MCP Deployment Guide

version q3-18

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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
November 26, 2018	Q3`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.

Seealso

- Plan an OpenStack environment
- Plan a Kubernetes cluster

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

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

6. Add the Reclass variable to your bash profile:

   ```
   vim ~/.bash_profile
   ```

   Example:

   ```
   export RECLASS_REPO=<PATH_TO_YOUR_DEV_DIRECTORY>
   ```

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

   ```
   echo $RECLASS_REPO
   ```

   The command returns the content of the ~/.bash_profile file.

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

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

   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.
```

10. Update the submodule:

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

11. Add your changes to a new commit:

```
git add -A
```

12. Commit your changes:

```
git commit
```

13. 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
```

14. Push your changes:

```
git push
```

15. Proceed to Create a deployment metadata model.

Create local mirrors

During an MCP deployment or MCP cluster update, you can make use of local mirrors.

By default, MCP deploys local mirrors with packages in a Docker container on the DriveTrain nodes with GlusterFS volumes. MCP creates and manages mirrors with the help of Aptly, which runs in the container named aptly in the Docker Swarm mode cluster on the DriveTrain nodes, or cid0x in terms of Reclass model.

MCP provides a prebuilt mirror image that you can customize depending on the needs of your MCP deployment, as well as the flexibility to manually create local mirrors. Specifically, the usage of the prebuilt mirror image is essential in the case of an offline MCP deployment scenario.

Get the prebuilt mirror image

The prebuilt mirror image contains the Debian package mirror (Aptly), Docker images mirror (Registry), Python packages mirror (PyPi), Git repositories mirror, and mirror of Mirantis Ubuntu VM cloud images.

To get the prebuilt mirror image:

1. On http://images.mirantis.com, download the latest version of the prebuilt mirror VM in the mcp-offline-image-<MCP_version>.qcow2 format.
2. If required, customize the VM contents as described in Customize the prebuilt mirror image.
3. Proceed to Deploy MCP DriveTrain.

Seealso

MCP Release Notes: Release artifacts section in the related MCP release documentation

Customize the prebuilt mirror image

You can easily customize mirrored Aptly, Docker, and Git repositories by configuring contents of the mirror VM defined in the cicd/aptly.yml file of the Reclass model.

After you perform the customization, apply the changes to the Reclass model as described in Update mirror image.

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:
  apt_mk_version: stable
  mirror_mirantis_openstack_xenial_extra_source: http://apt.mirantis.com/xenial/
  mirror_mirantis_openstack_xenial_extra_distribution: ${_param:apt_mk_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:apt_mk_version}
```

  > Note
  >
  > You can find all mirrors and their parameters that can be overriden in the aptly/server/mirror section of the Reclass System Model

- To add new mirrors, extend the aptly:server:mirror part of the model using the structure as shown in the example above

> Note
>
> The aptly:server:mirror:<REPO_NAME>:publisher parameter specifies how the custom repository will be published.

The example of a custom mirror specification:

```yaml
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
```

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. 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

Example of customization:

```yaml
docker:
  client:
    registry:
      target_registry: apt:5000
      image:
        - registry: ""
          name: registry:2
        - registry: osixia
          name: openldap:1.1.8
        - registry: tcpcloud
          name: aptly-public:latest
```

> Note
>
> The target_registry parameter specifies which registry the images will be pushed into.

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. Customize the list depending on the needs of your MCP deployment.

Example of customization:

```
git:
  server:
    directory: /srv/git/
    repos:
      - name: gerritlib
        url: https://github.com/openstack-infra/gerritlib.git
      - name: jeepyb
        url: https://github.com/openstack-infra/jeepyb.git
```

> Seealso
>
> Update mirror image

Create local mirrors manually

If you prefer to manually create local mirrors for your MCP deployment, check the MCP Release Notes: Release artifacts section in the related MCP release documentation for the list of mirrors required for the MCP deployment.

To manually create a 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

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.

Mirantis provides the following methods to create a deployment metadata model:

Create a deployment metadata model using the Model Designer UI

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

> 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.
>
> Alternatively, you can generate the deployment model manually as described in Create a deployment metadata model manually.

The workflow of a model creation includes the following stages:

1. Defining the model through the Model Designer web UI.
2. Tracking the execution of the model creation pipeline in the Jenkins web UI if required.
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.

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.
>
> Alterantivetly you can generate the deployment model manually as described in Create a deployment metadata model manually.

> **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	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
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
Back end for Barbican	barbican_backend: dogtag	The back end 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

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
- 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

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 back end	bluestore	The OSD back-end type

CI/CD

Parameter	Default JSON output	Description
OpenLDAP enabled	openldap_enabled: 'True'	Enables OpenLDAP authentication
Keycloak service enabled	keycloak_enabled: 'False'	Enables the Keycloak service

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

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_monitor_node01_address}	The IP address of the first OSS node
OSS node02 address	oss_node02_addres: ${_param:stacklight_monitor_node02_address}	The IP address of the second OSS node
OSS node03 address	oss_node03_addres: ${_param:stacklight_monitor_node03_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/s
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_ke
SFDC consumer secret	N/A	Consumer Secret from Salesforce required for OAuth. For example, sfdc_consumer_secret: example_consumer_
SFDC organization ID	N/A	Salesforce Organization ID in Salesforce required for OAuth. For example, sfdc_organization_id: example_organization_
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: 10.0.1	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 back end
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
Tenant Telemetry enabled	false	Enable Tenant Telemetry based on Ceilometer, Aodh, Panko, and Gnocchi. Disabled by default. If enabled, you can choose 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 back end	designate_backend: powerdns	The DNS back end for Designate
OpenStack internal protocol	openstack_internal_protocol: http	The protocol on internal OpenStack endpoints

Kubernetes product parameters

Section	Default JSON output	Description
Calico cni image	artifactory.mirantis.com/docker-prod-local/mirantis/projectcalico/calico/cni:latest	The Calico image with CNI binaries
Calico enable nat	calico_enable_nat: 'True'	If selected, NAT will be enabled for Calico
Calico image	artifactory.mirantis.com/docker-prod-local/mirantis/projectcalico/calico/node:latest	The Calico image
Calico netmask	16	The netmask of the Calico network

Calico network	192.168.0.0	The network that is used for the Kubernetes containers
Calicoctl image	artifactory.mirantis.com/docker-prod-local/mirantis/projectcalico/calico/ctl:latest	The image with the calicoctl command
etcd SSL	etcd_ssl: 'True'	If selected, the SSL for etcd will be enabled
Hyperkube image	artifactory.mirantis.com/docker-prod-local/mirantis/kubernetes/hyperkube-amd64:v1.4	The Kubernetes image
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 containerd enabled	False	Optional. Enables the containerd runtime to execute containers and manage container images on a node instead of Docker. Available as technical preview only.
Kubernetes externaldns enabled	False	If selected, ExternalDNS will be deployed. For details, see: Deploy ExternalDNS for Kubernetes.
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
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 count	ceph_osd_count: 10	The number of OSDs
Ceph OSD rack01 hostname	ceph_osd_rack01_hostname: osd	The OSD rack01 hostname
Ceph OSD rack01 single subnet	ceph_osd_rack01_single_subnet: 172.16.47	The control plane network prefix for Ceph OSDs

Ceph OSD rack01 back-end 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 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

Create a deployment metadata model manually

You can create a deployment metadata model manually by populating the Cookiecutter template with the required information and generating the model.

For simplicity, perform all the procedures described in this section on the same machine and in the same directory where you have configured your Git repository.

Before performing this task, you need to have a networking design prepared for your environment, as well as understand traffic flow in OpenStack. For more information, see MCP Reference Architecture.

For the purpose of example, the following network configuration is used:

Example of network design with OpenContrail

Network	IP range	Gateway	VLAN
Management network	172.17.17.192/26	172.17.17.193	130
Control network	172.17.18.0/26	N/A	131
Data network	172.17.18.128/26	172.17.18.129	133
Proxy network	172.17.18.64/26	172.17.18.65	132
Tenant network	172.17.18.192/26	172.17.18.193	134
Salt Master	172.17.18.5/26	172.17.17.197/26	N/A

This Cookiecutter template is used as an example throughout this section.

Define the Salt Master node

When you deploy your first MCP cluster, you need to define your Salt Master node.

For the purpose of this example, the following bash profile variables are used:

```
export RECLASS_REPO="/Users/crh/MCP-DEV/mcpdoc"
export ENV_NAME="mcpdoc"
export ENV_DOMAIN="mirantis.local"
export SALT_MASTER_NAME="cfg01"
```

> Note
>
> Mirantis highly recommends to populate ~/.bash_profile with the parameters of your environment to protect your configuration in the event of reboots.

Define the Salt Master node:

1. Log in to the computer on which you configured the Git repository.
2. Using the variables from your bash profile, create a $SALT_MASTER_NAME.$ENV_DOMAIN.yml file in the nodes/ directory with the Salt Master node definition:

   ```
   classes:
   - cluster.$ENV_NAME.infra.config
   parameters:
     _param:
       linux_system_codename: xenial
       reclass_data_revision: master
     linux:
       system:
         name: $SALT_MASTER_NAME
         domain: $ENV_DOMAIN
   ```

3. Add the changes to a new commit:

   ```
   git add -A
   ```

4. Commit your changes:

   ```
   git commit -m "your_message"
   ```

5. Push your changes:

   ```
   git push
   ```

Download the Cookiecutter templates

Use the Cookiecutter templates to generate infrastructure models for your future MCP cluster deployments. Cookiecutter is a command-line utility that creates projects from cookiecutters, that are project templates.

The MCP template repository contains a number of infrastructure models for CI/CD, infrastructure nodes, Kubernetes, OpenContrail, StackLight LMA, and OpenStack.

> **Note**
>
> To access the template repository, you need to have the corresponding privileges. Contact Mirantis Support for further details.

To download the Cookiecutter templates:

1. Install the latest Cookiecutter:

   ```
   pip install cookiecutter
   ```

2. Clone the template repository to your working directory:

   ```
   git clone https://github.com/Mirantis/mk2x-cookiecutter-reclass-model.git
   ```

3. Create a symbolic link:

   ```
   mkdir $RECLASS_REPO/.cookiecutters
   ln -sv $RECLASS_REPO/mk2x-cookiecutter-reclass-model/cluster_product/*
   $RECLASS_REPO/.cookiecutters/
   ```

Now, you can generate the required metadata model for your MCP cluster deployment.

> **Seealso**
>
> Generate an OpenStack environment metadata model

Generate an OpenStack environment metadata model

This section describes how to generate the OpenStack environment model using the cluster_product Cookiecutter template. You need to modify the cookiecutter.json files in the following directories under the .cookiecutter directory:

- cicd - cluster name, IP address for the CI/CD control nodes.
- infra - cluster name, cluster domain name, URL to the Git repository for the cluster, networking information, such as netmasks, gateway, and so on for the infrastructure nodes.
- opencontrail - cluster name, IP adresses and host names for the OpenContrail nodes, as well as router information. An important parameter that you need to set is the interface mask opencontrail_compute_iface_mask.
- openstack - cluster name, IP addresses, host names, and interface names for different OpenStack nodes, as well as bonding type according to your network design. You must also update the cluster name parameter to be identical in all files. For gateway_primary_first_nic, gateway_primary_second_nic, compute_primary_first_nic, compute_primary_second_nic, specify virtual interface addresses.
- stacklight - cluster name, IP addresses and host names for StackLight LMA nodes.

To generate a metadata model for your OpenStack environment:

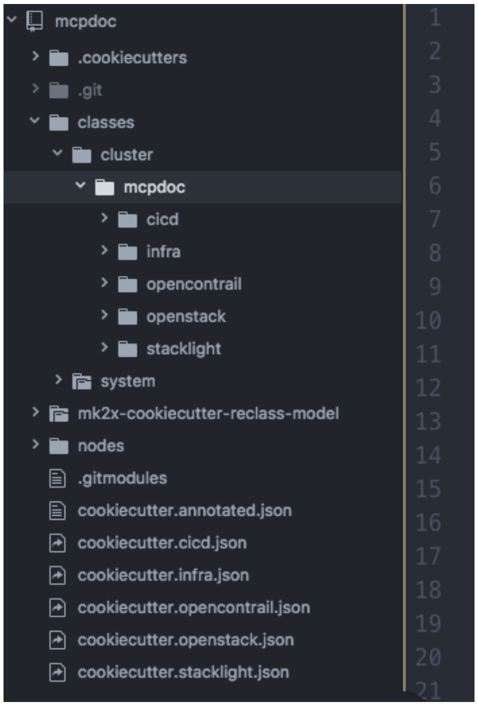
1. Log in to the compute on which you configured your Cookiecutter templates.
2. Generate the metadata model:
   1. Create symbolic links for all cookiecutter directories:

      ```
      for i in `ls .cookiecutters`; do ln -sf \
      .cookiecutters/$i/cookiecutter.json cookiecutter.$i.json; done
      ```

   2. Configure infrastructure specifications in all cookiecutter.json files. See: Deployment parameters.
   3. Generate or regenerate the environment metadata model:

      ```
      for i in cicd infra openstack opencontrail stacklight; \
      do cookiecutter .cookiecutters/$i --output-dir ./classes/cluster \
      --no-input -f; done
      ```

      The command creates directories and files on your machine. Example:



3. Add your changes to a new commit.
4. Commit and push.

Seealso

- Cookiecutter documentation
- Deployment parameters

Deployment parameters

This section lists all parameters that can be modified for generated environments.

Example deployment parameters

Parameter	Default value	Description
cluster_name	deployment_name	Name of the cluster, used as cluster/<ENV_NAME>/ in a directory structure
cluster_domain	deploy-name.local	Domain name part of FQDN of cluster in the cluster
public_host	public-name	Name or IP of public endpoint of the deployment
reclass_repository	https://github.com/Mirantis/mk-lab-salt-model.git	URL to reclass metadata repository
control_network_netmask	255.255.255.0	IP mask of control network
control_network_gateway	10.167.4.1	IP gateway address of control network
dns_server01	8.8.8.8	IP address of dns01 server
dns_server02	1.1.1.1	IP address of dns02 server
salt_master_ip	10.167.4.90	IP address of Salt Master on control network
salt_master_management_ip	10.167.5.90	IP address of Salt Master on management network
salt_master_hostname	cfg01	Hostname of Salt Master
kvm_vip_ip	10.167.4.240	VIP address of KVM cluster
kvm01_control_ip	10.167.4.241	IP address of a KVM node01 on control network
kvm02_control_ip	10.167.4.242	IP address of a KVM node02 on control network
kvm03_control_ip	10.167.4.243	IP address of a KVM node03 on control network
kvm01_deploy_ip	10.167.5.241	IP address of KVM node01 on management network
kvm02_deploy_ip	10.167.5.242	IP address of KVM node02 on management network
kvm03_deploy_ip	10.167.5.243	IP address of KVM node03 on management network
kvm01_name	kvm01	Hostname of a KVM node01
kvm02_name	kvm02	Hostname of a KVM node02
kvm03_name	kvm03	Hostname of a KVM node03

openstack_proxy_address	10.167.4.80	VIP address of proxy cluster on control network
openstack_proxy_node01_address	10.167.4.81	IP address of a proxy node01 on control network
openstack_proxy_node02_address	10.167.4.82	IP address of a proxy node02 on control network
openstack_proxy_hostname	prx	Hostname of VIP proxy cluster
openstack_proxy_node01_hostname	prx01	Hostname of a proxy node01
openstack_proxy_node02_hostname	prx02	Hostname of a proxy node02
openstack_control_address	10.167.4.10	VIP address of control cluster on control network
openstack_control_node01_address	10.167.4.11	IP address of a control node01 on control network
openstack_control_node02_address	10.167.4.12	IP address of a control node02 on control network
openstack_control_node03_address	10.167.4.13	IP address of a control node03 on control network
openstack_control_hostname	ctl	Hostname of VIP control cluster
openstack_control_node01_hostname	ctl01	Hostname of a control node01
openstack_control_node02_hostname	ctl02	Hostname of a control node02
openstack_control_node03_hostname	ctl03	Hostname of a control node03
openstack_database_address	10.167.4.50	VIP address of database cluster on control network
openstack_database_node01_address	10.167.4.51	IP address of a database node01 on control network
openstack_database_node02_address	10.167.4.52	IP address of a database node02 on control network
openstack_database_node03_address	10.167.4.53	IP address of a database node03 on control network
openstack_database_hostname	dbs	Hostname of VIP database cluster
openstack_database_node01_hostname	dbs01	Hostname of a database node01
openstack_database_node02_hostname	dbs02	Hostname of a database node02
openstack_database_node03_hostname	dbs03	Hostname of a database node03
openstack_message_queue_address	10.167.4.40	VIP address of message queue cluster on control network
openstack_message_queue_node01_address	10.167.4.41	IP address of a message queue node01 on control network

openstack_message_queue_node02_address	10.167.4.42	IP address of a message queue node02 on control network
openstack_message_queue_node03_address	10.167.4.43	IP address of a message queue node03 on control network
openstack_message_queue_hostname	msg	Hostname of VIP message queue cluster
openstack_message_queue_node01_hostname	msg01	Hostname of a message queue node01
openstack_message_queue_node02_hostname	msg02	Hostname of a message queue node02
openstack_message_queue_node03_hostname	msg03	Hostname of a message queue node03
openstack_gateway_node01_address	10.167.4.224	IP address of gateway node01
openstack_gateway_node02_address	10.167.4.225	IP address of gateway node02
openstack_gateway_node01_tenant_address	192.168.50.6	IP tenant address of gateway node01
openstack_gateway_node02_tenant_address	192.168.50.7	IP tenant address of gateway node02
openstack_gateway_node01_hostname	gtw01	Hostname of gateway node01
openstack_gateway_node02_hostname	gtw02	Hostname of gateway node02
stacklight_log_address	10.167.4.60	VIP address of StackLight LMA logging cluster
stacklight_log_node01_address	10.167.4.61	IP address of StackLight LMA logging node01
stacklight_log_node02_address	10.167.4.62	IP address of StackLight LMA logging node02
stacklight_log_node03_address	10.167.4.63	IP address of StackLight LMA logging node03
stacklight_log_hostname	log	Hostname of StackLight LMA logging cluster
stacklight_log_node01_hostname	log01	Hostname of StackLight LMA logging node01
stacklight_log_node02_hostname	log02	Hostname of StackLight LMA logging node02
stacklight_log_node03_hostname	log03	Hostname of StackLight LMA logging node03
stacklight_monitor_address	10.167.4.70	VIP address of StackLight LMA monitoring cluster
stacklight_monitor_node01_address	10.167.4.71	IP address of StackLight LMA monitoring node01
stacklight_monitor_node02_address	10.167.4.72	IP address of StackLight LMA monitoring node02
stacklight_monitor_node03_address	10.167.4.73	IP address of StackLight LMA monitoring node03
stacklight_monitor_hostname	mon	Hostname of StackLight LMA monitoring cluster
stacklight_monitor_node01_hostname	mon01	Hostname of StackLight LMA monitoring node01
stacklight_monitor_node02_hostname	mon02	Hostname of StackLight LMA monitoring node02

stacklight_monitor_node03_hostname	mon03	Hostname of StackLight LMA monitoring node03
stacklight_telemetry_address	10.167.4.85	VIP address of StackLight LMA telemetry cluster
stacklight_telemetry_node01_address	10.167.4.86	IP address of StackLight LMA telemetry node01
stacklight_telemetry_node02_address	10.167.4.87	IP address of StackLight LMA telemetry node02
stacklight_telemetry_node03_address	10.167.4.88	IP address of StackLight LMA telemetry node03
stacklight_telemetry_hostname	mtr	hostname of StackLight LMA telemetry cluster
stacklight_telemetry_node01_hostname	mtr01	Hostname of StackLight LMA telemetry node01
stacklight_telemetry_node02_hostname	mtr02	Hostname of StackLight LMA telemetry node02
stacklight_telemetry_node03_hostname	mtr03	Hostname of StackLight LMA telemetry node03
openstack_compute_node01_single_address	10.167.2.101	IP address of a compute node01 on a dataplane network
openstack_compute_node02_single_address	10.167.2.102	IP address of a compute node02 on a dataplane network
openstack_compute_node03_single_address	10.167.2.103	IP address of a compute node03 on a dataplane network
openstack_compute_node01_control_address	10.167.4.101	IP address of a compute node01 on a control network
openstack_compute_node02_control_address	10.167.4.102	IP address of a compute node02 on a control network
openstack_compute_node03_control_address	10.167.4.103	IP address of a compute node03 on a control network
openstack_compute_node01_tenant_address	10.167.6.101	IP tenant address of a compute node01
openstack_compute_node02_tenant_address	10.167.6.102	IP tenant address of a compute node02
openstack_compute_node03_tenant_address	10.167.6.103	IP tenant address of a compute node03
openstack_compute_node01_hostname	cmp001	Hostname of a compute node01
openstack_compute_node02_hostname	cmp002	Hostname of a compute node02
openstack_compute_node03_hostname	cmp003	Hostname of a compute node03
openstack_compute_node04_hostname	cmp004	Hostname of a compute node04
openstack_compute_node05_hostname	cmp005	Hostname of a compute node05

ceph_rgw_address	172.16.47.75	The IP address of the Ceph RGW storage cluster
ceph_rgw_hostname	rgw	The hostname of the Ceph RGW storage cluster
ceph_mon_node01_address	172.16.47.66	The IP address of the first Ceph MON storage node
ceph_mon_node02_address	172.16.47.67	The IP address of the second Ceph MON storage node
ceph_mon_node03_address	172.16.47.68	The IP address of the third Ceph MON storage node
ceph_mon_node01_hostname	cmn01	The hostname of the first Ceph MON storage node
ceph_mon_node02_hostname	cmn02	The hostname of the second Ceph MON storage node
ceph_mon_node03_hostname	cmn03	The hostname of the third Ceph MON storage node
ceph_rgw_node01_address	172.16.47.76	The IP address of the first Ceph RGW storage node
ceph_rgw_node02_address	172.16.47.77	The IP address of the second Ceph RGW storage node
ceph_rgw_node03_address	172.16.47.78	The IP address of the third Ceph RGW storage node
ceph_rgw_node01_hostname	rgw01	The hostname of the first Ceph RGW storage node
ceph_rgw_node02_hostname	rgw02	The hostname of the second Ceph RGW storage node
ceph_rgw_node03_hostname	rgw03	The hostname of the third Ceph RGW storage node
ceph_osd_count	10	The number of OSDs
ceph_osd_rack01_hostname	osd	The OSD rack01 hostname
ceph_osd_rack01_single_subnet	172.16.47	The control plane network prefix for Ceph OSDs
ceph_osd_rack01_backend_subnet	172.16.48	The deploy network prefix for Ceph OSDs
ceph_public_network	172.16.47.0/24	The IP address of Ceph public network with the network mask
ceph_cluster_network	172.16.48.70/24	The IP address of Ceph cluster network with the network mask
ceph_osd_block_db_size	20	The Ceph OSD block DB size in GB
ceph_osd_data_disks	/dev/vdd,/dev/vde	The list of OSD data disks

ceph_osd_journal_or_block_db_disks	/dev/vdb,/dev/vdc	The list of journal or block disks

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.
2	Create the deployment model using the Model Designer web UI.
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.
4	Bootstrap the APT node. Optional, for an offline deployment only.
5	Bootstrap the Salt Master node that contains MAAS provisioner.
6	Deploy the remaining bare metal servers through MAAS provisioner.
7	Deploy MCP CI/CD using Jenkins.

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 and MAAS provisioner.

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 using the Model Designer UI.

        > 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 bridges on the Foundation node:

   - br-mgm for the management network
   - 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. 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
```

4. Restart networking from the IPMI console to bring the bonds up.
5. 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 the offline deployment or online deployment with local mirrors, proceed to Deploy the APT node.
   - If you perform an online deployment, proceed to Deploy the Salt Master 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. 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 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/
   ```

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

> Note
>
> If you are using an already existing model that does not have configuration drives, or you want to generate updated configuration drives, proceed with Generate configuration drives manually.

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

6. Select from the following options to deploy the APT node:

    1. Download the shell script from GitHub:

        ```
        export MCP_VERSION="master"
        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="8388608"
        > - VM_CPUS="4"
        >
        > 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 apt01 VM:

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

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, 2018.11.0.

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, proceed with Generate configuration drives manually.

