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CHAPTER 1

About This Guide

This guide is intended for domain administrators and project members and explains how to manage project users and compute resources using the self-service panel.
CHAPTER 2

Logging in to the Self-Service Panel

To log in to the self-service panel, do the following:

1. Visit the panel’s IP address on port 8800.

2. Enter your domain name (case sensitive) as well as user name and password. Alternatively, if you are given the link to the self-service panel for a specific domain, you will only need to provide the user name and password.

Sign in

- Domain
  - Domain1

- Login
  - domadmin1

- Password
  - ●●●●●

Sign in
A user can be assigned one of the following roles:

- A domain administrator can manage virtual objects in all projects within the assigned domain as well as project and user assignment in the self-service panel.

- A project member acts as a project administrator in a specific domain in the self-service panel. A project member can be assigned to different projects and can manage virtual objects in them.

You can create, view, and edit users on the All users tab. Creating a user account differs slightly depending on the user role and is described in the following sections.

To edit the user credentials or permissions, click the ellipsis button next to the user and then click Edit.

Enabling and disabling a user account means allowing and prohibiting user login, respectively.

To enable/disable or remove a user, click the corresponding ellipsis button and select the desired action.

### 3.1 Creating Users

To create a user, do as follows:

1. Select the domain in the drop-down list in the top right corner.

2. Switch to All users and click Create user.

3. In the Create user window, specify the user name, password, and, if required, a user e-mail address and description. The user name must be unique within a domain.

4. Select the desired role from the Role drop-down menu.
5. Click **Create**.

![Create user form](image)

3.2 Assigning Users to Projects

Domain administrators can manage project members’ assignment on the **All projects** and **All users** screens.

To assign a user to a project, do one of the following:

- **On the All projects screen:**
  1. Click the project to which you want to assign users (not the project name).
  2. On the project panel, click **Assign members**.
  3. In the **Assign members** window, choose one or multiple users to assign to the project. Only user accounts with the **Project member** role are displayed. Optionally, click **Create project member** to create a new project member in a new window.
  4. Click **Assign**.
Chapter 3. Managing Users and Projects

**Assign members**

Select users to assign as members to the project “dom1project1”.

<table>
<thead>
<tr>
<th>Login</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>projectmember1</td>
<td>—</td>
</tr>
</tbody>
</table>

- Click [Cancel] or [Assign].

To unassign a user from a project, do one of the following:

- **On the All users screen:**
  1. Click the user account with the Project member role whom you want to assign to the project.
  2. On the user panel, click **Assign to project**.
  3. On the Assign user to projects window, select one or multiple projects and click **Assign**.

**Assign user to projects**

Select projects to assign to the user “user1”.

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>project1</td>
<td>A custom project</td>
</tr>
</tbody>
</table>

- Click [Cancel] or [Assign].

To unassign a user from a project, do one of the following:

- **On the All projects screen:**
  1. Click the project to unassign users from.
  2. On the project panel, open the Members tab.
3. Click the cross icon next to a user you want to unassign.

On the All users tab:

1. Click the user to unassign from the project.
2. On the user panel, open the Projects tab.
3. Click the cross icon next to the project from which you want to unassign the user.
3.3 Viewing Project Quotas

Each project is allocated a certain amount of compute resources by means of quotas. To view quotas of a project, open **PROJECTS**, click the desired project in the list, and switch to the **Quotas** tab.
4.1 Managing Virtual Machines

Each virtual machine (VM) is an independent system with an independent set of virtual hardware. Its main features are the following:

- A virtual machine resembles and works like a regular computer. It has its own virtual hardware. Software applications can run in virtual machines without any modifications or adjustment.
- Virtual machine configuration can be changed easily, e.g., by adding new virtual disks or memory.
- Although virtual machines share physical hardware resources, they are fully isolated from each other (file system, processes, sysctl variables) and the compute node.
- A virtual machine can run any supported guest operating system.

The following table lists the current virtual machine configuration limits:

<table>
<thead>
<tr>
<th>Resource</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAM</td>
<td>1 TiB</td>
</tr>
<tr>
<td>CPU</td>
<td>48 logical CPUs</td>
</tr>
<tr>
<td>Storage</td>
<td>15 volumes, 512 TiB each</td>
</tr>
<tr>
<td>Network</td>
<td>15 NICs</td>
</tr>
</tbody>
</table>

A logical CPU is a core (thread) in a multicore (multithreading) processor.
4.1.1 Supported Guest Operating Systems

The following guest operating systems have been tested and are supported in virtual machines:

### Table 4.1.1.1: Windows guest operating systems

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Edition</th>
<th>Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Server 2019</td>
<td>Essentials, Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows Server 2016</td>
<td>Essentials, Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows Server 2012 R2</td>
<td>Essentials, Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows Server 2012</td>
<td>Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows Server 2008 R2</td>
<td>Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows Server 2008</td>
<td>Standard, Datacenter</td>
<td>x64</td>
</tr>
<tr>
<td>Windows 10</td>
<td>Home, Professional, Enterprise, Enterprise 2016 LTSB</td>
<td>x64</td>
</tr>
<tr>
<td>Windows 8.1</td>
<td>Home, Professional, Enterprise</td>
<td>x64</td>
</tr>
<tr>
<td>Windows 7</td>
<td>Home, Professional, Enterprise</td>
<td>x64</td>
</tr>
</tbody>
</table>

### Table 4.1.1.2: Linux guest operating systems

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>CentOS 8.x</td>
<td>x64</td>
</tr>
<tr>
<td>CentOS 7.x</td>
<td>x64</td>
</tr>
<tr>
<td>CentOS 6.x</td>
<td>x64</td>
</tr>
<tr>
<td>RHEL 8.x</td>
<td>x64</td>
</tr>
<tr>
<td>RHEL 7.x</td>
<td>x64</td>
</tr>
<tr>
<td>Debian 9.x</td>
<td>x64</td>
</tr>
<tr>
<td>Ubuntu 18.04.x</td>
<td>x64</td>
</tr>
<tr>
<td>Ubuntu 16.04.x</td>
<td>x64</td>
</tr>
</tbody>
</table>

4.1.2 Creating Virtual Machines

Before you proceed to creating VMs, check that you have these:

- A guest OS source (see *Managing Images* (page 30)):
  - a distribution ISO image of a guest OS to install in the VM, or
• a boot volume template, or
• a boot volume

Note: To obtain a boot volume, create a volume as described in Managing Volumes (page 32), attach it to a VM, install an operating system in it, then delete the VM.

