:
  # GlusterFS
  - system.glusterfs.server.volume.devops_portal
  - system.glusterfs.server.volume.elasticsearch
  - system.glusterfs.server.volume.mongodb
  - system.glusterfs.server.volume.postgresql
  - system.glusterfs.server.volume.pushkin
  - system.glusterfs.server.volume.rundeck
  - system.glusterfs.server.volume.security_monkey

  - system.glusterfs.client.volume.devops_portal
  - system.glusterfs.client.volume.elasticsearch
  - system.glusterfs.client.volume.mongodb
  - system.glusterfs.client.volume.postgresql
  - system.glusterfs.client.volume.pushkin
  - system.glusterfs.client.volume.rundeck
  - system.glusterfs.client.volume.security_monkey

  # Docker services
  - system.docker.swarm.stack.devops_portal
  - system.docker.swarm.stack.elasticsearch
  - system.docker.swarm.stack.janitor_monkey
  - system.docker.swarm.stack.postgresql
  - system.docker.swarm.stack.pushkin
  - system.docker.swarm.stack.rundeck
  - system.docker.swarm.stack.security_monkey

  # Docker networks
```

```
- system.docker.swarm.network.runbook

# HAProxy
- system.haproxy.proxy.listen.oss.devops_portal
- system.haproxy.proxy.listen.oss.elasticsearch
- system.haproxy.proxy.listen.oss.janitor_monkey
- system.haproxy.proxy.listen.oss.mongodb
- system.haproxy.proxy.listen.oss.postgresql
- system.haproxy.proxy.listen.oss.pushkin
- system.haproxy.proxy.listen.oss.rundeck
- system.haproxy.proxy.listen.oss.security_monkey

# OSS tooling
- system.devops_portal.service.elasticsearch
- system.devops_portal.service.gerrit
- system.devops_portal.service.janitor_monkey
- system.devops_portal.service.jenkins
- system.devops_portal.service.pushkin
- system.devops_portal.service.rundeck
- system.devops_portal.service.security_monkey

# Rundeck
- system.rundeck.client.runbook
```

2. In the init.yml file in the /srv/salt/reclass/classes/cluster/${_param:cluster_name}/cicd/control/ directory, define the required parameters:

   - For the Runbook Automation service, define:

     ```
     parameters:
       _param:
         rundeck_runbook_public_key: <SSH_PUBLIC_KEY>
         rundeck_runbook_private_key: |
           <SSH_PRIVATE_KEY>
     ```

   - For the Security Audit service, define:

     ```
     parameters:
       _param:
         security_monkey_openstack:
           username: <USERNAME>
           password: <PASSWORD>
           auth_url: <KEYSTONE_AUTH_ENDPOINT>
     ```

     The configuration for the Security Audit service above will use the Administrator account to access OpenStack with the admin tenant. To configure the Security Audit

service deployment for a specific tenant, define the security_monkey_openstack parameter as follows:

```
parameters:
  _param:
    security_monkey_openstack:
      os_account_id: <OS_ACCOUNT_ID>
      os_account_name: <OS_ACCOUNT_NAME>
      username: <USERNAME>
      password: <PASSWORD>
      auth_url: <KEYSTONE_AUTH_ENDPOINT>
      project_domain_name: <PROJ_DOMAIN_NAME>
      project_name: <PROJ_NAME>
      user_domain_name: <USER_DOMAIN_NAME>
```

> Warning
>
> The project_name: <PROJ_NAME> parameter specifies a project for the Keystone authentication in the Security Audit service. Therefore, the service will not listen by projects, but synchronize issues from all projects in the current environment with the DevOps Portal using the specified project to authenticate.

- For the Janitor service, define:

```
parameters:
  _param:
    janitor_monkey_openstack:
      username: <USERNAME>
      password: <PASSWORD>
      auth_url: <KEYSTONE_AUTH_ENDPOINT>
```

The configuration for the Janitor service above will use the Administrator account to access OpenStack with the admin tenant. To configure the Security Audit service deployment for a specific tenant, define the janitor_monkey_openstack parameter as follows:

```
parameters:
  _param:
    janitor_monkey_openstack:
      username: <USERNAME>
      password: <PASSWORD>
      auth_url: <KEYSTONE_AUTH_ENDPOINT>
      project_domain_name: <PROJ_DOMAIN_NAME>
      project_name: <PROJ_NAME>
```

3. In the master.yml file in the /srv/salt/reclass/classes/cluster/${_param:cluster_name}/cicd/control/ directory, configure classes and parameters as required:

   - Define classes for the DevOps Portal and services as required:

   ```
   classes:
     # DevOps Portal
     - service.devops_portal.config

     # Elasticsearch
     - system.elasticsearch.client
     - system.elasticsearch.client.index.pushkin
     - system.elasticsearch.client.index.janitor_monkey

     # PostgreSQL
     - system.postgresql.client.pushkin
     - system.postgresql.client.rundeck
     - system.postgresql.client.security_monkey

     # Runbook Automation
     - system.rundeck.server.docker
     - system.rundeck.client
   ```

   - Define parameters for the Runbooks Automation service, if required:

   ```
   parameters:
     _param:
       rundeck_db_user: ${_param:rundeck_postgresql_username}
       rundeck_db_password: ${_param:rundeck_postgresql_password}
       rundeck_db_host: ${_param:cluster_vip_address}
       rundeck_postgresql_host: ${_param:cluster_vip_address}
       rundeck_postgresql_port: ${_param:haproxy_postgresql_bind_port}
   ```

4. Push all changes of the model to the dedicated project repository.

5. Verify that the metadata of the Salt Master node contains all the required parameters:

   ```
   reclass --nodeinfo=$SALT_MASTER_FQDN.$ENV_DOMAIN
   salt '*' saltutil.refresh_pillar
   salt '*' saltutil.sync_all
   salt '$SALT_MASTER_FQDN.$ENV_DOMAIN' pillar.get devops_portal
   ```

   For example, for the ci01 node on the cicd-lab-dev.local domain run:

   ```
   reclass --nodeinfo=ci01.cicd-lab-dev.local
   salt '*' saltutil.refresh_pillar
   ```

```
salt '*' saltutil.sync_all
salt 'ci01.cicd-lab-dev.local' pillar.get devops_portal
```

Deploy OSS services manually

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

Before you proceed with the services installation, verify that you have updated the Reclass model accordingly as described in Configure services in the Reclass model.

To deploy the DevOps portal:

1. Log in to the Salt Master node.
2. Refresh Salt pillars and synchronize Salt modules on all Salt Minion nodes:

   ```
   salt '*' saltutil.refresh_pillar
   salt '*' saltutil.sync_all
   ```

3. Set up GlusterFS:

   ```
   salt -b 1 -C 'I@glusterfs:server' state.sls glusterfs.server
   ```

   > Note
   >
   > The -b option specifies the explicit number of the Salt Minion nodes to apply the state at once to. Therefore, you will get a more stable configuration during the establishment of peers between the services.

4. Mount the GlusterFS volume on Docker Swarm nodes:

   ```
   salt -C 'I@glusterfs:client' state.sls glusterfs.client
   ```

5. Verify that the volume is mounted on Docker Swarm nodes:

   ```
   salt '*' cmd.run 'systemctl -a|grep "GlusterFS File System"|grep -v mounted'
   ```

6. Configure HAProxy and Keepalived for the load balancing of incoming traffic:

   ```
   salt -C "I@haproxy:proxy" state.sls haproxy,keepalived
   ```

7. Set up Docker Swarm:

```
salt -C 'I@docker:host' state.sls docker.host
salt -C 'I@docker:swarm:role:master' state.sls docker.swarm
salt -C 'I@docker:swarm:role:master' state.sls salt
salt -C 'I@docker:swarm:role:master' mine.flush
salt -C 'I@docker:swarm:role:master' mine.update
salt -C 'I@docker:swarm' state.sls docker.swarm
salt -C 'I@docker:swarm:role:master' cmd.run 'docker node ls'
```

8. Configure the OSS services:

```
salt -C 'I@devops_portal:config' state.sls devops_portal.config
salt -C 'I@rundeck:server' state.sls rundeck.server
```

> Note
>
> In addition to setting up the server side for the Runbook Automation service, the rundeck.server state configures users and API tokens.

9. Prepare aptly before deployment:

```
salt -C 'I@aptly:publisher' saltutil.refresh_pillar
salt -C 'I@aptly:publisher' state.sls aptly.publisher
```

10 Apply the docker.client state:
.

```
salt -C 'I@docker:swarm:role:master' state.sls docker.client
```

11 Prepare Jenkins for the deployment:
.

```
salt -C 'I@docker:swarm' cmd.run 'mkdir -p /var/lib/jenkins'
```

12 Identify the IP address on which HAProxy listens for stats:
.

```
HAPROXY_STATS_IP=$(salt -C 'I@docker:swarm:role:master' \
    --out=newline_values_only \
    pillar.fetch haproxy:proxy:listen:stats:binds:address)
```

> **Caution!**
>
> You will use the HAPROXY_STATS_IP variable to verify that the Docker-based service you are going to deploy is up in stats of the HAProxy service.

13 Verify that aptly is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep aptly
```

14 Deploy aptly:

```
salt -C 'I@aptly:server' state.sls aptly
```

15 Verify that OpenLDAP is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep openldap
```

16 Deploy OpenLDAP:

```
salt -C 'I@openldap:client' state.sls openldap
```

17 Verify that Gerrit is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep gerrit
```

18 Deploy Gerrit:

```
salt -C 'I@gerrit:client' state.sls gerrit
```

> Note
>
> The execution of the command above may hang for some time. If it happens, re-apply the state after its termination.

19 Verify that Jenkins is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep jenkins
```

20 Deploy Jenkins:

```
salt -C 'I@jenkins:client' state.sls jenkins
```

> **Note**
>
> The execution of the command above may hang for some time. If it happens, re-apply the state after its termination.

21 Verify that the process of bootstrapping of the PostgreSQL container has been finalized:

```
docker service logs postgresql_db | grep "ready to accept"
```

22 Verify that PostgreSQL is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep postgresql
```

23 Initialize OSS services databases by setting up the PostgreSQL client:

```
salt -C 'I@postgresql:client' state.sls postgresql.client
```

The postgresql.client state application will return errors due to cross-dependencies between the docker.stack and postgresql.client states. To configure integration between Push Notification and Security Audit services:

1. Verify that Push Notification service is UP in stats of the HAProxy service:

   ```
   curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep pushkin
   ```

2. Re-apply the postgresql.client state:

   ```
   salt -C 'I@postgresql:client' state.sls postgresql.client
   ```

24 Verify that Runbook Automation is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep rundeck
```

25 Deploy Runbook Automation:

```
salt -C 'I@rundeck:client' state.sls rundeck.client
```

26 Verify that Elasticksearch is UP in stats of the HAProxy service:

```
curl -s "http://${HAPROXY_STATS_IP}:9600/haproxy?stats;csv" | grep elasticsearch
```

27. Deploy the Elasticsearch back end:

```
salt -C 'I@elasticsearch:client' state.sls elasticsearch.client
```

Due to index creation, you may need to re-apply the state above.

28. If required, generate documentation and set up proxy to access it. The generated content will reflect the current configuration of the deployed environment:

```
salt -C  'I@sphinx:server' state.sls 'sphinx'
# Execute 'salt-run' on salt-master
salt-run state.orchestrate sphinx.orch.generate_doc || echo "Command execution failed"
salt -C 'I@nginx:server' state.sls 'nginx'
```

Build a custom image of the DevOps Portal

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

For testing purposes, you may need to create a custom Docker image to use it while deploying the DevOps Portal.

To build a custom Docker image:

1. Before you build the image and upload it to Sandbox, clone the source code of DevOps Portal:

   ```
   git clone https://gerrit.mcp.mirantis.net/oss/devops-portal
   cd devops-portal
   ```

2. Build your image:

   ```
   docker build --rm -f docker/Dockerfile -t \
   docker-sandbox.sandbox.mirantis.net/[USERNAME]/oss/devops-portal:latest .
   ```

3. Push the image into a specific prefix on Sandbox:

   ```
   docker push docker-sandbox.sandbox.mirantis.net/[USERNAME]/oss/devops-portal:latest
   ```

Configure Salesforce integration for OSS manually

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

The Push Notification services can automatically create tickets in Saleforce based on the alarms triggered by the issues that are found by Prometheus Alertmanager. Moreover, the Push Notification service ensures the following:

- The Salesforce tickets are not duplicated. When the same alarm gets triggered multiple times, only one Saleseforce ticket is created per the alarm.
- The Push Notification service creates one entry in a SalesForce feed, that is a FeedItem, per alarm with a link to an existing ticket. This enables the users to track important changes as well as close the ticket which has been fixed.

> Warning
>
> This section describes how to manually configure the Push Notification service Reclass metadata to integrate with Salesforce in an existing OSS deployment. Therefore, if you want to configure the Salesforce integration, perform the procedure below.
>
> Otherwise, if you are performing the initial deployment of your MCP environment, you should have already configured your deployment model with the Salesforce (SFDC) parameters as described in OSS parameters. In this case, skip this section.

To configure Salesforce integration for OSS manually:

1. Collect the following data from Saleforce:
   - auth_url
     The URL of a Salesforce instance. The same for the MCP users.
   - username
     The username in Salesforce used for integration; all Salesforce cases are created by this user. The unique identifier for an MCP user.
   - password
     The password used for logging in to the Support Customer Portal. The unique identifier for an MCP user.
   - environment
     The Cloud ID in Salesforce. The unique identifier for an MCP user.

The detailed information on a Salesforce Cloud is provided by either Mirantis support engineers or customer depending on whom the Cloud object was created by.

- consumer_key

  The Consumer Key in Salesforce required for Open Authorization (OAuth).

- consumer_secret

  The Consumer Secret from Salesforce required for OAuth.

- organization_id

  The Salesforce Organization ID in Salesforce required for OAuth.

2. Verify that the following services are properly configured and deployed:

   - Elasticsearch
   - PostgreSQL

   > Note
   >
   > For the configuration and deployment details, see:
   >
   > - Configure services in the Reclass model
   > - Deploy OSS services manually

3. In the classes/cluster/${_param:cluster_name}/oss/client.yml file of your deployment model, define the system.postgresql.client.sfdc class :

```
classes:
 - system.postgresql.client.sfdc
```

4. In the /srv/salt/reclass/classes/cluster/${_param:cluster_name}/oss/server.yml file, define the following parameters:

```
parameters:
  _param:
    # SFDC configuration
    sfdc_auth_url: <AUTH_URL>
    sfdc_username: <USERNAME>
    sfdc_password: <PASSWORD>
    sfdc_consumer_key: <CONSUMER_KEY>
    sfdc_consumer_secret: <CONSUMER_SECRET>
    sfdc_organization_id: <ORGANIZATION_ID>
    sfdc_sandbox_enabled:  True
```

> Note
>
> Sandbox environments are isolated from the production Salesforce clouds. Set the sfdc_sandbox_enabled to True to use Salesforce sandbox for testing and evaluation purposes. Verify that you specify the correct sandbox-url value in the sfdc_auth_url parameter. Otherwise, set the parameter to False.

5. Push all changes of the model to the dedicated project repository.
6. Refresh pillars and synchronize Salt modules:

```
salt '*' saltutil.refresh_pillar
salt '*' saltutil.sync_modules
```

7. If you have the running pushkin docker stack, remove it and apply the following Salt states:

```
salt -C 'I@docker:swarm:role:master' state.sls docker.client
salt -C 'I@postgresql:client' state.sls postgresql.client
```

8. To test whether the Push Notification service is configured properly:

    1. View the list of all applications, preconfigured in the Push Notification service, and their details by checking the system response for the following command:

    ```
    curl -D - http://${HAPROXY_STATS_IP}:8887/apps
    ```

    Example of system response:

    ```
    {"applications": [{"login_id": 11, "enabled": true, "id": 1, "name": "notify_service"}]}
    ```

    2. Send the test request to the service using the following command:

    ```
    curl -i -XPOST -H 'Content-Type: application/json' <PUSH_NOTIFICATION_ENDPOINT> -d \
      '{"notifications": [{"login_id" : <APP_LOGIN_ID>, \
      "title" : "Salesforce test notification", \
      "content" : {"handler": "sfdc","payload": \
      {"status": "<NOTIFICATION_STATUS>","priority": "<NOTIFICATION_PRIORITY>",\
      "subject": "<NOTIFICATION_SUBJECT>","host": "<EXAMPLE.NET>",\
      "service": "<SERVICE>","environment": "<ENVIRONMENT_ID>",\
      "body": "<NOTIFICATION_ITEM_BODY>"}, \
      "application_id": <APP_ID>}}]}'
    ```

    The table below provides the desription of the parameters required for the test request.

Parameter	Description
login_id	The Login ID of an application on behalf of which the notification will be send. Define the parameter according to the login_id parameter value retrieved during the previous step.
environment	The Cloud ID in Salesforce which the notification will be send to. Define the parameter according to the environment parameter value collected during the first step of this procedure.
application_id	The ID of an application on behalf of which the notification will be send. Define the parameter according to the id parameter value retrieved during the previous step.

Example:

```
curl -i -XPOST -H 'Content-Type: application/json' http://${HAPROXY_STATS_IP}:8887/post_notification_json -d \
  '{"notifications": [{"login_id" : 12, \
  "title" : "SFDC test notification", \
  "content" : {"handler": "sfdc","payload": \
  {"status": "down","priority": "070 Unknown",\
  "subject": "Notification subject","host": "example.net",\
  "service": "test-service","environment": "123",\
  "body": "Notification item body"}, \
  "application_id": 2}}]}'
```

3. Log in to Salesforce and verify that the alert is filed correctly.

Configure email integration for OSS manually

> Warning
>
> The DevOps Portal has been deprecated in the Q4`18 MCP release tagged with the 2019.2.0 Build ID.

> Note
>
> Configuring notifications through the Push Notification service is deprecated. Mirantis recommends that you configure Alertmanager-based notifications as described in MCP Operations Guide: Enable Alertmanager notifications.

The Push Notification service can route notifications based on the alarms triggered by the issues that are found by Prometheus Alertmanager through email.

> Warning
>
> This section describes how to manually configure the Push Notification service Reclass metadata to integrate email routing for notifications in an existing OSS deployment. Therefore, if you want to configure the email routing configuration, perform the procedure below.
>
> Otherwise, if you are performing the initial deployment of your MCP environment, you should have already configured your deployment model with the default Simple Mail Transfer Protocol (SMTP) parameters for the Push Notification service as described in OSS parameters and the OSS webhook parameters as described in StackLight LMA product parameters. In this case, skip this section.

> Note
>
> The Push Notification service only routes the received notifications to email recipients. Therefore, you must also provide the Prometheus Alertmanager service with a predefined alert template containing an email handler as described in MCP Operations Guide: Enable notifications through the Push Notification service.

To configure email integration for OSS manually:

1. Obtain the following data:

- pushkin_smtp_host
  SMTP server host for email routing. Gmail server host is used by default (smtp.gmail.com).
- pushkin_smtp_port
  SMTP server port for email routing. Gmail server port is used by default (587).
- webhook_from
  Source email address for notifications sending.
- pushkin_email_sender_password
  Source email password for notifications sending.
- webhook_recipients
  Comma-separated list of notification recipients.

2. Verify that the following services are properly configured and deployed:
   - Elasticsearch
   - PostgreSQL

   > Note
   >
   > For the configuration and deployment details, see:
   >
   > - Configure services in the Reclass model
   > - Deploy OSS services manually

3. In the /srv/salt/reclass/classes/cluster/${_param:cluster_name}/oss/server.yml file, define the following parameters:

```
parameters:
  _param:
    pushkin_smtp_host: smtp.gmail.com
    pushkin_smtp_port: 587
    webhook_from: your_sender@mail.com
    pushkin_email_sender_password: your_sender_password
    webhook_recipients: "recepient1@mail.com,recepient2@mail.com"
```

4. Push all changes of the model to the dedicated project repository.
5. Refresh pillars and synchronize Salt modules:

```
salt '*' saltutil.refresh_pillar
salt '*' saltutil.sync_modules
```

6. If you have the running pushkin docker stack, remove it and apply the following Salt states:

```
salt -C 'I@docker:swarm:role:master' state.sls docker.client
```

Deploy StackLight LMA

StackLight LMA is the Logging, Monitoring, and Alerting toolchain, the capacity planning, operational health, and response monitoring solution for Mirantis Cloud Platform (MCP). StackLight LMA is based on the time-series database and flexible cloud-native monitoring solution called Prometheus. Prometheus provides powerful querying capabilities and integrates with Grafana providing real-time visualization.

This section explains how to configure and install StackLight LMA including the components that it integrates after you deploy a Kubernetes cluster or an OpenStack environment on your MCP cluster.

Before you start installing the StackLight LMA components, verify that your MCP cluster meets the StackLight LMA hardware requirements.

Prerequisites

Before you start installing the StackLight LMA components, complete the following steps:

1. Configure StackLight LMA for installation.

   The configuration of StackLight LMA for installation is defined in the Reclass model. See stacklight-salt-model as an example of the Reclass model to install StackLight LMA on Mirantis Cloud Platform. Three levels of the Reclass models are currently collocated on the Salt Master node under the /srv/salt/reclass/classes directory:

   - The service level model is imported directly from the metadata/service directory of all MCP formulas. The Reclass parameters that are defined at the service level are the most generic parameters and should not be modified in practice.
   - The system level model, which is currently defined in the user Reclass model, imports the service level models and defines additional parameters. The parameters defined in the system level model relate to the system-wide configuration of StackLight LMA, such as the IP address and port number of the Elasticsearch server.
   - The cluster level model defines the configuration of StackLight LMA for a particular deployment. A user Reclass model to install OpenStack with StackLight LMA must be created. This is where you typically customize your deployment.
2. Deploy Docker Swarm master:

   ```
   salt -C 'I@docker:host' state.sls docker.host
   salt -C 'I@docker:swarm:role:master' state.sls docker.swarm
   ```
3. Deploy Docker Swarm workers:

   ```
   salt -C 'I@docker:swarm:role:manager' state.sls  docker.swarm -b 1
   ```
4. Deploy Keepalived:

   ```
   salt -C 'I@keepalived:cluster' state.sls keepalived -b 1
   ```
5. Deploy NGINX proxy:

   ```
   salt -C 'I@nginx:server' state.sls nginx
   ```
6. Verify that you have Internet access to download several external packages that are not included in the standard Ubuntu distribution. If there is no Internet access, these repositories must be mirrored on MCP.

Install the system-level Stacklight LMA services

StackLight LMA integrates several backend servers to visualize an environment monitoring and health statuses. This section describes how to install the Elasticsearch and Kibana logs analysis solution. For a Kubernetes-based MCP cluster, additionally install Galera.

Install Elasticsearch and Kibana

The Elasticsearch and Kibana servers must be installed on the log cluster of the Mirantis Cloud Platform.

Caution!

To avoid the split-brain issues, install the Elasticsearch and Kibana cluster on a minimum of three nodes.

Note

Advanced cluster operations may require manual steps.

Configure Elasticsearch and Kibana

The configuration parameters of the Elasticsearch engine and Kibana dashboards are defined in the corresponding Salt formulas. For details and the configuration examples, see Elasticsearch Salt formula and Kibana Salt formula.

Deploy Elasticsearch and Kibana

The deployment of Elasticsearch and Kibana consists of the server and the client deployment.

To deploy Elasticsearch and Kibana:

1. Log in to the Salt Master node.
2. Deploy the Elasticsearch and Kibana services:

