Acronis Cyber Infrastructure 3.0

Administrator's Guide

April 19, 2021

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Acronis patented technologies

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Contents

CHAPTER 1

About This Guide

This primary guide describes operations on Acronis Cyber Infrastructure that you can perform via the web-based admin panel. In particular, it explains how to:

- configure networking for both the storage and compute cluster;
- create and manage the storage cluster;
- set up and run storage services, including S3, iSCSI, NFS, and backup gateways;
- monitor the storage cluster;
- create and manage the compute cluster;
- create and manage virtual machines, volumes, images, and storage policies;
- perform auxiliary tasks: set up high availability, enable RDMA, manage licenses, send problem reports, and such.

CHAPTER 2

Managing the Storage Cluster

Before you create the storage cluster, you need to set up the networks and assign them to network interfaces as recommended in the *Installation Guide*. Next, configure an external DNS server as described in *Adding External DNS Servers* (page 214). Next, enable high availability of the management node (see *Enabling High Availability* (page 202)). Finally, make sure that storage nodes are shown on the **NODES** screen and proceed to create the storage cluster.

If you have remote iSCSI devices you wish to connect to cluster nodes, you can configure them prior to cluster creation as described in *Connecting Remote iSCSI Devices to Storage Cluster Nodes* (page 19).

2.1 Managing Networks and Traffic Types

To balance and optimize networking in Acronis Cyber Infrastructure, you can assign different types of traffic to separate networks. Assigning a traffic type to a network means that a firewall is configured on nodes connected to this network, specific ports are opened on node network interfaces, and the necessary `iptables` rules are set. For example, nodes connected to a network with only the **S3 public** traffic type will accept incoming connections only on ports 80 and 443.

As described in the *Installation Guide*, is it recommended to have these networks in Acronis Cyber Infrastructure:

- For internal storage traffic (traffic types: **Storage**, **Internal management**, **OSTOR private**, **ABGW private**), assigned to the first bonded connection;

Note: If you plan to use RDMA over InfiniBand, move the traffic type **Storage** to a dedicated network

and assign that network to the IB interface. See *Enabling RDMA* (page 215).

- For overlay networking (traffic type **VM private**), assigned to a VLAN created on the second bonded connection;
- For management and API (traffic types: **Admin panel**, **SSH**, **SNMP**, **Compute API**, **Self-service panel**), assigned to a VLAN created on the second bonded connection;
- For external networking (traffic types: **VM public**, **S3 public**, **ABGW public**, **iSCSI**, and **NFS**), assigned to a VLAN created on the second bonded connection.

You need to configure these networks on the **INFRASTRUCTURE** > **Networks** screen on the admin panel before you create the cluster (see *Creating, Editing, and Deleting Networks* (page 5)). By default, you have two preconfigured networks: **Public** and **Private**. They can be considered as templates that you can customize to create the desired (recommended) configuration.

Note: Some traffic types cannot be reassigned to a different network if they are in use.

After you create the networks, proceed to create the remaining of the recommended VLAN interfaces on each node and assign them to networks as described in *Creating VLAN Interfaces* (page 12).

An example of recommended networks and their traffic types is:

Table 2.1.1: Recommended network setup

Network	Traffic types
Public	Compute API, Admin panel, SSH, SNMP, Self-service panel
Private	Storage, Internal management, OSTOR private, ABGW private
Overlay	VM private
Export	S3 public, iSCSI, NFS, ABGW public, VM public

The next three subsections describe all traffic types that can be assigned to networks.

2.1.1 Exclusive Traffic Types

Exclusivity means that such a traffic type can be added only to one network. Exclusive traffic types cannot be reassigned between networks if they are in use. To do that, you will have to delete the service that uses them first.

Internal management
: Internal cluster management and transfers of node monitoring data to the admin panel. Without this traffic type, the administrator cannot control and monitor the cluster. The cluster, however, continues working.

Storage
: Internal transfers of data chunks, high availability service heartbeats, as well as data self-healing. This is the most critical traffic type that defines storage performance and enables cluster HA.

OSTOR private
: Internal data exchange between multiple S3/NFS services.

ABGW private
: Internal management of and data exchange between multiple ABGW services.

VM private
: Network traffic between VMs in private virtual networks and VNC console traffic. Private virtual networks are implemented as VXLAN, overlay networking fully isolated on L2.

Compute API
: External access to standard OpenStack API endpoints. Opens TCP ports 5000, 6080, 8004, 8041, 8774, 8776, 8780, 9191, 9292, 9696.

2.1.2 Regular Traffic Types

The traffic types listed further are not exclusive and can be added to multiple networks.

S3 public
: External data exchange with the S3 access point. Uses TCP ports 80 and 443.

iSCSI
: External data exchange with the iSCSI access point. Uses TCP port 3260.

NFS External data exchange with the NFS access point. Uses TCP/UDP ports 111, 892, and 2049.

ABGW public

External data exchange with Acronis Backup agents and Acronis Backup Cloud. Uses TCP port 44445.

Admin panel

External access to the admin panel. Uses TCP port 8888.

VM public

External data exchange between VMs and public networks (e.g., the Internet). When a node network interface is assigned to a network with this traffic type, an Open vSwitch bridge is created on that network interface.

SSH Remote access to nodes via SSH. Uses TCP port 22.

SNMP

External access to storage cluster monitoring statistics via the SNMP protocol. Opens UDP port 161.

Self-service panel

External access to the self-service panel. Opens TCP port 8800.