• One or more virtual networks (see Managing Private Virtual Networks (page 39))

• An SSH key (see Managing SSH Keys (page 55))

Note: You can specify an SSH key only when creating VMs from a template or boot volume.

Note: Virtual machines are created with the host CPU model by default. Having compute nodes with different CPUs may lead to live migration issues. To avoid them, you can manually set CPU model for all new VMs as described in the Administrator's Command Line Guide.

To create a VM, do the following:

1. On the Virtual machines screen, click Create virtual machine. A window will open where you will need to specify VM parameters.
2. Specify a name for the new VM.

3. In Deploy from, choose Volume if you have a boot volume or want to create one. Otherwise, choose Image.

4. Depending on your choice, click the pencil icon in the Volumes or Image section and do one of the following:
   
   - In the Images window, select the ISO image or template and click Done.

   ![Images window]

   You can add images to this list on the Images tab. Then reload the page.

   ![Volumes window]

   Then, in the Volumes window, make sure the default boot volume is large enough to accommodate the
guest OS and click Done.

- In the Volumes window, do one of the following:
  - If you have prepared a volume with an installed guest OS, click Attach, find and select the volume, and click Done.
  - Otherwise, click Add. In the Create volume window, specify a name, size in GB, and select a storage policy from the drop-down list. Click Add.

The top volume in the list is considered bootable. So the first created or attached volume becomes the boot volume by default.
5. Optionally, in the **Volumes** window, click **Add** or **Attach** to create or attach any other volumes you need. To select a volume as bootable, place it first in the list by clicking the up arrow button next to it.

6. After you select an image or a volume, the **Placement** drop-down list is displayed. Placements are created by the administrator to group nodes or VMs sharing a distinctive feature, like a special license. Select the placement corresponding to the VM characteristics. For more information, see the “Managing Placements” section of the *Administrator's Guide*.

7. In the **Flavor** window, choose a flavor and click **Done**.

<table>
<thead>
<tr>
<th>Name</th>
<th>vCPU</th>
<th>Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>tiny</td>
<td>1</td>
<td>512 MiB</td>
</tr>
<tr>
<td>small</td>
<td>1</td>
<td>2 GiB</td>
</tr>
<tr>
<td>medium</td>
<td>2</td>
<td>4 GiB</td>
</tr>
<tr>
<td>large</td>
<td>4</td>
<td>8 GiB</td>
</tr>
<tr>
<td>xlarge</td>
<td>8</td>
<td>16 GiB</td>
</tr>
</tbody>
</table>

You can add flavors to this list on the **Flavors** tab, then reload the page.

8. In the network window, click **Add**, select a virtual network interface and click **Add**. It will appear in the **Network interfaces** list.

You can edit additional parameters of newly added network interfaces, like IP and MAC addresses and spoofing protection. To do this, click interface's ellipsis icon, then **Edit**, and set parameters in the **Edit network interface** window.
You will not be able to edit these parameters later. Instead, you will be able to delete the old network interface and replace it with a new one.

Click **Done**.

9. (Optional) If you are deploying the VM from a template or boot volume (not an ISO image), you can specify the following:
• An SSH key to be injected into the VM. To do it, select an SSH key in the Select an SSH key window, and click Done.

**Note:** To be able to connect to the VM via SSH, make sure the VM template has cloud-init installed (see the “Preparing Templates” section of the Administrator’s Guide).

• User data to customize the VM after launch. To do it, write a script in the Customization script field or browse a file on your local server to load the script from.

You can specify user data in one of two formats: cloud-config or shell script. To inject a script in a Windows VM, refer to the Cloudbase-Init documentation.
Note: For the guest OS to be customizable, make sure the VM template or boot volume has cloud-init installed.

10. Back in the Create virtual machine window, click Deploy to create and boot the VM.

11. If you are deploying the VM from an ISO image (not a boot volume template or a volume with a pre-installed guest OS), select the VM, click Console, and install the guest OS using the built-in VNC console.

12. (Optional) If you are deploying the VM from a prepared template with an injected SSH key, you can connect to it via SSH using the username and the VM IP address:

   • For Linux templates, enter the username that is default for the cloud image OS (for example, for a CentOS cloud image, the default login is centos).
• For Windows templates, enter the username that you specified during Cloudbase-Init installation.

• For VMs customized with user data, enter the username specified in the script.

For example:

```bash
# ssh myuser@10.10.10.10
```

### 4.1.3 Virtual Machine Actions Overview

After you create a virtual machine, you can manage it using the actions available for its current state. To see the full list of available actions, click the ellipsis button next to a VM or on top of its panel. Actions include:

• **Run** powers up a VM.

• **Console** connects to running VMs via the built-in VNC console. In the console browser window, you can send a key combination to a VM, take a screenshot of the console window, and download the console log.

• **Reboot** soft-reboots a running VM.

• **Shut down** gracefully shuts down a running VM.

• **Hard reboot** cuts off and restores power, then starts a VM.

• **Power off** forcibly cuts off power from a VM.

• **Shelve** unbinds a stopped VM from the node it is hosted on and releases its reserved resources such as CPU and RAM. A shelved VM remains bootable and retains its configuration, including the IP addresses.

  Virtual machines in other states can be shelved by clicking **Shut down** or **Power off** and selecting the checkbox **Shelve virtual machine** in the confirmation window.

• **Unshelve** spawns a shelved VM on a node with enough resources to host it.

• **Suspend** saves the current VM state to a file.

  This may prove useful, for example, if you need to restart the host but do not want to quit the applications currently running in the VM or restart its guest OS.

• **Resume** restores a VM from suspended state.