```
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 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 and export the required variables:

      ```
      chmod 0755 define-vm.sh
      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="8388608"
      > * VM_CPUS="4"
      >
      > 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
   ```

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.

Generally, the procedure consists of the following steps:

1. In the existing cluster model, configure the pillars required to manage the offline mirror VM.
2. For the MCP releases below the 2018.8.0 Build ID, enable the Salt minion on the existing offline mirror VM.

> 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.

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.

To configure the APT node management in the Reclass model:

1. Log in to the Salt Master node.
2. Open the cluster level of your Reclass model.
3. 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}.cicd.aptly
          - cluster.${_param:cluster_name}.infra
          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}
```

4. If the offline mirror VM is in the full offline mode and does not have the cicd/aptly path, create the cicd/aptly.yml file with the following contents:

```
classes:
- system.linux.system.repo_local.mcp.apt_mirantis.docker_legacy
- system.linux.system.repo.mcp.apt_mirantis.ubuntu
- system.linux.system.repo.mcp.apt_mirantis.saltstack
- system.linux.system.repo_local.mcp.extra
parameters:
  linux:
    network:
      interface:
        ens3: ${_param:linux_deploy_interface}
```

5. 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}
```

6. Check out your inventory to be able to resolve any inconsistencies in your model:

```
reclass-salt --top
```

7. Use the system response of the reclass-salt --top command to define the missing variables and specify proper environment-specific values if any.
8. Generate the storage Reclass definitions for your offline image node:

```
salt-call state.sls reclass.storage -l debug
```

9. Synchronize pillars and check out the inventory once again:

```
salt '*' saltutil.refresh_pillar
reclass-salt --top
```

If your MCP version is Build ID 2018.8.0 or later, your offline mirror node should now be manageable through the Salt Master node. Otherwise, proceed to Enable the Salt minion on an existing APT node.

Enable the Salt minion on an existing APT node

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 automaticaly 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. 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 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.

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
```

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.

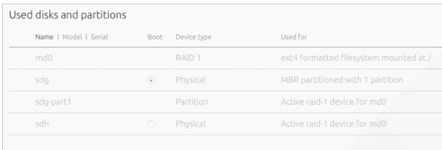
To discover and commission physical nodes manually:

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, your physical nodes are provisioned and you can proceed with configuring and deploying an MCP cluster on them.

Seealso

- Configure PXE booting over UEFI

Deploy physical servers

This section describes how to deploy physical servers 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.

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.

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
...
```

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.

For a description of MCP CI/CD components, see: MCP Reference Architecture: MCP CI/CD components

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 and start using Jenkins on cicd nodes.

Seealso

- Enable a watchdog

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 4.0 setup, add the following parameters to the <cluster_name>/opencontrail/init.yml file of your Reclass model:

   ```
   parameters:
     _param:
       opencontrail_version: 4.0
       linux_repo_contrail_component: oc40
   ```

   > Note
   >
   > OpenContrail 3.2 is not supported.

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
>
> The password for the admin user is defined in the classes/cluster/<cluster_name>/cicd/control/init.yml file of the Reclass model under the openldap_admin_password parameter variable.

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.
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.

Seealso

- View the deployment details
- Enable a watchdog

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

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

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

> Caution!
>
> OpenContrail 3.2 for Kubernetes is not supported. For production environments, use OpenContrail 4.0. For the list of OpenContrail limitations for Kubernetes, see: OpenContrail limitations.

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 using the Model Designer UI. 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.

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. For the OpenContrail 4.0 setup, add the following parameters to the <cluster_name>/opencontrail/init.yml file of your deployment model:

```
parameters:
  _param:
    opencontrail_version: 4.0
    linux_repo_contrail_component: oc40
```

   > **Caution!**
   >
   > OpenContrail 3.2 for Kubernetes is not supported. For production MCP Kubernetes deployments, use OpenContrail 4.0.

3. 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 or OpenContrail as a Kubernetes networking plugin.

> **Caution!**
>
> OpenContrail 3.2 for Kubernetes is not supported. For production MCP Kubernetes deployments, use OpenContrail 4.0.

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
   >
   > The password for the Administrator is defined in the classes/cluster/<CLUSTER_NAME>/cicd/control/init.yml file of the Reclass model under the openldap_admin_password parameter variable.

3. Depending on your use case, find the k8s_ha_calico heat or k8s_ha_contrail 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	• core,k8s,calico for a deployment with Calico • core,k8s,contrail for a deployment with OpenContrail	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 or OpenContrail 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, Docker, and etcd.
4	Install the Kubernetes control plane and networking plugins	• For the Calico deployments: 1. Installs Calico. 2. Sets up etcd. 3. Installs the control plane nodes. • For the OpenContrail deployments: 1. Installs the OpenContrail infrastructure. 2. Configures OpenContrail to be used by Kubernetes. 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 back-end 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 back-end provider yet.

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

Prepare a DNS back end for ExternalDNS

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

To prepare a DNS back end

Choose from the following options depending on your DNS back end:

- 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. Choose 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. Choose 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 back end as described in Prepare a DNS back end for ExternalDNS, prepare your cluster model as described below.

To configure the cluster model:

1. Choose 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 using the Model Designer UI.
     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: XXXXXXXXXXXXXXXXXXXX
              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:
```

```yaml
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

Choose 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 back end.

Verify ExternalDNS with Designate back end after deployment

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

To verify ExternalDNS with Designate back end:

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 back end after deployment

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

To verify ExternalDNS with CoreDNS back end:

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. Choose 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 back end after deployment

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

To verify ExternalDNS with Google CloudDNS back end:

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 back end after deployment

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

To verify ExternalDNS with AWS Route 53 back end:

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.

Seealso

MCP Operations Guide: Kubernetes operations

Deploy StackLight LMA with the DevOps Portal

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
   >
   > The password for the admin user is defined in the classes/cluster/<cluster_name>/cicd/control/init.yml file of the Reclass model under the openldap_admin_password parameter variable.

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.

> 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 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.

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

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
```

- 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

<table>
<tr><td>Barbican</td><td><pre><code>bind:
  address: 127.0.0.1
identity:
  protocol: https</code></pre></td></tr>
<tr><td>Cinder</td><td><pre><code>identity:
  protocol: https
osapi:
  host: 127.0.0.1
glance:
  protocol: https</code></pre></td></tr>
<tr><td>Designate</td><td><pre><code>identity:
  protocol: https
bind:
  api:
    address: 127.0.0.1</code></pre></td></tr>
<tr><td>Glance</td><td><pre><code>bind:
  address: 127.0.0.1
identity:
  protocol: https
registry:
  protocol: https</code></pre></td></tr>
<tr><td>Heat</td><td><pre><code>bind:
  api:
    address: 127.0.0.1
  api_cfn:
    address: 127.0.0.1
  api_cloudwatch:
    address: 127.0.0.1
identity:
  protocol: https</code></pre></td></tr>
<tr><td>Horizon</td><td><pre><code>identity:
  encryption: ssl</code></pre></td></tr>
<tr><td>Ironic</td><td><pre><code>ironic:
  bind:
    api:
      address: 127.0.0.1</code></pre></td></tr>
</table>

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. Apply the model changes to your deployment:

```
salt -C 'I@haproxy' state.apply haproxy
salt -C 'I@apache' state.apply apache
salt 'ctl0*' state.apply kesytone,nova,neutron,heat,glance,cinder,designate,manila,ironic
salt 'mdb0*' state.apply aodh,ceilometer,panko,gnocchi
```

Enable TLS for RabbitMQ and MySQL back ends

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

<table>
<tr><td>Heat</td><td><pre>heat:
  server:
    database:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file></pre></td><td><pre>salt -C 'I@heat:server' state.sls heat</pre></td></tr>
<tr><td>Ironic</td><td><pre>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></pre></td><td><pre>salt -C 'I@ironic:api' state.sls ironic.api
salt -C 'I@ironic:conductor' state.sls ironic.conductor</pre></td></tr>
<tr><td>Keystone</td><td><pre>keystone:
  server:
    database:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file></pre></td><td><pre>salt -C 'I@keystone:server' state.sls keystone.server</pre></td></tr>
<tr><td>Manila</td><td><pre>manila:
 common:
   database:
     x509:
       ca_cert: <path/to/cert/file>
       cert_file: <path/to/cert/file>
       key_file: <path/to/cert/file></pre></td><td><pre>salt -C 'I@manila:common' state.sls manila</pre></td></tr>
<tr><td>Neutron</td><td><pre>neutron:
  server:
    database:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file></pre></td><td><pre>salt -C 'I@neutron:server' state.sls neutron.server</pre></td></tr>
</table>

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
```

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

penStack 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

<table>
<tr><td>Cinder</td><td><pre>
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>
</pre></td><td><pre>salt -C 'I@cinder:controller or I@cinder:volume' state.sls cinder</pre></td></tr>
<tr><td>Designate</td><td><pre>
designate:
  server:
    message_queue:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file>
</pre></td><td><pre>salt -C 'I@designate:server' state.sls designate</pre></td></tr>
<tr><td>Glance</td><td><pre>
glance:
  server:
    message_queue:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file>
</pre></td><td><pre>salt -C 'I@glance:server' state.sls glance.server</pre></td></tr>
<tr><td>Heat</td><td><pre>
heat:
  server:
    message_queue:
      x509:
        ca_cert: <path/to/cert/file>
        cert_file: <path/to/cert/file>
        key_file: <path/to/cert/file>
</pre></td><td><pre>salt -C 'I@heat:server' state.sls heat</pre></td></tr>
</table>

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	<pre>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></pre>
		`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'
```

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

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

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, for example.

To deploy Memcached:

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

Deploy a DNS back end 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 back end for Designate.

Deploy BIND9 for Designate

Berkely Internet Name Domain (BIND9) server can be used by Designate as its underlying back end. 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 back end 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 back end 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 back end. 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 back end 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 back end instead of the default SQLite one, modify the backend section parameters accordingly and configure your metadata model as described in Enable the MySQL back end 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 back end instead of the default SQLite one, modify the backend section parameters accordingly and configure your metadata model as described in Enable the MySQL back end 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 back end for PowerDNS

You can use PowerDNS with the MySQL back end 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 back end 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 back end:

```
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 back end 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/keystonerc; 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/keystonerc; 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 keystonerc; 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/keystonerc; 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/keystonerc; 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/keystonerc; heat 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 back ends, 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 manually 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 back end 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 back end 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 back end, 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
        dev-telemetry:
          pg_num: 512
          pgp_num: 512
          type: replicated
          application: rgw
#          crush_rule: sata
```

2. In the classes/cluster/<cluster_name>/ceph/init.yml file, specify the Telemetry user names and keyrings:

```
parameters:
 _param:
   dev_gnocchi_storage_user: gnocchi_user
   dev_gnocchi_storage_client_key: "secret_key"
```

> Note
>
> To generate the keyring, run the salt -C 'I@ceph:mon and *01*' cmd.run 'ceph-authtool --gen-print-key' command from the Salt Master node.