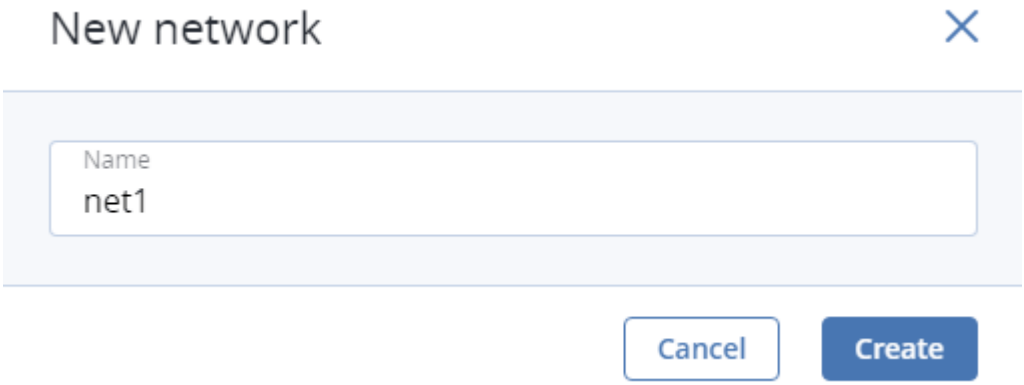
2.1.3 Custom Traffic Types

You can create custom traffic types that will open desired TCP ports. Such traffic types can be added to multiple networks. See *Creating, Editing, and Deleting Traffic Types* (page 6).

2.1.4 Creating, Editing, and Deleting Networks

If required, you can add a new network by doing as follows:

1. On the **INFRASTRUCTURE** > **Networks** screen, click **Edit** and then **Create network**.
2. In the **New network** window, specify a network name. Network names must be alphanumerical and 2-32 characters long.



3. Click **Create**.
4. Add the needed traffic types to the new network by ticking the corresponding checkboxes.
5. When finished, click **Save** to apply the changes.

To edit a network name or delete a custom network, click on the ellipsis icon next to it and select the action you want to perform.

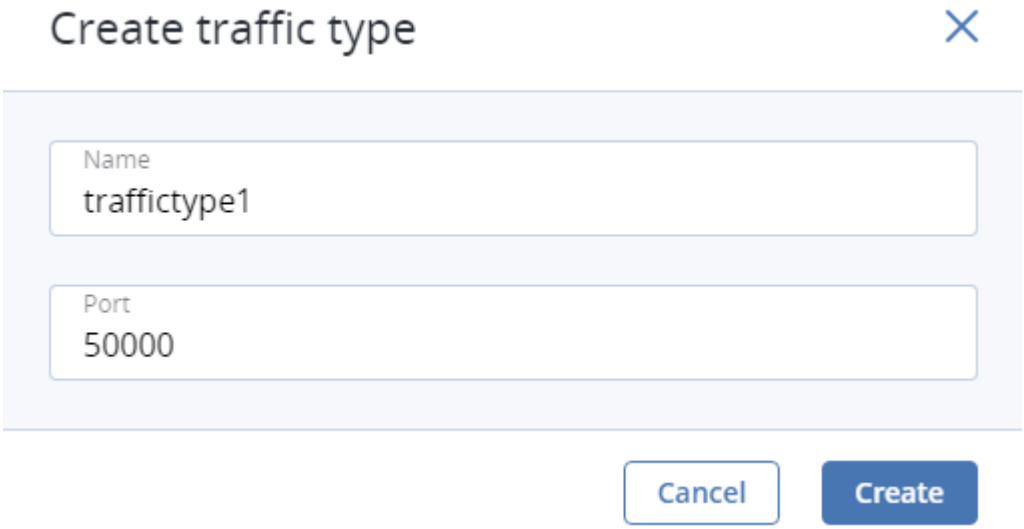
You can only delete networks that are not assigned to any network adapters.

2.1.5 Creating, Editing, and Deleting Traffic Types

If required, you can add a new traffic type by doing as follows:

1. On the **INFRASTRUCTURE** > **Networks** screen, click **Edit** and then **Create traffic type**.
2. In the **Create traffic type** window, specify a traffic type name and port to open.

   Traffic type names must be alphanumerical and 3-32 characters long.



3. Click **Create**.
4. Add the newly created traffic type to one or more of your networks by ticking the corresponding checkboxes.
5. When finished, click **Save** to apply the changes.

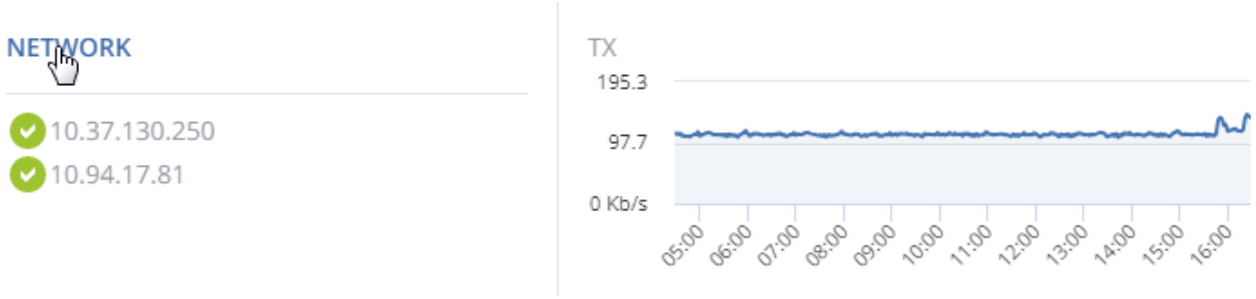
To edit or delete a custom traffic type, make sure it is excluded from all networks, click the ellipsis icon next to it, and select the desired action.