```
salt -C 'I@elasticsearch:server' state.sls elasticsearch.server -b 1
salt -C 'I@kibana:server' state.sls kibana.server -b 1
```

3. Deploy the Elasticsearch and Kibana clients that will configure the corresponding servers:

```
salt -C 'I@elasticsearch:client' state.sls elasticsearch.client
salt -C 'I@kibana:client' state.sls kibana.client
```

4. Apply the haproxy state on the log nodes:

```
salt 'log*' state.sls haproxy
```

Verify Elasticsearch and Kibana after deployment

After you deploy Elasticsearch and Kibana, verify that they are up and running using the steps below.

To verify the Elasticsearch cluster:

1. Log in to one of the log hosts.
2. Run the following command:

   ```
   curl http://log:9200
   ```

   Example of the system response:

   ```
   curl http://log:9200
   {
     "name" : "log01",
     "cluster_name" : "elasticsearch",
     "cluster_uuid" : "KJM5s5CkTNKGkhd807gcCg",
     "version" : {
       "number" : "2.4.4",
       "build_hash" : "fcbb46dfd45562a9cf00c604b30849a6dec6b017",
       "build_timestamp" : "2017-06-03T11:33:16Z",
       "build_snapshot" : false,
       "lucene_version" : "5.5.2"
     },
     "tagline" : "You Know, for Search"
   }
   ```

To verify the Kibana dashboard:

1. Log in to the Salt Master node.
2. Identify the prx VIP of your MCP cluster:

   ```
   salt-call pillar.get _param:openstack_proxy_address
   ```

3. Open a web browser.
4. Paste the prx VIP and the default port 5601 to the web browser address field. No credentials are required.

   Once you access the Kibana web UI, you must be redirected to the Kibana Logs analytics dashboard.

Install Galera (MySQL)

For the Kubernetes-based MCP clusters, you must also install Galera as a back end for StackLight LMA. Galera is a synchronous multi-master database cluster based on the MySQL storage engine.

To install Galera:

1. Log in to the Salt Master node.
2. Apply the galera state:

```
salt -C 'I@galera:master' state.sls galera
salt -C 'I@galera:slave' state.sls galera -b 1
```

3. Verify that Galera is up and running:

```
salt -C 'I@galera:master' mysql.status | grep -A1 wsrep_cluster_size
salt -C 'I@galera:slave' mysql.status | grep -A1 wsrep_cluster_size
```

Install the StackLight LMA components

After you deploy Elasticsearch and Kibana as described in Install the system-level Stacklight LMA services, proceed to configuring and installing Prometheus-based StackLight LMA.

> Warning
>
> If any of the steps below fail, do not proceed without resolving the issue.

To install the StackLight LMA components:

1. Log in to the Salt Master node.
2. Install Telegraf:

   ```
   salt -C 'I@telegraf:agent or I@telegraf:remote_agent' state.sls telegraf
   ```

   This formula installs the Telegraf package, generates configuration files, and starts the Telegraf service.
3. Configure Prometheus exporters:

   ```
   salt -C 'I@prometheus:exporters' state.sls prometheus
   ```
4. Configure Fluentd:

   ```
   salt -C 'I@fluentd:agent' state.sls fluentd.agent
   ```
5. Install MongoDB:

   ```
   salt -C 'I@mongodb:server' state.sls mongodb
   ```
6. Generate the configuration for services running in Docker Swarm:

   ```
   salt -C 'I@docker:swarm and I@prometheus:server' state.sls prometheus -b 1
   ```
7. Deploy Prometheus long-term storage.

   ```
   salt -C 'I@prometheus:relay' state.sls prometheus
   ```
8. Deploy the monitoring containers:

   ```
   salt -C 'I@docker:swarm:role:master and I@prometheus:server' state.sls docker
   ```
9. Configure the Grafana client:

```
salt -C 'I@grafana:client' state.sls grafana.client
```

10 Customize the alerts as described in MCP Operations Guide: Alerts that require tuning.
.

11 Proceed to Verify the StackLight LMA components after deployment.
.

Verify the StackLight LMA components after deployment

Once you install the StackLight LMA components as described in Install the StackLight LMA components, verify that all components have been successfully deployed and all services are up and running.

To verify the StackLight LMA components:

1. Log in to the Salt Master node.
2. Verify that all the monitoring services running in Docker Swarm have their expected number of replicas:

   ```
   salt -C 'I@docker:client:stack:monitoring' cmd.run 'docker service ls'
   ```

   Example:

   ```
   root@sup01:~# docker service ls
   ID            NAME                      MODE         REPLICAS IMAGE
   j0hrlth0agyx monitoring_server          replicated 1/1      prometheus:latest
   pqeqda711a69 dashboard_grafana          replicated 1/1      grafana/grafana:latest
   xrdmspdexojs monitoring_pushgateway     replicated 2/2      pushgateway:latest
   xztynkgfo1pu monitoring_alertmanager    replicated 2/2      alertmanager:latest
   i2xc7j9ei81k monitoring_remote_agent    replicated 1/1      telegraf:latest
   ```

3. Verify the status of the containers:

   ```
   salt -C 'I@docker:swarm:role:master and I@prometheus:server' cmd.run \
   'docker service ps $(docker stack services -q monitoring)'
   ```

4. Inspect the monitoring containers logs for any unusual entries:

   ```
   salt -C 'I@docker:swarm:role:master and I@prometheus:server' cmd.run \
   'for i in $(docker stack services -q monitoring); do docker service logs --tail 10 $i; done'
   ```

5. Verify that the Fluentd service is running:

   ```
   salt -C 'I@fluentd:agent' service.status td-agent
   ```

6. Verify Prometheus Relay:

   ```
   salt -C 'I@prometheus:relay' service.status prometheus-relay
   ```

7. If deployed, verify Prometheus long-term storage:

   ```
   salt -C 'I@prometheus:relay' service.status prometheus
   ```

8. Verify the Prometheus web UI:
    1. Connect to the Prometheus web UI as described in the corresponding section of the MCP Operations Guide.
    2. From the Status drop-down list, select Targets.
    3. Verify that all targets are in the UP state.
    4. Click the Alerts tab.
    5. Verify that no alerts are active.
9. Verify the Alertmanager web UI:
    1. Connect to the Alertmanager web UI as described in Use the Alertmanager web UI.
    2. Click Alerts.
    3. Verify that no alerts are active.
10. Verify the Grafana dashboards:
    1. Enter the prx VIP on port 3000 by default.
    2. Authenticate using your credentials as described in Connect to Grafana. You should be redirected to the Grafana Home page with a list of available dashboards sorted by name.
    3. Verify that all nodes are listed in the System dashboard.
11. Verify the Kibana dashboards by connecting to Kibana as described in the Connect to Kibana.

Seealso

- MCP Reference Architecture: StackLight LMA
- MCP Operations Guide: StackLight LMA operations

Finalize the deployment

The last step of a manual deployment is ensuring highstates on all nodes.

To ensure highstates:

1. Log in to the Salt Master node.
2. Verify that all machines have connectivity with the Salt Master node:

   ```
   salt '*' test.ping
   ```

3. Ensure highstate on the Salt Master node:

   ```
   salt-call state.apply -l debug
   ```

4. Ensure highstate on the GlusterFS nodes one by one to avoid race condition:

   ```
   salt -C 'I@glusterfs:server' state.apply -b1 -l debug
   ```

5. Ensure highstate on the rest of the nodes:

   ```
   salt -C '* and not I@glusterfs:server and not cfg*' state.apply -l debug
   ```

Deployment customizations guidelines

This section contains instructions that do not belong to a specific part of the deployment workflow. Otherwise speaking, the procedures included in this section are optional and contain only customizations guidelines that can be skipped if you perform the default MCP deployment.

The procedures below are referenced from the sections where they can merge into the general deployment workflow. You should not perform these procedures as standalone instructions. And always remember to continue the deployment exactly from the step that referenced you to this section.

Generate configuration drives manually

You may need to manually generate the configuration drives for an automated MCP deployment after you customize their content to meet specific requirements of your deployment. This section describes how to generate the configuration drives using the create-config-drive script.

To generate a configuration drive for the cfg01 VM:

1. Download the create-config-drive script for generating the configuration drive:

   ```
   export MCP_VERSION="master"
   wget -O /root/create-config-drive.sh \
   https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/create_config_drive.sh
   chmod +x /root/create-config-drive.sh
   ```

2. Download the Salt Master configuration script:

   ```
   wget -O /root/user_data.yaml \
   https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/master_config.yaml
   ```

3. In user_data.yaml, modify the lines that start with export to fit your environment. If you use local (aptly) repositories, select the following parameters to point to your local repositories address on port 8088:

   - MCP_VERSION
   - PIPELINES_FROM_ISO=false
   - PIPELINE_REPO_URL
   - MCP_SALT_REPO_KEY
   - MCP_SALT_REPO_URL

4. For debugging purposes, configure custom access to the cfg01 node in user_data.yaml using the following parameters:

   - name - user name.
   - sudo, NOPASSWD - the sudo permissions for a user. The value ALL grants administrator privileges to a user.
   - groups - a user group. For example, admin. Add a comma-separated list of groups if necessary.
   - lock_passwd - deny or allow logging in using a password. Possible values are true (deny) or false (allow). Select false.
   - passwd - a password hash, not the password itself. To generate a password and its hash, run mkpasswd --method=SHA-512 --rounds=4096. Remember the generated password for further access to the virsh console.

   Configuration example:

```
users:
 - name: barfoo
   sudo: ALL=(ALL) NOPASSWD:ALL
   groups: admin
   lock_passwd: false
   passwd: <generated_password_hash>
```

5. Select from the following options:

   - If you do not use local repositories:

     1. Clone the mk-pipelines and pipeline-library Git repositories:

        ```
        git clone --mirror https://github.com/Mirantis/mk-pipelines.git /root/mk-pipelines
        git clone --mirror https://github.com/Mirantis/pipeline-library.git /root/pipeline-library
        ```

     2. Put your Reclass model that contains the classes/cluster, classes/system, nodes, .git, and .gitmodules directories in /root/model.

     3. Install genisoimage:

        ```
        apt install genisoimage
        ```

     4. Run the configuration drive generator script:

        ```
        /root/create-config-drive.sh -u /root/user_data.yaml -h cfg01 \
        --model /root/model --mk-pipelines /root/mk-pipelines \
        --pipeline-library /root/pipeline-library cfg01-config.iso
        ```

     The generated configuration drive becomes available as the cfg01-config.iso file.

   - If you use local repositories:

     1. Install genisoimage:

        ```
        apt install genisoimage
        ```

     2. Put your Reclass model that contains the classes/cluster, classes/system, nodes, .git, and .gitmodules directories in /root/model.

        ```
        mkdir /root/model
        cp -r /root/mcpdoc/{classes, .git, .gitmodules, nodes } /root/model
        tree /root/model -aL 2
        ```

     3. Run the configuration drive generator script:

        ```
        /root/create-config-drive.sh -u /root/user_data.yaml -h cfg01 \
        --model /root/model cfg01-config.iso
        ```

The generated configuration drive becomes available as the cfg01-config.iso file.

To generate a configuration drive for the APT VM:

1. Download the create-config-drive script for generating the configuration drive:

```
export MCP_VERSION="master"
wget -O /root/create-config-drive.sh \
https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/create_config_drive.sh
chmod +x /root/create-config-drive.sh
```

2. Download the mirror configuration script:

```
wget -O /root/user_data.yaml \
https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/mirror_config.yaml
```

3. In user_data.yaml, modify the lines that start with export to fit your environment.
4. Run the configuration drive generator script:

```
/root/create-config-drive.sh -u /root/user_data.yaml -h apt01 apt-config.iso
```

The generated configuration drive should now be available as the apt-config.iso file.

To generate a simple configuration drive for any cloud-image:

1. Install the cloud-image-utils tool:

```
apt-get install -y cloud-image-utils
```

2. For example, create a configuration file with the config-drive-params.yaml name.
3. In this file, enable the password access for root and Ubuntu users. For example:

```
#cloud-config
debug: True
ssh_pwauth: True
disable_root: false
chpasswd:
  list: |
    root:r00tme
    ubuntu:r00tme
  expire: False

runcmd:
  - sed -i 's/PermitRootLogin.*/PermitRootLogin yes/g' /etc/ssh/sshd_config
  - sed -i 's/PasswordAuthentication.*/PasswordAuthentication yes/g' /etc/ssh/sshd_config
  - service sshd restart
```

4. Create the configuration drive:

```
cloud-localds  --hostname testvm --dsmode local mynewconfigdrive.iso  config-drive-params.yaml
```

Now, you can use mynewconfigdrive.iso with any cloud-image. For example, with the MCP VCP images or any other image that has cloud-init pre-installed.

Add custom commissioning scripts

Using MAAS, you can extend the default commissioning logic with additional user-defined scripts. Each defined script will be applied to a VM commissioning by default.

For example, to set custom NIC names that are oneXX for a 1 GB Ethernet and tenXX for a 10 GB Ethernet, refer to the following procedures.

In the examples below, the default 00-maas-05-simplify-network-interfaces script from the salt-formulas-maas package is used. The script is located on the Salt Master node in the /srv/salt/env/prd/maas/files/commisioning_scripts/ directory.

To automatically add the commissioning script using Salt:

1. Prepare a script for commissioning and save it on the MAAS control node, which is located on the Salt Master node. For example, use the default script from the salt-formulas-maas package.
2. Enable automatic importing of the script by defining it in /srv/salt/reclass/classes/cluster/<CLUSTER_NAME>/infra/maas.yml:

```
...
parameters:
  maas:
    region:
      commissioning_scripts:
        00-maas-05-simplify-network-interfaces: /etc/maas/files/commisioning_scripts/00-maas-05-simplify-network-interfaces
      machines:
...
```

> Caution!
>
> The commissioning script name is important. If you have several scripts, they will run in the alphanumeric order depending on their name.

3. Run the following command:

```
salt-call -l debug --no-color maas.process_commissioning_scripts
```

Example of system response:

```
...
local:
----------
errors:
    ----------
success:
    - 00-maas-05-simplify-network-interfaces
```

The script 00-maas-05-simplify-network-interfaces is uploaded to MAAS from the /etc/maas/files/commisioning_scripts/ directory.

After the importing is done, proceed with commissioning depending on your use case as described in Provision physical nodes using MAAS.

To clean up old software RAID:

If you re-install the operating system on the nodes where the software RAID was set up and was not correctly removed, MAAS may encounter the problem while attempting to provision the system. Therefore, you may want to enable the cleanup commissioning script before you proceed with the comissioning of such a hardware node.

> Note
>
> The cleanup commissioning script is not included in MAAS by default.

> **Caution!**
>
> If the cleanup commissioning script is allowed, it erases all data located on the disks.

To enable the cleanup commissioning script, select from the following options:

- Enable the script through the Reclass model:
  1. Log in to the Salt Master node.
  2. Open the cluster level of your Reclass model.
  3. Define the script:

     ```
     parameters:
       maas:
         region:
           commissioning_scripts:
             00-maas-01-disk-cleanup: /etc/maas/files/commisioning_scripts/00-maas-01-disk-cleanup
           ...
     ```

  4. Apply the change:

     ```
     salt -C 'I@maas:region' maas.process_commissioning_scripts
     ```

- Define the script through the MAAS web UI as described in Upload procedure in the official MAAS documentation.

After the script is enabled, proceed with commissioning depending on your use case as described in Provision physical nodes using MAAS.

To manually add the commissioning script using the MAAS web UI:

1. Log in to the MAAS web UI through salt_master_management_address/MAAS with the following credentials:
   - Username: mirantis
   - Password: r00tme
2. Go to the Settings tab.
3. Scroll to Commissioning scripts.
4. Click Upload script to chose a file for uploading. For example, use the default script from the salt-formulas-maas package.

   > Caution!
   >
   > The commissioning script name is important. If you have several scripts, they will run in the alphanumeric order depending on their name.

After the importing is done, proceed with commissioning depending on your use case as described in Provision physical nodes using MAAS.

Customize the prebuilt mirror node

This section describes the content and sources definition for the apt01 node. For the deployment details, see: Deploy the APT node. Using procedures described in this section, you can enable a full lifecycle management of an offline apt01 node.

By default, an MCP deployment does not contain any pillar information about an offline node content.

> Warning
>
> Enabling of the offline mirror management is not fully supported, and may override some variables on the cluster level of the Reclass model.

Enable the APT node management in the Reclass model

This section instructs you on how to configure your existing cluster model to enable the management of the offline mirror VM through the Salt Master node.

> Warning
>
> Perform the procedure below only in case of an offline deployment or when using a local mirror from the prebuilt image.

To configure the APT node management in the Reclass model:

1. Verify that you have completed Enable the management of the APT node through the Salt Master node.
2. Log in to the Salt Master node.
3. Open the cluster level of your Reclass model.
4. In infra/config/nodes.yml, add the following pillars:

```
parameters:
  reclass:
    storage:
      node:
        aptly_server_node01:
          name: ${_param:aptly_server_hostname}01
          domain: ${_param:cluster_domain}
          classes:
          - cluster.${_param:cluster_name}.infra
          - cluster.${_param:cluster_name}.infra.mirror
          - system.linux.system.repo.mcp.apt_mirantis.extra
          - system.linux.system.repo.mcp.apt_mirantis.ubuntu
          - system.linux.system.repo.mcp.apt_mirantis.docker
          params:
            salt_master_host: ${_param:reclass_config_master}
            linux_system_codename: xenial
            single_address: ${_param:aptly_server_control_address}
            deploy_address: ${_param:aptly_server_deploy_address}
```

5. If the offline mirror VM is in the full offline mode and does not have the infra/mirror path, create the infra/mirror/init.yml file with the following contents:

```
classes:
- service.docker.host
- system.git.server.single
- system.docker.client
parameters:
```

```
linux:
  network:
    interface:
      ens3: ${_param:single_address}
```

For a complete example of the mirror content per MCP release, refer to init.yml located at https://github.com/Mirantis/mcp-local-repo-model/blob/<BUILD_ID>/ tagged with a corresponding Build ID.

6. Add the following pillars to infra/init.yml or verify that they are present in the model:

```
parameters:
  linux:
    network:
      host:
        apt:
          address: ${_param:aptly_server_deploy_address}
          names:
          - ${_param:aptly_server_hostname}
          - ${_param:aptly_server_hostname}.${_param:cluster_domain}
```

7. Check out your inventory to be able to resolve any inconsistencies in your model:

```
reclass-salt --top
```

8. Use the system response of the reclass-salt --top command to define the missing variables and specify proper environment-specific values if any.
9. Generate the storage Reclass definitions for your offline image node:

```
salt-call state.sls reclass.storage -l debug
```

10. Synchronize pillars and check out the inventory once again:

```
salt '*' saltutil.refresh_pillar
reclass-salt --top
```

11. Verify the availability of the offline mirror VM. For example:

```
salt 'apt01.local-deployment.local' test.ping
```

If the VM does not respond, verify that Salt Master accepts the key for the VM using the salt-key command.

Customize the prebuilt mirrors

You can easily customize mirrored Aptly, Docker, and Git repositories by configuring contents of the mirror VM defined in the infra/mirror/init.yml file of the Reclass model.

To customize the debmirror repositories mirrors

You can either customize the already existing debmirrors content or specify any custom mirror required by your MCP deployment.

1. Customize the debmirror content as required. Example of customization:

   > Note
   >
   > Starting from the MCP Build ID 2019.2.0, the default list of repositories per release is defined in reclass-system/debmirror/mirror_mirantis_com/init.yml. For earlier MCP releases, the repositories are included directly from the corresponding classes.

   ```
   debmirror:
     client:
       enabled: true
       mirrors:
         mirror_mirantis_com_ceph_luminous_xenial:
           arch:
           - amd64
           dist:
           - xenial
           extra_flags:
           - --verbose
           - --progress
           - --nosource
           - --no-check-gpg
           - --rsync-extra=none
           filter:
             '1': --exclude='(-dbg_|-dbg-)'
           force: false
           lock_target: true
           log_file: /var/log/debmirror/mirror_mirantis_com_ceph_luminous_xenial.log
           method: rsync
           mirror_host: mirror.mirantis.com
           mirror_root: :mirror/proposed/ceph-luminous/xenial/
           section:
           - main
           target_dir: /srv/volumes/aptly/public/proposed//ceph-luminous/xenial/
   ```

2. Include the debmirror content class to infra/mirror/init.yml. For example, to include all repositories by default for future MCP cluster update, add the following class:

```
- system.debmirror.mirror_mirantis_com
```

3. Apply the debmirror state:

```
salt '<offline_node_name>' state.apply debmirror
```

Example: Deliver the OpenStack Pike update repository to an offline deployment

For a fully isolated MCP cluster with no access to the Mirantis mirrors even from the apt01 node, you can enable generation of a copy of a mirrored repository directly on a host node. You can then move this copy to the apt01 node using scp or rsync, for example.

This is the exemplary procedure of the debmirror repository customization that delivers the OpenStack Pike update repository. Such customization enables you to obtain the MCP maintenance updates.

> Note
>
> The exemplary steps described below are performed locally in a non-customized Docker container that runs Ubuntu 16.04. However, you can use any other debmirror-compatible operating system.

1. In reclass-system/debmirror/mirror_mirantis_com/init.yml described above, identify the repository classes available for an MCP release version deployed on your cluster and select the one that you need to receive maintenance updates for. For example, for OpenStack Pike:

```
cat debmirror/mirror_mirantis_com/init.yml |grep openstack-pike
  ...
  - system.debmirror.mirror_mirantis_com.openstack-pike.xenial
  ...
```

2. Obtain the required data for the selected class and convert it to a debmirror utility.

> Note
>
> For human readability, the debmirror formula has the native debmirror syntax that allows you to convert a class data into a local cmdline.

For example:

1. Display contents of the OpenStack xenial.yml file:

```
cat debmirror/mirror_mirantis_com/openstack-pike/xenial.yml
...
 parameters:
   debmirror:
     client:
       enabled: true
       mirrors:
         mirror_mirantis_com_openstack_pike_xenial:
           force: ${_param:mirror_mirantis_com_openstack_pike_xenial_force}
           lock_target: True
           extra_flags: [ '--verbose', '--progress', '--nosource', '--no-check-gpg', '--rsync-extra=none' ]
           method: "rsync"
           arch: [ 'amd64' ]
           mirror_host: "mirror.mirantis.com"
           mirror_root: ":mirror/${_param:mcp_version}/openstack-pike/xenial/"
           target_dir: "${_param:debmirror_mirrors_base_target_dir}/openstack-pike/xenial/"
           log_file: "/var/log/debmirror/mirror_mirantis_com_openstack_pike_xenial.log"
           dist: [ xenial ]
           section: [ main ]
           filter:
             001: --exclude='(-|_)dbg(_|-)'
```

2. Convert the contents obtained in the previous step into the debmirror cmdline:

```
debmirror --verbose --progress --nosource --no-check-gpg --rsync-extra=none --dist=xenial --section=main \
--method=rsync --host="mirror.mirantis.com" --root=":mirror/update/2019.2.0/openstack-pike/xenial/" \
--arch=amd64 --exclude='(-|_)dbg(_|-)' /debmirror_example/update/2019.2.0/update/openstack-pike/xenial/
```

   In the example cmdline above, the path to mirror_root is extended with the /update/ subdirectory to fetch the update repository.

3. Create a directory for the update repository. For example:

```
mkdir debmirror_example/2019.2.0/update/openstack-pike/xenial/
```

4. Run a non-customized Docker container that runs Ubuntu 16.04. For example:

```
docker run -v $(pwd)/debmirror_example:/debmirror_example --hostname=docker-16  \
--cpus=4 -ti ubuntu:xenial /bin/bash
```

5. Install debmirror in this container:

```
root@docker-16:/# apt-get update && apt-get install -y xz-utils debmirror rsync apt-transport-https curl
root@docker-16:/# curl -fsSL https://mirror.mirantis.com/update/2019.2.0/openstack-pike/xenial/archive-pike.key | apt-key add -
```

6. Run cmdline prepared in the step 2.2:

```
root@docker-16:/# debmirror --verbose --progress --keyring=/etc/apt/trusted.gpg --nosource \
--rsync-extra=none --dist=xenial --section=main --method=rsync \
--host="mirror.mirantis.com" --root=":mirror/update/2019.2.0/openstack-pike/xenial/" \
--arch=amd64 --exclude='(-|_)dbg(_|-)' /debmirror_example/update/2019.2.0/openstack-pike/xenial/
```

7. Exit from the Docker container.
8. Inspect the update mirror that is now locally available in:

```
tree -L 5 debmirror_example/
debmirror_example/
└── update
    └── 2019.2.0
        └── openstack-pike
            └── xenial
                ├── dists
                └── pool
```

9. Move the structure of the downloaded repository to the apt01 node. By default, the update mirror structure is located on the apt01 node in /srv/volumes/aptly/public/update/2019.2.0/openstack-pike.

> Warning
>
> While modifying /srv/volumes/aptly/public/update/, make sure that you remove the symlinks only for those repositories that you are going to update. In this example, this is only openstack-pike. Otherwise, the main release binaries for the components that are not being updated will be lost.

1. In /srv/volumes/aptly/public/update/, remove the default symlink that refers to the MCP release version deployed on a cluster. For example:

```
rm -v /srv/volumes/aptly/public/update/2019.2.0
```

> Note
>
> The symlink is created in the offline mirror for backward compatibility purposes.

2. Create the same links for the underlay repositories. Use the following script as example:

```
apt01:# export release='2019.2.0'; pushd '/srv/volumes/aptly/public/update/' \
      if [[ -d ${release} && ! -h ${release} ]]; then echo 'Its already dir, nothing todo' ;else \
       rm -v ${release}; \
       mkdir -p ${release}; \
       cd ${release}; \
       for repo in $(ls ../../${release}/) ; do ln -sv ../../${release}/$repo . ; done ; \
      fi
```

3. Remove only required symlink, for example, openstack-pike, and move the newly generated data to the new structure.

   The final example structure is as follows:

```
tree -L 4 /srv/volumes/aptly/public/update/
update/
└── 2019.2.0
    ├── ceph-luminous -> ../../2019.2.0/ceph-luminous
    ...
    ├── maas -> ../../2019.2.0/maas
    ├── openstack-pike
    │   └── xenial
    │       ├── dists
    │       ├── pool
    ...
    ├── saltstack-2017.7 -> ../../2019.2.0/saltstack-2017.7
    └── td-agent -> ../../2019.2.0/td-agent
```

To customize the Docker images mirrors

The Docker repositories are defined as an image list that includes a registry and name for each Docker image.

1. Customize the list depending on the needs of your MCP deployment:

   - Specify a different Docker registry for the existing image to be pulled from
   - Add a new Docker image

   Customization example in infra/mirror/init.yml:

> Note
>
> Starting from the MCP Build ID 2019.2.0, the default list of repositories per release is defined in default_local_mirrror_content:docker_client_registry_image.

```
docker:
  client:
    registry:
```

```
    target_registry: apt:5000
    image:
      - name: openldap:1.2.2
        registry: docker-prod-local.artifactory.mirantis.com/mirantis/external/osixia
      - name: jenkins:proposed
        registry: docker-prod-local.artifactory.mirantis.com/mirantis/cicd
        target_registry: apt:5000/mirantis/cicd
```

> Note
>
> The target_registry parameter specifies which registry the images will be pushed into.

2. Synchronize the Docker registry:

```
salt '<offline_node_name>' state.sls docker.client.registry
```

To customize the Git repositories mirrors

The Git repositories are defined as a repository list that includes a name and URL for each Git repository.

1. Customize the Git repositories list depending on the needs of your MCP deployment.

> Note
>
> Starting from the MCP Build ID 2019.2.0, the default list of repositories per release is defined in default_local_mirrror_content:git_server_repos.

Customization example in infra/mirror/init.yml:

```
git:
  server:
    directory: /srv/git/
    repos:
      - name: mk-pipelines
        url: https://github.com/Mirantis/mk-pipelines.git
      - name: pipeline-library
        url: https://github.com/Mirantis/pipeline-library.git
```

2. Synchronize the Git repositories:

```
salt '<offline_node_name>' state.sls git.server
```

To customize the MAAS mirrors

The MAAS mirrors are defined as image sections that include bootloaders and packages. Usually, they should not be customized since they mirror the upstream MAAS repositories directly.

> Note
>
> Starting from the MCP Build ID 2019.2.0, the default list of the MAAS image sections per release is defined in default_local_mirrror_content:maas_mirror_image_sections.

1. Inspect the default MAAS pillar structure in defaults/maas.yml on the system level of the Reclass model:

```
parameters:
  _param:
    maas_postgresql_server: ${_param:postgresql_server}
    default_local_mirrror_content:
      maas_mirror_image_sections:
        bootloaders:
          keyring: /usr/share/keyrings/ubuntu-cloudimage-keyring.gpg
          upstream: ${_param:linux_system_repo_update_url}/maas-ephemeral-v3/
          local_dir: /srv/http/${_param:mcp_version}/maas-ephemeral-v3/
          count: 1
          # i386 need for pxe
          filters: ['arch~(i386|amd64)', 'os~(grub*|pxelinux*)']
        xenial:
          keyring: /usr/share/keyrings/ubuntu-cloudimage-keyring.gpg
          upstream: ${_param:linux_system_repo_update_url}/maas-ephemeral-v3/
          local_dir: /srv/http/${_param:mcp_version}/maas-ephemeral-v3/
          count: 1
          filters: ['release~(xenial)', 'arch~(amd64)', 'subarch~(generic|hwe-16*|ga-16*)']
```

2. In infra/mirror/init.yml, add the customizations under the maas:mirror:image:sections pillar.

   Also, use this pillar to update the MAAS mirrors. For example:

```
maas:
 mirror:
   enabled: true
   image:
     sections: ${_param:default_local_mirrror_content:maas_mirror_image_sections}
```

3. Synchronize the MAAS repositories:

```
salt '<offline_node_name>' state.sls maas.mirror
```

To customize static binaries or images

Depending on the needs of your MCP deployment, you can customize the storage of the offline image static binaries, images, and other files.

> Note
>
> Starting from the MCP Build ID 2019.2.0, the static binaries are defined in default_local_mirrror_content:linux_system_file.

1. In infra/mirror/init.yml, add the required customizations under the linux:system:directory and linux:system:file pillars:

```
linux:
  system:
    directory:
      /srv/http/custom-binaries:
        user: www-data
        group: www-data
        mode: 755
        makedirs: true
    file:
      new_image_file:
        name: /srv/http/custom-binaries/custom-binary_1
        source: <some_source_binary_source>/custom-binary_1
        hash: <some_source_binary_source>/custom-binary_1.md5
```

2. Synchronize the customized files locally:

```
salt '<offline_node_name>' state.sls linux.system.file
```

To customize the Aptly repositories mirrors

You can either customize the already existing mirrors content or specify any custom mirror required by your MCP deployment.

- To customize existing mirror sources:

  The sources for existing mirrors can be configured to use different upstream.

  Each Aptly mirror specification includes parameters that define their source on the system level of the Reclass model as well distribution, components, key URL, and GPG keys. To customize a mirror content, redefine these parameters as required.

  An example of the apt.mirantis.com mirror specification:

```
_param:
  mcp_version: stable
  mirror_mirantis_openstack_xenial_extra_source: http://apt.mirantis.com/xenial/
  mirror_mirantis_openstack_xenial_extra_distribution: ${_param:mcp_version}
```

```
  mirror_mirantis_openstack_xenial_extra_components: extra
  mirror_mirantis_openstack_xenial_extra_key_url: "http://apt.mirantis.com/public.gpg"
  mirror_mirantis_openstack_xenial_extra_gpgkeys:
    - A76882D3
aptly:
  server:
    mirror:
      mirantis_openstack_xenial_extra:
        source: ${_param:mirror_mirantis_openstack_xenial_extra_source}
        distribution: ${_param:mirror_mirantis_openstack_xenial_extra_distribution}
        components: ${_param:mirror_mirantis_openstack_xenial_extra_components}
        architectures: amd64
        key_url: ${_param:mirror_mirantis_openstack_xenial_extra_key_url}
        gpgkeys: ${_param:mirror_mirantis_openstack_xenial_extra_gpgkeys}
        publisher:
          component: extra
          distributions:
            - ubuntu-xenial/${_param:mcp_version}
```

> Note
>
> You can find all mirrors and their parameters that can be overridden in the aptly/server/mirror section of the Reclass System Model.

- To add new mirrors, extend the aptly:server:mirror pillar of the model using the structure defined in the example above.

> Note
>
> The aptly:server:mirror:<REPO_NAME>:publisher parameter specifies how the custom repository will be published.

Example of a custom mirror specification:

```
aptly:
  server:
    mirror:
      my_custom_repo_main:
        source: http://my-custom-repo.com
        distribution: custom-dist
        components: main
        architectures: amd64
```

```
      key_url: http://my-custom-repo.com/public.gpg
      gpgkeys:
        - AAAA0000
      publisher:
        component: custom-component
        distributions:
          - custom-dist/stable
```

Create local mirrors manually

If you prefer to manually create local mirrors for your MCP deployment, refer to MCP Release Notes: Release artifacts for the list of repositories and artifacts required for an installation of MCP.

> Warning
>
> Perform the procedure below only in case you need a new downstream, self-hosted repository structure. To fetch and update the Mirantis mirrors, refer to Customize the prebuilt mirrors.

To manually create an Aptly-based local mirror:

1. Log in to the Salt Master node.
2. Identify where the container with the aptly service is running in the Docker Swarm cluster.

   ```
   salt -C 'I@docker:swarm:role:master' cmd.run 'docker service ps aptly|head -n3'
   ```

3. Log in to the node where the container with the aptly service is running.
4. Open the console in the container with the aptly service:

   ```
   docker exec -it <CONTAINER_ID> bash
   ```

5. In the console, import the public key that will be used to fetch the repository.

   > Note
   >
   > The public keys are typically available in the root directory of the repository and are called Release.key or Release.gpg. Also, you can download the public key from the key server keys.gnupg.net.

   ```
   gpg --no-default-keyring --keyring trustedkeys.gpg --keyserver keys.gnupg.net \
     --recv-keys <PUB_KEY_ID>
   ```

   For example, for the apt.mirantis.com repository:

   ```
   gpg --no-default-keyring --keyring trustedkeys.gpg --keyserver keys.gnupg.net \
     --recv-keys 24008509A76882D3
   ```

6. Create a local mirror for the specified repository:

> **Note**
>
> You can find the list of repositories in the Repository planning section of the MCP Reference Architecture guide.

```
aptly mirror create <LOCAL_MIRROR_NAME> <REMOTE_REPOSITORY> <DISTRIBUTION>
```

For example, for the http://apt.mirantis.com/xenial repository:

```
aptly mirror create local.apt.mirantis.xenial http://apt.mirantis.com/xenial stable
```

7. Update a local mirror:

```
aptly mirror update <LOCAL_MIRROR_NAME>
```

For example, for the local.apt.mirantis.xenial local mirror:

```
aptly mirror update local.apt.mirantis.xenial
```

8. Verify that the local mirror has been created:

```
aptly mirror show <LOCAL_MIRROR_NAME>
```

For example, for the local.apt.mirantis.xenial local mirror:

```
aptly mirror show local.apt.mirantis.xenial
```

Example of system response:

```
Name: local.apt.mirantis.xenial
Status: In Update (PID 9167)
Archive Root URL: http://apt.mirantis.com/xenial/
Distribution: stable
Components: extra, mitaka, newton, oc31, oc311, oc32, oc323, oc40, oc666, ocata,
          salt, salt-latest
Architectures: amd64
Download Sources: no
Download .udebs: no
Last update: never

Information from release file:
Architectures: amd64
```

```
Codename: stable
Components: extra mitaka newton oc31 oc311 oc32 oc323 oc40 oc666 ocata salt
            salt-latest
Date: Mon, 28 Aug 2017 14:12:39 UTC
Description:  Generated by aptly

Label: xenial stable
Origin: xenial stable
Suite: stable
```

9. In the Model Designer web UI, set the local_repositories parameter to True to enable using of local mirrors.
10. Add the local_repo_url parameter manually to classes/cluster/<cluster_name>/init.yml after model generation.

Seealso

- Repository planning
- GitLab Repository Mirroring
- The aptly mirror

Enable authentication for Aptly repositories

This section describes how to enable authentication for Aptly repositories. In this case, access to Aptly API is restricted to anonymous users and granted through <aptly_user>:<aptly_user_password>.

Prior to enabling authentication, configure it through the installed proxy service such as NGINX or HAProxy:

- If Aptly is running on the offline node or in the non-Swarm mode, configure authentication through NGINX.
- Starting from the MCP 2019.2.7 maintenance update, if Aptly is running on the cid nodes, configure authentication through HAProxy.

Configure Aptly authentication through HAProxy

> Note
>
> This feature is available starting from the MCP 2019.2.7 maintenance update. Before using the feature, follow the steps described in Apply maintenance updates.

This section describes how to configure authentication for Aptly repositories through HAProxy if Aptly is running on the cid nodes.

To configure Aptly authentication through HAProxy:

1. Log in to the Salt Master node.
2. Verify that HAProxy is enabled on the node that runs Aptly API:

```
salt -C 'I@docker:client:stack:aptly' pillar.get haproxy:proxy:listen:aptly-api
salt -C 'I@docker:client:stack:aptly' pillar.get haproxy:proxy:listen:aptly-public
```

3. If HAProxy is not enabled, include the following class to cluster/<cluster_name>/cicd/control/init.yml:

```
- system.haproxy.proxy.listen.cicd.aptly
```

4. In cluster/<cluster_name>/cicd/control/init.yml, add the following overrides:

```
haproxy:
  proxy:
    userlist:
      aptly_users:
        name: aptly_users
        groups:
          - name: <user_group_name>
          - name: <user_group_name2>
        users:
          - name: <user_name>
            password: <user_password>
            groups: [ <user_group_name> ]
          - name: <user_name2>
            password: <user_password2>
            groups: [ <user_group_name2> ]
    listen:
      aptly-api:
        acl:
          auth_reg: "http_auth(${haproxy:proxy:userlist:aptly_users:name})"
        http_request:
```

```
      - action: auth
        condition: 'if !auth_reg'
    aptly-public:
      acl:
        auth_reg: "http_auth(${haproxy:proxy:userlist:aptly_users:name})"
      http_request:
        - action: auth
          condition: 'if !auth_reg'
```

For password, define the required password types depending on your needs:

- Add an insecure password and HAProxy will shadow it to the configuration file. For example:

  ```
  users:
    - name: user1
      password: r00tme
  ```

- Add an insecure_password: True parameter and HAProxy will add the password as an insecure one to the configuration file. For example:

  ```
  users:
    - name: user2
      password: r00tme
      insecure_password: True
  ```

- Add a shadowed password and HAProxy will add it to the configuration file. For example:

  ```
  users:
    - name: user3
      password: '$6$wf0xxoXj$VqoqozsTPpeKZtw6c7gl2CYyEXfOccdif1ZmJwDT1AMKYp/.JUTZcDiZthai3xN9CzDQex9ZUOf3nFMbCm/Oe.'
      shadow_password: False
  ```

5. Apply the haproxy.proxy state on the Aptly API node:

   ```
   salt -C 'I@docker:client:stack:aptly' state.apply haproxy.proxy
   ```

Once done, access to Aptly API is granted through <aptly_user>:<aptly_user_password>. Now, proceed to Enable authentication for Aptly repositories.

Configure Aptly authentication through NGINX

This section describes how to configure authentication for Aptly repositories through NGINX if Aptly is running in the Swarm mode on the offline node or in the non-Swarm mode (as standalone processes).

To configure Aptly authentication through NGINX:

1. Log in to the Salt Master node.
2. Verify that NGINX is enabled on the node that runs Aptly API:
   - If Aptly runs on the offline node in the Swarm mode:

     ```
     salt -C 'I@docker:client:stack:aptly' pillar.get nginx:server:enabled
     ```

   - If Aptly runs in the non-Swarm mode:

     ```
     salt -C 'I@aptly:server' pillar.get nginx:server:enabled
     ```

3. Open one of the following files for editing:
   - If Aptly runs on the offline node in the Swarm mode, use cluster/<cluster_name>/infra/apt.yml.
   - If Aptly runs in the non-Swarm mode, open the file with Aptly configuration on the cluster level.
4. If NGINX is not enabled or not configured through Salt for the offline node, include the following class on the cluster level for the node that runs Aptly:

   ```
   - system.nginx.server.single
   ```

5. Configure the Aptly NGINX site using the example below. Correlate the port and host parameters.

   > Note
   >
   > If Aptly runs in the non-Swarm mode, skip the aptly_public section in the NGINX site configuration.

   ```
   nginx:
     server:
       user:
         aptly_user:
           enabled: true
           password: <aptly_user_password>
           htpasswd: .htpasswd_aptly
       site:
   ```

```
    aptly_api:
      enabled: true
      type: nginx_proxy
      name: aptly_api
      auth:
        engine: basic
        htpasswd: .htpasswd_aptly
      proxy:
        host: 127.0.0.1
        port: 18084
        protocol: http
        size: 1G
      host:
        name: <server_name>.<domain>.local
        port: 8080
    aptly_public:
      enabled: true
      type: nginx_proxy
      name: aptly_public
      auth:
        engine: basic
        htpasswd: .htpasswd_aptly
      proxy:
        host: 127.0.0.1
        port: 18085
        protocol: http
        size: 1G
      host:
        name: <server_name>.<domain>.local
        port: 80
```

6. Apply the nginx.server state on the Aptly API node:

   - If Aptly runs on the offline node in the Swarm mode:

     ```
     salt -C 'I@docker:client:stack:aptly' state.apply nginx.server
     ```

   - If Aptly runs in the non-Swarm mode:

     ```
     salt -C 'I@aptly:server' state.apply nginx.server
     ```

Once done, access to Aptly API is granted through <aptly_user>:<aptly_user_password>. Now, proceed to Enable authentication for Aptly repositories.

Enable authentication for Aptly repositories

After you have configured authentication through HAProxy or NGINX as described in Configure Aptly authentication through HAProxy or Configure Aptly authentication through NGINX, enable authentication for Aptly repositories.

To enable authentication for Aptly repositories:

1. Log in to the Salt Master node.
2. Select from the following options:

   - For MCP versions starting from 2019.2.7, specify the following parameters in the linux:system:repo pillar in cluster/<cluster_name>/infra/init.yml:

     ```
     linux:
       system:
         common_repo_secured:
           user: aptly_user
           password: <aptly_user_password>
           secured_repos: [ 'all' ]
     ```

     Specify all in the secured_repos parameter to enable authentication for all available repositories. To enable authentication for a list of repositories, specify them within secured_repos. For example:

     ```
     linux:
       system:
         ...
         common_repo_secured:
           user: aptly_user
           password: <aptly_user_password>
           secured_repos: [ 'test1', 'test2' ]
         repo:
           test1:
             ...
           test2:
             ...
           test3:
             secure: False
             ...
     ```

     In the example above, the test1 and test2 repositories will be secured. However, the repo parameter has precedence over common_repo_secured. Therefore, the test3 repository will not be secured.

   - For MCP versions prior to 2019.2.7, specify the entire pillar structure in the configuration files of the Aptly repositories. For details, see Use secured sources for mirrors, repositories, and files.

For example:

```
linux:
  system:
    ...
    common_repo_secured:
      arch: deb
      protocol: http
      user: aptly_user
      password: <aptly_user_password>
      distribution: stable
      component: main
    repo:
      test1:
        secure: true
        url: <mirror_address>/ubuntu
      test2:
        secure: true
        url: <mirror_address>/ubuntu
```

3. Apply the new Linux repository configuration on the nodes that are using Aptly:

```
salt -C '<target_compound>' saltutil.sync_all
salt -C '<target_compound>' state.apply linux.system.repo
```

4. If you use MAAS, also enable authentication for Aptly repositories for MAAS:

    1. Obtain the Aptly repositories for MAAS. For example:

```
salt-call pillar.get _param:maas_region_main_archive
local:
    http://10.10.0.14/update/proposed//ubuntu/

salt-call pillar.get _param:maas_region_boot_sources_maas_ephemeral_v3_bs_url
local:
    http://10.10.0.14:8078/2019.2.0/maas-ephemeral-v3/

salt-call pillar.get maas:cluster:saltstack_repo_trusty
local:
    deb [arch=amd64] http://10.10.0.14/2019.2.0//saltstack-2017.7//trusty/ trusty main

salt-call pillar.get maas:cluster:saltstack_repo_xenial
local:
    deb [arch=amd64] http://10.10.0.14/2019.2.0//saltstack-2017.7//xenial/ xenial main
```

    2. In the cluster/<name>/infra/maas.yml file, specify the following pillar using the obtained repositories and Aptly credentials. For example:

```
parameters:
  _param:
    maas_region_main_archive: http://aptly_user:<aptly_user_password>@10.10.0.14/update/proposed//ubuntu/
    maas_region_boot_sources_maas_ephemeral_v3_bs_url: http://aptly_user:<aptly_user_password>@10.10.0.14:8078/2019.2.0/maas-ephemeral-v3/
  maas:
    cluster:
      saltstack_repo_trusty: deb [arch=amd64] http://aptly_user:<aptly_user_password>@10.10.0.14/2019.2.0//saltstack-2017.7//trusty/ trusty main
      saltstack_repo_xenial: deb [arch=amd64] http://aptly_user:<aptly_user_password>@10.10.0.14/2019.2.0//saltstack-2017.7//xenial/ xenial main
```

3. Apply the MAAS configuration changes:

```
salt -C 'I@salt:master' saltutil.sync_all
salt -C 'I@salt:master' state.sls maas
```

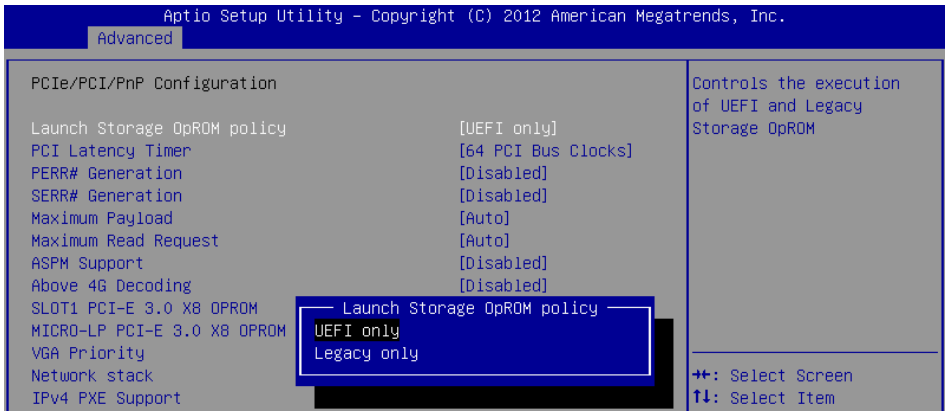
Configure PXE booting over UEFI

This section explains how to configure the Preboot Execution Environment (PXE) to boot a hardware server from the network over Unified Extensible Firmware Interface (UEFI), which details the interface between the platform firmware and the operating system at boot time.

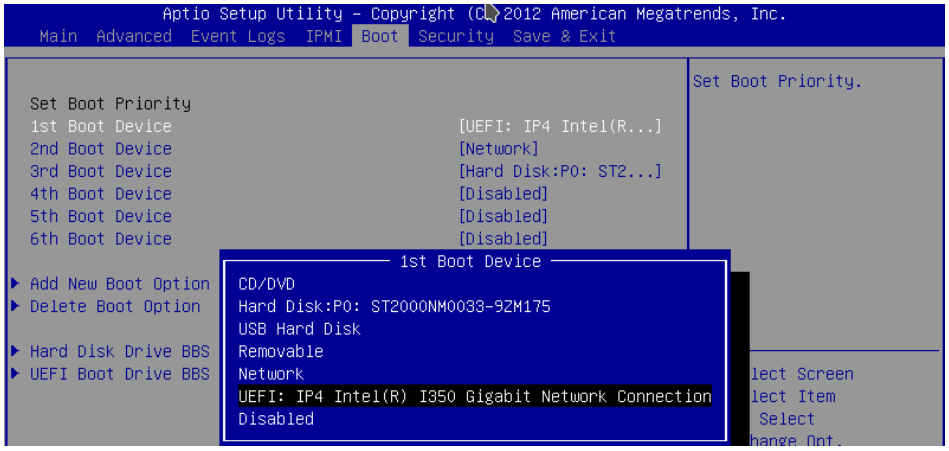
During the manual MCP infrastructure deployment, the PXE boot takes place when you add new physical servers that are not yet loaded with an operating system to your deployment. The Foundation node is installed with all the necessary software from a virtual machine image. All other hardware servers are installed remotely by MAAS using PXE boot. If required, you can configure a server to boot from network over UEFI.

To configure the UEFI network boot:

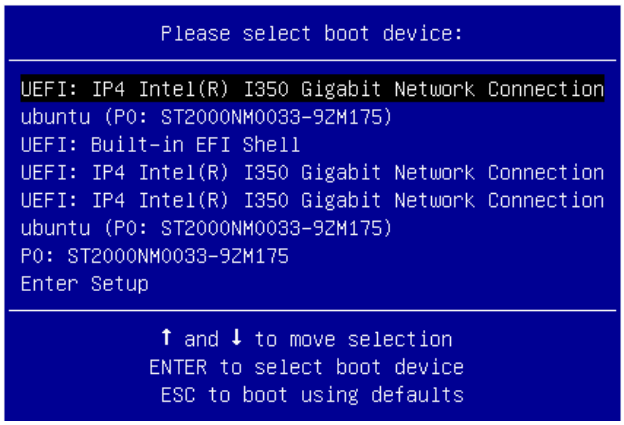
1. Configure the server in BIOS to use UEFI on boot time:
    1. On the Advanced tab, set the Launch Storage OpROM policy option to UEFI only:



    2. On the Boot tab, specify the UEFI network connection as the first boot device. For example:



2. During comissioning through MAAS, verify that the server uses UEFI. For example:



Note

If you perform standard PXE boot, the MAAS commissioning process will not recognize UEFI.

Seealso

- Provision physical nodes using MAAS

Manage kernel version

> Note
>
> This feature is available starting from the MCP 2019.2.7 maintenance update. Before using the feature, follow the steps described in Apply maintenance updates.

During a node provisioning, the default image kernel version is set by MAAS. If the node is not provisioned by MAAS, the kernel version is taken from the node image. However, you can manually configure the kernel version as required to control which kernel version to install.

To manage the kernel version:

1. Open your Git project repository with the Reclass model on the cluster level.
2. In configuration files for the required nodes, specify the following example pillar. For example, use infra/config/init.yml for the cfg node and openstack/proxy.yml for the prx nodes.

```
linux:
  system:
    kernel:
      type: generic
      extra: true
      headers: true
      version: 4.15.0-65
      hwe:
        type: hwe
        version: 16.04
        kernel_version: 4.15.0.65
```

3. Select from the following options:

   - If you perform the changes before running an MCP cluster deployment or before adding new nodes, proceed with the cluster deployment since the changes apply automatically.
   - If you perform the changes after the MCP cluster deployment, apply the following states from the Salt Master node:

     ```
     salt '*' saltutil.sync_all
     salt '*' state.sls linux.system.kernel
     ```

Add a custom disk layout per node in the MCP model

In MAAS, you can define the disk layout, either flat or Logical Volume Manager (LVM), as well as the partitioning schema per server. This section describes how to define these parameters in the MAAS section of the MCP model. The disk configuration applies during the deployment process. If you want to define the disk configuration after deployment, you can use salt-formula-linux that also has a capability to set up LVM partitioning. But the whole definition for each Volume Group must be either in the maas or linux section, since the linux state cannot override or extend an existing Volume Group created using MAAS but can create a new one.

Caution!

You can define the disk configuration in the model before the deployment starts. But be aware that enforcing of this configuration to MAAS using the salt state must be done after servers are commissioned and before they are deployed. Basically, maas.machines.storage works only if a server is in the READY state.

Caution!

The maas.machines.storage state overlaps with the linux.storage state. Therefore, we recommend using only one of them. If your deployment requires both, be aware that:

- The linux.storage configuration must match the maas.machines.storage configuration.
- MAAS may use an inexplicit mapping. For example, the following MAAS configuration will create an inexplicit mapping to sda1. And this specific sda1 device must be defined in the linux.storage configuration.

```
maas:
...
    vg0:
      type: lvm
      devices:
        - sda
...
```

You can use several options to design the disk layout in a deployment depending on specific use cases. This section includes three most common examples that can be combined to get your desired configuration.

To define a different disk layout with custom parameters

The default layouts used by MAAS are flat and Logical Volume Manager (LVM). Flat layout creates a root partition on the first disk of a server. LVM creates a Volume Group on this partition with one volume per root. By default, in both types of disk layout, the entire space on the first disk is used. If you want to change this behavior, redefine the disk layout parameters.

The following examples illustrate a modified configuration of the default values for partition size as well as LVM names for Volume Group and Logical Volume:

- Flat layout:

```
maas:
  region:
    machines:
      server1:
        disk_layout:
          type: flat
          root_size: 10G    #sda disk has more then 10G
          root_device: sda
          bootable_device: sda
```

- LVM layout:

```
maas:
  region:
    machines:
      server1:
        disk_layout:
          type: lvm
          root_size: 20G    #sda disk has more then 20G
          root_device: sda
          bootable_device: sda
          volume_group: vg0
          volume_name: root
          volume_size: 10G    #If not defined, whole root partition is used.
```

> Caution!
>
> When defining the disk layout in the model, do not modify the rest of the disk using the MAAS dashboard. Each run of maas.machines.storage deletes and recreates the disk configuration of a server. Currently, this state is not idempotent.

To define a custom partitioning schema

To define a more complex configuration for disks, use the disk section under the disk_layout parameter.

The following example illustrates how to create partitions on the sda disk and a Volume Group with Logical Volumes on the sdb disk. Be aware that sdb is also defined without any partitioning schema. Therefore, you can enforce no partition to be present on sdb. Also, due to the volume_group1 dependency on this device, it must be defined with some configuration in the model. In the example below, it has no partitioning schema.

Example of creating partitions and Logical Volumes:

```
maas:
  region:
    machines:
      server3:
        disk_layout:
          type: custom
          bootable_device: sda
          disk:
            sda:
              type: physical
              partition_schema:
                part1:
                  size: 10G
                  type: ext4
                  mount: '/'
                part2:
                  size: 2G
                part3:
                  size: 3G
            sdb:
              type: physical
            volume_group1:
              type: lvm
              devices:
                - sdb
              volume:
                tmp:
                  size: 5G
                  type: ext4
                  mount: '/tmp'
                log:
                  size: 7G
                  type: ext4
                  mount: '/var/log'
```

> **Caution!**
>
> The naming convention for partition in MAAS does not allow using custom names. Therefore, key names in YAML for partition are always part1, part2, ..., partN.

To define the software RAID

Using the disk section from the previous example, you can create the software RAID on servers. You can use this device for LVM or you can define a partitioning schema directly on this device.

The following example illustrates how to create raid 1 on sda and sdb with the partitioning schema. In this example, we use flat layout that creates a root partition on sda, but this partition is eventually deleted because sda is defined without any partitioning schema.

Example of creating the software RAID disks:

```
maas:
  region:
    machines:
      server3:
        disk_layout:
          type: custom
          bootable_device: sda
          disk:
            sda:
              type: physical
            sdb:
              type: physical
            md0:
              type: raid
              level: 1
              devices:
                - sda
                - sdb
              partition_schema:
                part1:
                  size: 10G
                  type: ext4
                  mount: '/'
                part2:
                  size: 5G
                part3:
                  size: 25G
```

To apply changes to MAAS

To enforce the disk configuration on servers in MAAS, run the maas state on a node where the MAAS model is included. Usually, this is the cfg01 node.

```
salt-call state.sls maas.machines.storage
```

Now, proceed with the MCP deployment depending on your use case as described in Provision physical nodes using MAAS.

Enable NTP authentication

This section describes how to enable Network Time Protocol (NTP) authentication in a deployment model and apply it to your environment.

To configure authentication for NTP:

1. Log in to the Salt Master node.
2. Create the classes/cluster/<cluster_name>/infra/ntp_auth.yml file with the following configuration as an example:

```
ntp:
  client:
    enabled: true
    auth:
      enabled: true
      secrets:
        1:
          secret_type: 'M'
          secret: '<Runrabbitrundigthath>'
          trustedkey: true
        2:
          secret_type: 'M'
          secret: '<Howiwishyouwereherew>'
          trustedkey: true
    stratum:
      primary:
        server: <ntp1.example.com>
        key_id: 1
      secondary:
        server: <ntp2.example.com>
        key_id: 2
```

   In the secrets and stratum sections, specify your own keys and strata servers accordingly.

   The key_id parameter for each strata server represents the id of a secret from the secrets section.

   The above configuration example enables authentication for two servers. For a specific use case, see README.rst at NTP Salt formula.

3. In the classes/cluster/<cluster_name>/infra/init.yml file, include the following class to distribute the settings across all nodes:

```
classes:
- cluster.<cluster_name>.infra.ntp_auth
```

4. Apply the ntp state on the Salt Master node:

```
salt '*' state.sls ntp
```

Seealso

- ntp-genkeys
- MCP Operations Guide: Configure multiple NTP servers

Enable a watchdog

This section describes how to enable a watchdog in your MCP cluster and applies to both existing and new MCP deployments.

> Note
>
> This feature is available as technical preview. Use such configuration for testing and evaluation purposes only.

The watchdog detects and recovers servers from serious malfunctions which can include hardware faults as well as program errors. While operating normally, the server resets the watchdog preventing it from generating a timeout signal. Otherwise, the watchdog initiates corrective actions to restore the normal operation of a system.

This functionality can be implemented through either a watchdog timer, which is a hardware device, or a software-only softdog driver.

To install and configure the watchdog:

1. Log in to the Salt Master node.
2. In the classes/cluster/<cluster_name>/init.yml or classes/cluster/<cluster_name>/init/init.yml file of your Reclass model, include the following class:

   ```
   classes:
   - system.watchdog.server
   ```

3. In the classes/cluster/<cluster_name>/infra/config.yml file of your Reclass model, add the watchdog server configuration. For example:

   ```
   watchdog:
     server:
       admin: root
       enabled: true
       interval: 1
       log_dir: /var/log/watchdog
       realtime: yes
       timeout: 60
       device: /dev/watchdog

       # Salt Stack will automatically detect the necessary kernel module
       # which needs to be loaded (ex. hpwdt, iTCO_wdt).
       # If the hardware model is not predefined in map.jinja, the default
       # watchdog driver is used: softdog
       # You may specify the kernel module parameters if needed:
       kernel:
   ```

```
    parameter:
      soft_panic: 1
      parameter: value
      parameter_only_without_value: none
```

4. Select from the following options:

   - If you are performing the initial deployment of your environment, the watchdog service will be installed during the Finalize stage of the Deploy - OpenStack pipeline. See Deploy an OpenStack environment for details.
   - If you are enabling the watchdog service in an existing environment, apply the changes to the deployment model to install the service:

     ```
     salt \* state.sls watchdog
     ```

5. Verify that the watchdog service is enabled in your deployment:

   ```
   salt \* cmd.run "service watchdog status"
   ```

Enable the Linux Audit system

The Linux Audit system enables the system administrator to track security-relevant events by creating an audit trail, which is a log for every action on the server. More specifically, based on the pre-configured rules, the audit system creates log entries that record system calls. By monitoring the events happening on your system, you can reveal violations of system security policies and adjust the set of audit rules to prevent further misuse or unauthorized activities within the system.

This section describes how to enable the audit system in your MCP deployment in compliance with CIS audit benchmarks and applies to both existing and new MCP deployments. Once you enable the audit system, the Fluentd service of StackLight LMA collects the audit logs and sends them to Elasticsearch for storage.

To enable the Linux Audit system:

1. Log in to the Salt Master node.
2. In the classes/cluster/<cluster_name>/infra/init.yml file of your Reclass model, include the following class:

   ```
   classes:
   ...
   - system.auditd.server.ciscat
   ```

3. If required, configure the CIS-CAT rules depending on the needs of your deployment.
4. Select from the following options:

   - If you are performing the initial deployment of your environment, the auditd service will be installed during the MCP cluster deployment.
   - If you are enabling the auditd service in an existing environment:

     1. Refresh pillars and synchronize Salt modules:

        ```
        salt '*' saltutil.refresh_pillar
        salt '*' saltutil.sync_modules
        ```

     2. Apply the salt state:

        ```
        salt '*' state.sls salt
        ```

     3. Apply the changes to the Reclass model by running the auditd state:

        ```
        salt \* state.sls auditd
        ```

5. Verify that the auditd service is enabled in your deployment:

   ```
   salt \* service.status auditd
   ```

6. Verify that the rules are being applied as expected using the auditctl tool:

```
salt \* cmd.run "auditctl -l"
```

Configure a company name for the SSH and interactive logon disclaimer

On an SSH and interactive logon to the MCP VCP nodes, a security disclaimer displays. The disclaimer states that an unauthorized access to or misuse of a computer system is prohibited under the Computer Misuse Act 1990.

> Note
>
> The act is designed to protect computer users against wilful attacks and theft of information. The act makes it an offence to access or even attempt to access a computer system without the appropriate authorization. Therefore, if a hacker makes even unsuccessful attempts to get into a system, they can be prosecuted using this law.

This section provides an instruction on how to configure the company name managing the computer from which the operator is required to have authorization before proceeding.

To configure the company name in the logon disclaimer:

1. Log in to the Salt Master node.
2. Configure the company name for the SSH logon by specifying the company name in the classes/cluster/<cluster_name>/openssh/server/single.yml file in your Reclass model:

   ```
   classes:
   - service.openssh.server
   - service.openssh.server.cis

   parameters:
     _param:
       ssh_banner_company_name: COMPANY_NAME
   ```

3. Configure the company name for the interactive logon by specifying the company name in the classes/cluster/<cluster_name>/linux/system/banner.yml file in your Reclass model:

   ```
   parameters:
     _param:
       banner_company_name: COMPANY_NAME_HERE
   ```

4. Apply the changes:

   ```
   salt -C 'I@salt:control' state.sls openssh.server.service linux.system
   ```

Now, the logon disclaimer should display the configured company name.

Configure secure SSH ciphers

For security and compliance purposes, the following SSH ciphers are disabled in MCP:

- arcfour
- arcfour128
- arcfour256

The default ciphers can be changed in the classes/cluster/<cluster_name>/openssh/server/single.yml file of your Reclass model to satisfy the cluster needs. Mirantis highly recommends adjusting the cipher suites according to compliance requirements as well as applying and testing the changes on staging environments first.

The structure with enabled ciphers from openssh/server/single.yml is converted to a comma-separated string in /etc/ssh/sshd_config. For a list of all supported ciphers, inspect man sshd_config.5 on any node of your MCP cluster.

> Warning
>
> The following instruction can potentially lead to security or compliance issues on your cluster. Therefore, proceed at your own risk.

To configure SSH ciphers:

1. Log in to the Salt Master node.
2. In the classes/cluster/<cluster_name>/openssh/server/single.yml file of your Reclass model, add the supported SSH ciphers under the ciphers parameter as follows:

```
parameters:
  openssh:
    server:
      ciphers:
        "<cipher_name>":
          enabled: True
```

   The following SSH ciphers are enabled by default in MCP:

```
parameters:
  openssh:
    server:
      ciphers:
        "3des-cbc":
          enabled: True
        "aes128-cbc":
          enabled: True
```

```
      "aes192-cbc":
        enabled: True
      "aes256-cbc":
        enabled: True
      "aes128-ctr":
        enabled: True
      "aes192-ctr":
        enabled: True
      "aes256-ctr":
        enabled: True
      "aes128-gcm@openssh.com":
        enabled: True
      "aes256-gcm@openssh.com":
        enabled: True
      "chacha20-poly1305@openssh.com":
        enabled: True
      "rijndael-cbc@lysator.liu.se":
        enabled: True
```

3. Apply the changes:

```
salt -C 'I@salt:control' state.sls openssh.server.service linux.system
```

Set custom Transmit Queue Length

The Transmit Queue Length (txqueuelen) is a TCP/IP stack network interface value that sets the number of packets allowed per kernel transmit queue of a network interface device.

By default, the txqueuelen value for TAP interfaces is set to 1000 in the MCP Build ID 2019.2.0 and to 10000 in the MCP 2019.2.3 maintenance update. You can also tune the txqueuelen value for TAP interfaces to optimize VM network performance under high load in certain scenarios.

To set a custom Transmit Queue Length value for TAP interfaces:

1. Log in to the Salt Master node.
2. Set the tap_custom_txqueuelen parameter for the OpenContrail or OVS compute nodes in one of the following files as required:
   - For the OpenContrail compute nodes, modify the cluster/<cluster_name>/opencontrail/networking/compute.yml file.
   - For the OVS compute nodes, modify the cluster/<cluster_name>/openstack/networking/compute.yml file.

   Example:

   ```
   linux:
     network:
       ...
       tap_custom_txqueuelen: 20000
   ```

3. Apply the change:

   ```
   salt '*' state.sls linux
   ```

4. Verify that the txqueuelen value has changed:
   1. Log in to the target node.
   2. Verify the output of the ifconfig <interface_name>. The txqueuelen value should equal the newly set value.

Configure a CPU model

The Compute service enables you to control the guest host CPU model that is exposed to KVM virtual machines. The use cases include:

- Maximization of performance of virtual machines by exposing new host CPU features to the guest
- Ensuring a consistent default CPU value across all machines by removing the reliance on the QEMU variable default values

You can define the CPU model for your deployment by setting the cpu_mode parameter on the Reclass cluster level. A universal default value for this parameter does not exist as the configuration depends a lot on a particular use case, workload needs, and compute hardware. Therefore, picking up the value for the cpu_mode parameter is worth careful consideration.

The supported values include:

host-model
: Clone the host CPU feature flags

host-passthrough
: Use the host CPU model

custom
: Use the CPU model defined with [libvirt]cpu_model

none
: Do not set a specific CPU model. For example, with the [libvirt] virt_type as KVM/QEMU, the default CPU model from QEMU will be used providing a basic set of CPU features that are compatible with most hosts

The cpu_mode parameter directly affects the possibility of performing the VM migration. To be able to migrate a VM from one compute host to another one, the destination host must support the CPU flags of the guest host. If a cloud environment is running on a heterogeneous hardware, the cpu_mode parameter should be set to custom. Though, such configuration will decrease the workload performance.

Starting from the MCP maintenance update 2019.2.10, you can use the custom CpuFlagsFilter Nova scheduler filter. The filter works only for live migrations and ensures that the CPU features of a live migration source host match the target host. Use the CpuFlagsFilter filter only if your deployment meets the following criteria:

- The CPU mode is set to host-passthrough or host-model.
- The OpenStack compute nodes have heterogeneous CPUs.
- The OpenStack compute nodes are not organized in aggregates with the same CPU in each aggregate.

Configure Galera parameters

This section provides an instruction on how to configure the parameters of the MySQL my.cnf configuration file by overriding them on the cluster level of the Reclass model.

> Note
>
> The capability to configure the tmp_table_size, max_heap_table_size, and table_open_cache parameters is available starting from the 2019.2.5 maintenance update. To enable the feature, follow the steps described in Apply maintenance updates.

To configure parameters of the MySQL configuration file:

1. Open your project Git repository with the Reclass model on the cluster level.
2. In cluster/<cluster_name>/openstack/database/init.yml, define the following parameters as required. The available values for <role> are master or slave.

   > Warning
   >
   > The following list may be not exhaustive.

Galera configurable parameters

Section	Galera parameter	Pillar parameter key name
[mysql]	ssl-ca	galera:<role>:ssl:ca_file [1]
	ssl-cert	galera:<role>:ssl:cert_file [1]
	ssl-key	galera:<role>:ssl:key_file [1]
[mysqld]	bind-address	galera:<role>:bind:address
	max_connections	galera:<role>:max_connections
	log_error	galera:<role>:error_log_path [2]
	table_open_cache	galera:<role>:table_open_cache
	tmp_table_size	galera:<role>:tmp_table_size
	max_heap_table_size	galera:<role>:max_heap_table_size
	innodb_buffer_pool_size	galera:<role>:innodb_buffer_pool_size
	innodb_read_io_threads	galera:<role>:innodb_read_io_threads
	innodb_write_io_threads	galera:<role>:innodb_write_io_threads
	wsrep_provider	galera:<role>:wsrep_provider

	wsrep_slave_threads	galera:<role>:wsrep_slave_threads
	wsrep_sst_auth	(galera:<role>:sst:user):(galera:<role>:sst:password) [3]
	wsrep_node_address	galera:<role>:bind:address
[xtrabackup]	parallel	galera:<role>:xtrabackup_parallel

For example:

```
parameters:
  galera:
    slave:
      bind:
        address: 127.0.0.1
```

1(1, 2, 3) Requires galera:<role>:ssl:enabled == true.

2 Requires galera:<role>:error_log_enabled == true.

3 The parameter is concatenated from two pillar values.

Configure HAProxy parameters

> Note
>
> This feature is available starting from the MCP 2019.2.5 maintenance update. Before enabling the feature, follow the steps described in Apply maintenance updates.

This section provides an instruction on how to configure the parameters of the HAProxy configuration file by overriding them on the cluster level of the Reclass model. For the list of all available global parameters, see the official HAProxy documentation.

To configure global parameters of the HAProxy configuration file:

1. Open your project Git repository with the Reclass model on the cluster level.
2. In cluster/<cluster_name>/openstack/init.yml, define the parameters in the global section using the haproxy:proxy:global pillar and the following pattern:

   ```
   parameters:
     haproxy:
       proxy:
         global:
           <key>: <value>
   ```

   In the configuration above, <key> is any required parameter and <value> is its value that can be a number, string, or boolean. Replace all dot . signs in the parameter key names with undescores _ in the pillar definiton. For example, the tune.ssl.cachesize parameter must be tune_ssl_cachesize in the pillar configuration.

   Example configuration:

   ```
   parameters:
     haproxy:
       proxy:
         global:
           tune_ssl_cachesize: 4
   ```

   Some keys in the global configuration have dedicated configurable pillar keys in the pillar structure and are kept for the backward compatibility. If both parameters are defined, the one from haproxy:proxy:global pillar has higher priority and overwrites any other values. For example, the nbproc value can be defined with both haproxy:proxy:nbproc and haproxy:proxy:global:nbproc parameters.

   The timeout values are assumed to be defined in ms if no other unit is specifically defined. For details, see HAProxy documentation.

Use secured sources for mirrors, repositories, and files

> Note
>
> This feature is available starting from the MCP 2019.2.5 maintenance update. Before enabling the feature, follow the steps described in Apply maintenance updates.

This section provides an instruction on how to configure your cluster model if you plan to download Debian packages, Git mirrors, VM images, or any files required for cluster deployment from a secured HTTP/HTTPS server that can be accessible through login credentials. Such functionality may be required for offline installations when internal mirrors are secured.

If the source HTTP/HTTPS server is secured, the source or url parameters should still include the user ID and password, for example, http://user:password@example.mirantis.com/xenial. Previously, MCP did not enable you to use encrypted pillar inside another variable. Starting from MCP 2019.2.5, you can use a secured HTTP/HTTPS server even if the secrets encryption feature in Reclass is enabled as described in Enable all secrets encryption.

> Warning
>
> We recommend that you apply the procedure before the cluster deployment to avoid the cluster breakdown and to automatically apply the changes.

To define secured APT repositories on the cluster nodes:

> Note
>
> The exemplary default structure of the APT repositories definition in the cluster model:
>
> ```
> linux:
>   system:
>     repo:
>       repo-example:
>         source: 'deb http://example.com/ubuntu xenial main'
> ```

- Define a secured APT repository, for example:

  ```
  linux:
    system:
      repo:
  ```

```
    repo-example:
      secure: true
      url: example.com/ubuntu
      arch: deb
      protocol: http
      user: foo
      password: bar
      distribution: xenial
      component: main
```

- Define the APT repositories in case of several APT repositories under the same HTTP/HTTPS secured server with the same credentials. The exemplary structure:

```
linux:
  system:
    common_repo_secured:
      arch: deb
      protocol: http
      user: foo
      password: bar
      distribution: xenial
      component: main
    repo:
      test1:
        secure: true
        url: example1.com/ubuntu
      test2:
        secure: true
        url: example2.com/ubuntu
```

Warning

We do not recommend that you apply the changes after the MCP cluster deployment. Though, on your own responsibility, you can apply the changes as follows:

1. Log in to the Salt Master node.
2. Run:

```
salt '*' saltutil.refresh_pillar
salt '*' state.apply linux.system.repo
```

To define a secured file source on cluster nodes:

Note

The exemplary default structure of the file sources definition in the cluster model:

```
linux:
  system:
    file:
      /tmp/sample.txt:
        source: http://techslides.com/demos/samples/sample.txt
        source_hash: 5452459724e85b4e12277d5f8aab8fc9
      sample2.txt:
        name: /tmp/sample2.txt
        source: http://techslides.com/demos/samples/sample.txt
```

Define a secured file source, for example:

```
linux:
  system:
    file:
      sample3.tar.gz:
        name: /tmp/sample3.tar.gz
        secured_source:
          protocol: http #optional
          user: username
          password: password
          url: wordpress.org/latest.tar.gz
        secured_hash: #optional
          url: wordpress.org/latest.tar.gz.md5
```

Warning

We do not recommend that you apply the changes after the MCP cluster deployment. Though, on your own responsibility, you can apply the changes as follows:

1. Log in to the Salt Master node.
2. Run:

```
salt '*' saltutil.refresh_pillar
salt '*' state.apply linux.system.repo
```

To define a secured image source on cluster nodes:

Note

The exemplary default structure of the image sources definition in cluster model:

```
salt:
  control:
    cluster:
      cluster-name:
        node:
          node1:
            provider: node01.domain.com
            size: medium
            image: http://ubuntu.com/download/ubuntu.qcow2
```

- Define a secured image sources. The exemplary structure:

```
salt:
  control:
    cluster:
      cluster-name:
        node:
          node1:
            provider: node01.domain.com
            size: medium
            image_source:
              secured: true
              protocol: http
              user: foo
              password: bar
              url_prefix: ubuntu.com/download
              url_path: ubuntu.qcow2
```

- Define the image sources in case of several images from the same HTTP/HTTPS secured server with the same credentials. The exemplary structure:

```
salt:
  control:
    common_image_source:
      protocol: http
      user: foo
      password: bar
      url_prefix: ubuntu.com/download
    cluster:
      cluster-name:
        node:
```

```
      node1:
        provider: node01.domain.com
        size: medium
        image_source:
          secured: true
          url_path: ubuntu-xenial.qcow2
      node2:
        provider: node02.domain.com
        size: medium
        image_source:
          secured: true
          url_path: ubuntu-bionic.qcow2
```

Warning

Do not apply the changes after the MCP cluster deployment to avoid the cluster breakdown.

To define a secured Git repositories source for CI/CD nodes:

1. Update the configuration of the Gerrit project source:

   Note

   The exemplary default structure of the Gerrit project sources in cluster model:

   ```
   gerrit:
     client:
       enabled: True
       project:
         test_salt_project:
           enabled: true
           upstream: https://github.com/example/library
   ```

   Define a secured Gerrit project source, fore example:

   ```
   gerrit:
     client:
       enabled: True
       project:
         test_salt_project:
           enabled: true
   ```

```
      upstream_secured: true
      protocol: https
      username: foo
      password: bar
      address: github.com/example/library
```

2. If the target Gerrit repositories are any of mcp-ci/pipeline-library or mk/mk-pipelines, or they are required for the pipelines execution in Jenkins, add the Jenkins login credentials:

   1. Navigate to the root folder of your cluster model. On the Salt Master node, this is the /srv/salt/reclass directory.
   2. Add the following parameters into ./classes/cluster/<cluster_name>/infra/config/jenkins.yml for Jenkins on the Salt Master node and ./classes/cluster/<cluster_name>/cicd/control/leader.yml for Jenkins on the CI/CD nodes:

      ```
      parameters:
        _param:
          source_git_username: <ENCRYPTED_USERNAME>
          source_git_password: <ENCRYPTED_PASSWORD>
      ```

   3. Include the system.jenkins.client.credential.source_git class into same files for both Jenkins instances:

      ```
      classes:
        ...
        - system.jenkins.client.credential.source_git
        ...
      ```

Warning

We do not recommend that you apply the changes after the MCP cluster deployment. Though, on your own responsibility, you can apply the changes as follows:

1. Log in to the Salt Master node.
2. Refresh the pillars:

   ```
   salt -C 'I@gerrit:client' saltutil.refresh_pillar
   salt -C 'I@jenkins:client' saltutil.refresh_pillar
   ```

3. Apply the gerrit and jenkins states:

   ```
   salt -C 'I@gerrit:client' state.apply gerrit.client
   salt -C 'I@jenkins:client' state.apply jenkins.client
   ```


Advanced configuration

MCP exposes a number of advanced configuration options.

Enable NFV features

Network Functions Virtualization (NFV) is a powerful technology that leverages virtualization of particular network functions which allows a better flexibility in network administration and enables you to use network hardware more efficiently.

MCP supports the following NFV features:

- Data Plane Development Kit or DPDK is a set of libraries and drivers to perform fast packet processing in the user space that OVS/vRouter can use to move network packets processing from a kernel to a user space. OVS/vRouter with DPDK acceleration on compute nodes reduces the processing time of network packets transferred between a host's network interface and a guest bypassing the host's kernel. Moreover, DPDK leverages benefits of usage of other technologies such as Huge Pages, CPU pinning, and NUMA topology scheduling.
- SR-IOV is an extension to the PCI Express (PCIe) specification that enables a network adapter to separate access to its resources among various PCIe hardware functions: Physical Function (PF) and Virtual Functions (VFs). As a result, you can achieve near bare-metal performance, since network devices can forward traffic directly to a VF bypassing the host.
- Multiqueue for DPDK-based vrouters enables the scaling of packet sending/receiving processing to the number of available vCPUs of a guest by using multiple queues.

The following table shows compatibility matrix for MCP of NFV features for different deployments.

NFV for MCP compatibility matrix

Type	Host OS	Kernel	HugePages	DPDK	SR-IOV	NUMA	CPU pinning	Multiqueue
OVS	Xenial	4.8	Yes	No	Yes	Yes	Yes	Yes
Kernel vRouter	Xenial	4.8	Yes	No	Yes	Yes	Yes	Yes
DPDK vRouter	Trusty	4.4	Yes	Yes	No	Yes	Yes	No (version 3.2)
DPDK OVS	Xenial	4.8	Yes	Yes	No	Yes	Yes	Yes

Enable DPDK

Enabling Data Plane Development Kit (DPDK) strongly requires Huge Pages configuration before an application start. To perform fast packet processing, a DPDK-based network application may require to use isolated CPUs and resources spread on the multi-NUMA topology. These configurations are common for both OVS and OpenContrail.

Warning

Before you proceed with the DPDK enabling, verify that you have performed the following procedures:

1. Enable Huge Pages
2. Configure NUMA and CPU pinning architecture

Limitations

The usage of the OVS DPDK or OpenContrail DPDK features in MCP includes the following limitations.

OVS DPDK limitations:

- OVS DPDK can be used only for tenant traffic
- Compute with DPDK cannot be used for non-DPDK workload
- When deployed with StackLight LMA, the libvirt_domain_interface_stats_* metrics are not available

OpenContrail DPDK limitations:

- When deployed with StackLight LMA, the libvirt_domain_interface_stats_* metrics are not available

Enable OVS DPDK

This section explains how to prepare for and enable OVS DPDK in MCP.

> Warning
>
> Before you proceed with the DPDK enabling, verify that you have performed the following procedures:
>
> 1. Enable Huge Pages
> 2. Configure NUMA and CPU pinning architecture

Prepare your environment for OVS DPDK

This section describes the initialization steps needed to prepare your deployment for the enablement of the OVS DPDK feature.

> Warning
>
> Before you proceed with the DPDK enabling, verify that you have performed the following procedures:
>
> 1. Enable Huge Pages
> 2. Configure NUMA and CPU pinning architecture

To prepare your environment for OVS DPDK:

1. Specify the DPDK driver.

   DPDK Environment Abstract Layer(EAL) uses either Userspace I/O (UIO) module or VFIO to provide userspace access on low-level buffers. MCP supports both configurations.

   > Note
   >
   > To use VFIO approach, verify that both kernel and BIOS are configured to use I/O virtualization. This requirement is similar to SR-IOV Intel IOMMU and VT-d being enabled.

   To use one of Userspace I/O drivers, define the compute_dpdk_driver parameter. For example:

   ```
   compute_dpdk_driver: uio # vfio
   ```

2. In respect to the parameter specified above, configure the DPDK physical driver. There is one-to-one dependency of what driver must be selected for physical DPDK NIC based on the configured I/O mechanism. For example:

   ```
   dpdk0:
     ...
     driver: igb_uio # vfio-pci
   ```

3. To enable the physical DPDK device to run several RX/TX queues for better packet processing, configure the following parameter specifying the number of queues to be used. For example:

```
dpdk0:
  ...
  n_rxq: 2 # number of RX/TX queues
```

Note

The increasing number of queues results in PMD threads consuming more cycles to serve physical device. We strongly recommend that you configure the number of physical queues not greater that CPUs configured for the DPDK-based application.

Enable OVS DPDK support

Before you proceed with the procedure, verify that you have performed the preparatory steps described in Prepare your environment for OVS DPDK.

While enabling DPDK for Neutron Open vSwitch, you can configure a number of settings specific to your environment that assist in optimizing your network performance, such as manual pinning and others.

To enable OVS DPDK:

1. Verify your NUMA nodes on the host operating system to see what vCPUs are available. For example:

```
lscpu | grep NUMA
NUMA node(s):          1
NUMA node0 CPU(s):     0-11
```

2. Include the class to cluster.<name>.openstack.compute and configure the dpdk0 interface. Select from the following options:

   - Single interface NIC dedicated for DPDK:

```
...
- system.neutron.compute.nfv.dpdk
...
parameters:
  linux:
    network:
     interfaces:
        ...
        # other interface setup
        ...
       dpdk0:
         name: ${_param:dpdk0_name}
         pci: ${_param:dpdk0_pci}
         driver: igb_uio
         enabled: true
         type: dpdk_ovs_port
         n_rxq: 2
        br-prv:
         enabled: true
         type: dpdk_ovs_bridge
```

   - OVS DPDK bond with 2 dedicated NICs

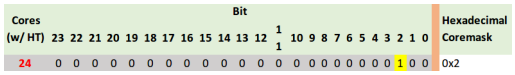
```
...
- system.neutron.compute.nfv.dpdk
...
parameters:
```

```
linux:
  network:
   interfaces:
      ...
      # other interface setup
      ...
     dpdk0:
       name: ${_param:dpdk0_name}
       pci: ${_param:dpdk0_pci}
       driver: igb_uio
       bond: dpdkbond1
       enabled: true
       type: dpdk_ovs_port
       n_rxq: 2
     dpdk1:
       name: ${_param:dpdk1_name}
       pci: ${_param:dpdk1_pci}
       driver: igb_uio
       bond: dpdkbond1
       enabled: true
       type: dpdk_ovs_port
       n_rxq: 2
     dpdkbond1:
       enabled: true
       bridge: br-prv
       type: dpdk_ovs_bond
       mode: active-backup
     br-prv:
       enabled: true
       type: dpdk_ovs_bridge
```

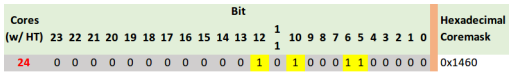
3. Calculate the hexadecimal coremask.

   As well as for OpenContrail, OVS-DPDK needs logical cores parameter to be set. Open vSwitch requires two parameters: lcore mask to DPDK processes and PMD mask to spawn threads for poll-mode packet processing drivers. Both parameters must be calculated respectively to isolated CPUs and are representing hexadecimal numbers. For example, if we need to take single CPU number 2 for Open vSwitch and 4 CPUs with numbers 5, 6, 10 and 12 for forwarding PMD threads, we need to populate parameters below with the following numbers:

   - The lcores mask example:



   - PMD CPU mask example:



4. Define the parameters in the cluster.<name>.openstack.init if they are the same for all compute nodes. Otherwise, specify them in cluster.<name>.infra.config:

   - dpdk0_name
     Name of port being added to OVS bridge
   - dpdk0_pci
     PCI ID of physical device being added as a DPDK physical interface
   - compute_dpdk_driver
     Kernel module to provide userspace I/O support
   - compute_ovs_pmd_cpu_mask
     Hexadecimal mask of CPUs to run DPDK Poll-mode drivers
   - compute_ovs_dpdk_socket_mem
     Set of amount HugePages in Megabytes to be used by OVS-DPDK daemon taken for each NUMA node. Set size is equal to NUMA nodes count, elements are divided by comma
   - compute_ovs_dpdk_lcore_mask
     Hexadecimal mask of DPDK lcore parameter used to run DPDK processes
   - compute_ovs_memory_channels
     Number of memory channels to be used.

   Example

   ```
   compute_dpdk_driver: uio
   compute_ovs_pmd_cpu_mask: "0x6"
   compute_ovs_dpdk_socket_mem: "1024"
   compute_ovs_dpdk_lcore_mask: "0x400"
   compute_ovs_memory_channels: "2"
   ```

5. Optionally, map the port RX queues to specific CPU cores.

   Configuring port queue pinning manually may help to achieve maximum network performance through matching the ports that run specific workloads with specific CPU cores. Each port can process a certain number of Transmit and Receive (RX/TX) operations, therefore it is up to the Network Administrator to decide on the most efficient port mapping. Keeping a constant polling rate on some performance critical ports is essential in achieving best possible performance.

   Example

   ```
   dpdk0:
     ...
     pmd_rxq_affinity: "0:1,1:2"
   ```

   The example above illustrates pinning of the queue 0 to core 1 and pinning of the queue 1 to core 2, where cores are taken in accordance with pmd_cpu_mask.

6. Specify the MAC address and in some cases PCI for every node.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: xenial
    dpdk0_name: enp5s0f1
    dpdk1_name: enp5s0f2
    dpdk0_pci: '"0000:05:00.1"'
    dpdk1_pci: '"0000:05:00.2"'
```

7. If the VXLAN neutron tenant type is selected, set the local IP address on br-prv for VXLAN tunnel termination:

```
...
- system.neutron.compute.nfv.dpdk
...
parameters:
  linux:
    network:
     interfaces:
        ...
        # other interface setup
        ...
        br-prv:
          enabled: true
          type: dpdk_ovs_bridge
          address: ${_param:tenant_address}
          netmask: 255.255.255.0
```

8. Select from the following options:

   - If you are performing the initial deployment of your environment, proceed with further environment configurations.
   - If you are making changes to an existing environment, re-run salt configuration on the Salt Master node:

     ```
     salt "cmp*" state.sls linux.network,neutron
     ```

> **Note**
>
> For the changes to take effect, servers require a reboot.