• **Download console log** downloads the console log. Make sure logging is enabled inside the VM, otherwise the log will be empty (for more information, see *Enabling Logging inside Virtual Machines* (page 18)).
Examining console logs may be useful in troubleshooting failed virtual machines.

- **Reset state** resets the VM stuck in a failed or transitional state to its last stable state: active, shut down or shelved.
- **Delete** removes a VM from the compute cluster.

### 4.1.4 Enabling Logging inside Virtual Machines

VM's console log will contain log messages only if the TTY1 and TTYS0 logging levels are enabled inside the VM. For example, you can enable them as follows in Linux VMs:

1. Add the line `GRUB_CMDLINE_LINUX_DEFAULT="console=tty1 console=ttyS0"` to the file `/etc/default/grub`.
2. Depending on the boot loader, run either
   
   ```bash
   # grub-mkconfig -o /boot/grub/grub.cfg
   ```
   or
   
   ```bash
   # grub2-mkconfig -o /boot/grub2/grub.cfg
   ```
3. Reboot the VM.

In Windows VMs, you can enable Emergency Management Services (EMS) console redirection for this purpose. Do the following:

1. Start **Windows PowerShell** with administrator privileges.
2. In the PowerShell console, set the COM port and baud rate for EMS console redirection. As Windows VMs have only the COM1 port with the transmission rate of 9600 bps, run:
   
   ```cmd
   bcdedit /emssettings EMSPORT:1
   ```
3. Enable EMS for the current boot entry:
   
   ```cmd
   bcdedit /ems on
   ```

You may also enable driver status logging to see the list of loaded drivers. This can be useful for troubleshooting a faulty driver or long boot process. You can do this as follows:

1. Start **System Configuration** with administrator privileges.
2. In the **System Configuration** windows, open the **Boot** tab, select the checkboxes **OS boot information** and **Make all boot settings permanent**.
3. Confirm the changes and restart the system.

4.1.5 Reconfiguring and Monitoring Virtual Machines

To monitor virtual machine’s CPU, storage, and network usage, select the VM and open the Monitoring tab.

The default time interval for the charts is 12 hours. To zoom into a particular time interval, select the internal with the mouse; to reset zoom, double click any chart.

The following performance charts are available:

**CPU / RAM**
- CPU and RAM usage by the VM.

**Network**
- Incoming and outgoing network traffic.

**Storage read/write**
- Amount of data read and written by the VM.

**Read/write latency**
- Read and write latency. Hovering the mouse cursor over a point on the chart, you can also see the average and maximum latency for that moment as well as the 95 and 99 percentiles.

To reconfigure a VM, select it and, on the Overview tab, click the pencil icon next to a parameter you need to change. You cannot do the following:

- Change, detach, or delete the boot volume
- Manage non-boot volumes except attaching and detaching
- Modify previously added network interfaces
- Attach and detach network interfaces to and from shelved VMs

4.2 Managing Kubernetes Clusters

Self-service users can deploy ready-to-use Kubernetes clusters with persistent storage for managing containerized applications.

The prerequisites for creating a Kubernetes cluster are:
• The Kubernetes-as-a-service component. It can be deployed along with the compute cluster or later (see the “Creating the Compute Cluster” or “Managing Add-On Services” section of the Administrator’s Guide).

• A virtual router that links a public network to a private network that will interconnect the Kubernetes master and worker nodes. The private network needs to have a gateway and a DNS server specified.

• An SSH key that will be installed on both the master and worker nodes.

• Enough resources for all of the Kubernetes nodes, taking their flavors into account.

To create a Kubernetes cluster, on the Kubernetes clusters screen, click Create on the right. A window will open where you can set your cluster parameters:

1. In the Cluster section, select a Kubernetes version, enter a cluster name, and select an SSH key.

<table>
<thead>
<tr>
<th>Cluster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kubernetes version</td>
</tr>
<tr>
<td>Cluster name</td>
</tr>
<tr>
<td>SSH key</td>
</tr>
</tbody>
</table>

2. In the Network section, select a virtual router mentioned in the prerequisites above. It is also recommended to check the Use a floating IP address box. In this case, the Kubernetes nodes will be assigned public IP addresses, simplifying access to them.

<table>
<thead>
<tr>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Use a floating IP address</td>
</tr>
<tr>
<td>The new floating IP addresses will be picked from the network &quot;public1 (10.94.0.0/16)&quot;.</td>
</tr>
</tbody>
</table>

3. In the Master node section, select a flavor and choose whether or not to enable high availability for the master node. If you enable HA, three master node instances will be created. They will work in the Active/Active mode.
4. In the **Container volume** section, select a storage policy and enter size for volumes on both master and worker nodes.

5. In the **Workers** section, set a number of workers to create and select a flavor for each worker.

6. Finally, click **Create**.

Creation of the Kubernetes cluster will start. The master and worker nodes will appear on the **Virtual machines** screen, while their volumes will show up on the **Volumes** screen.

After the cluster is ready, click **Kubernetes access** for instructions on how you can access the dashboard.

To delete a Kubernetes cluster, click it on the **Kubernetes clusters** screen and click **Delete**. The master and worker VMs will be deleted along with their volumes.
4.2.1 Using Persistent Volumes for Kubernetes Pods

Kubernetes allows using compute volumes as persistent storage for pods. Persistent volumes (PV) exist independently of pods, meaning that such a volume persists after the pod it is mounted to is deleted. This PV can be mounted to other pods for accessing data stored on it. You can provision PVs dynamically, without having to create them manually, or statically, using volumes that exist in the compute cluster.

4.2.1.1 Dynamically Provisioning Persistent Volumes

Persistent volumes can be dynamically provisioned via persistent volume claims (PVC). A PVC requests for a PV of a specific storage class, access mode, and size. If a suitable PV exists in the cluster, it is bound to the claim. If suitable PVs do not exist but can be provisioned, a new volume is created and bound to the claim. Kubernetes uses a PVC to obtain the PV backing it and mounts it to the pod.