2.2 Configuring Node Network Interfaces

After configuring the networks, you need to assign them to the network interfaces on each node. A network can only be assigned to one network interface per node.

To assign a network to a network interface, do the following:

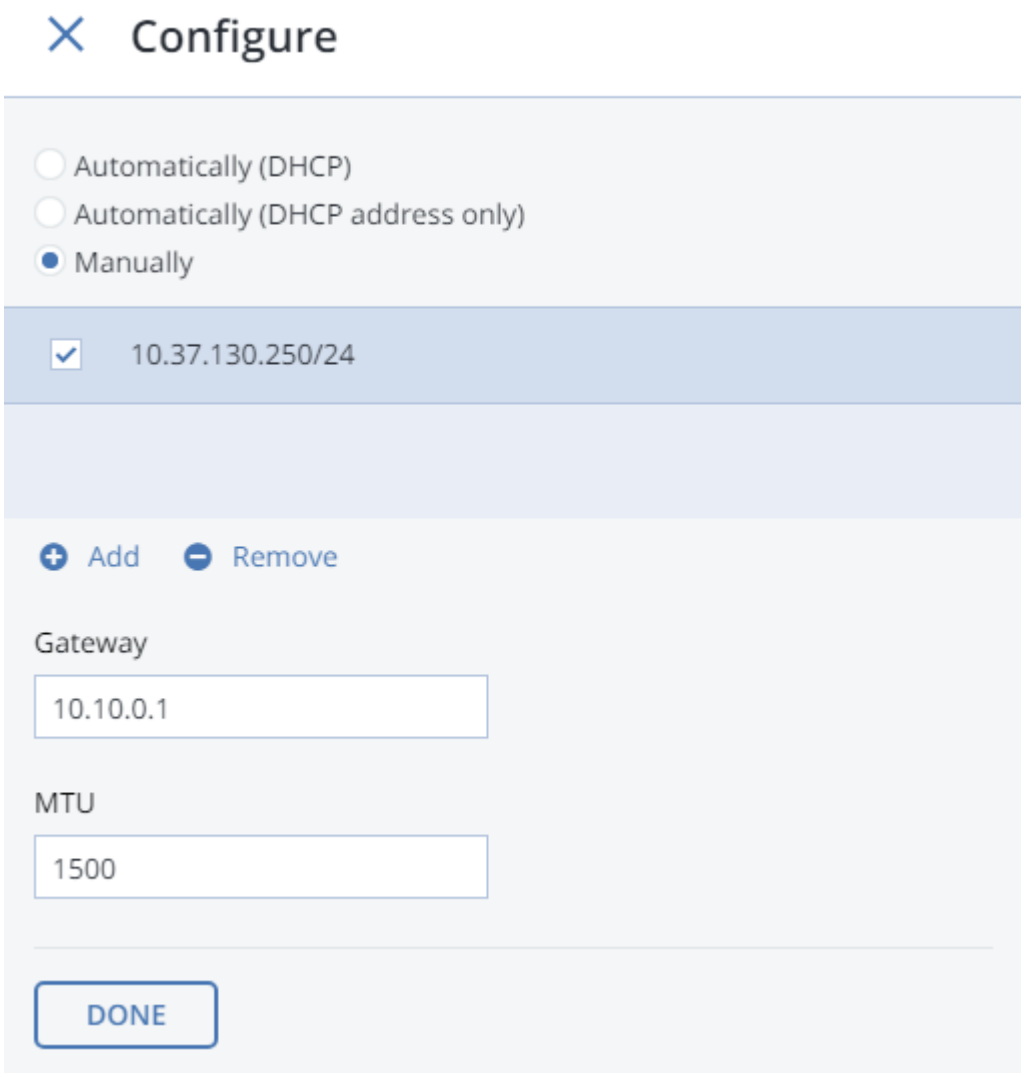
1. On the **Infrastructure** > **Nodes** screen, click a node to configure.
2. On the node overview screen, click **NETWORK**.



3. Select a network interface and click **Configure**.
4. On the **Configure** screen, do one of the following:
   - To obtain the IP address, DNS, and routing settings from the DHCP server, select **Automatically (DHCP)**.
   - To obtain just the IP address from the DHCP server, select **Automatically (DHCP address only)**.
   - To specify the IP address manually, select **Manually** and add the IP address.

Warning: Dynamic IP address allocation will cause network issues as soon as the IP addresses of cluster nodes will change. Configure static IP addresses from the start or as soon as possible.

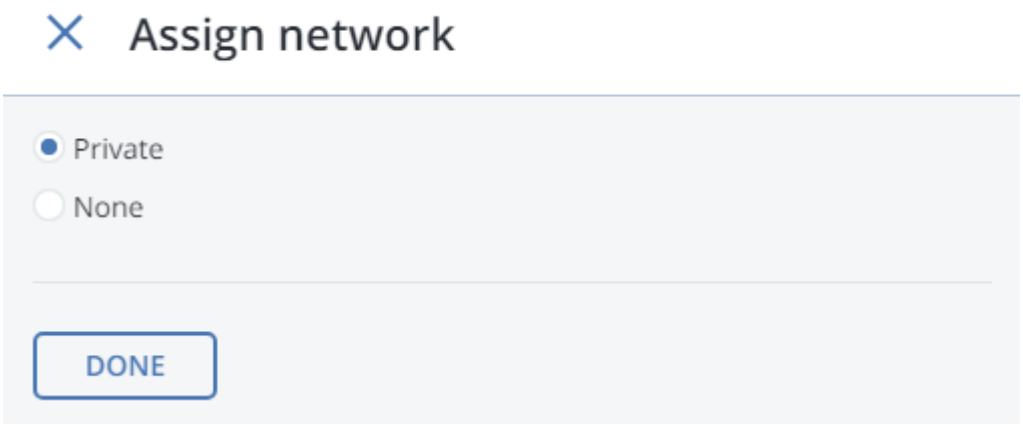
Note: For information about configuring RDMA-enabled network interfaces, see *Enabling RDMA* (page 215).