9. If you need to set different values for each compute node, define them in cluster.<NAME>.infra.config.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: xenial
    dpdk0_name: enp5s0f1
    dpdk1_name: enp5s0f2
    dpdk0_pci: '"0000:05:00.1"'
    dpdk1_pci: '"0000:05:00.2"'
    compute_dpdk_driver: uio
    compute_ovs_pmd_cpu_mask: "0x6"
    compute_ovs_dpdk_socket_mem: "1024"
    compute_ovs_dpdk_lcore_mask: "0x400"
    compute_ovs_memory_channels: "2"
```

Enable OpenContrail DPDK

OpenContrail 4.x uses DPDK libraries version 17.02.

> **Caution!**
>
> Starting from OpenContrail version 4.x, the Mellanox NICs are not supported in the DPDK-based OpenContrail deployments.

A workload running on a DPDK vRouter does not provide better pps if an application is not DPDK-aware. The performance result is the same as for kernel vRouter.

To enable the OpenContrail DPDK pinning:

1. Verify that you have performed the following procedures:
    1. Enable Huge Pages
    2. Configure NUMA and CPU pinning architecture
2. Verify your NUMA nodes on the host operating system to identify the available vCPUs. For example:

```
lscpu | grep NUMA
NUMA node(s):          1
NUMA node0 CPU(s):     0-11
```

3. Include the following class to cluster.<name>.openstack.compute and configure the vhost0 interface:

```
classes:
...
- system.opencontrail.compute.dpdk
...
parameters:
  linux:
    network:
     interfaces:
        ...
        # other interface setup
        ...
        vhost0:
          enabled: true
          type: eth
          address: ${_param:single_address}
          netmask: 255.255.255.0
          name_servers:
```

```
      - 8.8.8.8
      - 1.1.1.1
```

4. Set the parameters in cluster.<name>.openstack.init on all compute nodes:

   - compute_vrouter_taskset

     Hexadecimal mask of CPUs used for DPDK-vRouter processes

   - compute_vrouter_socket_mem

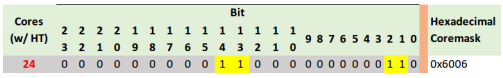
     Set of amount HugePages in Megabytes to be used by vRouter-DPDK taken for each NUMA node. Set size is equal to NUMA nodes count, elements are divided by comma

   - compute_vrouter_dpdk_pci

     PCI of a DPDK NIC. In case of BOND there must be 0000:00:00.0

5. Calculate the hexadecimal mask. To enhance vRouter with DPDK technology, several isolated host CPUs should be used for such DPDK processes as statistics, queue management, memory management, and poll-mode drivers. To perform this, you need to configure the hexadecimal mask of CPUs to be consumed by vRouter-DPDK.

   The way to calculate the hexadecimal mask is simple as a set of CPUs corresponds to the bits sequence size of CPUs number. 0 on i-th place in this sequence means that CPU number i will not be taken for usage, and 1 has the opposite meaning. Simple translation of binary-to-hexadecimal based on bit sequence of size 24 is illustrated below (vRouter is bound to 4 cores: 14,13,2,1.)



6. Pass the hexadecimal mask to vRouter-DPDK command line using the following parameters. For example:

```
compute_vrouter_taskset: "-c 1,2" # or hexadecimal 0x6
compute_vrouter_socket_mem: '1024' # or '1024,1024' for 2 NUMA nodes
```

7. Specify the MAC address and in some cases PCI for every node.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: trusty
    compute_vrouter_dpdk_mac_address: 00:1b:21:87:21:99
```

```
  compute_vrouter_dpdk_pci: "'0000:05:00.1'"
  primary_first_nic: enp5s0f1 # NIC for vRouter bind
```

8. Select from the following options:

   - If you are performing the initial deployment of your environment, proceed with the further environment configurations.
   - If you are making changes to an existing environment, re-run salt configuration on the Salt Master node:

     ```
     salt "cmp*" state.sls opencontrail
     ```

     > Note
     >
     > For the changes to take effect, servers require a reboot.

9. If you need to set different values for each compute node, define them in cluster.<NAME>.infra.config.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: trusty
    compute_vrouter_dpdk_mac_address: 00:1b:21:87:21:99
    compute_vrouter_dpdk_pci: "'0000:05:00.1'"
    compute_vrouter_taskset: "-c 1,2"
    compute_vrouter_socket_mem: "1024"
    primary_first_nic: enp5s0f1 # NIC for vRouter bind
```

Enable SR-IOV

Single Root I/O Virtualization (SR-IOV) is an I/O virtualization technology that allows a single PCIe device to appear as multiple PCIe devices. This helps to optimize the device performance and capacity, as well as hardware costs.

Prerequisites

If you want to use the SR-IOV feature with OpenContrail or Neutron OVS, your environment must meet the following prerequisites:

- Intel Virtualization Technology for Directed I/O (VT-d) and Active State Power Management (ASPM) must be supported and enabled in BIOS
- Physical NIC with Virtual Function (VF) driver installed Enable ASPM (Active State Power Management) of PCI Devices in BIOS. If required, upgrade BIOS to see ASPM option.

Enable generic SR-IOV configuration

The following procedure is common for both OpenVSwitch and OpenContrail. SR-IOV can be enabled before or after installation on the MCP cluster model level.

To enable SR-IOV:

1. Include the class to cluster.<NAME>.openstack.compute:

```
- system.neutron.compute.nfv.sriov
```

> Note
>
> By default, the metadata model contains configuration for 1 NIC dedicated for SR-IOV.

2. Set the following parameters:

   - sriov_nic01_device_name
     Name of the interface, where the Virtual Functions are enabled
   - sriov_nic01_numvfs
     Number of Virtual Functions
   - sriov_nic01_physical_network
     Default is physnet1, label for the physical network the interface belongs to
   - sriov_unsafe_interrupts
     Default is False, needs to be set to True if your hardware platform does not support interrupt remapping

   For most deployments with 1 NIC for SR-IOV, we recommend the following configuration in cluster.<name>.openstack.init on all compute nodes:

```
sriov_nic01_device_name: eth1
sriov_nic01_numvfs: 7
sriov_nic01_physical_network: physnet3
```

3. If you need to set different values for each compute node, specify them in cluster.<name>.infra.config.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
```

```
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: xenial
    sriov_nic01_device_name: eth1
    sriov_nic01_numvfs: 7
    sriov_nic01_physical_network: physnet3
```

4. If your hardware does not support interrupt remapping, set the following parameter:

```
sriov_unsafe_interrupts: True
```

5. If you need more than one NIC on a compute node, set the following parameters in cluster.<NAME>.openstack.compute.

   Example

```
...
  nova:
    compute:
      sriov:
        sriov_nic01:
          devname: eth1
          physical_network: physnet3
        sriov_nic02:
          devname: eth2
          physical_network: physnet4
        sriov_nic03:
          devname: eth3
          physical_network: physnet5
        sriov_nic04:
          devname: eth4
          physical_network: physnet6
  linux:
    system:
      kernel:
        sriov: True
        unsafe_interrupts: False
      sysfs:
        sriov_numvfs:
          class/net/eth1/device/sriov_numvfs: 7
          class/net/eth2/device/sriov_numvfs: 15
          class/net/eth3/device/sriov_numvfs: 15
          class/net/eth4/device/sriov_numvfs: 7
```

6. Enable the kernel boot parameter for the OpenStack compute node:

```
linux:
  system:
```

```
kernel:
  boot_options:
    - intel_iommu=on
```

7. Select from the following options:

   - If you are performing the initial deployment of your environment, proceed with the further environment configurations.
   - If you are making changes to an existing environment:

     1. Run the virt-host-validate command from an OpenStack compute node to ensure that it is ready for SR-IOV.
     2. Re-run the salt configuration on the Salt Master node:

        ```
        salt "cmp*" state.sls linux,nova
        ```

     3. Reboot the OpenStack compute nodes one by one as described in MCP Operations Guide: Reboot a compute node.

Configure SR-IOV with OpenContrail

Since OpenContrail does not use Neutron SR-IOV agents, it does not require any special changes on the Neutron side. Port configuration can be done through the Neutron APIs or the OpenContrail UI.

Configure SR-IOV with OpenVSwitch

Neutron OVS requires enabling of the sriovnicswitch mechanism driver on the Neutron server side and the neutron-sriov-nic-agent running on each compute node with this feature enabled.

To configure SR-IOV with OpenVSwitch:

1. Include the class to cluster.<NAME>.openstack.compute:

```
- system.neutron.compute.nfv.sriov
```

> Note
>
> By default, the metadata model contains configuration for 1 NIC dedicated for SR-IOV.

2. Include the class to cluster.<NAME>.openstack.control:

```
- system.neutron.control.openvswitch.sriov
```

3. If you need more than 1 NIC, extend the previous configuration by extra Neutron cluster.<NAME>.openstack.compute.

   Example

```
...
  neutron:
    compute:
      backend:
        sriov:
          sriov_nic01:
            devname: eth1
            physical_network: physnet3
          sriov_nic02:
            devname: eth2
            physical_network: physnet4
          sriov_nic03:
            devname: eth3
            physical_network: physnet5
          sriov_nic04:
            devname: eth4
            physical_network: physnet6
```

Create instances with SR-IOV ports

To enable the SR-IOV support, you must create virtual instances with SR-IOV ports.

To create virtual instances with SR-IOV ports:

1. Create a network and a subnet with a segmentation ID. For example:

```
neutron net-create --provider:physical_network=physnet3 \
    --provider:segmentation_id=100 net04
neutron subnet-create net04 a.b.c.d/netmask
```

2. Request the ID of the Neutron network where you want the SR-IOV port to be created. For example:

```
net_id=`neutron net-show net04 | grep "\ id\ " | awk '{ print $4 }'`
```

3. Create an SR-IOV port with one of the available VNIC driver types that are direct, normal, direct-physical, and macvtap:

```
port_id=`neutron port-create $net_id --name sriov_port \
  --binding:vnic_type direct | grep "\ id\ " | awk '{ print $4 }'`
```

4. Create a virtual instance with the SR-IOV port created in step 3:

```
nova boot --flavor m1.large --image ubuntu_14.04 --nic port-id=$port_id test-sriov
```

Seealso

Using SR-IOV functionality in the official OpenStack documentation

Seealso

Enable Multiqueue

Enable Huge Pages

Huge Pages is a technology that supports 2MB and 1GB size memory pages. Huge Pages reduces time to access data stored in the memory by using bigger memory pages, which leads to fewer page entries to look up by CPU when choosing a page associated with a current process. Use of Huge Pages is beneficial in operations and processes that require large amount of memory.

> Warning
>
> Verify that CPU supports HugePages before you proceed.

Enable the Huge Pages support

This section exaplains how to configure the support for the Huge Pages feature in your MCP depoyment.

To enable Huge Pages:

1. Log in to the host machine.
2. To verify that CPU supports Huge Pages, analyze the system response of the following command:

   ```
   cat /proc/cpuinfo
   ```

   In the system output, search for the parameters:

   - PSE - support of 2MB hugepages
   - PDPE1GB - support of 1GB hugepages
3. Include the class in cluster.<name>.openstack.compute:

   ```
   - system.nova.compute.nfv.hugepages
   ```
4. Set the parameters in cluster.<name>.openstack.init on all compute nodes:

   ```
   compute_hugepages_size: 1G # or 2M
   compute_hugepages_count: 40
   compute_hugepages_mount: /mnt/hugepages_1G # or /mnt/hugepages_2M
   ```
5. Select from the following options:

   - If you are performing the initial deployment your environment, proceed with the further environment configurations.
   - If you are making changes to an existing environment, re-run the salt configuration on the Salt Master node:

     ```
     salt "cmp*" state.sls linux,nova
     ```
6. Reboot the affected servers.
7. If you need to set different values for each compute node, define them in cluster.<name>.infra.config for each node.

   Example:

   ```
   openstack_compute_node02:
     name: ${_param:openstack_compute_node02_hostname}
     domain: ${_param:cluster_domain}
     classes:
     - cluster.${_param:cluster_name}.openstack.compute
   ```

```
params:
  salt_master_host: ${_param:reclass_config_master}
  linux_system_codename: xenial
  compute_hugepages_size: 1G # or 2M
  compute_hugepages_count: 40
  compute_hugepages_mount: /mnt/hugepages_1G # or /mnt/hugepages_2M
```

Seealso

Boot a virtual machine with Huge Pages

Boot a virtual machine with Huge Pages

This section explains how to boot a VM with Huge Pages.

To boot a virtual machine with Huge Pages:

1. Create a new flavor or use an existing one to use with Huge Pages. To create a new image flavor:

   ```
   . openrc admin admin
   nova flavor-create huge 999 1024 4 1
   ```

2. Add the size of huge pages to the image flavor:

   ```
   nova flavor-key huge set hw:mem_page_size=2048
   ```

3. Verify the image flavor exists:

   ```
   nova flavor-show huge
   ```

   Example of system response

   ```
   +----------------------------+-----------------------------+
   | Property                   | Value                       |
   +----------------------------+-----------------------------+
   | OS-FLV-DISABLED:disabled   | False                       |
   | OS-FLV-EXT-DATA:ephemeral  | 0                           |
   | disk                       | 4                           |
   | extra_specs                | {"hw:mem_page_size": "2048"} |
   | id                         | 7                           |
   | name                       | huge                        |
   | os-flavor-access:is_public | True                        |
   | ram                        | 1024                        |
   | rxtx_factor                | 1.0                         |
   | swap                       |                             |
   | vcpus                      | 1                           |
   +----------------------------+-----------------------------+
   ```

4. Create a new image or use an existing image. You need an Ubuntu image and the default Cirros image.

   To create a new Ubuntu image:

   ```
   glance --os-image-api-version 1 image-create --name ubuntu \
     --location https://cloud-images.ubuntu.com/trusty/current/trusty-server-cloudimg-amd64-disk1.img \
     --disk-format qcow2 --container-format bare
   ```

5. Boot a new instance using the created flavor:

```
nova boot --flavor huge --image ubuntu inst1
```

6. Verify that the new VM uses 512 huge pages:

```
grep Huge /proc/meminfo
```

Example of system response

```
AnonHugePages:   1138688 kB
HugePages_Total:    1024
HugePages_Free:      512
HugePages_Rsvd:        0
HugePages_Surp:        0
Hugepagesize:       2048 kB
```

Configure NUMA and CPU pinning architecture

NUMA and CPU pinning is a shared memory architecture that describes the placement of main memory modules on processors in a multiprocessor system. You can leverage NUMA when you have data strongly associated with certain tasks or users. In such case, CPU can use its local memory module to access data reducing access time.

NUMA usage is beneficial on particular workloads, for example, on configurations where data is often associated with certain tasks or users.

Enable NUMA and CPU pinning

Before you proceed with enabling DPDK in your deployment, the NUMA and CPU pinning enablement is required.

To enable NUMA and CPU pinning:

1. Verify your NUMA nodes on the host operating system:

   ```
   lscpu | grep NUMA
   ```

   Example of system response

   ```
   NUMA node(s):        1
   NUMA node0 CPU(s):   0-11
   ```

2. Include the class to cluster.<NAME>.openstack.compute:

   ```
   - system.nova.compute.nfv.cpu_pinning
   ```

3. Set the parameters in cluster.<name>.openstack.init on all compute nodes:

   - compute_kernel_isolcpu

     Set of host CPUs to be isolated from system. Kernel will not assign internal processes on this set of CPUs. This parameter is configured in grub

   - nova_cpu_pinning

     Subset of CPUs isolated on previous step. This parameter is used by Nova to run VMs only on isolated CPUs with dedicated pinning. Nova vCPU pinning set is configured in the nova.conf file after system isolates appropriate CPUs

   Example

   ```
   nova_cpu_pinning: "1,2,3,4,5,7,8,9,10,11"
   compute_kernel_isolcpu: ${_param:nova_cpu_pinning}
   ```

4. Select from the following options:

   - If you are performing the initial deployment, proceed with the further environment configurations.
   - If you are making changes to an existing environment, re-run the salt configuration on the Salt Master node:

     ```
     salt "cmp*" state.sls linux,nova
     ```

> **Note**
>
> To take effect, servers require a reboot.

5. If you need to set different values for each compute node, define them in cluster.<name>.infra.config.

   Example

```
openstack_compute_node02:
  name: ${_param:openstack_compute_node02_hostname}
  domain: ${_param:cluster_domain}
  classes:
  - cluster.${_param:cluster_name}.openstack.compute
  params:
    salt_master_host: ${_param:reclass_config_master}
    linux_system_codename: xenial
    nova_cpu_pinning: "1,2,3,4,5,7,8,9,10,11"
    compute_kernel_isolcpu: "1,2,3,4,5,7,8,9,10,11"
```

Boot a VM with two NUMA nodes

This example demonstrates booting a VM with two NUMA nodes.

To boot VM with two NUMA nodes:

1. Create a new flavor or use an existing one to use with NUMA. To create a new flavor, run:

```
. openrc admin admin
nova flavor-create m1.numa 999 1024 5 4
```

2. Add numa_nodes to the flavor.

> Note
>
> vCPUs and RAM will be divided equally between the NUMA nodes.

```
nova flavor-key m1.numa set hw:numa_nodes=2
nova flavor-show m1.numa
```

Example of system response:

```
+----------------------------+-----------------------+
| Property                   | Value                 |
+----------------------------+-----------------------+
| OS-FLV-DISABLED:disabled   | False                 |
| OS-FLV-EXT-DATA:ephemeral  | 0                     |
| disk                       | 5                     |
| extra_specs                | {"hw:numa_nodes": "2"} |
| id                         | 999                   |
| name                       | m1.numa               |
| os-flavor-access:is_public | True                  |
| ram                        | 1024                  |
| rxtx_factor                | 1.0                   |
| swap                       |                       |
| vcpus                      | 4                     |
+----------------------------+-----------------------+
```

3. Create a new image or use an existing image.

> Note
>
> You need an Ubuntu image and the default Cirros image.

To create a new Ubuntu image:

```
glance --os-image-api-version 1 image-create --name ubuntu \
      --location https://cloud-images.ubuntu.com/trusty/current/\
      trusty-server-cloudimg-amd64-disk1.img \
      --disk-format qcow2 --container-format bare
```

4. To enable SSH connections:
   1. Add a new rule to the security group:

      ```
      nova secgroup-add-rule default tcp 22 22 0.0.0.0/0
      ```

   2. Create a new SSH key pair or use the existing key pair. To create a new ssh key pair:

      ```
      ssh-keygen
      ```

   3. Add the key pair to Nova:

      ```
      nova keypair-add --pub_key ~/.ssh/id_rsa.pub my_kp
      ```

5. Verify free memory before you boot the VM:

   ```
   numactl -H
   ```

   Example of system response:

   ```
   available: 2 nodes (0-1)
   node 0 cpus: 0 1
   node 0 size: 3856 MB
   node 0 free: 718 MB
   node 1 cpus: 2 3
   node 1 size: 3937 MB
   node 1 free: 337 MB
   node distances:
   node   0   1
    0:  10  20
    1:  20  10
   ```

6. Boot a new instance using the created flavor:

   ```
   nova boot --flavor m1.numa --image ubuntu --key-name my_kp inst1
   ```

7. Verify if free memory has been changed after booting the VM:

```
numactl -H
```

Example of system response:

```
available: 2 nodes (0-1)
node 0 cpus: 0 1
node 0 size: 3856 MB
node 0 free: 293 MB          # was 718 MB
node 1 cpus: 2 3
node 1 size: 3937 MB
node 1 free: 81 MB          # was 337 MB
node distances:
node   0   1
  0:  10  20
  1:  20  10
```

8. Retrieve the instance's IP:

```
nova show inst1 | awk '/network/ {print $5}'
```

Example of system response:

```
10.0.0.2
```

9. Connect to the VM using SSH:

```
ssh ubuntu@10.0.0.2
```

10. Install numactl:

```
sudo apt-get install numactl
```

11. Verify the NUMA topology on the VM:

```
numactl -H
```

Example of system response:

```
available: 2 nodes (0-1)
node 0 cpus: 0 1
node 0 size: 489 MB
node 0 free: 393 MB
node 1 cpus: 2 3
node 1 size: 503 MB
```

```
node 1 free: 323 MB
node distances:
node   0   1
  0:  10  20
  1:  20  10
```

Boot a VM with CPU and memory pinning

This example demonstrates booting VM with CPU and memory pinning.

To boot VM with CPU and memory pining:

1. Create a new flavor with specific division of vCPUs and RAM between the NUMA nodes:

   ```
   . openrc admin admin
   nova flavor-create m1.numa_2 9992 1024 5 4
   ```

2. Add numa_nodes and other specific options to the flavor:

   ```
   nova flavor-key m1.numa_2 set hw:numa_nodes=2 hw:numa_cpus.0=0,2 \
       hw:numa_cpus.1=1,3 hw:numa_mem.0=324 hw:numa_mem.1=700
   nova flavor-show m1.numa_2 | grep extra
   ```

   Example of system response:

   ```
   | extra_specs  | {"hw:numa_cpus.0": "0,2", "hw:numa_cpus.1": "1,3", \
   "hw:numa_nodes": "2", "hw:numa_mem.1": "700", "hw:numa_mem.0": "324"} |
   ```

3. Create a new image or use an existing image.

   > **Note**
   >
   > You need an Ubuntu image or the default Cirros image.