**Important:** A pod and the persistent volume claim it uses must exist in the same namespace.

You can dynamically provision a PV to a pod as follows:

1. Access the Kubernetes cluster via the dashboard. Click **Kubernetes access** for instructions.
2. On the Kubernetes dashboard, create a storage class and persistent volume claim. To do it, click `CREATE` and specify a YAML file that defines these objects. For example:

```yaml
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: mysc
provisioner: csi-cinderplugin
parameters:
  type: mystoragepolicy

---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mypvc
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: mysc
```
This manifest describes the storage class `mysc` with the storage policy `mystoragepolicy`. The storage policy must exist in the compute cluster and be specified in the storage quotas to the current project. The configuration file also specifies the persistent volume claim `mypvc` that requests from the storage class `mysc` a volume of at least 10 GiB that can be mounted in the read/write mode by a single node.

Creation of the PVC triggers dynamic provisioning of a persistent volume that satisfies the claim's requirements. Kubernetes then binds it to the claim.

### Details

**Name**: mypvc  
**Namespace**: default  
**Annotations**:  
- `pv.kubernetes.io/bind-completed`: yes  
- `pv.kubernetes.io/bound-by-controller`: yes  
- `volume.beta.kubernetes.io/storage-provisioner`: csi-cinderpl..  

**Creation Time**: 2020-02-04T14:38 UTC  
**Status**: Bound  
**Volume**: `pvc-b1b257ba-5588-4989-8517-006dc41e6629`  
**Access modes**: ReadWriteOnce  
**Storage class**: `mysc`

3. Create a pod and specify the PVC as its volume. To do it, click + CREATE and enter the following YAML file:

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: nginx
spec:
  containers:
  - image: nginx
    imagePullPolicy: IfNotPresent
    name: nginx
    ports:
    - containerPort: 80
      protocol: TCP
    volumeMounts:
    - mountPath: /var/lib/www/html
      name: mydisk
  volumes:
  - name: mydisk
```
This configuration file describes the pod nginx that uses the persistent volume claim mypvc. The persistent volume bound to the claim will be accessible at /var/lib/www/html inside the nginx container.

### 4.2.1.2 Statically Provisioning Persistent Volumes

You can mount existing compute volumes to pods using static provisioning of persistent volumes. To mount a compute volume, do the following:

1. In the self-service panel, obtain the ID of the desired volume.

   ![myvolume]

   ![Attach, Clone, Create snapshot, Create image, Delete]

   ![Overview, Snapshots (0)]

   ![Details]

   - Status: Available
   - Volume ID: c5850e42-4f9d-42b5-9bee-8809dedae424

2. Access the Kubernetes cluster via the dashboard. Click **Kubernetes access** for instructions.

3. On the Kubernetes dashboard, create a storage class and persistent volume. To do it, click **CREATE** and specify a YAML file that defines these objects. For example:
This manifest describes the storage class `mysc` with the storage policy `mystoragepolicy`. The storage policy must exist in the compute cluster and be specified in the storage quotas to the current project. The configuration file also specifies the persistent volume `mypv` from the storage class `mysc` that has 10 GiB of storage and access mode that allows it to be mounted in the read/write mode by a single node. The PV `mypv` uses the compute volume with the ID `c5850e42-4f9d-42b5-9bee-8809dedae424` as backing storage.

4. Create a persistent volume claim. Before you define the PVC, make sure the PV is created and has the status “Available”. The existing PV must meet the claim’s requirements to storage size, access mode and storage class. Click + CREATE and specify the following YAML file:

```yaml
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: mypvc
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 10Gi
  storageClassName: mysc
```

Once the persistent volume claim `mypvc` is created, the volume `mypv` is bound to it.
5. Create a pod and specify the PVC as its volume. Use the example from Step 3 in *Dynamically Provisioning Persistent Volumes* (page 22).

In the self-service panel, the compute volume will be mounted to the virtual machine running the Kubernetes pod.
4.2.2 Creating External Load Balancers in Kubernetes

In Kubernetes, you can create a service with an external load balancer that provides access to it from public networks. The load balancer will receive a publicly accessible IP address and route incoming requests to the correct port on the Kubernetes cluster nodes.

To create a service with an external load balancer, do the following:

1. In the self-service panel, obtain the ID of the shared public network.
2. Access the Kubernetes cluster via the dashboard. Click **Kubernetes access** for instructions.

3. On the Kubernetes dashboard, create a deployment and service of the **LoadBalancer** type. To do it, click **+ CREATE** and specify a YAML file that defines these objects. For example:

```yaml
apiVersion: apps/v1beta1
kind: Deployment
metadata:
  name: external-nginx
spec:
  replicas: 2
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
      - name: nginx
        image: nginx
        ports:
          - containerPort: 80