5. If necessary, set up a gateway and a DNS server. The provided gateway will become node's default.
6. If you have set a custom maximum transmission unit (MTU) on the network hardware, set the same value in the corresponding field. See "Step 2: Configuring the Network" in the *Installation Guide* for more details.

> **Warning:** Setting a custom MTU in admin panel prior to configuring it on the network hardware will result in network failure on the node and require manual resetting. Setting an MTU that differs from the one configured on the network hardware may result in network outage or poor performance.

7. Click **Done** to return to the list of network interfaces, do not change the selection, and click **Assign network**.
8. On the **Assign network** panel, select a network to connect the network interface to (for details, see *Managing Networks and Traffic Types* (page 2)) and click **Done**.



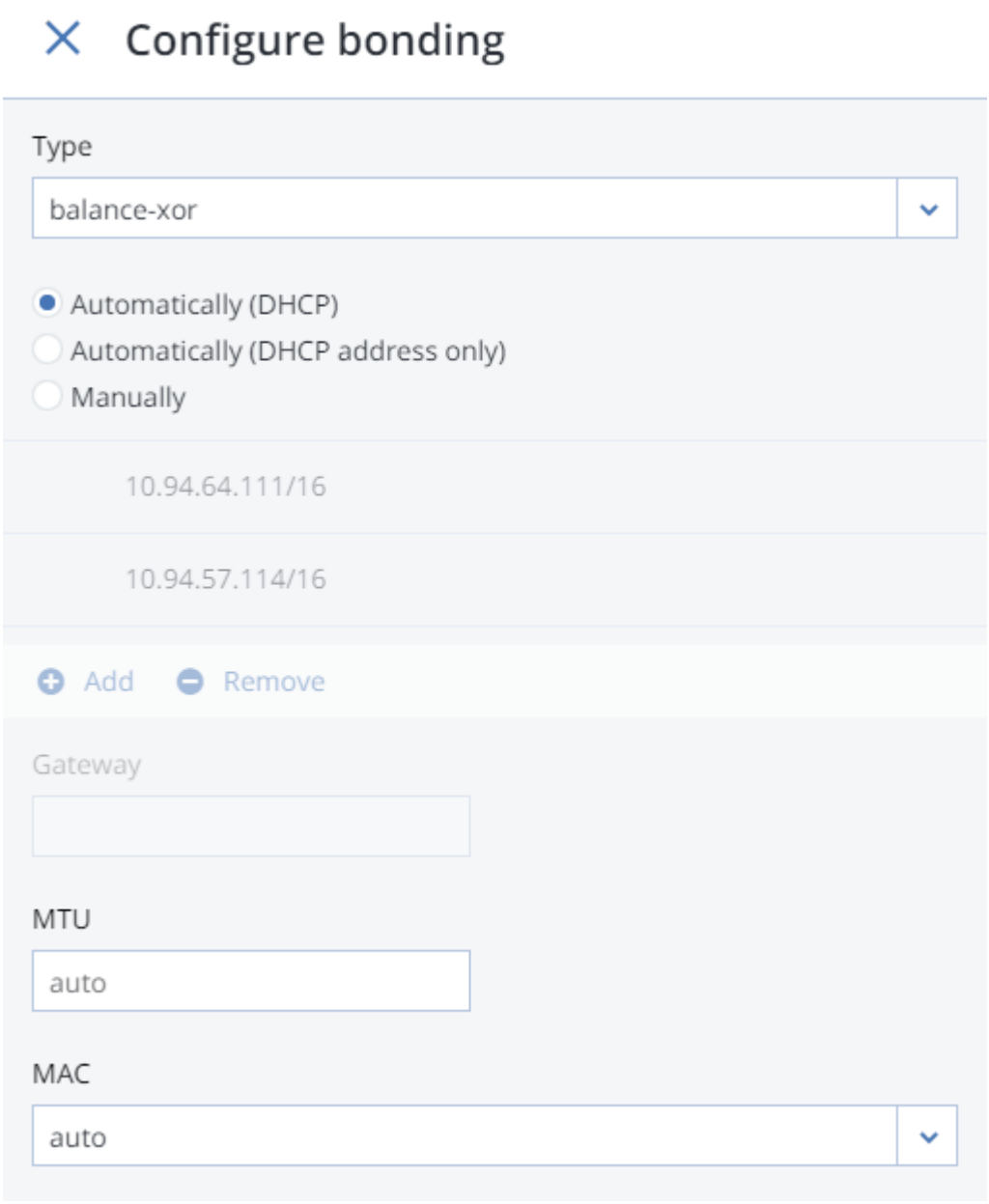
2.2.1 Setting Up Network Bonding

Bonding multiple network interfaces is optional but provides the following benefits:

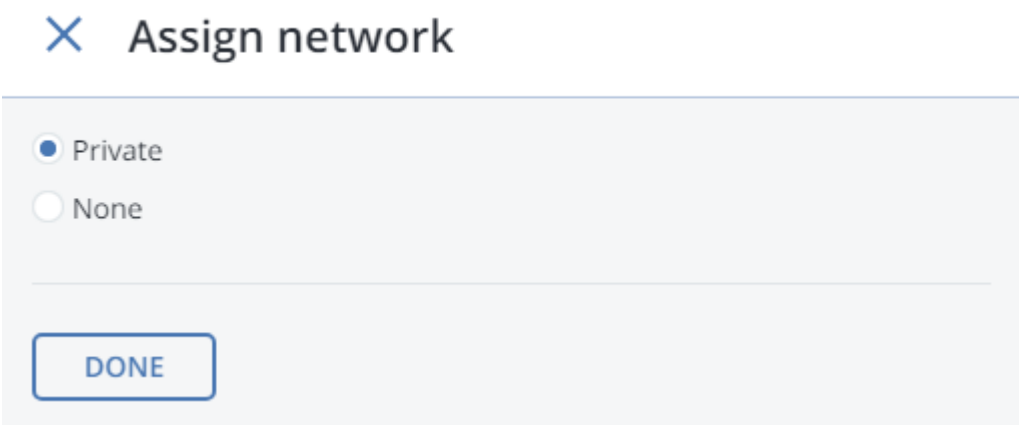
- High network availability. If one of the interfaces fails, the traffic will be automatically routed through the working interface(s).
- Higher network performance. For example, two bonded Gigabit interfaces will deliver the throughput of about 1.7 Gbit/s or up to 200 MB/s. For a storage node, the required number of network interfaces to bond may depend on the number of disks. For example, an HDD can deliver data at speeds of up to 1 Gbps.

To create a bond, do the following:

1. On the **Infrastructure** > **Nodes** screen, click the node to bond the network interfaces on.
2. On the node overview screen, click **NETWORK**.
3. In the **NETWORK** list, check network interfaces to bond, and click **Create bonding** in the menu to the right.
4. On the **Configure Bonding** panel, select the bonding type from the drop-down list. The balance-xor type is selected by default and recommended for both fault tolerance and good performance.



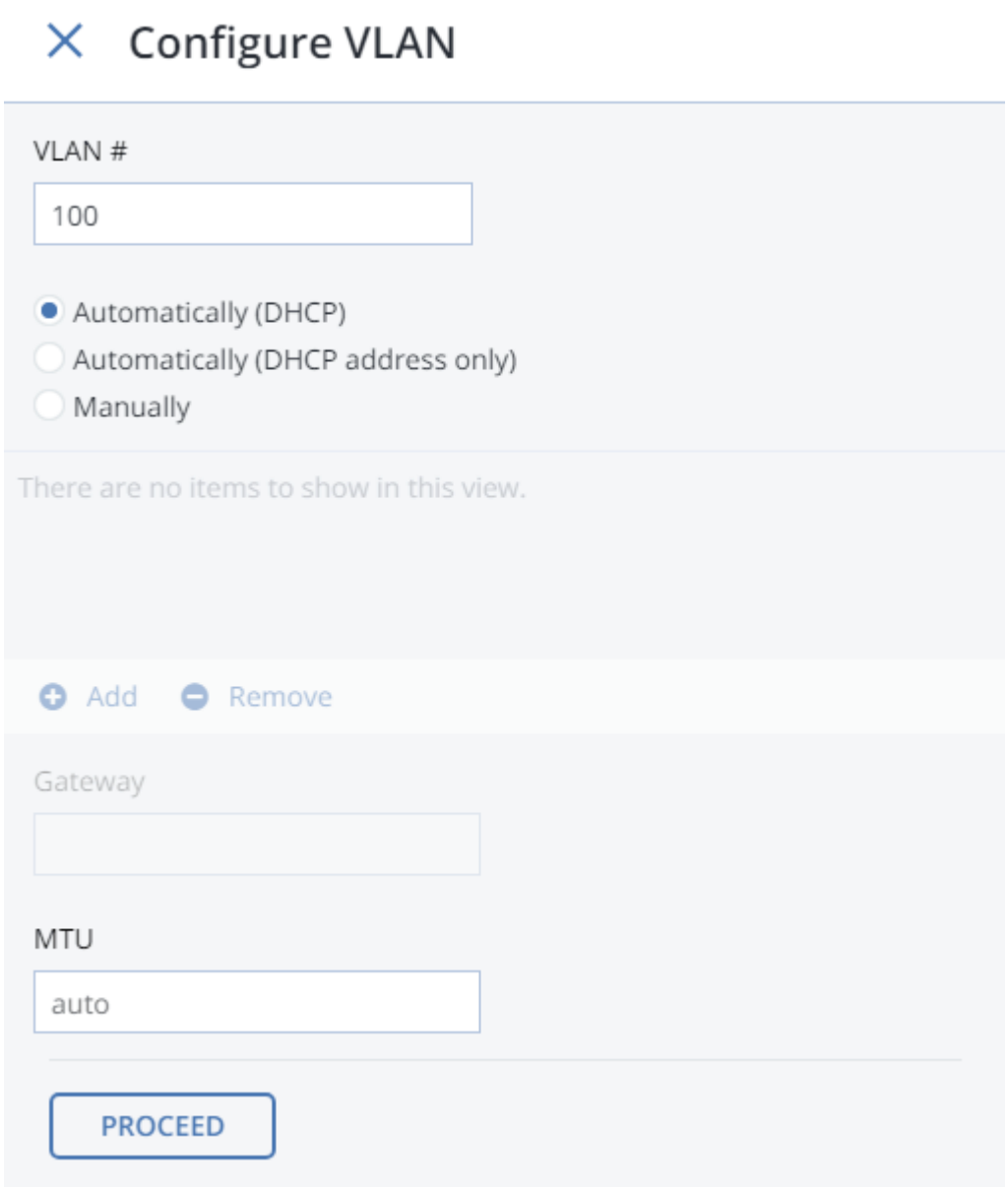
5. Set up network parameters as described in step 4 in *Configuring Node Network Interfaces* (page 7) and click **PROCEED**.
6. On the **Assign network** panel, select a network to connect the bonding network interface to (for details, see *Managing Networks and Traffic Types* (page 2)) and click **Done**.