   To create a new Ubuntu image:

   ```
   glance --os-image-api-version 1 image-create --name ubuntu \
         --location https://cloud-images.ubuntu.com/trusty/current/\
         trusty-server-cloudimg-amd64-disk1.img \
         --disk-format qcow2 --container-format bare
   ```

4. To enable SSH connections:

   1. Add a new rule to the security group:

      ```
      nova secgroup-add-rule default tcp 22 22 0.0.0.0/0
      ```

   2. Create a new SSH key pair or use the existing key pair. To create a new ssh key pair, run:

      ```
      ssh-keygen
      ```

3. Add the key pair to Nova:

```
nova keypair-add --pub_key ~/.ssh/id_rsa.pub my_kp
```

5. Boot a new instance using the created flavor:

```
nova boot --flavor m1.numa_2 --image ubuntu --key-name my_kp inst2
```

6. Verify if free memory has been changed after booting the VM:

```
numactl -H
```

Example of system response:

```
available: 2 nodes (0-1)
node 0 cpus: 0 1
node 0 size: 3856 MB
node 0 free: 293 MB          # was 718 MB
node 1 cpus: 2 3
node 1 size: 3937 MB
node 1 free: 81 MB          # was 337 MB
node distances:
node   0   1
  0:  10  20
  1:  20  10
```

7. Retrieve the instance's IP:

```
nova show inst2 | awk '/network/ {print $5}'
```

Example of system response:

```
10.0.0.3
```

8. Connect to the VM using SSH:

```
ssh ubuntu@10.0.0.3
```

9. Install numactl:

```
sudo apt-get install numactl
```

10 Verify the NUMA topology on the VM:
.

```
numactl -H
```

Example of system response:

```
available: 2 nodes (0-1)
node 0 cpus: 0 2
node 0 size: 303 MB
node 0 free: 92 MB
node 1 cpus: 1 3
node 1 size: 689 MB
node 1 free: 629 MB
node distances:
node   0   1
  0:  10  20
  1:  20  10
```

You can see that the NUMA topology has two NUMA nodes. Total RAM size is about 1GB:

- node-0 CPUs are 0 and 2
- node-1 CPUs are 1 and 3, node-1 RAM is about 324 MB
- node-2 RAM is about 700 as specified in the m1.numa_2 flavor

Enable Multiqueue

The MCP Multiqueue enables the scaling of packet sending/receiving processing to the number of available vCPUs of a guest by using multiple queues. The feature includes:

- **Multiqueue for DPDK-based vrouters**

  Is supported by OpenVSwitch only. Underlay configuration for OVS is a part of DPDK interfaces and is defined by the n_rxq parameter. For example:

```
...
- system.neutron.compute.nfv.dpdk
...
parameters:
  linux:
    network:
     interfaces:
        ...
        # other interface setup
        ...
       dpdk0:
         name: ${_param:dpdk0_name}
         pci: ${_param:dpdk0_pci}
         driver: igb_uio
         bond: dpdkbond1
         enabled: true
         type: dpdk_ovs_port
         n_rxq: 2
       dpdk1:
         name: ${_param:dpdk1_name}
         pci: ${_param:dpdk1_pci}
         driver: igb_uio
         bond: dpdkbond1
         enabled: true
         type: dpdk_ovs_port
         n_rxq: 2
```

- **Multiqueue Virtio**

  Is supported by OpenContrail and OVS

Provision a VM with Multiqueue

To provision a VM with Multiqueue:

1. Set the image metadata property with the Multiqueue enabled:

   ```
   nova image-meta <IMAGE_NAME> set hw_vif_multiqueue_enabled="true"
   ```

2. After the VM is spawned, use the following command on the virtio interface in the guest to enable multiple queues inside the VM:

   ```
   ethtool –L <INTERFACE_NAME> combined <#queues>
   ```

Configure load balancing with OpenStack Octavia

You can use the OpenStack Octavia service to provide advanced load balancing in your OpenStack environment. For the Octavia architecture details and limitations, see: MCP Reference Architecture: Plan load balancing with OpenStack Octavia.

You can enable Octavia before or after you have an operational OpenStack environment with Neutron OVS as a networking solution deployed by MCP.

Enable Octavia on a new OpenStack environment

You can enable Octavia before deploying an OpenStack-based MCP cluster and automatically deploy it together with other OpenStack components using the dedicated Jenkins pipeline.

To enable Octavia on a new OpenStack environment:

1. While generating a deployment metadata model for your new OpenStack-based MCP cluster as described in Create a deployment metadata model, select the following parameters in the Model Designer web UI:
    - OVS as a networking engine in the Infrastructure parameters section
    - Openstack octavia enabled in the Product parameters section
    - For MCP versions starting from the 2019.2.8 maintenance update:
        - To use the amphora HA mode, set Octavia amphora topology to ACTIVE_STANDBY
        - To use a spare amphorae pool for the Octavia load balancer, set the required pool size in Octavia spare amphora pool size
    - If you need TLS support with Barbican, select Barbican enabled in the Product parameters section
    - TECHNICAL PREVIEW If you want to enable Octavia Cluster Manager, select Octavia Cluster Manager in the Product parameters section
2. Proceed with further cluster configuration as required. Octavia will be deployed during your OpenStack environment deployment by the dedicated Jenkins pipeline. For the deployment details, see: Deploy an OpenStack environment.

Seealso

Example of a load balancing topology

Enable Octavia on an existing OpenStack environment

You can enable Octavia on an operational OpenStack environment with Neutron OVS as a networking solution deployed by MCP.

To enable Octavia on an existing OpenStack environment:

1. Log in to the Salt Master node.
2. Add the following class to cluster/<cluster_name>/openstack/database.yml:

```
- system.galera.server.database.octavia
```

3. Add the following classes to cluster/<cluster_name>/openstack/control/init.yml:

```
- system.keystone.client.service.octavia
- system.glance.client.image.octavia
- system.nova.client.service.octavia
- system.octavia.client
```

4. Select from the following options:

   - To run Octavia worker services in a cluster, add the following class to cluster/<cluster_name>/openstack/control/init.yml:

     ```
     - system.neutron.client.service.octavia
     ```

   - To run a single instance of Octavia worker services, add the following class to cluster/<cluster_name>/openstack/control/init.yml:

     ```
     - system.neutron.client.service.octavia.single
     ```

5. If Barbican support is required, add the following classes to cluster/<cluster_name>/openstack/control/init.yml:

```
- system.barbican.client.v1.octavia
- system.barbican.client.v1.signed_images.octavia
- system.salt.minion.cert.octavia.image_sign
```

> ### Caution!
>
> If signing of images is disabled for Nova, do not add the images-related classes.

6. Add the following classes to cluster/<cluster_name>/openstack/control.yml:

```
- system.neutron.control.openvswitch.octavia
- system.octavia.api.cluster
```

> Note
>
> Starting the OpenStack Queens release, the system.neutron.control.openvswitch.octavia class is not required.

The system.octavia.api.cluster class configures an Octavia API cluster to run on the OpenStack controller nodes. Alternatively, if you want to run a single instance of Octavia API, add the following class instead:

```
- system.octavia.api.single
```

7. In cluster/<cluster_name>/infra/config.yml, configure the Octavia Manager services (Controller Worker, Health Manager, and Housekeeping) to run on one of the gateway nodes that is gtw01 by default:

   - Add the following classes:

     ```
     - system.salt.minion.ca.octavia_amphora_ca
     - system.salt.minion.cert.octavia.amphora_cluster_client
     ```

   - If you run the OpenStack gateway services in a cluster, add the following class:

     ```
     - system.reclass.storage.system.openstack_gateway_single_octavia
     ```

     before

     ```
     - system.reclass.storage.system.openstack_gateway_cluster
     ```

   - If you run the OpenStack gateway services in a single mode, add the following class:

     ```
     - system.reclass.storage.system.openstack_gateway_single_octavia
     ```

     before

     ```
     - system.reclass.storage.system.openstack_gateway_single
     ```

   - TECHNICAL PREVIEW If you want to add Octavia Cluster Manager, also add the following class:

```
- system.reclass.storage.system.openstack_gateway_cluster_octavia
```

8. Verify the classes and parameters:

    1. Verify that the cluster/<cluster_name>/openstack/octavia_manager.yml file exists and contains import of the following classes as well as a private key that will be used to log in to amphorae. For example:

```
classes:
- system.octavia.manager.single
- system.salt.minion.ca.octavia_ca
- system.salt.minion.cert.octavia.amphora_client
parameters:
  _param:
    cluster_local_address: ${_param:single_address}
    octavia_private_key: |
      -----BEGIN RSA PRIVATE KEY-----
      MIIEpAIBAAKCAQEAtjnPDJsQToHBtoqIo15mdSYpfi8z6DFMi8Gbo0KCN33OUn5u
      OctbdtjUfeuhvI6px1SCnvyWi09Ft8eWwq+KwLCGKbUxLvqKltuJ7K3LlrGXkt+m
      qZN4O9XKeVKfZH+mQWkkxRWgX2r8RKNV3GkdNtd74VjhP+R6XSKJQ1Z8b7eHM10v
      6IjTY/jPczjK+eyCeEj4qbSnV8eKlqLhhquuSQRmUO2DRSjLVdpdf2BB4/BdWFsD
      YOmX7mb8kpEr9vQ+c1JKMXDwD6ehzyU8kE+1kVm5zOeEy4HdYIMpvUfN49P1anRV
      2ISQ1ZE+r22IAMKl0tekrGH0e/1NP1DF5rINMwIDAQABAoIBAQCkP/cgpaRNHyg8
      lSKIHs67SWqdEm73G3ijgB+JSKmW2w7dzJgN//6xYUAnP/zIuM7PnJ0gMQyBBTMS
      NBTv5spqZLKJZYivj6Tb1Ya8jupKm0jEWlMfBo2ZYVrfgFmrfGOfEebSvmuPlh9M
      vuzlftmWVSSUOkjODmM9D6QpzgrbpktBuA/WpX+6esMTwJpOcQ5xZWEnHXnVzuTc
      SncodVweE4gz6F1qorbqIJz8UAUQ5T0OZTdHzlS1IbamACHWaxQfixAO2s4+BoUK
      ANGGZWkfneCxx7lthvY8DiKn7M5cSRnqFyDToGqaLezdkMNlGC7v3U11FF5blSEW
      fL1o/HwBAoGBAOavhTr8eqezTchqZvarorFIq7HFWk/l0vguIotu6/wlh1V/KdF+
      aLLHgPgJ5j+RrCMvTBoKqMeeHfVGrS2udEy8L1mK6b3meG+tMxU05OA55abmhYn7
      7vF0q8XJmYIHIXmuCgF90R8Piscb0eaMlmHW9unKTKo8EOs5j+D8+AMJAoGBAMo4
      8WW+D3XiD7fsymsfXalf7VpAt/H834QTbNZJweUWhg11eLutyahyyfjjHV200nNZ
      cnU09DWKpBbLg7d1pyT69CNLXpNnxuWCt8oiUjhWCUpNqVm2nDJbUdlRFTzYb2fS
      ZC4r0oQaPD5kMLSipjcwzMWe0PniySxNvKXKInFbAoGBAKxW2qD7uKKKuQSOQUft
      aAksMmEIAHWKTDdvOA2VG6XvX5DHBLXmy08s7rPfqW06ZjCPCDq4Velzvgvc9koX
      d/lP6cvqlL9za+x6p5wjPQ4rEt/CfmdcmOE4eY+1EgLrUt314LHGjjG3ScWAiirE
      QyDrGOlGaYoQf89L3KqIMr0JAoGARYAklw8nSSCUvmXHe+Gf0yKA9M/haG28dCwo
      780RsqZ3FBEXmYk1EYvCFqQX56jJ25MWX2n/tJcdpifz8Q2ikHcfiTHSI187YI34
      lKQPFgWb08m1NnwoWrY//yx63BqWz1vjymqNQ5GwutC8XJi5/6Xp+tGGiRuEgJGH
      EIPUKpkCgYAjBIVMkpNiLCREZ6b+qjrPV96ed3iTUt7TqP7yGlFI/OkORFS38xqC
      hBP6Fk8iNWuOWQD+ohM/vMMnvIhk5jwlcwn+kF0ra04gi5KBFWSh/ddWMJxUtPC1
      2htvlEc6zQAR6QfqXHmwhg1hP81JcpqpicQzCMhkzLoR1DC6stXdLg==
      -----END RSA PRIVATE KEY-----
```

    The private key is saved to /etc/octavia/.ssh/octavia_ssh_key on the Octavia manager node.

> Note
>
> To generate an SSH key pair, run:
>
> ```
> ssh-keygen -b 2048 -t rsa -N "" -f ~/.ssh/octavia_ssh_key
> ```

2. To use a spare amphorae pool for the Octavia load balancer, specify the spare_amphora_pool_size parameter as required.

```
octavia:
  manager:
    house_keeping:
      spare_amphora_pool_size: 0
```

9. Verify that the following Octavia parameters are configured in cluster/<cluster_name>/openstack/init.yml. For example:

```
parameters:
  _param:
    octavia_version: ${_param:openstack_version}
    octavia_service_host: ${_param:openstack_control_address}
    mysql_octavia_password: <db_password>
    keystone_octavia_password: <keystone_password>
    amp_flavor_id: <amphora-flavor-id>
    octavia_health_manager_node01_address: 192.168.0.10
    # If clusterization enaled:
    # octavia_health_manager_node02_address: 192.168.0.11
    # octavia_health_manager_node03_address: 192.168.0.12
    octavia_loadbalancer_topology: "SINGLE"
    octavia_public_key: |
      ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQC2Oc8MmxBOgcG2ioijXmZ1J
      il+LzPoMUyLwZujQoI3fc5Sfm45y1t22NR966G8jqnHVIKe/JaLT0W3x5bCr4
      rAslYptTEu+oqW24nsrcsisZeS36apk3g71cp5Up9kf6ZBaSTFFaBfavxEo1X
      caR0213vhWOE/5HpdIolDVnxvt4czXS/oiNNj+M9zOMr57IJ4SPiptKdXx4qW
      ouGGq65JBGZQ7YNFKMtV2l1/YEHj8F1YWwNg6ZfuZvySkSv29D5zUkoxcPAPp
      6HPJTyQT7WRWbnM54TLgd1ggym9R83j0/VqdFXYhJDVkT6vbYgAwqXS16SsYf
      R7/U0/UMXmsg0z root@cfg01
```

> Note

- The parameter octavia_public_key should contain a public key generated in the previous step. In our example, it is taken from ~/.ssh/octavia_ssh_key.pub.
- To use the amphora HA mode, set octavia_loadbalancer_topology to ACTIVE_STANDBY. By default, octavia_loadbalancer_topology is set to SINGLE to use the default load balancer topology.

10. Optional. Override the default Octavia parameters in cluster/<cluster_name>/openstack/octavia_manager.yml. The default parameters are as follows:

```
parameters:
  octavia:
    manager:
      certificates:
        ca_private_key: '/etc/octavia/certs/private/cakey.pem'
        ca_certificate: '/etc/octavia/certs/ca_01.pem'
      controller_worker:
        amp_flavor_id: ${_param:amp_flavor_id}
        amp_image_tag: amphora
        amp_ssh_key_name: octavia_ssh_key
        loadbalancer_topology: 'SINGLE'
      haproxy_amphora:
        client_cert: '/etc/octavia/certs/client.pem'
        client_cert_key: '/etc/octavia/certs/client.key'
        client_cert_all: '/etc/octavia/certs/client_all.pem'
        server_ca: '/etc/octavia/certs/ca_01.pem'
      health_manager:
        bind_ip: ${_param:octavia_hm_bind_ip}
        heartbeat_key: 'insecure'
      house_keeping:
        spare_amphora_pool_size: 0
```

Note

Starting from MCP 2019.2.7 maintenance update, haproxy_amphora includes the build_rate_limit parameter, set to 2 by default. Use the parameter to configure the build rate limit for the Octavia manager.

11. Add the configured Octavia roles to the corresponding nodes:

```
salt-call state.sls reclass.storage
```

12 Refresh pillars:

```
salt '*' saltutil.refresh_pillar
```

13 Update the Salt Minion configuration:

```
salt-call state.sls salt.minion.service
```

14 Create the Octavia database:

```
salt -C 'I@galera:master' state.sls galera
salt -C 'I@galera:slave' state.sls galera -b 1
```

15 Configure HAProxy for Octavia API:

```
salt -C 'I@haproxy:proxy' state.sls haproxy
```

16 Configure NGINX proxy for Octavia API:

```
salt -C 'I@nginx:server' state.sls nginx
```

17 Create an Octavia user and endpoints in Keystone:

```
salt -C 'I@keystone:client' state.sls keystone.client
```

18 Upload an amphora image to Glance:

```
salt -C 'I@glance:client' state.sls glance.client
```

19 Create an amphora flavor and a key pair in Nova:

```
salt -C 'I@nova:client' state.sls nova.client
```

This state expects you to provide an SSH key that is used to create a key pair.

20 Create the Neutron resources for Octavia:

```
salt -C 'I@neutron:client' state.sls neutron.client
```

This state creates security groups and rules for amphora instances and Health Manager, a management network with a subnet for Octavia, and a port for Health Manager.

21 If Barbican and signing of the images for Nova are enabled, apply the following states to create a certificate and sign the Octavia amphora image:

```
salt -C 'I@barbican:client' state.sls salt.minion.cert
salt -C 'I@barbican:client' state.sls barbican.client
```

22 Update the Salt mine:

```
salt '*' mine.update
```

23 Deploy the Octavia services:

```
salt -C 'I@octavia:api and *01*' state.sls octavia
salt -C 'I@octavia:api' state.sls octavia
salt -C 'I@octavia:manager' state.sls octavia
```

24 Generate certificates for the Octavia controller-amphora communication:

```
salt-call state.sls salt.minion.ca
salt-call state.sls salt.minion.cert
```

> **Note**
>
> You may need to apply the above states twice before they succeed.

If you added Octavia Cluster Manager in previous steps, also apply the following states:

```
salt-call state.sls salt.minion.ca
salt-call state.sls salt.minion.cert
```

25 Set up the Octavia client:

```
salt -C 'I@octavia:client' state.sls octavia.client
```

> **Seealso**
>
> Example of a load balancing topology

Example of a load balancing topology

After you enable Octavia on your new or existing OpenStack environment as described in Configure load balancing with OpenStack Octavia, create a topology for your use case. Each topology requires you to configure the load balancer, port listener, LBaaS pool, and, optionally, the Health Monitor with a specific set of parameters.

For the purpose of this example, a topology for balancing traffic between two HTTP servers listening on port 80 is used. The topology includes the following parameters:

- Backend servers 10.10.10.7 and 10.10.10.29 in the private-subnet subnet run an HTTP application that listens on the TCP port 80.
- The public-subnet subnet is a shared external subnet created by the cloud operator which is accessible from the Internet.
- You must create a load balancer accessible by an IP address from public-subnet that will be responsible for distributing web requests between the backend servers.

For more examples, see: OpenStack Octavia documentation

Caution!

Starting the OpenStack Queens release, use only the OpenStack Octavia client. For details, see OpenStack Queens documentation.

Workflow:

1. Log in to a controller node.
2. Create a load balancer:

```
neutron lbaas-loadbalancer-create --name lb1 private-subnet
```

3. Create an HTTP listener:

```
neutron lbaas-listener-create --name listener1 --loadbalancer \
lb1 --protocol HTTP --protocol-port 80
```

4. Create a LBaaS pool that will be used as default for listener1:

```
neutron lbaas-pool-create --name pool1 --lb-algorithm \
ROUND_ROBIN --listener listener1 --protocol HTTP
```

5. Create a health monitor that ensures health of the pool members:

```
neutron lbaas-healthmonitor-create --delay 5 --name hm1 --timeout \
3 --max-retries 4 --type HTTP --pool pool1
```

6. Add backend servers 10.10.10.7 and 10.10.10.29 to the pool:

```
neutron lbaas-member-create --subnet private-subnet --address \
10.10.10.7 --protocol-port 80 --name member1 pool1
neutron lbaas-member-create --subnet private-subnet --address \
10.10.10.29 --protocol-port 80 --name member2 pool1
```

7. Create a floating IP address in a public network and associate it with a port of the load balancer VIP:

```
vip_port_id=$(neutron lbaas-loadbalancer-show lb1 -c vip_port_id -f \
value)
fip_id=$(neutron floatingip-create admin_floating_net -c id -f value)
neutron floatingip-associate $fip_id $vip_port_id
```

8. Access the VIP floating IP address and verify that requests are distributed between the two servers.

   Example:

```
$ curl http://172.24.4.14:80
Welcome to addr:10.10.10.7

$ curl http://172.24.4.14:80
Welcome to addr:10.10.10.29
```

   In the example above, an HTTP application that runs on the backend servers returns an IP address of the host on which it runs.

Example of a load balancing topology with TLS support

This section describes an example of the Nova instances working as simple HTTP web servers that return Hello, world from instance_name! as a response to requests. The example describes how to create a TLS-terminated HTTPS load balancer that is accessible from the Internet with a certificate stored in Barbican. This load balancer will distribute requests to the backend servers over the non-encrypted HTTP protocol.

> ### Caution!
>
> The load balancer certificate must be uploaded to Barbican under the octavia user, so that it can be used later during a listener creation. Therefore, make sure that a user that will create the load balancing topology has access to the Octavia service project (tenant).