---

kind: Service
apiVersion: v1
metadata:
  name: external-load-balancer
  annotations:
    service.beta.kubernetes.io/openstack-internal-load-balancer: "false"
    loadbalancer.openstack.org/floating-network-id: "a1787f1e-1e79-44db-8d5b-90670bf8d924"
spec:
  selector:
    app: nginx
  type: LoadBalancer
  ports:
  - port: 80
    targetPort: 80
```
The manifest above describes the deployment external-nginx with a replica set of two pods and the service external-load-balancer with the LoadBalancer type. The annotations used for the service indicate that the load balancer will be external and allocated a floating IP address from the public network with the ID a1787f1e-1e79-44db-8d5b-90670bf8d924.

Details

**Name**: external-load-balancer

**Namespace**: default

**Annotations**:
- loadbalancer.openstack.org/floating-network-id: a1787f1e-1e79-44db-8d5b-90670bf8d924
- service.beta.kubernetes.io/openstack-internal-load-balancer: false

**Creation Time**: 2020-02-04T15:10 UTC

**Label selector**: app: nginx

**Type**: LoadBalancer

**Session Affinity**: None

**Connection**

**Cluster IP**: 10.254.52.183

**Internal endpoints**: external-load-balancer:80 TCP
  - external-load-balancer:32761 TCP

**External endpoints**: 10.94.129.73:80

Once the service is created, it can be accessed at the load balancer’s external endpoint.

The load balancer will also appear in the self-service panel, where you can monitor its performance and health.

Load balancers

<table>
<thead>
<tr>
<th>Name</th>
<th>Status</th>
<th>IP address</th>
<th>Floating IP</th>
<th>Members state</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>kube_service_d66...</td>
<td>Active</td>
<td>192.168.10.201</td>
<td>10.94.129.73</td>
<td>2</td>
<td>...</td>
</tr>
</tbody>
</table>
4.3 Managing Images

Virtuozzo Infrastructure Platform allows you to upload ISO images and templates that can be used to create VM volumes. An ISO image is a typical OS distribution that needs to be installed on disk. In turn, a template is a ready volume in the QCOW2 format with an installed operating system and applications and a set minimum size. Many OS vendors offer templates of their operating systems under the name “cloud images”. For a list of guest OSes supported in virtual machines, see Supported Guest Operating Systems (page 9).

4.3.1 Uploading and Removing Images

To add an image, do the following:

1. On the Images screen, click Add image.

2. In the Add image window, do the following:
   1. Click Browse and select a template or ISO file.
   2. Specify an image name to be shown in the admin panel.
   3. Select a correct OS type from the drop-down list.

**Important:** OS type affects VM parameters like hypervisor settings. VMs created from an image with a wrong OS type may not work correctly, e.g., crash.
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3. Click Done to start uploading the image. Upload progress will be shown in the bottom right corner.

**Note:** If you select an image assigned to a placement, the created virtual machine will also be included in this placement. For more information, see the Administrator's Guide.

To download or remove an image, click the ellipsis button next to it and click the desired action.

### 4.3.2 Creating Volumes from Images

You can create volumes from both ISO images and templates. Do the following:

1. On the image panel, click **Create volume**.

2. In the **Create volume** window, specify the volume name, size, and choose a storage policy.
3. Click **Create**.

The new volume will appear on the **Volumes** screen.

### 4.3.3 Mounting ISO Images to Virtual Machines

**Note:** This feature is supported only for Linux virtual machines.

To mount an ISO image to a Linux VM, do as follows:

1. Create a volume from the ISO image as described in *Creating Volumes from Images* (page 31).

2. Attach the resulting volume to the desired VM as described in *Attaching and Detaching Volumes* (page 35).

The mounted disk will appear inside the Linux VM.

### 4.4 Managing Volumes

A volume in Virtuozzo Infrastructure Platform is a virtual disk drive that can be attached to a VM. The integrity of data in volumes is protected by the redundancy mode specified in the storage policy.
4.4.1 Creating, Editing, and Removing Volumes

To create a volume, do the following:

1. On the Volumes screen, click Create volume.

   ![Create volume screen]

   **Create volume**
   
   - Name: vol1
   - Size (GiB): 1
     
     Min. 1 GiB, Max. 512 TiB
   - Storage policy: default

2. In the Create volume window, specify a volume name and size in gigabytes, select a storage policy, and click Add.

   ![Create volume window]

   - **Name**: vol1
   - **Size (GiB)**: 1
     
     Min. 1 GiB, Max. 512 TiB
   - **Storage policy**: default

To edit a volume, select it and click the pencil icon next to a parameter you need to change. Note the following restrictions:

- You cannot shrink volumes.
- To extend volumes that are in use, stop the VM first.
- You cannot change the volume redundancy type.
To remove a volume, click its ellipsis button then click Delete. To remove multiple volumes at once, select them and click Delete. To remove a volume that is in use, detach it first.

**Note:** A volume is removed along with all its snapshots.

### 4.4.2 Cloning Volumes

You can clone volumes that are not attached to VMs or attached to stopped VMs. To clone a volume, do the following:

1. On the **Volumes** screen, click a volume.

2. In volume details that opens, click **Clone**.

3. In the **Clone volume** window that opens, specify a volume name, size, and storage policy. Click **Clone**.
4.4.3 Attaching and Detaching Volumes

To add a writable virtual disk drive to a VM, attach a volume to it. To do this:

1. On the Volumes screen, click the ellipsis button next to an unused volume and click Attach in the context menu.

2. In the Attach volume window, select the VM from the drop-down list and click Done.
To detach a volume, do the following:

1. Click the ellipsis button next to the volume that is in use.

2. If the VM is not running, click **Detach**. If the VM is running, you can only click **Force detach** to immediately detach the volume with a risk of data loss.

### 4.4.4 Creating Images from Volumes

To create multiple VMs with the same boot volume, you can create an image from an existing boot volume and deploy VMs from it. Make sure to install cloud-init in the volume before creating the image.

Do the following:

1. Power off the VM that the original volume is attached to.

2. Switch to the **Volumes** screen, click volume's ellipsis button and choose **Create image**.

3. In the **Create image** window, enter an image name and click **Create**.

The new image will appear on the **IMAGES** tab.
4.4.5 Managing Volume Snapshots

You can save the current state of a VM file system or user data by creating a snapshot of a volume. A snapshot of a boot volume may be useful, for example, before updating VM software. If anything goes wrong, you will be able to revert the VM to a working state at any time. A snapshot of a data volume can be used for backing up user data and testing purposes.

To create a snapshot of a volume, do the following:

1. On the Volumes screen, click a volume.

2. In the volume panel that opens, switch to Snapshots and click Create snapshot.

   ![Create snapshot](image)

   vm1/cirros/Boot volume

   Create snapshot

   Overview

   Snapshots

   Details

   Status

   In use

   Volume ID

   821ad5f5-deeb-4412-b322-18d662ba1b57