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"
        dev-gnocchi:
          name: ${_param:dev_gnocchi_storage_user}
          key: ${_param:dev_gnocchi_storage_client_key}
          caps:
            mon: "allow r"
            osd: "allow rwx pool=dev-telemetry"
```

- For the file back end 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.yml file, add the Telemetry node definitions:

```
classes:
- system.reclass.storage.system.openstack_telemetry_cluster
parameters:
  salt:
    reclass:
      storage:
        node:
          openstack_telemetry_node01:
            params:
              linux_system_codename: xenial
              deploy_address: ${_param:openstack_telemetry_node01_deploy_address}
              storage_address: ${_param:openstack_telemetry_node01_storage_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}
              storage_address: ${_param:openstack_telemetry_node02_storage_address}
              redis_cluster_role: 'slave'
          openstack_telemetry_node03:
            params:
              linux_system_codename: xenial
              deploy_address: ${_param:openstack_telemetry_node03_deploy_address}
              storage_address: ${_param:openstack_telemetry_node03_storage_address}
              redis_cluster_role: 'slave'
```

4. 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:
      size:
        openstack.telemetry:
          cpu: 4
          ram: 8192
          disk_profile: large
          net_profile: mdb
      cluster:
        internal:
          node:
            mdb01:
```

```
          name: ${_param:openstack_telemetry_node01_hostname}
          provider: ${_param:infra_kvm_node01_hostname}.${_param:cluster_domain}
          image: ${_param:salt_control_xenial_image}
          size: openstack.telemetry
          rng:
            backend: /dev/urandom
        mdb02:
          name: ${_param:openstack_telemetry_node02_hostname}
          provider: ${_param:infra_kvm_node02_hostname}.${_param:cluster_domain}
          image: ${_param:salt_control_xenial_image}
          size: openstack.telemetry
          rng:
            backend: /dev/urandom
        mdb03:
          name: ${_param:openstack_telemetry_node03_hostname}
          provider: ${_param:infra_kvm_node03_hostname}.${_param:cluster_domain}
          image: ${_param:salt_control_xenial_image}
          size: openstack.telemetry
          rng:
            backend: /dev/urandom
  virt:
    nic:
##Telemetry
      mdb:
        eth2:
          bridge: br-mgm
        eth1:
          bridge: br-ctl
        eth0:
          bridge: br-storage
```

5. Define the Panko and Gnocchi secrets:

    1. In the classes/cluster/<cluster_name>/infra/secrets.yml file, add passwords for Gnocchi and Panko services:

    ```
    parameters:
      _param:
        mysql_gnocchi_password: <GNOCCHI_MYSQL_PASSWORD>
        mysql_panko_password: <PANKO_MYSQL_PASSWORD>
        keystone_gnocchi_password: <GNOCCHI_KEYSTONE_PASSWORD>
        keystone_panko_password: <PANKO_KEYSTONE_PASSWORD>
    ```

    2. Optional. If you have configured Ceph as the aggregation metrics storage for Gnocchi, specify the following parameters in the classes/cluster/<cluster_name>/openstack/init.yml file:

    ```
    gnocchi_storage_user: gnocchi_storage_user_name
    gnocchi_storage_pool: telemetry_storage_pool
    ```

> Note
>
> Use dev-telemetry for Gnocchi storage pool and devgnocchi for Gnocchi storage user.

6. In the classes/cluster/<cluster_name>/openstack/init.yml file, define the global parameters and linux:network:host:

```
parameters:
  _param:
    telemetry_public_host: ${_param:openstack_telemetry_address}
    ceilometer_service_host: ${_param:openstack_telemetry_address}
    aodh_service_host: ${_param:openstack_control_address}
    aodh_service_host: ${_param:openstack_telemetry_address}
    panko_version: ${_param:openstack_version}
    gnocchi_version: 4.0
    gnocchi_service_host: ${_param:openstack_telemetry_address}
    gnocchi_public_host: ${_param:telemetry_public_host}
    aodh_public_host: ${_param:telemetry_public_host}
    ceilometer_public_host: ${_param:telemetry_public_host}
    panko_public_host: ${_param:telemetry_public_host}
    panko_service_host: ${_param:openstack_telemetry_address}
    mysql_gnocchi_password: ${_param:mysql_gnocchi_password_generated}
    mysql_panko_password: ${_param:mysql_panko_password_generated}
    keystone_gnocchi_password: ${_param:keystone_gnocchi_password_generated}
    keystone_panko_password: ${_param:keystone_panko_password_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_node01_storage_address: 10.160.196.66
    openstack_telemetry_node02_storage_address: 10.160.196.67
    openstack_telemetry_node03_storage_address: 10.160.196.68


    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}
```

7. Add endpoints:

    1. In the classes/cluster/<cluster_name>/openstack/control_init.yml file, add the Panko and Gnocchi endpoints:

        ```
        classes:
        - system.keystone.client.service.panko
        - system.keystone.client.service.gnocchi
        ```

    2. In the classes/cluster/<cluster_name>/openstack/proxy.yml file, add the Aodh public endpoint:

        ```
        classes:
        - system.nginx.server.proxy.openstack.aodh
        ```

8. In the classes/cluster/<cluster_name>/openstack/database.yml file, add classes for the Panko and Gnocchi databases:

    ```
    classes:
    - system.galera.server.database.panko
    - system.galera.server.database.gnocchi
    ```

9. Change the configuration of the OpenStack controller nodes:

    1. In the classes/cluster/<cluster_name>/openstack/control.yml file, remove Heka, Ceilometer, and Aodh. Optionally, add the Panko client package to test the OpenStack event CLI command. Additionally, verify that the file includes the ceilometer.client classes.

```
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
```

10. Change the configuration of compute nodes:

1. Open the classes/cluster/<cluster_name>/openstack/compute.yml file for editing.
2. Verify that ceilometer.client and 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. Set the following parameters:

```
parameters:
  ceilometer:
    agent:
      message_queue:
        port: ${_param:rabbitmq_port}
        ssl:
          enabled: ${_param:rabbitmq_ssl_enabled}
      identity:
        protocol: https
```

11. 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}
        ens4:
          enabled: true
          type: eth
          mtu: 9000
          proto: static
          address: ${_param:storage_address}
          netmask: 255.255.252.0
```

12. 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:
- cluster.<cluster_name>.ceph.common
parameters:
  gnocchi:
    common:
      storage:
        driver: ceph
        ceph_pool: ${_param:gnocchi_storage_pool}
        ceph_username: ${_param:gnocchi_storage_user}
```

        - For the file back end 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.linux.system.repo.mcp.extra
- system.linux.system.repo.mcp.apt_mirantis.openstack
- system.linux.system.repo.mcp.apt_mirantis.ubuntu
- system.linux.system.repo.mcp.apt_mirantis.saltstack_2016_3
- system.keepalived.cluster.instance.openstack_telemetry_vip
- system.memcached.server.single
- system.apache.server.single
- system.apache.server.site.gnocchi
- system.apache.server.site.panko
- service.redis.server.single
- system.nginx.server.single
- system.nginx.server.proxy.openstack.aodh
- 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
- system.ceph.common.cluster
- 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: secret_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}
    cluster_internal_protocol: https
    redis_sentinel_node01_address: ${_param:openstack_telemetry_node01_address}
    redis_sentinel_node02_address: ${_param:openstack_telemetry_node02_address}
    redis_sentinel_node03_address: ${_param:openstack_telemetry_node03_address}
    openstack_telemetry_redis_url: redis://${_param:redis_sentinel_node01_address}:26379?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}
    nginx_proxy_openstack_api_host: ${_param:openstack_telemetry_address}
    nginx_proxy_openstack_api_address: ${_param:single_address}
    nginx_proxy_openstack_ceilometer_host: 127.0.0.1
    nginx_proxy_openstack_aodh_host: 127.0.0.1
    nginx_proxy_ssl:
      enabled: true
      engine: salt
      authority: "${_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"
    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}
  salt:
    minion:
      cert:
        internal_proxy:
          host: ${_param:salt_minion_ca_host}
          authority: ${_param:salt_minion_ca_authority}
          common_name: internal_proxy
          signing_policy: cert_open
          alternative_names: IP:127.0.0.1,IP:${_param:cluster_local_address},IP:${_param:openstack_proxy_address},IP:${_param:openstack_telemetry_address},DNS:${linux:system:name},DNS:${linux:network:fqdn},DNS:${_param:single_address},DNS:${_param:openstack_telemetry_address},DNS:${_param:openstack_proxy_address}
          key_file: "/etc/ssl/private/internal_proxy.key"
          cert_file: "/etc/ssl/certs/internal_proxy.crt"
          all_file: "/etc/ssl/certs/internal_proxy-with-chain.crt"
  redis:
    server:
      version: 3.0
      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:
      bind:
        host: 127.0.0.1
      coordination_backend:
        url: ${_param:openstack_telemetry_redis_url}
      identity:
        protocol: ${_param:cluster_internal_protocol}
        host: ${_param:openstack_control_address}
      database:
        ssl:
          enabled: true
      message_queue:
        port: 5671
        ssl:
          enabled: true
  ceilometer:
    server:
      bind:
        host: 127.0.0.1
      coordination_backend:
        url: ${_param:openstack_telemetry_redis_url}
      identity:
        protocol: ${_param:cluster_internal_protocol}
        host: ${_param:openstack_control_address}
      message_queue:
        port: 5672
        ssl:
          enabled: true
  haproxy:
    proxy:
      listen:
        panko_api:
          type: ~
        gnocchi_api:
         type: ~
        aodh-api:
          type: ~
```

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, choose 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 back end 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 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 nginx
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 back end 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' state.sls gnocchi -b 1
salt -C 'I@gnocchi:client' state.sls gnocchi.client -b 1
salt -C 'I@panko:server' state.sls panko -b 1
salt -C 'I@ceilometer:server' state.sls ceilometer -b 1
salt -C 'I@aodh:server' state.sls aodh -b 1
```

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 ceilometer
```

7. 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 back end 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 back end, 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 back end for Designate as described in Deploy a DNS back end 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 back end for Designate as described in Deploy a DNS back end 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 back end for Designate
- Plan the Domain Name System
- Designate operations

Deploy Barbican

MCP enables you to integrate LBaaSv2 Barbican to OpenContrail. 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 back end to store secret data in its database. If you have an existing Dogtag back end, deploy and configure Barbican with it as described in Deploy Barbican with the Dogtag back end. Otherwise, deploy a new Dogtag back end as described in Deploy Dogtag. For testing purposes, you can use the simple_crypto back end.

Deploy Dogtag

Dogtag is one of the Barbican plugins that represents a back end for storing symmetric keys, for example, for volume encryption, as well as passwords, and X.509 certificates.

To deploy the Dogtag back end 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. Modify classes/cluster/os-ha-ovs/infra/config.yml:

   1. Add the - salt.master.formula.pkg.dogtag class to the classes section.
   2. 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:

```
classes:
- salt.master.formula.pkg.dogtag
...

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
```

4. Commit and push the changes to the project Git repository.
5. Log in to the Salt Master node.
6. 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.
7. 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
```

8. Proceed to Deploy Barbican with the Dogtag back end.

> 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 back end

You can deploy and configure Barbican to work with the private Key Recovery Agent (KRA) Dogtag back end.

Before you proceed with the deployment, make sure that you have a running Dogtag back end. If you do not have a Dogtag back end yet, deploy it as described in Deploy Dogtag.

To deploy Barbican with the Dogtag back end:

1. Open the classes/cluster/<cluster_name>/ directory of your Git project repository.
2. In infra/config.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. Choose 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 back end

Warning

The deployment of Barbican with the simple_crypto back end described in this section is intended for testing and evaluation purposes only. For production deployments, use the Dogtag back end. For details, see: Deploy Dogtag.

You can configure and deploy Barbican with the simple_crypto back end.

To deploy Barbican with the simple_crypto back end:

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

- Integrate Barbican to OpenContrail LBaaSv2
- 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
>
> This feature is available as technical preview. Use such configuration for testing and evaluation purposes only.

By default, MCP does not deploy Ironic, therefore, to use this functionality, you need to make changes to your Reclass model manually prior to deploying an OpenStack environment.

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. For example, for the limitations of the Cumulus Supermicro SSE-X3648S/R switch used as an example in this guide, see Prepare a physical switch for TSN.

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.

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 by updating the Salt states.