Workflow:

1. Log in to any OpenStack controller node.
2. Create a load balancer with a VIP in the public subnet:

   ```
   openstack loadbalancer create --name lb1 --vip-subnet-id public-subnet
   ```

3. Verify the load balancer VIP address:

   ```
   openstack loadbalancer list
   ```

   Example of system response extract:

   ```
   +-----------------+------+-------------+-------------+---------------------+----------+
   | id              | name | project_id  | vip_address | provisioning_status | provider |
   +-----------------+------+-------------+-------------+---------------------+----------+
   | 959b0946-75ba...| lb1  | 070bc4ddda...| 10.0.0.17  | ACTIVE              | octavia  |
   +-----------------+------+-------------+-------------+---------------------+----------+
   ```

4. Combine the individual certificate, key, and intermediate certificate to a single PKCS12 file. For example:

   ```
   openssl pkcs12 -export -in certificate1.crt -inkey privatekey.key -out \
   test1.p12 -passout pass:
   ```

> **Note**
>
> Use the load balancer VIP address as a FQDN during the certificate generation.

5. In the Octavia service tenant, create a secret in Barbican from the Octavia user:

```
openstack secret store --name='tls_secret1' -t 'application/octet-stream' \
-e 'base64' --payload="$(base64 < test1.p12)"
```

6. Add acl for the created secret:

```
secret_id=$(openstack secret list | awk '/ tls_secret1 / {print $2}')
openstack acl user add -u $(openstack user show octavia -c id -f value) $secret_id
```

7. Create a listener that uses the TERMINATED_HTTPS protocol and set the secret that was created in the step 5:

```
openstack loadbalancer listener create --protocol-port 443 --protocol TERMINATED_HTTPS \
--name listener1 --default-tls-container=$secret_id lb1
```

8. Create a pool that will be used by listener1:

```
openstack loadbalancer pool create --name pool1 --lb-algorithm ROUND_ROBIN \
--listener listener1 --protocol HTTP
```

9. Add members to the created pool with addresses 10.0.0.25 and 10.0.0.20:

```
openstack loadbalancer member create --subnet-id public-subnet \
--address 10.0.0.25 --protocol-port 80 pool1

openstack loadbalancer member create --subnet-id public-subnet \
--address 10.0.0.20 --protocol-port 80 pool1
```

10. Obtain the load balancer VIP:

```
openstack loadbalancer show lb1 -c vip_address -f value
```

11. Using the load balancer VIP floating IP address, verify that requests are distributed between the two servers:

```
curl --cacert certificate1.crt https://10.0.0.17
Hello, world from VM1!
curl --cacert certificate1.crt https://10.0.0.17
Hello, world from VM2!
```

Note

Make sure that the security group allows traffic on port 443.

Move the Octavia certificates from the gtw01 to the Salt Master node

Starting from the Q4‘18 MCP release, the certificates for connection to amphora are created on the Salt Master node and then loaded on the gtw nodes. Previously, they were created and stored on the gtw01 node. Therefore, if you have an existing OpenStack environment with Octavia where certificates were initially created on the gtw01 node, you can move these certificates to the Salt Master node to update your previously created load balancers.

To move certificates from the gtw01 to the Salt Master node:

1. Log in to the Salt Master node.
2. In /etc/salt/master.d/master.conf, verify that the file_recv parameter is set to True.
3. Update the Octavia Salt formula:

   ```
   apt install --upgrade salt-formula-octavia
   ```

4. Update the Reclass model:

   1. Remove the following classes from cluster/<cluster_name>/openstack/octavia_manager.yml:

      ```
      - system.salt.minion.ca.octavia_ca
      - system.salt.minion.cert.octavia.amphora_client
      ```

   2. Add the following classes to cluster/<cluster_name>/infra/config.yml:

      ```
      - system.salt.minion.ca.octavia_amphora_ca
      - system.salt.minion.cert.octavia.amphora_cluster_client
      ```

   3. TECHNICAL PREVIEW If you want to add the Octavia Cluster Manager to your OpenStack environment, change the following class

      ```
      - system.reclass.storage.system.openstack_gateway_single_octavia
      ```

      to

      ```
      - system.reclass.storage.system.openstack_gateway_cluster_octavia
      ```

5. Load the certificates from the gtw01 to the Salt Master node:

   ```
   salt 'gtw01*' cp.push_dir /etc/octavia/certs upload_path=octavia_certs
   salt 'gtw01*' cp.push_dir /etc/pki/ca/octavia_ca upload_path=octavia_certs
   mkdir -p /srv/salt/env/prd/_certs
   cp -R /var/cache/salt/master/minions/gtw01.<cluster_name>/files/octavia_certs/* \
   /srv/salt/env/prd/_certs/octavia
   ```

6. Refresh the pillars:

```
salt-call state.sls reclass.storage
salt '*' saltutil.refresh_pillar
salt '*' saltutil.sync_all
```

7. TECHNICAL PREVIEW If you are going to use the Octavia Cluster Manager:

    1. Rename the existing port on the gtw01 node:

    ```
    salt -C 'I@neutron:client' state.sls octavia._rename_hm_neutron_port
    ```

    2. Update monitor ports:

    ```
    salt -C 'I@neutron:client' state.sls neutron.client
    salt '*' mine.update
    ```

8. Apply the changes:

```
salt -C 'I@octavia:manager' state.sls octavia
```

Seealso

OpenStack Octavia developer documentation

Configure LDAP integration with MCP

This section describes how to integrate your LDAP server with Keystone and a host operating system in MCP. This configuration is not enabled by default and, therefore, requires manual modifications in your cluster model.

Configure LDAP with Keystone server

To configure LDAP integration with Keystone server in MCP, you must create a separate file for this definition in your cluster model. In this section, the ldap.yml file is used as an example. You must also set up the rights mapping for users and groups. If required, you can also specify filtering.

To configure LDAP with Keystone server:

1. In your Git project repository, open the cluster/<cluster_name>/openstack/ directory of your cluster model.
2. In this directory, create the ldap.yml file.
3. Create a configuration for the LDAP integration in the ldap.yml file.

   Example:

```
parameters:
  keystone:
    server:
      service_name: apache2
      domain:
        example.com:
          description: ""
          backend: ldap
          identity:
            driver: ldap
          assignment:
            backend: sql
          ldap:
            url: ldap://<LDAP ADDRESS>
            bind_user: CN=<UserName>,OU=<OU-name>,DC=<DomainName>,DC=<DomainExtension>
            query_scope: sub
            page_size: 1000
            password: <LDAP PASSWORD>
            suffix: DC=<DomainName>,DC=<DomainExtension>
            user_tree_dn: DC=<DomainName>,DC=<DomainExtension>
            group_tree_dn: DC=<DomainName>,DC=<DomainExtension>
            user_objectclass: person
            user_id_attribute: sAMAccountName
            user_name_attribute: sAMAccountName
            user_pass_attribute: userPassword
            user_enabled_attribute: userAccountControl
            user_mail_attribute: mail
            group_objectclass: ""
            group_id_attribute: sAMAccountName
            group_name_attribute: cn
            group_member_attribute: member
            group_desc_attribute: cn
            filter:
              user: "(&(&(objectClass=person)(uidNumber=*))(unixHomeDirectory=*))"
              group: ""
```

4. Optional. Configure the TLS encryption on LDAP traffic as follows:

```
parameters:
  keystone:
    domain:
      example.com:
        ldap:
          url: ldaps://<LDAP ADDRESS>
          tls:
            enabled: True
            req_cert: demand|allow|never
            cacert: |
              ----BEGIN CERTIFICATE----
              ...
              ----END CERTIFICATE----
```

Note

The req_cert configuration key specifies the client certificate checks to be performed on incoming TLS sessions from the LDAP server. The possible values for req_cert include:

- demand
  The LDAP server always receives certificate requests. If no certificate is provided or the provided certificate cannot be verified against the existing certificate authorities file, the session terminates.
- allow
  The LDAP server always receives certificate requests. If no certificate is provided or the provided certificate cannot be verified against the existing certificate authorities file, the session proceeds as normal.
- never
  A certificate is never requested.

For details, see the Integrate Identity with LDAP section in the upstream Keystone Administrator Guide.

5. In cluster/<cluster_name>/openstack/control.yml, include the previously created class to the bottom of the classes section:

```
classes:
  ...
  cluster.<cluster_name>.openstack.ldap
  cluster.<cluster_name>
parameters:
  ...
```

6. Add parameters for Horizon to cluster/<cluster_name>/openstack/proxy.yml:

```
parameters:
  horizon:
    server:
      multidomain: true
```

7. Enforce the Keystone update:

```
salt -C 'I@keystone:server' state.sls keystone -b 1
salt -C 'I@horizon:server' state.sls horizon
```

8. Verify the LDAP integration:

```
source /root/keystonercv3
openstack user list --domain <your_domain>
```

9. Grant the admin role to a specific user:

    1. Obtain the user ID:

    ```
    openstack user list --domain <your_domain> | grep <user_name>
    | <user_id> | <user_name>  |
    ```

    2. Set the admin role:

    ```
    openstack role add --user <user_id> admin --domain <your_domain>
    ```

Configure LDAP with host OS

To configure the pluggable authentication module (PAM) on a host operating system to support LDAP authentication in MCP, you must create a separate file for this definition in your cluster model and add it to all the nodes where you want to enable this authentication method.

In this section, the ldap.yml file is used as an example.

To enable PAM authentication:

1. Open the Git project repository with your cluster model.
2. Create the cluster/<cluster_name>/infra/auth/ldap.yml file.
3. Create a configuration for your LDAP server in this file.

   Example:

```
parameters:
  linux:
    system:
      auth:
        enabled: true
        ldap:
          enabled: true
          binddn: CN=<UserName>,OU=<OU-name>,DC=<DomainName>,DC=<DomainExtension>
          bindpw: <Password>
          uri: ldap://<LDAP URL>
          base: DC=<DomainName>,DC=<DomainExtension>
          ldap_version: 3
          pagesize: 1000
          referrals: "off"
          ##You can also setup grouping, mapping, and filtering using these parameters.
          filter:
            passwd: (&(&(objectClass=person)(uidNumber=*))(unixHomeDirectory=*))
            shadow: (&(&(objectClass=person)(uidNumber=*))(unixHomeDirectory=*))
            group:  (&(objectClass=group)(gidNumber=*))
          map:
            passwd:
              uid: sAMAccountName
              homeDirectory: unixHomeDirectory
              gecos: displayName
              loginShell: '"/bin/bash"'
            shadow:
              uid: sAMAccountName
              shadowLastChange: pwdLastSet
```

4. In cluster/<cluster_name>/openstack/cluster.yml, include the previously created class to the bottom of the classes section:

```
classes:
  ...
  cluster.<cluster_name>.infra.auth.ldap
  cluster.<cluster_name>
```

```
parameters:
  ...
```

5. Enforce the linux.system update:

```
salt '<target_node>*' state.sls linux.system
```

Seealso

MCP Operations Guide: Disable LDAP authentication on host OS

Tune the RabbitMQ performance in the OpenStack with OVS deployments

Proper configuration of Nova and Neutron services in your Reclass deployment model allows for decreasing the load on the RabbitMQ service making the service more stable under high load in the deployments with 1000+ nodes.

To tune the RabbitMQ performance on a new MCP OpenStack deployment:

1. Generate a deployment metadata model for your new MCP OpenStack as described in Create a deployment metadata model using the Model Designer UI.
2. Open the cluster level of your Git project repository.
3. In openstack/gateway.yml, define the following parameters as required. For example:

```
neutron:
  gateway:
    dhcp_lease_duration: 86400
    message_queue:
      rpc_conn_pool_size: 300
      rpc_thread_pool_size: 2048
      rpc_response_timeout: 3600
```

4. In openstack/compute/init.yml, define the following parameters as required. For example:

```
neutron:
  compute:
    message_queue:
      rpc_conn_pool_size: 300
      rpc_thread_pool_size: 2048
      rpc_response_timeout: 3600
```

5. In openstack/control.yml, define the following parameters as required. For example:

```
nova:
  controller:
    timeout_nbd: 60
    heal_instance_info_cache_interval: 600
    block_device_creation_timeout: 60
    vif_plugging_timeout: 600
    message_queue:
      rpc_poll_timeout: 60
      connection_retry_interval_max: 60
      default_reply_timeout: 60
      default_send_timeout: 60
      default_notify_timeout: 60
```

6. In openstack/compute/init.yml, define the following parameters as required. For example:

```
nova:
  compute:
    timeout_nbd: 60
    heal_instance_info_cache_interval: 600
    block_device_creation_timeout: 60
    vif_plugging_timeout: 600
    message_queue:
      rpc_poll_timeout: 60
      connection_retry_interval_max: 60
      default_reply_timeout: 60
      default_send_timeout: 60
      default_notify_timeout: 60
```

7. In openstack/control.yml, define the following parameters as required. For example:

```
neutron:
  server:
    dhcp_lease_duration: 86400
    agent_boot_time: 7200
    message_queue:
      rpc_conn_pool_size: 300
      rpc_thread_pool_size: 2048
      rpc_response_timeout: 3600
```

8. Optional. Set additional parameters to improve the RabbitMQ performance.

   The following parameters should be set in correlation with each other. For example, the value of the report_interval parameter should be a half or less than the value of the agent_down_time parameter. The report_interval parameter should be set on all nodes where the Neutron agents are running.

   - In openstack/control.yml, define the agent_down_time parameter as required. For example:

```
neutron:
  server:
    agent_down_time: 300
```

- In openstack/compute/init.yml and openstack/gateway.yml, define the report_interval parameter as required. For example:

```
neutron:
  compute:
    report_interval: 120
```

> **Caution!**
>
> The time of workload being unavailable can be increased in case of the Neutron agents failover. Though, the number of the AMQP messages in the RabbiMQ queues can be lower.

9. Optional. To speed up message handling by the Neutron agents and Neutron API, define the rpc_workers parameter in openstack/control.yml. The defined number of workers should be equal to the number of CPUs multiplied by two. For example, if the number of CPU is 24, set the rpc_workers parameter to 48:

```
neutron:
  server:
    rpc_workers: 48
```

10. Optional. Set the additional parameters for the Neutron server role to improve stability of the networking configuration:

    - Set the allow_automatic_dhcp_failover parameter to false. If set to true, the server reschedules nets from the failed DHCP agents so that the alive agents catch up the net and serve DHCP. Once the agent reconnects to RabbitMQ, the agent detects that its net has been rescheduled and removes the DHCP port, namespace, and flows. This parameter was implemented for the use cases when the whole gateway node goes down. In case of the RabbitMQ instability, agents do not actually go down, and the data plane is not affected. Therefore, we recommend that you set it to false. But you should consider the risks of a gateway node going down as well before setting the allow_automatic_dhcp_failover parameter.
    - Define the dhcp_agents_per_network parameter that sets the number of the DHCP agents per network. To have one DHCP agent on each gateway node, set the parameter to the number of the gateway nodes in your deployment. For example, dhcp_agents_per_network: 3.

    Configuration example:

```
neutron:
  server:
    dhcp_agents_per_network: 3
    allow_automatic_dhcp_failover: false
```

11 Proceed to the new MCP OpenStack environment configuration and deployment as required.
.

Seealso

- Deploy an OpenStack environment
- Deploy an OpenStack environment manually

Deploy Edge Cloud MVP

This section describes how to deploy an Edge Cloud minimum viable product (MVP) based on the Kubernetes with Calico architecture together with Virtlet and the CNI Genie plugin that enables the Flannel CNI plugin support.

For demonstration purposes, you can also download a virtual appliance of MCP Edge. For details, see: MCP Edge.

> Warning
>
> Edge Cloud MVP is available as technical preview. Use such configurations for testing and evaluation purposes only.

To deploy Edge Cloud:

1. Provision three KVM nodes and three compute nodes based on Ubuntu Xenial.

   > Caution!
   >
   > During provisioning, disable swap on the target nodes, since this feature is not supported for Edge Cloud MVP.

2. Create bridges on the first KVM node as described in the step 3 of the Prerequisites for MCP DriveTrain deployment procedure.
3. Set an IP for br-mgm.
4. Enable DHCP on the first interface of the br-mgm network.
5. Create a deployment metadata model:
   1. Navigate to the Model Designer web UI and click Create Model.
   2. In the Version drop-down menu, select 2018.11.0 and click Continue.
   3. In the General parameters section, set the parameters as required and change the below ones as follows:
      1. In Public host, specify ${_param:kubernetes_proxy_address}.
      2. In Deployment type, select Physical.
      3. In OpenSSH groups, specify lab,k8s_team.
      4. In Platform, select Kubernetes.
      5. Disable OpenContrail, StackLight, Ceph, CICD, and OSS.
      6. Enable Use default network scheme.

7. Enable Kubernetes Control on KVM.
8. Specify the deploy and control subnets.

4. In the Infrastructure parameters section:
    1. Disable MAAS.
    2. In Kubernetes Networking, select the following plugins:
        - Kubernetes network calico enabled
        - Kubernetes network flannel enabled
        - Kubernetes network genie enabled
        - Kubernetes metallb enabled
    3. Set other parameters as required.
5. In the Product parameters section:
    1. Specify the KVM hostnames and IP addresses. The KVM hosts must have the hostnames kvm01, kvm02, kvm03 due to a limitation in the Jenkins pipeline jobs.
    2. Set the subnets for Calico and Flannel.
    3. In Metallb addresses, specify the MetalLB public address pool.
    4. Select Kubernetes virtlet enabled.
    5. Select Kubernetes containerd enabled.
    6. In Kubernetes compute count, specify 3.
    7. In Kubernetes keepalived vip interface, specify ens3.
    8. In Kubernetes network scheme for master nodes, select Virtual - deploy interface + single control interface.
    9. In Kubernetes network scheme for compute nodes, select the scheme as required.
    10. Specify the names of the Kubernetes network interfaces and addresses.
    .
6. Generate the model and obtain the ISO configuration drive from email received after you generated the deployment metadata model or from the Jenkins pipeline job artifacts.

6. Log in to the KVM node where the Salt Master node is deployed.
7. Download the ISO configuration drive obtained after completing the step 5 of this procedure.
8. Create and configure the Salt Master VM. For details, see: Deploy the Salt Master node.
9. Once the Salt Master node is up and running, set the salt-minion configurations on each kvm and cmp node.

> Warning
>
> Due to a limitation in the Jenkins deployment pipeline job, the kvm nodes must have the minion IDs kvm01.domain, kvm02.domain, kvm03.domain with a proper domain.

10 Verify that all nodes are connected to the Salt Master node using the salt-key state.
.

11 Verify that all nodes are up and running:
.

```
salt '*' test.ping
```

12 In a web browser, open http://<ip address>:8081 to access the Jenkins web UI.
.

> Note
>
> The IP address is defined in the classes/cluster/<cluster_name>/cicd/init.yml file of the Reclass model under the cicd_control_address parameter variable.

13 Log in to the Jenkins web UI as an admin.
.

> Note
>
> To obtain the password for the admin user, run the salt "cid*" pillar.data _param:jenkins_admin_password command from the Salt Master node.

14 In the Deploy - OpenStack Jenkins pipeline job, define the STACK_INSTALL: core,kvm,k8s
. parameters.

15 Click Build.
.

Seealso

- View the deployment details

Configure Salt Master threads and batching

> Note
>
> This feature is available starting from the MCP 2019.2.6 maintenance update. Before using the feature, follow the steps described in Apply maintenance updates.

You can configure the number of worker threads for Salt Master based on the number of CPUs available on your Salt Master node.

Also, you can set up batching for the pipeline jobs to run Salt states, targeted for a large number of nodes, on a batch of nodes and define the batch size. By default, batching is force-enabled for the Deploy - OpenStack and Deploy - upgrade MCP DriveTrain Jenkins pipeline jobs as they do not support node targeting. Batch sizing is by default supported by the Deploy - OpenStack, Deploy - update system package(s), and Deploy - upgrade MCP DriveTrain Jenkins pipeline jobs.

To configure Salt Master threads:

1. Open your Git project repository with the Reclass model on the cluster level.
2. In infra/config/init.yml, specify the following pillar for the cfg01 node:

   ```
   salt:
     master:
       worker_threads_per_cpu: <value>
   ```

   Depending on the amount of CPUs, the total amount of worker threads is based on worker_threads_per_cpu multiplied by the number of CPUs. By default, the number of worker threads is set to 40 using the following pillar:

   ```
   salt:
     master:
       worker_threads: 40
   ```

   If both worker_threads_per_cpu and worker_threads are defined, worker_threads_per_cpu is prioritized.
3. Log in to the Salt Master node.
4. Apply the following state:

   ```
   salt-call state.sls salt.master
   ```
5. Verify that the required settings have been applied:

   ```
   cat /etc/salt/master.d/master.conf | grep worker_threads
   ```

To configure Salt Master batching:

1. Open the required Jenkins pipeline job.
2. Configure batch sizing:

   - For the Deploy - OpenStack, Deploy - update system package(s), and Deploy - upgrade MCP DriveTrain Jenkins pipeline jobs, set the BATCH_SIZE parameter to an integer or percentage. For example, 20 or 20%.

     Batch sizing applies using the following workflow:

     1. Verifies that the BATCH_SIZE pipeline job parameter exists.
     2. Verifies the SALT_MASTER_OPT_WORKER_THREADS environment variable.
     3. Verifies the worker_threads_per_cpu pillar parameter and the available number of CPUs.
     4. Verifies the worker_threads pillar parameter.
     5. If none of the steps above match:

        - Prior to the MCP 2019.2.8 maintenance update, disables batching.
        - Starting from the MCP 2019.2.8 maintenance update, sets batching to 2/3 of the available Salt Master worker threads.

   - For other pipeline jobs, to use batching, set the SALT_MASTER_OPT_WORKER_THREADS environment variable in the global Jenkins settings or directly in the pipeline jobs to an integer or percentage. For example, 20 or 20%.

     Batch sizing applies using the following workflow:

     1. Verifies that the BATCH_SIZE pipeline job parameter exists.
     2. Verifies the SALT_MASTER_OPT_WORKER_THREADS environment variable.
     3. If none of the steps above match:

        - Prior to the MCP 2019.2.8 maintenance update, disables batching.
        - Starting from the MCP 2019.2.8 maintenance update, sets batching to 2/3 of the available Salt Master worker threads.