Note: To create a consistent snapshot of a running VM's volume, make sure the guest tools are installed in the VM. QEMU guest agent included in the guest tools image automatically quiesces the filesystem during snapshotting. For the instructions on installing the guest tools, see the section “Installing Guest Tools” in the Administrator's Command Line Guide.

Once the snapshot is created, you can see and manage it on the Snapshots tab on the volume panel.
To see the full list of available actions, click the ellipsis button next to a snapshot. Actions include:

- **Create volume** creates a new volume from the snapshot.
- **Create image** creates a template image from the snapshot.
- **Revert to snapshot** discards all changes that have been made to the volume since the snapshot was taken. This action is available only for VMs with the “Shut down” and “Shelved offloaded” statuses.

**Warning:** As each volume has only one snapshot branch, all snapshots created after the snapshot you are reverting to will be deleted. If you want to save a subsequent snapshot before reverting, create a volume or an image from it first.

- **Edit** changes the snapshot name and description.
- **Reset** resets the snapshot stuck in the “Error” state or one of transitional states to the “Available” state.
- **Delete** removes the snapshot.
4.5 Managing Private Virtual Networks

To add a new virtual private network, do the following:

1. On the **Networks** screen, click **Create virtual network**.

2. In the **Network configuration** section, configure the network parameters:

   1. Enable or disable IP address management.

      With IP address management enabled, Virtuozzo Infrastructure Platform will handle virtual machine IP addresses and provide the following features:

      - Allocation pools. You can specify ranges of IP addresses that will be automatically assigned to VMs.

      - Built-in DHCP server. Assigns IP addresses to virtual machines. With the DHCP server enabled, VM network interfaces will automatically be assigned IP addresses: either from allocation pools or, if there are no pools, from network's entire IP range. With the DHCP server disabled, VM network interfaces will still get IP addresses, but you will have to manually assign them inside VMs.

      - Custom DNS servers. You can specify DNS servers that will be used by VMs. These servers will be delivered to virtual machines via the built-in DHCP server.

      With IP address management disabled:

      - VMs connected to a network will be able to obtain IP addresses from DHCP servers in that network.

      - Spoofing protection will be disabled for all VM network ports. Each VM network interface will accept all traffic, even frames addressed to other network interfaces.

      In any case, you will be able to manually assign static IP addresses from inside VMs.

   2. Choose network type.

   3. Specify a name. If IP address management is enabled, specify network's IPv4 address range in **Subnet CIDR**. Optionally specify a gateway. If you leave the **Gateway** field blank, the gateway will be omitted from network settings.

      Click **Next**.
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3. If you enabled IP address management on the previous step, you will move on to the **DHCP and DNS** section. In it, enable or disable the built-in DHCP server and specify one or more allocation pools and DNS servers. Click **Next**.

Create virtual network

<table>
<thead>
<tr>
<th>Network configuration</th>
<th>Configure network settings.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHCP and DNS</td>
<td>IP address management</td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
</tbody>
</table>

- **Name**: privnet1
- **Subnet CIDR**: 192.168.0.0/24
- **Gateway (optional)**: 192.168.0.1

Create virtual network

<table>
<thead>
<tr>
<th>Network configuration</th>
<th>Set DHCP and specify one or more allocation pools for the public virtual network.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHCP and DNS</td>
<td>Enable the built-in DHCP server.</td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
</tbody>
</table>

**Allocation pools**
- **192.168.0.2 — 192.168.0.128**
  - 127 addresses available

**DNS servers**
- **10.10.10.10**
4. In the Summary section, review the configuration and click Create virtual network.

Create virtual network

<table>
<thead>
<tr>
<th>Network configuration</th>
<th>Review the virtual network details and go back to change them if necessary.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHCP and DNS</td>
<td></td>
</tr>
<tr>
<td>Summary</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>privnet1</td>
</tr>
<tr>
<td>Subnet CIDR</td>
<td>192.168.0.0/24</td>
</tr>
<tr>
<td>Gateway</td>
<td>192.168.0.1</td>
</tr>
<tr>
<td>DHCP</td>
<td>Enabled</td>
</tr>
<tr>
<td>Allocation pools</td>
<td>192.168.0.2 — 192.168.0.128</td>
</tr>
<tr>
<td>DNS servers</td>
<td>10.10.10.10</td>
</tr>
</tbody>
</table>

To view and edit parameters of a virtual network, click it on the Networks screen. On the virtual network panel, you can change the virtual network name, gateway, DHCP settings, allocation pools, and DNS servers. To do this, click the pencil icon, enter a new value, and click the check mark icon to confirm.

To delete a virtual network, click the ellipsis icon next to it and Delete. To remove multiple virtual networks at once, select them and click Delete. Before deleting a virtual network, make sure no VMs are connected to it.

4.6 Managing Virtual Routers

Virtual routers provide L3 services such as routing and Source Network Address Translation (SNAT) between private and public networks or different private networks:

- a virtual router between private and public networks provides access to public networks, such as the Internet, for VMs connected to this private network;

- a virtual router between different private networks provides network communication for VMs connected to these private networks.

A virtual router has two types of ports:
• an external gateway that is connected to a public network,
• an internal port that is connected to a private network.

*Note:* A router can only connect networks with enabled IP management.

To create a virtual router, do the following:

1. On the **COMPUTE > Networks > NETWORKS** tab, make sure the virtual networks that are to be connected to a router have a gateway specified.
2. Navigate to the **COMPUTE > Routers** tab and click **Add router**.
3. In the **Add router** window:
   1. Specify a router name.
   2. From the **Network** drop-down menu, select a public network through which external access will be provided via an external gateway. The new external gateway will pick an unused IP address from the selected public network.
3. In the **Add internal interfaces** section, select one or more private networks to connect to a router via internal interfaces. The new internal interfaces will attempt to use the gateway IP address of the selected private networks by default.
4. Optionally, select or deselect the **SNAT** checkbox to enable or disable SNAT, respectively, on the external gateway of the router. With SNAT enabled, the router replaces VM private IP addresses with the public IP address of its external gateway.
4. Click **Create**.

To edit a router name, click the ellipsis icon next to it and **Rename**.

To remove a virtual router, click the ellipsis icon next to it and **Delete**. To remove multiple virtual networks at once, select them and click **Delete**. Before deleting a virtual router, make sure no floating IP addresses are associated with any network it is connected to.