> Note
>
> This feature is available as technical preview. Use such configuration for testing and evaluation purposes only.

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 examples describe:

- OpenStack Bare Metal API service running on the OpenStack Controller node
- A single-node Bare Metal service for ironic-conductor and other services per the baremetal role residing on the bmt01 node

To modify the deployment model:

1. Create a deployment model as described in Create a deployment metadata model using the Model Designer UI.
2. In the top Reclass ./init.yml file, add:

```
parameters:
  _param:
    openstack_baremetal_node01_address: 172.16.10.110
    openstack_baremetal_address: 192.168.90.10
    openstack_baremetal_node01_baremetal_address: 192.168.90.11
    openstack_baremetal_neutron_subnet_cidr: 192.168.90.0/24
    openstack_baremetal_neutron_subnet_allocation_start: 192.168.90.100
    openstack_baremetal_neutron_subnet_allocation_end: 192.168.90.150
    openstack_baremetal_node01_hostname: bmt01
```

> Note
>
> The openstack_baremetal_neutron_subnet_ parameters must match your baremetal network settings. The baremetal nodes must connected to the network before the deployment. During the deployment, MCP automatically registers this network in the OpenStack Networking service.

3. Modify the ./infra/config.yml:

```
classes:
- system.salt.master.formula.pkg.baremetal
- system.keystone.client.service.ironic
- system.reclass.storage.system.openstack_baremetal_single

parameters:
  reclass:
    storage:
      class_mapping:
        expression: <<node_hostname>>__startswith__bmt
        node_class:
          value_template:
            - cluster.<<node_cluster>>.openstack.baremetal
        cluster_param:
          openstack_baremetal_node01_address:
            value_template: <<node_control_ip>>
      node:
        openstack_baremetal_node01:
          params:
            single_baremetal_address: ${_param:openstack_baremetal_node01_baremetal_address}
```

```
    keepalived_openstack_baremetal_vip_priority: 100
    ironic_api_type: 'deploy'
    tenant_address: 10.1.0.110
    external_address: 10.16.0.110
```

4. Modify the OpenStack nodes:

   * ./openstack/init.yml:

```
parameters:
  _param:
    ironic_version: ${_param:openstack_version}
    ironic_api_type: 'public'
    ironic_service_host: ${_param:cluster_vip_address}
    cluster_baremetal_local_address: ${_param:cluster_local_address}
    mysql_ironic_password: workshop
    keystone_ironic_password: workshop
  linux:
    network:
      host:
        bmt01:
          address: ${_param:openstack_baremetal_node01_address}
          names:
          - bmt01
          - bmt01.${_param:cluster_domain}
```

   * ./openstack/control.yml:

```
classes:
- system.haproxy.proxy.listen.openstack.ironic
- system.galera.server.database.ironic
- service.ironic.client
- system.ironic.api.cluster
- cluster.virtual-mcp11-ovs-ironic
```

   * ./openstack/baremetal.yml:

```
classes:
- system.linux.system.repo.mcp.openstack
- system.linux.system.repo.mcp.extra
- system.linux.system.repo.saltstack.xenial
- system.keepalived.cluster.instance.openstack_baremetal_vip
- system.haproxy.proxy.listen.openstack.ironic_deploy
- system.ironic.api.cluster # deploy only api (heartbeat and lookup
  endpoints are open)
- system.ironic.conductor.cluster
- system.ironic.tftpd_hpa
- system.nova.compute_ironic.cluster
- system.apache.server.single
```

```
- system.apache.server.site.ironic
- system.keystone.client.core
- system.neutron.client.service.ironic
- cluster.virtual-mcp11-ovs-ironic
parameters:
  _param:
    primary_interface: ens4
    baremetal_interface: ens5
    linux_system_codename: xenial
    interface_mtu: 1450
    cluster_vip_address: ${_param:openstack_control_address}
    cluster_baremetal_vip_address: ${_param:single_baremetal_address}
    cluster_baremetal_local_address: ${_param:single_baremetal_address}
    linux_system_codename: xenial
  linux:
    network:
      concat_iface_files:
      - src: '/etc/network/interfaces.d/50-cloud-init.cfg'
        dst: '/etc/network/interfaces'
      bridge: openvswitch
      interface:
        dhcp_int:
          enabled: true
          name: ens3
          proto: dhcp
          type: eth
          mtu: ${_param:interface_mtu}
        primary_interface:
          enabled: true
          name: ${_param:primary_interface}
          proto: static
          address: ${_param:single_address}
          netmask: 255.255.255.0
          mtu: ${_param:interface_mtu}
          type: eth
        baremetal_interface:
          enabled: true
          name: ${_param:baremetal_interface}
          mtu: ${_param:interface_mtu}
          proto: static
          address: ${_param:cluster_baremetal_local_address}
          netmask: 255.255.255.0
          type: eth
          mtu: ${_param:interface_mtu}
```

5. Proceed to Install the Bare Metal service components.

Install the Bare Metal service components

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. Use the procedure below for both new or existing clusters.

> Note
>
> This feature is available as technical preview. Use such configuration for testing and evaluation purposes only.

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' 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 'source keystonerc; ironic driver-list'
```

Deploy Manila

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

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 back ends. This section provides examples of deployment model modifications for the LVM back end. 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 back end 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 using the Model Designer UI, 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. Proceed to Install the Manila components.

Install the Manila components

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'
   ```

Deploy a Ceph cluster manually

Ceph is a storage back end for cloud environments. This section guides you through the manual deployment of a Ceph cluster.

> 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. 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
```

8. Deploy RADOS Gateway:

```
salt -C 'I@ceph:radosgw' saltutil.sync_grains
salt -C 'I@ceph:radosgw' state.sls ceph.radosgw
```

9. Set up the Keystone service and endpoints for Swift or S3:

```
salt -C 'I@keystone:client' state.sls keystone.client
```

10. 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
```

11. 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
```

12. (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
   ```

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

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 or OpenContrail plugins set for Kubernetes networking. For an easier deployment process, use the automated DriveTrain deployment procedure described in Deploy a Kubernetes cluster.

> Caution!
>
> OpenContrail 3.2 for Kubernetes is not supported. For production MCP Kubernetes deployments, use OpenContrail 4.0.

> Note
>
> For the list of OpenContrail limitations for Kubernetes, see: OpenContrail limitations.

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 Virtlet
    - Enable the role-based access control (RBAC)
    - Enable the MetalLB support
    - Enable an external Ceph RBD storage

6. For the OpenContrail 4.0 setup, add the following parameters to the <cluster_name>/opencontrail/init.yml file of your deployment model:

```
parameters:
  _param:
    opencontrail_version: 4.0
    linux_repo_contrail_component: oc40
```

> **Caution!**
>
> OpenContrail 3.2 for Kubernetes is not supported. For production MCP Kubernetes deployments, use OpenContrail 4.0.

7. 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.
8. Define interfaces.
9. 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

salt-formula-etcd

Provisions etcd clusters

salt-formula-docker

Installs and configures the Docker daemon

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 -C 'I@docker:host' 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
    salt -C 'I@docker:host' state.sls docker.host
    ```

    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:
        - For the OpenContrail-based clusters:

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

        - For the Calico-based clusters:

        ```
        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:

   - For the OpenContrail-based clusters:

   ```
   salt -C 'I@kubernetes:master and *01*' state.sls kubernetes.master \
   exclude=kubernetes.master.setup,kubernetes.master.kube-addons
   ```

   - For the Calico-based clusters:

   ```
   salt -C 'I@kubernetes:master and *01*' state.sls kubernetes.master \
   exclude=kubernetes.master.setup
   ```

8. Apply the following state:

   - For the OpenContrail-based clusters:

   ```
   salt -C 'I@kubernetes:master' state.sls kubernetes \
   exclude=kubernetes.master.setup,kubernetes.master.kube-addons
   ```

   - For the Calico-based clusters:

   ```
   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. For the OpenContrail setup, deploy OpenContrail 4.0 as described in Deploy OpenContrail 4.0 for Kubernetes.

Caution!

OpenContrail 3.2 for Kubernetes is not supported.

8. Log in to any Kubernetes Master node and verify that all nodes have been registered successfully:

   ```
   kubectl get nodes
   ```

9. 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 Docker:

      ```
      salt -C 'I@docker:host' state.sls docker.host
      ```

   5. Install Kubernetes:

      ```
      salt -C 'I@kubernetes:pool and not I@kubernetes:master' state.sls kubernetes.pool
      ```

   6. Restart kubelet:

      - For the OpenContrail-based clusters:

        ```
        salt -C 'I@kubernetes:master' state.sls kubernetes.master.kube-addons
        salt -C 'I@kubernetes:pool and not I@kubernetes:master' service.restart kubelet
        ```

      - For the Calico-based clusters:

        ```
        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 components.

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 Docker 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/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
   ```

4. 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:master' state.sls kubernetes.master.kube-addons
salt -C 'I@kubernetes:pool' state.sls kubernetes.pool
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/v1.1.2/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/v1.1.2/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 role-based access control (RBAC)

Enabling the role-based access control (RBAC) allows you to dynamically configure and control access rights to a cluster resources for users and services.

To enable RBAC on a new MCP cluster:

1. Generate a deployment metadata model for your new MCP Kubernetes deployment as described in Create a deployment metadata model using the Model Designer UI.
2. Open your Git project repository.
3. In classes/cluster/<cluster-name/kubernetes/control.yml, define the following parameters:

```
parameters:
  ...
  kubernetes:
    master:
      auth:
        mode: Node,RBAC
```

Proceed with further MCP cluster configuration. RBAC will be enabled during the Kubernetes cluster deployment.

> Seealso
>
> MCP Operations Guide: Use RBAC

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 using the Model Designer UI, 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 using the Model Designer UI, 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 using the Model Designer UI, 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. Choose 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
```

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.

Deploy OpenContrail

This section instructs you on how to manually deploy OpenContrail 4.0 on your Mirantis Cloud Platform (MCP) cluster.

> **Caution!**
>
> New deployments with OpenContrail 3.2 are not supported.

Deploy OpenContrail 4.0 for OpenStack

This section provides instructions on how to manually deploy OpenContrail 4.0 on your OpenStack-based MCP cluster.

To deploy OpenContrail 4.0 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
```

Deploy OpenContrail 4.0 for Kubernetes

This section provides instructions on how to manually deploy OpenContrail 4.0 as an add-on on your Kubernetes-based MCP cluster.

To deploy OpenContrail 4.0 on a Kubernetes-based MCP cluster:

1. Log in to the Salt Master node.
2. Run the following basic states to prepare the OpenContrail nodes:

```
salt -C 'ctl*' saltutil.refresh_pillar
salt -C 'I@opencontrail:control' saltutil.sync_all
salt -C 'I@opencontrail:control' state.sls salt.minion,linux,ntp,openssh
```

3. Create configuration files for OpenContrail:

```
salt -C 'I@opencontrail:control' state.sls opencontrail exclude=opencontrail.client
```

4. Apply the following states to configure OpenContrail as an add-on for Kubernetes:

```
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
```

5. 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.