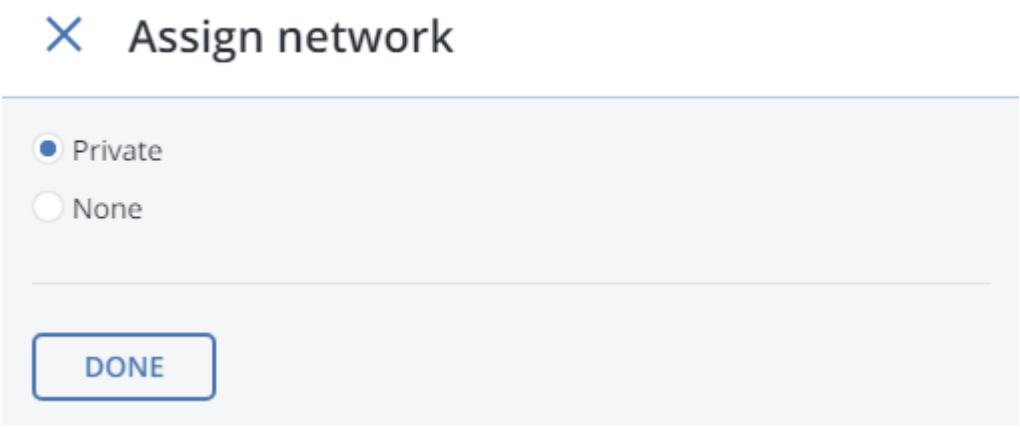
2.2.2 Creating VLAN Interfaces

To create a VLAN interface on a node, do the following:

1. On the **Infrastructure** > **Nodes** screen, click the node on which to configure VLAN.
2. On the node overview screen, click **NETWORK**.
3. Select a network interface and click **Create VLAN**.
4. On the **Configure VLAN** panel, specify a number for VLAN, add an IP address, and, if necessary, set up a gateway and a DNS server. The provided gateway will become node's default.



5. On the **Assign network** panel, select a network to connect the VLAN network interface to (for details, see *Managing Networks and Traffic Types* (page 2)) and click **Done**.



2.3 Creating the Storage Cluster

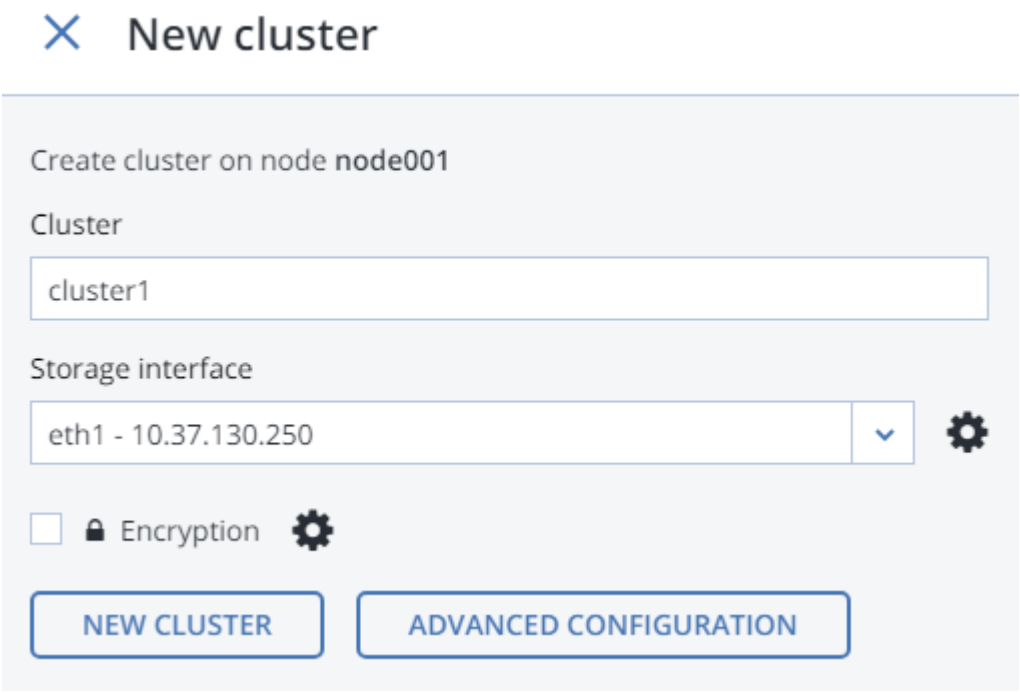
Before you create the storage cluster, enable high availability of the management node as described in *Enabling High Availability* (page 202).

To create a storage cluster, you need to create a basic storage cluster on one (first) node, then populate it with more nodes.

If networks adapters on your nodes support RDMA (via RoCE, iWARP or IB) and you want to enable this functionality, you must do so before creating the storage cluster as explained in *Enabling RDMA* (page 215).

2.3.1 Creating the Storage Cluster on the First Node

1. Open the **INFRASTRUCTURE** > **Nodes** screen and click a node in the **UNASSIGNED** list.
2. On the node overview screen, click **Create cluster**.
3. In the **Cluster** field, type a name for the cluster. The name may only contain Latin letters (a-z, A-Z), numbers (0-9), underscores (“_”) and hyphens (“-”).