### 4.6.1 Managing Router Interfaces

You can add an external router interface as follows:

**Note:** To change an external gateway, remove the existing one first.

1. On **Routers** screen, click the router name to open the list of its interfaces.
2. Click **Add** on the toolbar, or click **Add interface** if there are no interfaces to show.

3. In the **Add interface** window, do the following:
   
   1. Choose **External gateway**.
   
   2. From the **Network** drop-down menu, select a public network to connect to the router. The new interface will pick an unused IP address from the selected public network. You can also provide a specific IP address from the selected public network to assign to the interface in the **IP address** field.
   
   3. Optionally, select or deselect the **SNAT** checkbox to enable or disable SNAT, respectively, on the external gateway of the router. With SNAT enabled, the router replaces VM private IP addresses with the public IP address of its external gateway.

4. Click **Add**.

To edit the external gateway parameters, click the ellipsis icon next to it and **Edit**. In the **Edit interface** window, you can change the external gateway IP address and enable or disable SNAT on it. To save your changes, click **Save**.
You can add an internal router interface as follows:

1. On **Routers** screen, click the router name to open the list of its interfaces.

2. Click **Add**.

3. In the **Add interface** window, select a network to connect to the router from the **Network** drop-down menu. The new interface will attempt to use the gateway IP address of the selected private network by default. If it is in use, specify an unused IP address from the selected private network to assign to the interface in the **IP address** field.

4. Click **Add**.

To remove a router interface, click the ellipsis icon next to it and **Delete**. To remove multiple interfaces at once, select them and click **Delete**.

### 4.6.2 Managing Static Routes

You can also configure static routes of a router by manually adding entries into its routing table. This can be useful, for example, if you do not need a mutual connection between two private networks and want only one private network to be accessible from the other.

Consider the following example:
• the virtual machine `vm1` is connected to the private network `private1` (192.168.128.0/24) via the network interface with IP address 192.168.128.10,

• the virtual machine `vm2` is connected to the private network `private2` (192.168.30.0/24) via the network interface with IP address 192.168.30.10,

• the router `router1` connects the network `private1` to the public network via the external gateway with the IP address 10.94.129.73,

• the router `router2` connects the network `private2` to the public network via the external gateway with the IP address 10.94.129.74.

To be able to access `vm2` from `vm1`, you need to add a static route for `router1`, specifying the CIDR of `private2`, that is 192.168.30.0/24, as the destination subnet and the external gateway IP address of `router2`, that is 10.94.129.74, as the next hop IP address. In this case, when an IP packet for 192.168.30.10 reaches `router1`, it will be forwarded to `router2` and then to `vm2`.

To create a static route for a router, do the following:

1. On the **Routers** screen, click the router name. Open the **STATIC ROUTES** tab and click **Add** on the toolbar. Or click **Add static route** if there are no routes to show.

2. In the **Add static route** window, specify the destination subnet range and mask in CIDR notation and the next hop's IP address. The next hop's IP address must belong to one of the networks that the router is connected to.
3. Click **Add**.

To edit a static route, click the ellipsis icon next to it and **Edit**. In the **Edit static route** window, change the desired parameters and click **Save**.

To remove a static route, click the ellipsis icon next to it and **Delete**. To remove multiple routes at once, select them and click **Delete**.

### 4.7 Managing Floating IP Addresses

A virtual machine connected to a virtual private network can be accessed from public networks, such as the Internet, by means of a floating IP address. Such an address is picked from a public network and mapped to VM's private IP address. The floating and private IP addresses are used at the same time on the VM's network interface. The private IP address is used to communicate with other VMs on the private network. The floating IP address is used to access the VM from public networks. The VM guest operating system is unaware of the assigned floating IP address.

Note the following prerequisites:

1. A VM must have a fixed private IP address.

2. A virtual router must connect the public network from which a floating IP will be picked with VM's private network.
You can create a floating IP address and assign it to a VM as follows:

1. On the **Floating IPs** screen, click **Add floating IP**.
2. In the **Add floating IP address**, select a public network from which a floating IP will be picked and a VM network interface with a fixed private IP address.
3. Click **Add**.

A floating IP address can be re-assigned to another virtual machine. Do the following:

1. Click the ellipsis icon next to the floating IP address and then click **Unassign**.
2. Once the VM name disappears in the **Assigned to** column, click the ellipsis icon again and choose **Assign**.
3. In the **Assign floating IP address** window, select a VM network interface with a fixed private IP address.
4. Click **Assign**.

To remove a floating IP address, unassign it from a VM as described above, then click the ellipsis icon again and choose **Delete**.

### 4.8 Managing Load Balancers

Virtuozzo Infrastructure Platform offers load balancing as a service for the compute infrastructure. Load balancing ensures fault tolerance and improves performance of web applications by distributing incoming network traffic across virtual machines from a balancing pool. A load balancer receives and then routes incoming requests to a suitable VM based on a configured balancing algorithm and VM health.
Note the following requirements:

1. A load balancer can only operate in networks with enabled IP management.
2. All VMs in balancing pools must have fixed IP addresses.

You can create a load balancer with balancing pools as follows:

1. On the **Load balancers** screen, click **Create load balancer**.
2. In the **Create load balancer** window, do the following:
   
   1. Specify a name and optionally description.
   2. Enable or disable high availability:
      
      • With high availability enabled, two load balancer instances will be created. They will work in the Active/Standby mode according to the Virtual Router Redundancy Protocol (VRRP).
      
      • With high availability disabled, a single load balancer instance will be created.

1. In the **Network settings** section, select the network that the load balancer will operate in and optionally specify an IP address that will be allocated to the load balancer.

   If a chosen private network is connected to a public network via a router, you can assign a floating IP address to the load balancer. To do it, select **Use a floating IP address**, and from the drop-down menu that appears, choose either to use an available floating IP address or to create a new one.
1. In the **Balancing pools** section, create a balancing pool to forward traffic from the load balancer to virtual machines by clicking **Add**.

In the **Create balancing pool** window that opens, do the following:

1. In the **Forwarding rule** section, select a forwarding rule from the load balancer to the backend protocol: **HTTPS -> HTTPS, HTTPS -> HTTP, HTTP -> HTTP**, or **TCP -> TCP**. Additionally, specify the ports for incoming and destination connections in the **LB port** and **Backend port** fields.

Note the following:

- With the **HTTPS -> HTTPS** rule, all virtual machines need to have the same SSL certificate (or a certificate chain).
- With the **HTTPS -> HTTP** rule, you need to upload an SSL certificate (or a certificate chain) in the PEM format and a private key in the PEM format.

**Important:** The forwarding rule cannot be changed after the load balancer is created.

2. In the **Balancing settings** section, choose a balancing algorithm:

- **Least connections.** Requests will be forwarded to the VM with the least number of active
connections.

- **Round robin.** All VMs will receive requests in the round-robin manner.
- **Source IP.** Requests from a unique source IP address will be directed to the same VM.

Enable/disable the **Sticky session** option to enable/disable session persistence. The load balancer will generate a cookie that will be inserted into each response. The cookie will be used to send future requests to the same VM.

**Note:** This option is not available in the SSL passthrough mode.

3. In the **Members** section, add members, i.e. virtual machines, to the balancing pool by clicking **Add**. Each VM can be included to multiple balancing pools.

In the **Add members** window that opens, select desired VMs and click **Add**.

4. In the **Health monitor** section, choose the protocol that will be used for monitoring members availability:
• **HTTP/HTTPS.** The HTTP/HTTPS method GET will be used to check for the response status code 200. Additionally, specify the URL path to the health monitor.

• **TCP.** The health monitor will check the TCP connection on the backend port.

• **PING.** The health monitor will check members’ IP addresses.

---

**Important:** The protocol cannot be changed after the load balancer is created.

---

The health monitor defines how the load balancer monitors the availability of members in the pool.

- [Protocol](#) [URL path](#)

The HTTP method GET will be used to check for the response status code 200.

---

**Health monitor**

The health monitor defines how the load balancer monitors the availability of members in the pool.

- [Protocol](#) [URL path](#)

The protocol cannot be changed after the load balancer is created.

---

The HTTP method GET will be used to check for the response status code 200.

---

By default, the health monitor removes a member from a balancing pool if it fails three consecutive health checks of five-second intervals. When a member returns to operation and responds successfully to three consecutive health checks, it is added to the pool again. You can manually set the health monitor parameters, such as the interval after which VM health is checked, the time after which the monitor times out, healthy and unhealthy thresholds. To change the default parameters, click **Edit parameters**, enter the desired values, and click **Save**.
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5. Click **Create**.

2. Add more balancing pools as described above, if required.

3. Click **Create**.

Create one or more balancing pools to forward traffic from the load balancer to members.

Once the load balancer is created, you can monitor its performance and health on the **Overview** tab of its
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The following charts are available:

**Members state**
- The total number of members in the balancing pools grouped by status: “Healthy”, “Unhealthy”, “Error”, and “Disabled”.

**CPU/RAM**
- CPU and RAM usage by the load balancer.

**Network**
- Incoming and outgoing network traffic.

**Active connections**
- The number of active connections.

**Error requests**
- The number of error requests.

You can see the load balancer parameters on its Properties tab.

To edit the name or description of a load balancer, click the ellipsis icon next to it and Edit.

To disable/enable or remove a load balancer, click the ellipsis icon next to it and the desired action. To remove multiple load balancers at once, select them and click Delete.

### 4.8.1 Managing Balancing Pools

To see a list of balancing pools in a load balancer, click its name.

To add another balancing pool to a load balancer, click Create balancing pool and fill in the fields as described in Managing Load Balancers (page 48). The newly added pool will appear in the list of balancing
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You can open the pool’s panel to monitor its performance and health on the **Overview** tab, see its parameters on the **Properties** tab, and manage its members on the **Members** tab.

To edit the balancing settings such as the balancing algorithm and session persistence, click the ellipsis icon next to a pool and **Edit**. To edit the health monitor parameters, click the ellipsis icon next to a pool and **Edit health monitor**.

To add more members to a balancing pool, click the ellipsis icon next to it and **+ Add members**.

To remove a balancing pool, click the ellipsis icon next to it and click **Delete**. To remove multiple balancing pools at once, select them and click **Delete**.

### 4.9 Managing SSH Keys

Use of SSH keys allows you to secure SSH access to virtual machines. You can generate a key pair on a client from which you will connect to VMs via SSH. The private key will be stored on the client and you will be able to copy it to other nodes. The public key will need to be uploaded to Virtuozo Infrastructure Platform and specified during VM creation. It will be injected into the VM by **cloud-init** and used for OpenSSH authentication. Keys injection is supported for both Linux and Windows virtual machines.

**Note:** You can specify an SSH key only if you deploy a VM from a template or boot volume (not an ISO image).

Before using the SSH keys feature, make sure the following requirements are met:

- The **cloud-init** utility is installed in a VM template or boot volume.
- OpenSSH Server is installed in a Windows template or boot volume.

For the instructions on preparing templates or boot volumes, see the “Preparing Templates” section of the *Administrator’s Guide*.

To add a public key, do the following:

1. Generate an SSH key pair on a client using the **ssh-keygen** utility:

   ```
   # ssh-keygen -t rsa
   ```
2. On the **SSH Keys** screen, click **Add key**.

3. In the **Add SSH key** window, specify a key name and copy the key value from the generated public key located in `/root/.ssh/id_rsa.pub`. Optionally, you can add a key description.

   ![Add SSH key window](image)

   **For the key to be successfully injected into the VM, the template must contain the cloud-init package.**

   - **Name**: `root_node001vstoragedomain`
   - **Description (optional)**: `My public key`
   - **Key value**: `n1h0cuizlqbj2AHYqgiUWX7W3bE3nCCUxEX9DuHH2GJPxy8Kz7HKaRY0GULMioJz7QrywZThQ3TI1YX+Qj5i7kbUek9hgy+RR/kjnMMi
g6gyP2b4BDrflpZUNx4Nxm1L9iCGUoTWPliec0n2LQMh2fAfxBBh
m6DVUPBLpowsnA1b00kemV51DJsKxuDulqY35X27anWPcJFKTZN47RnyCDT/X6tBYdxQj6ARIQsp1JDWkjN7B6h9gwNZj/PpyXi5wEvh
SLXrIMam93b3WzMYyVhLVXGuvgbP+dF5Cq6B8FthXefktpt121
5P/FD root@node001.vstoragedomain`

   To delete one or more keys, select them and click **Delete**.

**Note:** If a key has been injected into one or more VMs, it will remain inside those VMs even if you delete it from the admin panel.