6. Set up the OpenContrail resources:

   ```
   salt -C 'I@opencontrail:database:id:1' state.sls opencontrail.client
   ```

7. 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
   ```

8. Proceed to the step 14 of the Deploy a Kubernetes cluster procedure.

> Seealso
>
> OpenContrail limitations

Integrate Barbican to OpenContrail LBaaSv2

The Transport Layer Security (TLS) termination on OpenContrail HAProxy load balancer requires Barbican. Barbican is a REST API that is used for secured storage as well as for provisioning and managing of secrets such as passwords, encryption keys, and X.509 certificates.

To connect to the Barbican API, OpenContrail requires configuring the authentication in /etc/contrail/contrail-lbaas-auth.conf and the Barbican client library package python-barbicanclient installed on compute nodes.

To install the Barbican client library:

1. Deploy Barbican.

2. Open your Git project repository.
3. Include the following class to classes/cluster/<cluster_name>/openstack/compute/init.yml:

```
- service.barbican.client.cluster
```

4. Commit and push the changes to the project Git repository.
5. Log in to the Salt Master node.
6. 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.
7. Apply the following state:

```
salt -C 'I@barbican:client' state.apply barbican
```

To configure OpenContrail for the Barbican authentication:

1. Open the classes/cluster/<cluster_name>/ directory of your Git project repository.
2. In openstack/compute.yml, include the following class:

```
- service.opencontrail.compute.lbaas.barbican
```

3. In openstack/init.yml, edit the following parameters:

```
opencontrail_barbican_user: admin
opencontrail_barbican_password: ${_param:keystone_admin_password}
opencontrail_barbican_tenant: admin
```

4. Commit and push the changes to the project Git repository.
5. Log in to the Salt Master node.
6. 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.
7. Log in to the Salt Master node.
8. Apply the following state:

```
salt -C 'I@opencontrail:compute' state.apply opencontrail
```


Seealso

Use HTTPS termination in OpenContrail load balancer

Enable TSN support

While deploying your MCP cluster with OpenContrail, you can connect the OpenContrail virtual network to a bare metal server through a top-of-rack (ToR) switch. Using this feature on large deployments enhances the performance of the tenant-to-tenant networking and simplifies communication with the virtual instances that run on the OpenContrail cluster.

A basic ToR services node (TSN) of the OpenContrail cluster consists of two physical servers that host the ToR Service node and ToR agents. TSN is the multicast controller of the ToR switches.

The modification of the MCP DriveTrain pipeline is not required since deployment of a TSN is the same as deploying a compute node. You only have to modify the TARGET_SERVERS field when enabling TSN on an existing MCP cluster. The configuration of TSN and the ToR agent is part of the OpenContrail compute role along with Keepalived and HAProxy.

Add a ToR services node to MCP

This section describes how to add one top-of-rack (ToR) services node (TSN) with one ToR agent to manage one ToR switch for the OpenContrail cluster in MCP.

Before you proceed with the procedure:

- If you are performing the initial deployment of your MCP cluster, verify that you have created the deployment metadata model as described in Create a deployment metadata model.
- If you are making changes to an existing MCP cluster:
    1. Verify that two physical servers dedicated for TSN are provisioned by MAAS as described in Provision physical nodes using MAAS.
    2. Verify that these two nodes are ready for deployment:

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

       Caution!

       If any of these states fail, fix the issue provided in the output and re-apply the state before you proceed to the below procedure.

To add a TSN to an MCP cluster:

1. Open your Git project repository.

2. In classes/cluster/<cluster_name>/infra/config.yml, include the following class:

   ```
   - reclass.storage.system.opencontrail_tor_cluster
   ```

3. In classes/cluster/<cluster_name>/opencontrail/init.yml, add the TSN IP addresses and ToR VIP address. For example:

   ```
   opencontrail_tor01_node01_address: 172.16.174.61
   opencontrail_tor01_node02_address: 172.16.174.62
   opencontrail_tor01_vip_address: 172.16.174.60
   opencontrail_tor01_node01_tenant_address: 172.16.175.61
   opencontrail_tor01_node02_tenant_address: 172.16.175.62
   ```

4. In classes/cluster/<cluster_name>/opencontrail/, create a tor01.yml file with the following content:

   ```
   classes:
   - system.haproxy.proxy.listen.opencontrail.tor
   - system.salt.minion.cert.opencontrail.tor
   - system.opencontrail.tor.cluster
   - system.opencontrail.client.resource.tor.yml
   - cluster.deployment_name.opencontrail.compute
   parameters:
     _param:
       keepalived_vip_interface: bond0.${_param:control_vlan}
       keepalived_vip_virtual_router_id: 61
       contrail_client_virtual_router_type: tor-service-node
       cluster_node01_address: ${_param:opencontrail_tor01_node01_address}
       cluster_node02_address: ${_param:opencontrail_tor01_node02_address}
       cluster_vip_address: ${_param:opencontrail_tor01_vip_address}
       deploy_nic: one1
       primary_first_nic: ten1
       primary_second_nic: ten2
   ```

5. Commit and push the changes to the project Git repository.

6. Select from the following options:

   - If you are performing the initial deployment of your MCP cluster, proceed with the further cluster configuration as required.
   - If you are making changes to an existing MCP cluster, re-run the Salt configuration on the Salt Master node to apply changes:

     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 git pull origin master command.
    3. Run the salt-call state.sls salt.master command.
    4. Run the salt-call state.sls reclass command.
3. In the Jenkins web UI, find and open the Deploy - OpenStack Compute node pipeline.
4. Open the Build with Parameters section.
5. Specify the following parameters:

Parameter	Description and values
SALT_MASTER_CREDENTIALS	Credentials to the Salt API.
SALT_MASTER_URL	A full Salt API address. For example, https://10.10.10.1:8000.
TARGET_SERVERS	Add I@opencontrail:compute:tor or target the global name of your TSN node, for example tor*.

6. Click Deploy. To view the deployment process, see View the deployment details.

7. Configure a physical switch dedicated for TSN as described in Prepare a physical switch for TSN.

Seealso

Add second ToR agent to an existing TSN

Add second ToR agent to an existing TSN

After you enable TSN for OpenContrail as described in Add a ToR services node to MCP, you should have TSN running one ToR agent tor01 with ID 0 managed by default. You can also add another ToR agent to an existing TSN.

To add a ToR agent to an existing TSN:

1. Open your Git project repository.
2. In classes/cluster/<cluster_name>/opencontrail/, add the following snippet to the tor01.yml file:

```
parameters:
  opencontrail:
    compute:
      tor:
        agent:
```

```
        tor02:
          id: 1
          address: ${_param:single_address}
          port: 6634
          ssl:
            enabled: True
haproxy:
  proxy:
    listen:
      contrail_tor02:
        type: contrail-tor
        service_name: contrail
        binds:
        - address: ${_param:cluster_vip_address}
          port: 6633
        servers:
        - name: tor01
          host: ${_param:cluster_node01_address}
          port: 6634
          params: check
        - name: tor02
          host: ${_param:cluster_node02_address}
          port: 6634
          params: check backup
```

3. Commit and push the changes to the project Git repository.
4. Log in to the Salt Master node.
5. 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.
6. Apply the following states:

```
salt '*' saltutil.refresh_pillar
salt -C 'I@opencontrail:compute:tor' state.sls haproxy,opencontrail
```

Now, you have two ToR agents tor01 with IDs 0 and 1 on the TSN of your OpenContrail cluster.

Prepare a physical switch for TSN

After adding the top-of-rack (ToR) services node (TSN) as described in Add a ToR services node to MCP, you must prepare a physical switch for TSN depending on your needs. This section describes how to configure the Cumulus Supermicro SSE-X3648S/R switch as an example.

The Cumulus Supermicro SSE-X3648S/R switch has the following limitations:

- VXLAN is supported only on switches in the Cumulus Linux hardware compatibility list using the Broadcom Tomahawk, Trident II+, and Trident II chipsets, as well as the Mellanox Spectrum chipset.
- VXLAN encapsulation over layer 3 sub-interfaces, for example, swp3.111, is not supported. Therefore, configure VXLAN uplinks only as layer 3 interfaces without any sub-interfaces.
- The VXLAN tunnel endpoints cannot share a common subnet. Therefore, configure at least one layer 3 hop between the VXLAN source and destination.

> Note
>
> For details about the Cumulus limitations, see the official Cumulus documentation.

To prepare the Cumulus switch for TSN:

1. Log in to the Cumulus node.
2. Add openvswitch-vtep to autostart:

   ```
   sudo sed -i.bak s/START=no/START=yes/g /etc/default/openvswitch-vtep
   systemctl enable openvswitch-vtep
   ```

3. Configure the Open vSwitch Database (OVSDB) in one of the following modes:

   - Plain Transmission Control Protocol (PTCP) mode:

     1. Verify that ovsdb listens on TCP by updating /usr/share/openvswitch/scripts/ovs-ctl-vtep. For example:

        ```
        set "$@" --remote=ptcp:6633:$LOCALIP)
        ```

     2. Configure tunnel_ips and management_ips:

        ```
        sudo vtep-ctl set Physical_switch <switch_name> tunnel_ips=<tunnel_ip>
        sudo vtep-ctl set Physical_switch <switch_name> management_ips=<management_ip>
        ```

   - Secure Sockets Layer (SSL) mode:

     1. Log in to the TSN node.
     2. Copy the certificates to the Cumulus node:

        ```
        scp /etc/contrail/ssl/certs/tor.key IP:<Cumulus_IP> $PRIVATE_KEY_PATH
        scp /etc/contrail/ssl/certs/tor.crt IP:<Cumulus_IP> $CERTIFICATE_PATH
        scp /etc/contrail/ssl/certs/ca.crt IP:<Cumulus_IP> $BOOTSTRAP_CA_CERT_PATH
        ```

     3. Log in to the Cumulus node.
     4. Configure OVSDB to use generated certificates by updating /usr/share/openvswitch/scripts/ovs-ctl-vtep:

```
set "$@" --private-key=$PRIVATE_KEY_PATH
set "$@" --certificate=$CERTIFICATE_PATH
set "$@" --bootstrap-ca-cert=$BOOTSTRAP_CA_CERT_PATH
```

5. Define the OVSDB controller for the ToR switch. For example:

```
sudo vtep-ctl set-manager ssl:192.168.100.17:6632
```

Seealso

VXLAN Layer 2 Gateway and OVSDB configuration example in the official Juniper documentation

Verify TSN after deployment

Once you enable TSN support as described in Enable TSN support, verify that all services are up and running.

To verify TSN after deployment:

1. Log in to any OpenStack controller ctl node.
2. Verify that the Ironic bare metal nodes are in the available state:

```
ironic node-list
```

Example of system response extract:

```
+----------------+-------+-------------+-----------+------------------+
|UUID            |Name   |Instance UUID|Power State|Provisioning State|
+----------------+-------+-------------+-----------+------------------+
|653309c7-a9f3...|cz7788 | None        | power off | available        |
+----------------+-------+-------------+-----------+------------------+
|7541cb97-8427...|cz7396 | None        | power off | available        |
+----------------+-------+-------------+-----------+------------------+
|0f09bef9-baed...|cz7787 | None        | power off | available        |
+----------------+-------+-------------+-----------+------------------+
|4fa42ff7-21d8...|cz7789 | None        | power off | available        |
+----------------+-------+-------------+-----------+------------------+
```

3. Verify the bare metal nodes settings using the ironic node-show <node_name> command. For example:

```
ironic --ironic-api-version latest node-show cz7789
```

The nodes must be registered with the neutron network_interface to pass the connection information to Neutron.

4. Verify the connection information of the nodes that is stored in the local_link_connection field. For example:

```
ironic --ironic-api-version latest node-port-list cz7789
```

Example of system response:

```
+------------------------------------+------------------+
|UUID                                |Address           |
+------------------------------------+------------------+
|0c187be9-86b0-4527-89-15-0baf24c5d263|0c:c4:7a:6a:fb:1e |
+------------------------------------+------------------+
```

```
ironic --ironic-api-version latest node-port-show 0c187be9-86b0-4527-89-15-0baf24c5d263
```

Example of system response:

```
+--------------------------+-------------------------------------+
|Property                  |Value                                |
+--------------------------+-------------------------------------+
|address                   |0c:c4:7a:6a:fb:1e                    |
+--------------------------+-------------------------------------+
|created_at                |2018-01-07T08:55:32+00:00            |
+--------------------------+-------------------------------------+
|extra                     |{}                                   |
+--------------------------+-------------------------------------+
|internal_info             |{}                                   |
+--------------------------+-------------------------------------+
|local_link_connection     |{u'switch_info': u'cz-eth1303-3',    |
|                          |u'port_id': u'swp5', u'switch_id':   |
|                          |u'00:00:00:00:00:00'}                |
+--------------------------+-------------------------------------+
|node_uuid                 |4fa42ff7-21d8-49db-bcdf-090939fc4859 |
+--------------------------+-------------------------------------+
|portgroup_uuid            |None                                 |
+--------------------------+-------------------------------------+
|pxe_enabled               |True                                 |
+--------------------------+-------------------------------------+
|updated_at                |2018-01-08T09:47:55+00:00            |
+--------------------------+-------------------------------------+
|uuid                      |0c187be9-86b0-4527-89-15-0baf24c5d263 |
+--------------------------+-------------------------------------+
```

5. Log in to the Cumulus switch node.

6. Identify physical switches available on the node:

```
vtep-ctl list-ps
```

   Example of system response:

```
cz-eth1303-3
```

7. Verify the port bindings of the switch. Use the port_id value displayed in the local_link_connection field. For example, swp5:

```
vtep-ctl list-bindings cz-eth1303-3 swp5
```

   The output displays no switch ports bound to the Contrail network.

8. Log in to any OpenStack controller ctl node.
9. Display the Nova VMs spawned in the network:

```
nova list
```

   Example of system response extract:

```
+--------------------+------+------+----------+-----------+-------------------+
|ID                  |Name  |Status|Task State|Power State|Networks           |
+--------------------+------+------+----------+-----------+-------------------+
|49074df4-4d4b-47a3...|demovm|ACTIVE| -        |Running    |demo-test=10.11.12.3|
+--------------------+------+------+----------+-----------+-------------------+
```

10. Provision two new bare metal servers in the same network where the Nova VMs are spawned. For example:

```
nova boot --image ubuntu16-server.qcow2 --key-name demo --nic \
net-name=demo-test --flavor bm_flavor --min-count 2 demo-BM-test
```

   Use the nova list command to verify the provisioning status.

11. Provision the remaining bare metal servers in a different network. For example, in demo-test2:

```
nova boot --image ubuntu16-server.qcow2 --key-name demo --nic \
net-name=demo-test2 --flavor bm_flavor --min-count 2 demo-BM-test2
```

12. Log in to the Cumulus switch node.
13. Verify that the corresponding ports are bound to the tenant network used by Ironic for provisioning. For example:

    ```
    vtep-ctl list-bindings cz-eth1303-3 swp5
    ```

    Example of system response:

    ```
    0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
    ```

    ```
    for i in {2..5}; do echo "swp$i $(vtep-ctl list-bindings cz-eth1303-3 swp$i)"; done
    ```

    Example of system response:

    ```
    swp2 0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
    swp3 0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
    swp4 0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
    swp5 0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
    ```

14. Log in to any OpenStack controller ctl node.
15. Verify that the instances that you have created are placed on the Ironic bare metal nodes:

    ```
    ironic node-list
    ```

    Example of system response extract:

    ```
    +----------------+------+----------------+-----------+------------------+
    |UUID            |Name  |Instance UUID   |Power State|Provisioning State|
    +----------------+------+----------------+-----------+------------------+
    |653309c7-a9f3...|cz7788|bd82aa9b-c034...|power on   |active            |
    +----------------+------+----------------+-----------+------------------+
    |7541cb97-8427...|cz7396|f51bf0b7-7bbd...|power on   |deploying         |
    +----------------+------+----------------+-----------+------------------+
    |0f09bef9-baed...|cz7787|806ae56b-64e1...|power on   |deploying         |
    ```

```
+----------------+------+----------------+-----------+------------------+
|4fa42ff7-21d8...|cz7789|e60dae5f-5a2c...|power on   |active            |
+----------------+------+----------------+-----------+------------------+
```

Wait until the Provisioning state of the bare metal machines is active.

16. Log in to the Cumulus switch node.
17. Verify that the nodes ports are connected to the tenant network. For example:

```
for i in {2..5}; do echo "swp$i $(vtep-ctl list-bindings cz-eth1303-3 swp$i)"; done
```

Example of system response:

```
swp2 0000 Contrail-2b141da7-db89-49a5-9120-fb5228980761
swp3 0000 Contrail-22de534e-9ab3-4fe6-bb41-71accd56c47e
swp4 0000 Contrail-a85c8ab2-84ef-418b-aa1b-0d45a626afff
swp5 0000 Contrail-4c951bcf-ac90-54ff-1048-cd56c85a6265
```

18. Verify that the bare metal machines are reachable from compute nodes and the OpenContrail vRouter. For example:
    1. Log in to any bare metal machine.
    2. Run the following command:

    ```
    ip route
    ```

    Example of system response:

    ```
    default via 10.11.12.1 dev eno1
    10.11.12.0/24 dev eno1  proto kernel  scope link  src 10.11.12.4
    ```

    3. Run the following command:

    ```
    ping 10.11.12.3
    ping 10.11.12.2
    ```

Seealso

MCP Operations Guide: Ironic operations

Seealso

- OpenContrail SDN Lab testing in Mirantis blog
- Using ToR Switches and OVSDB in Juniper documentation

Seealso

- OpenContrail limitations
- Troubleshoot OpenContrail for OpenStack
- OpenContrail operations
- Integrate Barbican to OpenContrail LBaaSv2
- Plan OpenContrail networking

Deploy compute nodes

Provisioning and deploying of OpenStack or Kubernetes compute nodes (cmpX, cmp0X) 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. Run the reclass.storage state to 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 on 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 run the reclass state on the cfg node.

5. Apply all states for the target nodes:

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

> 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.

After you deploy compute nodes, deploy StackLight LMA to your MCP cluster as described in Deploy StackLight LMA components.

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.

> Note
>
> The DevOps Portal is currently supported for OpenStack environments only.

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 a deployment metadata model using the Model Designer 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

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.

> Note
>
> Before proceeding, consider the dependencies described in MCP Reference Architecture: Dependencies between services.

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

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

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

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

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 components

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.

> Caution!
>
> If you plan to install StackLight LMA with the DevOps Portal, you should deploy the OSS sub-cluster first as described in Deploy the DevOps Portal manually.

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 and InfluxDB servers.
  - 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 define the name of the InfluxDB database, username, password of the InfluxDB admin, and others.

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 back ends for StackLight LMA

StackLight LMA integrates several back-end servers to visualize an environment monitoring and health statuses. This section describes how to to install various back-end visualization solutions, including: InfluxDB, Elasticsearch, and Kibana. 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 the GitHub projects for SaltStack Elasticsearch formula and SaltStack Kibana 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. 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
```

2. 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
```

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 InfluxDB

The InfluxDB server must be installed on the monitoring cluster of the Mirantis Cloud Platform.

> Note
>
> The current implementation of StackLight LMA for MCP uses the latest version of the community edition, InfluxDB 1.5.2-1. However, InfluxDB 1.5.2-1 does not support clustering. StackLight LMA uses InfluxDB Relay to increase redundancy.

Configure InfluxDB

The configuration parameters of the InfluxDB are defined in the Salt formula. For details and configuration examples, see the SaltStack InfluxDB formula GitHub project.

Deploy InfluxDB

Depending on the cluster Reclass model, the InfluxDB server may run on one or several nodes of the monitoring cluster. But only one InfluxDB server is active at a time.

> **Note**
>
> To use a fully supported InfluxDB cluster for HA and scale-out, install the InfluxEnterprise version separately.

To deploy InfluxDB:

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

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

   By applying this state, you install InfluxDB on the Salt minion nodes that have the influxdb:server role defined in the Salt pillar.

   > **Note**
   >
   > To identify the Salt minion nodes that have the influxdb:server role defined in the Salt pillar, run:
   >
   > ```
   > salt -C 'I@influxdb:server' grains.get id
   > ```

Verify InfluxDB

Depending on the number of nodes and deployment setup, deploying InfluxDB may take up to several hours.

To verify InfluxDB:

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

   ```
   http://<influxDB_VIP>:8086/ping
   ```

3. In the interactive InfluxDB CLI, view the dump file of all the collected time series:

   ```
   > show series
   ```

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 the Elasticsearch and the InfluxDB back ends and their components as described in Install back ends for StackLight LMA, 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. (Optional) If you have enabled and configured the Gainsight service during the deployment model creation, enable the Gainsight integration service:

```
salt -C 'I@docker:swarm and I@prometheus:server' state.sls prometheus.gainsight
```

8. Deploy Prometheus long-term storage. Skip this step if you have selected InfluxDB as a long-term storage when creating the deployment metadata model.

```
salt -C 'I@prometheus:relay' state.sls prometheus
```

9. Deploy the monitoring containers:

```
salt -C 'I@docker:swarm:role:master and I@prometheus:server' state.sls docker
```

10. Configure the Grafana client:

```
salt -C 'I@grafana:client' state.sls grafana.client
```

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
u81ic0p8tdot monitoring_remote_storage_adapter replicated 1/1      remote_storage_adapter: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

- Logging, monitoring, and alerting planning
- Logging, monitoring, and alerting 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 \
   https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/create_config_drive.sh
   chmod +x /root/create-config-drive
   ```

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, choose 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). Choose 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. Choose 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. Run the configuration drive generator script:

        ```
        /root/create-config-drive -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. Put your Reclass model that contains the classes/cluster, classes/system, nodes, .git, and .gitmodules directories in /root/model.

     2. Run the configuration drive generator script:

        ```
        /root/create-config-drive -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:

   ```
   wget -O /root/create-config-drive \
   https://raw.githubusercontent.com/Mirantis/mcp-common-scripts/${MCP_VERSION}/config-drive/create_config_drive.sh
   chmod +x /root/create-config-drive
   ```

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 -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 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.

Configure PXE booting over UEFI

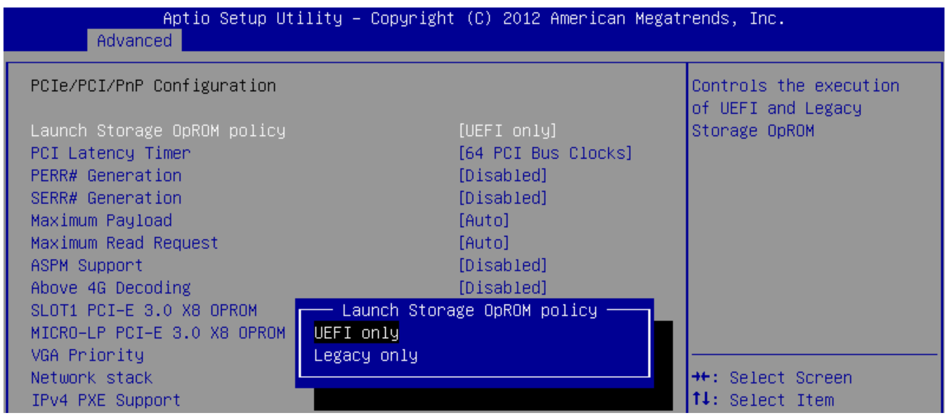
This section explains how to configure the Preboot Execution Environment (PXE) to boot a hardware server from the network over Unified Extensible Firmware Interface (UEFI), which details the interface between the platform firmware and the operating system at boot time.

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.