4. From the **Storage interface** drop-down list, select a node network interface connected to a network with the traffic type **Storage**.

   If node network interfaces are not configured, click the cogwheel icon and assign a network with the traffic type **Storage** to a node's network interface.

5. If required, enable data encryption. To do this, check the **Encryption** box (see *Managing Tier Encryption* (page 185)) and proceed to create the cluster. Encryption will be enabled for all tiers by default. To enable encryption for particular tiers, click the cogwheel icon to open the **Encryption Configuration** panel, select tiers to encrypt, and click **Done**. You can later disable encryption for new chunk services (CS) on the **SETTINGS** > **Advanced settings** panel.

6. Click **New cluster** to have Acronis Cyber Infrastructure assign the roles to disks automatically. Alternatively, click **Advanced configuration** to assign the roles to each drive manually and tweak other settings.

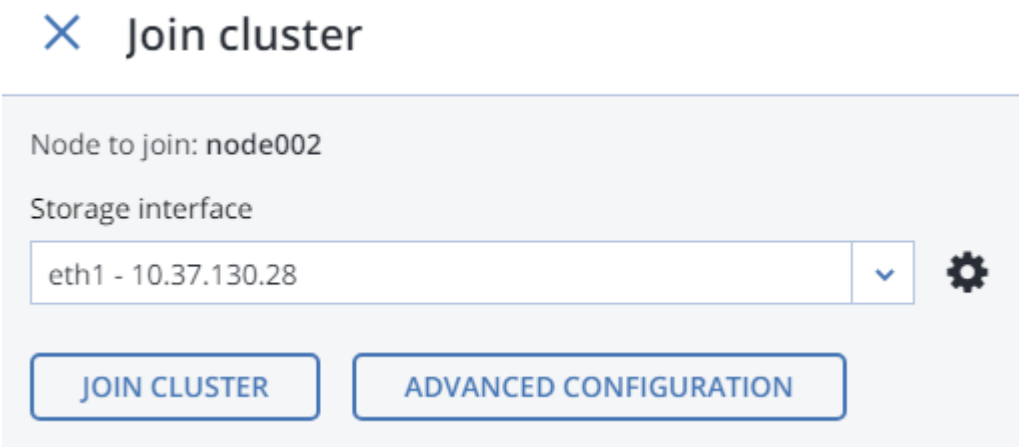
You can monitor cluster creation in the **HEALTHY** list of the **INFRASTRUCTURE** > **Nodes** screen. The creation might take some time depending on the number of disks to be configured. Once the automatic configuration is complete, the cluster is created.

2.3.2 Adding Nodes to Storage Cluster

To add an unassigned node to a cluster, do the following:

1. On the **INFRASTRUCTURE** > **Nodes** screen, click an unassigned node.
2. On the node overview screen, click **Join cluster**.
3. Make sure a network interface that is connected to a network with the traffic type **Storage** is selected from the **Storage interface** drop-down list.

   If node network interfaces are not configured, click the cogwheel icon and assign a network with the traffic type **Storage** to a node's network interface.

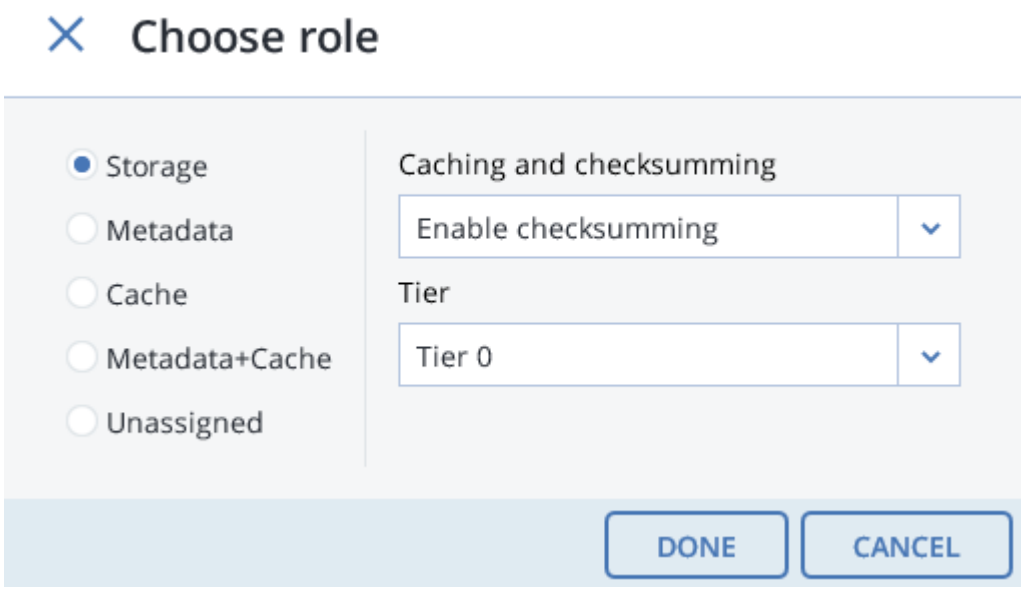


4. Click **Join cluster** to have Acronis Cyber Infrastructure assign the roles to disks automatically and add the node to the current cluster. Alternatively, click **Advanced configuration** to assign the roles to each drive manually (see *Assigning Disk Roles Manually* (page 16)).