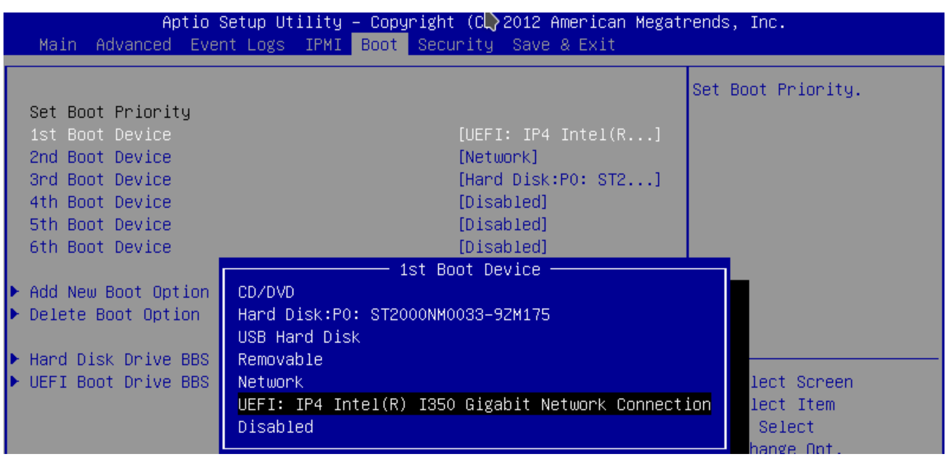
To configure the UEFI network boot:

1. Configure the server in BIOS to use UEFI on boot time:

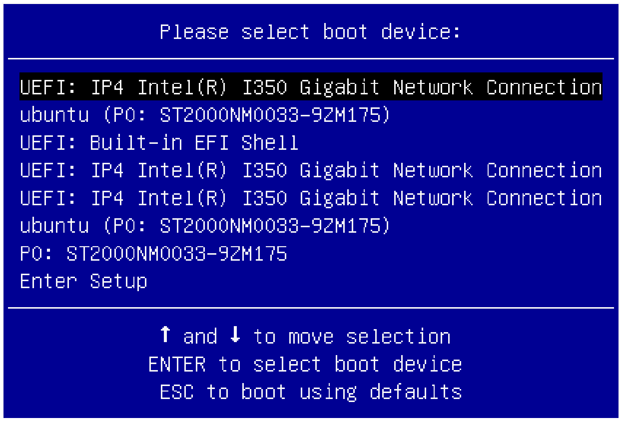
    1. On the Advanced tab, set the Launch Storage OpROM policy option to UEFI only:

    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

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 salt-formula-ntp/README.rst.

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

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 unauthorised 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 authorisation. 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 authorisation before proceeding.

To configure the company name in the logon disclaimer:

1. Log in to the Salt Master node.
2. To configure the company name for the SSH logon, specify 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. To configure the company name for the interactive logon, specify 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 to your deployment:

```
salt -C 'I@salt:control' state.sls openssh.server.service linux.system
```

Now, the logon disclaimer should display the configured company name.

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 is set to 1000. Though, MCP enables you to 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 OpenContrail or OVS compute nodes in one of the following files as required:

   - For OpenContrail compute nodes, modify the cluster/<cluster_name>/opencontrail/networking/compute.yml file.
   - For OVS compute nodes, modify the cluster/<cluster_name>/openstack/networking/compute.yml file.

   Example:

   ```
   linux:
     network:
       ...
       tap_custom_txqueuelen: 20000
   ```

3. Apply the change by running the linux state:

   ```
   salt '*' state.sls linux
   ```

4. Verify that the txqueuelen value has changed:

   1. Log in to the appropriate node.
   2. Check the output of the ifconfig <interface_name>. The txqueuelen value should now equal to the newly set value.

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:

Cores (w/ HT)	Bit 23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Hexadecimal Coremask
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0x2

- PMD CPU mask example:

Cores	Bit																								Hexadecimal
(w/ HT)	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Coremask
24	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0x1460

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 4.0 uses DPDK libraries version 17.02.

> 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

A workload running on 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 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 vhost0 interface:

   - For a single interface in DPDK:

```
...
- 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
```

3. 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

4. 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.)

5. 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
```

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: 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
```

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, 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.

8. 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. 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
     ```

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 with the Neutron LBaaS driver version 2 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 using the Model Designer UI, select OVS as a networking engine in the Infrastructure parameters section and Openstack octavia enabled in the Product parameters section of the Model Designer UI.
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 with the Neutron lbaasv2 service plugin 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 class to cluster/<cluster_name>/openstack/control_init.yml:

   ```
   - system.keystone.client.service.octavia
   ```

4. Add the following classes to cluster/<cluster_name>/openstack/control.yml:

   ```
   - system.neutron.control.openvswitch.octavia
   - system.keystone.client.service.octavia
   - system.glance.client.image.octavia
   - system.nova.client.service.octavia
   - system.neutron.client.service.octavia
   - system.octavia.api.cluster
   - system.octavia.client
   ```

   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
   ```

5. In cluster/<cluster_name>/infra/config.yml, configure the Octavia management services (Controller Worker, Health Manager, and Housekeeping) to run on one of the gateway nodes (gtw01 by default).:

   - 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
```

6. 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:
    octavia_private_key: |
      -----BEGIN RSA PRIVATE KEY-----
      MIIEpAIBAAKCAQEAtjnPDJsQToHBtoqIo15mdSYpfi8z6DFMi8Gbo0KCN33OUn5u
      OctbdtjUfeuhvI6px1SCnvyWi09Ft8eWwq+KwLCGKbUxLvqKltuJ7K3LIrGXkt+m
      qZN4O9XKeVKfZH+mQWkkxRWgX2r8RKNV3GkdNtd74VjhP+R6XSKJQ1Z8b7eHM10v
      6IjTY/jPczjK+eyCeEj4qbSnV8eKlqLhhquuSQRmUO2DRSjLVdpdf2BB4/BdWFsD
      YOmX7mb8kpEr9vQ+c1JKMXDwD6ehzyU8kE+1kVm5zOeEy4HdYIMpvUfN49P1anRV
      2ISQ1ZE+r22IAMKl0tekrGH0e/1NP1DF5rINMwIDAQABAoIBAQCkP/cgpaRNHyg8
      ISKIHs67SWqdEm73G3ijgB+JSKmW2w7dzJgN//6xYUAnP/zIuM7PnJ0gMQyBBTMS
      NBTv5spqZLKJZYivj6Tb1Ya8jupKm0jEWlMfBo2ZYVrfgFmrfGOfEebSvmuPlh9M
      vuzlftmWVSSUOkjODmM9D6QpzgrbpktBuA/WpX+6esMTwJpOcQ5xZWEnHXnVzuTc
      SncodVweE4gz6F1qorbqlJz8UAUQ5T0OZTdHzIS1IbamACHWaxQfixAO2s4+BoUK
      ANGGZWkfneCxx7lthvY8DiKn7M5cSRnqFyDToGqaLezdkMNlGC7v3U11FF5blSEW
      fL1o/HwBAoGBAOavhTr8eqezTchqZvarorFIq7HFWk/l0vguIotu6/wlh1V/KdF+
      aLLHgPgJ5j+RrCMvTBoKqMeeHfVGrS2udEy8L1mK6b3meG+tMxU05OA55abmhYn7
      7vF0q8XJmYIHIXmuCgF90R8Piscb0eaMlmHW9unKTKo8EOs5j+D8+AMJAoGBAMo4
      8WW+D3XiD7fsymsfXalf7VpAt/H834QTbNZJweUWhg11eLutyahyyfjjHV200nNZ
      cnU09DWKpBbLg7d1pyT69CNLXpNnxuWCt8oiUjhWCUpNqVm2nDJbUdlRFTzYb2fS
      ZC4r0oQaPD5kMLSipjcwzMWe0PniySxNvKXKInFbAoGBAKxW2qD7uKKKuQSOQUft
      aAksMmEIAHWKTDdvOA2VG6XvX5DHBLXmy08s7rPfqW06ZjCPCDq4Velzvgvc9koX
      d/lP6cvqlL9za+x6p5wjPQ4rEt/CfmdcmOE4eY+1EgLrUt314LHGjjG3ScWAiirE
      QyDrGOIGaYoQf89L3KqIMr0JAoGARYAklw8nSSCUvmXHe+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
> ```

7. 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_hm_bind_ip: 192.168.0.12
    octavia_loadbalancer_topology: "SINGLE"
    octavia_public_key: |
      ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQC2Oc8MmxBOgcG2ioijXmZ1J
      il+LzPoMUyLwZujQoI3fc5Sfm45y1t22NR966G8jqnHVIKe/JaLT0W3x5bCr4
      rAsIYptTEu+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.

8. 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
```

9. Add the configured Octavia roles to the corresponding nodes:

```
salt-call state.sls reclass.storage
```

10. Refresh pillars:

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

11. Update the Salt Minion configuration:

```
salt-call state.sls salt.minion.service
```

12. Enable the Neutron lbaasv2 service plugin:

```
salt -C 'I@neutron:server and *01*' state.sls neutron.server
salt -C 'I@neutron:server' state.sls neutron.server
```

13. Create the Octavia database:

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

14. Configure HAProxy for Octavia API:

```
salt -C 'I@haproxy:proxy' state.sls haproxy
```

15. Configure NGINX proxy for Octavia API:

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

16. Create an Octavia user and endpoints in Keystone:

```
salt -C 'I@keystone:client' state.sls keystone.client
```

17. Upload an amphora image to Glance:

```
salt -C 'I@glance:client' state.sls glance.client
```

18. 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.

19. 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.

20. Update the Salt mine:

```
salt '*' mine.update
```

21. 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
```

22. Generate certificates for the Octavia controller-amphora communication:

```
salt -C 'I@octavia:manager' state.sls salt.minion.ca
salt -C 'I@octavia:manager' state.sls salt.minion.cert
```

> Note
>
> You may need to apply the above states twice before they succeed.

23. 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:

- Back-end 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 back-end 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 back end 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 back-end servers returns an IP address of the host on which it runs.

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:
           backend: 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 using the Jenkins Deploy - update service(s) config pipeline or directly using Salt:

```
salt -C 'I@keystone:server and *01*' state.sls keystone
salt -C 'I@keystone:server and not *01*' state.sls keystone
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 using the Jenkins Deploy - update service(s) config pipeline or directly using Salt:

```
salt '<target_node>*' state.sls linux.system
```

Deploy Keycloak

Keycloak is an open-source identity and access management solution that provides a single entry point for MCP deployments.

MCP enables you to configure the Keycloak service metadata in a Reclass model using Cookiecutter and deploy Keycloak together with the CI/CD infrastructure. Therefore, if you are performing the initial deployment of your MCP cluster, you should have already enabled Keycloak in your deployment model and deployed Keycloak during the Create a deployment metadata model using the Model Designer UI and Deploy CI/CD stages.

For existing deployments without Keycloak, follow the procedure below.

> Warning
>
> Keycloak identity and access management solution is available as technical preview only. Use such configuration for testing and evaluation purposes only.

To deploy Keycloak:

1. Log in to the Salt Master node.
2. Prepare the the Keycloak formula:
    1. Upload the formula to the Salt Master node:

       ```
       git clone https://gerrit.mcp.mirantis.net/salt-formulas/keycloak /usr/share/salt-formulas/env/_formulas/keycloak
       ```

    2. Install the formula:

       ```
       cd /usr/share/salt-formulas/env/_formulas/keycloak
       make install
       ```

3. Configure the cluster metadata:
    1. Add the following classes to the cluster/cluster_name/cicd/control/init.yml file:

       ```
       - system.glusterfs.server.volume.keycloak
       - system.glusterfs.client.volume.keycloak
       - system.haproxy.proxy.listen.keycloak
       ```

    2. Add the following classes to the cluster/cluster_name/cicd/control/leader.yml file:

       ```
       - system.docker.swarm.stack.keycloak
       - system.docker.swarm.network.keycloak_backend
       ```

       If required, also add additional classes for the components located in the keycloak folder on the system level.

4. Verify that the metadata contains the required parameters:

```
reclass --nodeinfo=ci*
salt '*' saltutil.refresh_pillar
salt 'ci*' pillar.get keycloak
```

5. Deploy Keycloak:

    1. Synchronize Salt modules:

    ```
    salt '*' saltutil.sync_modules
    ```

    2. Apply the states below strictly in the following order:

    ```
    # For creating shared volumes
    salt '*' state.sls glusterfs
    # Generating config files
    salt -I 'keycloak:server' state.sls keycloak
    # Applying Docker network and creating a Docker stack
    salt -I 'docker:swarm:role:master' state.sls docker.client
    # Update HAProxy
    salt '*' state.sls haproxy.proxy
    ```

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
>
> The password for the admin user is defined in the classes/cluster/<cluster_name>/cicd/control/init.yml file of the Reclass model under the openldap_admin_password parameter variable.

14. In the Deploy - OpenStack Jenkins pipeline job, define the STACK_INSTALL: core,kvm,k8s parameters.
15. Click Build.

> Seealso
>
> - View the deployment details