2.3.3 Assigning Disk Roles Manually

If you clicked **Advanced configuration** while creating a cluster or adding nodes to it, you will be taken to the list of drives on the node where you can manually assign roles to these drives. Do the following:

1. On the **Join cluster** or **New cluster** panel, select a drive or check multiple drives in the list and click **Configure**.
2. On the **Choose role** screen, select one of the following roles for the disk:



- **Storage**. Use the disk to store chunks and run a chunk service on the node. From the **Caching and checksumming** drop-down list, select one of the following:
  - **Use SSD for caching and checksumming**. Available and recommended only for nodes with SSDs.
  - **Enable checksumming** (default). Recommended for nodes with HDDs as it provides better reliability.
  - **Disable checksumming**. Not recommended for production. For an evaluation or testing environment, you can disable checksumming for nodes with HDDs, to provide better performance.

  Data caching improves cluster performance by placing the frequently accessed data on an SSD.

  Data checksumming generates checksums each time some data in the cluster is modified. When this data is then read, a new checksum is computed and compared with the old checksum. If the two are not identical, a read operation is performed again, thus providing better data reliability and integrity.

  If a node has an SSD, it will be automatically configured to keep checksums when you add a node to a cluster. This is the recommended setup. However, if a node does not have an SSD drive, checksums will be stored on a rotational disk by default. It means that this disk will have to handle double the I/O, because for each data read/write operation there will be a corresponding checksum read/write operation. For this reason, you may want to disable checksumming on nodes

without SSDs to gain performance at the expense of checksums. This can be especially useful for hot data storage.

To add an SSD to a node that is already in the cluster (or replace a broken SSD), you will need to release the node from the cluster, attach the SSD, choose to join the node to the cluster again, and, while doing so, select **Use SSD for caching and checksumming** for each disk with the role **Storage**.

With the **Storage** role, you can also select a tier from the **Tier** drop-down list. To make better use of data redundancy, do not assign all the disks on a node to the same tier. Instead, make sure that each tier is evenly distributed across the cluster with only one disk per node assigned to it. For more information, see the *Installation Guide*.

Note: If the disk contains old data that was not placed there by Acronis Cyber Infrastructure, the disk will not be considered suitable for use in Acronis Cyber Infrastructure.

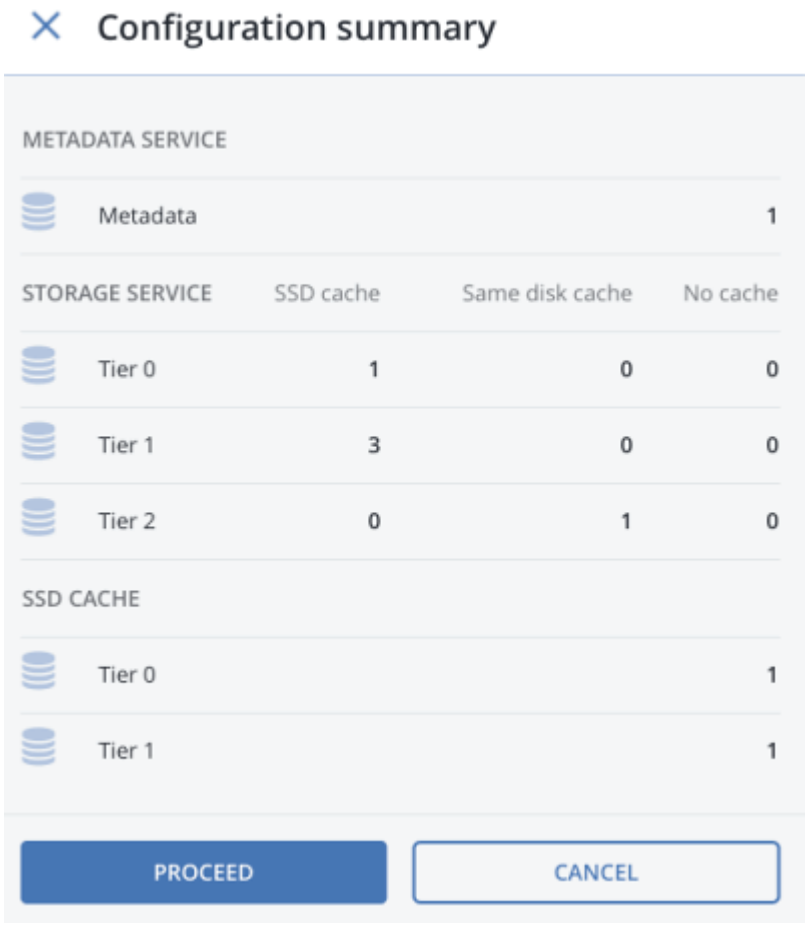
- **Metadata**. Use the disk to store metadata and run a metadata service on the node.
- **Cache**. Use the disk to store write cache. This role is only for SSDs. To cache a specific storage tier, select it from the drop-down list. Otherwise, all tiers will be cached.
- **Metadata+Cache**. A combination of two roles described above.
- **Unassigned**. Remove the roles from the disk.

Take note of the following:

- If a physical server has a system disk with the capacity greater than 100GB, that disk can be additionally assigned the **Metadata** or **Storage** role. In this case, a physical server can have at least 2 disks.
- It is recommended to assign the **System+Metadata** role to an SSD. Assigning both these roles to an HDD will result in mediocre performance suitable only for cold data (e.g., archiving).
- The **System** role cannot be combined with the **Cache** and **Metadata+Cache** roles. The reason is that is I/O generated by the operating system and applications would contend with I/O generated by journaling, negating its performance benefits.

3. Click **Done**.
4. Repeat steps 1 to 3 for every disk you want to be used in the storage cluster.

5. Click **NEW CLUSTER** or **JOIN CLUSTER**. On the **Configuration summary** screen, check the number of disks per each configuration category.



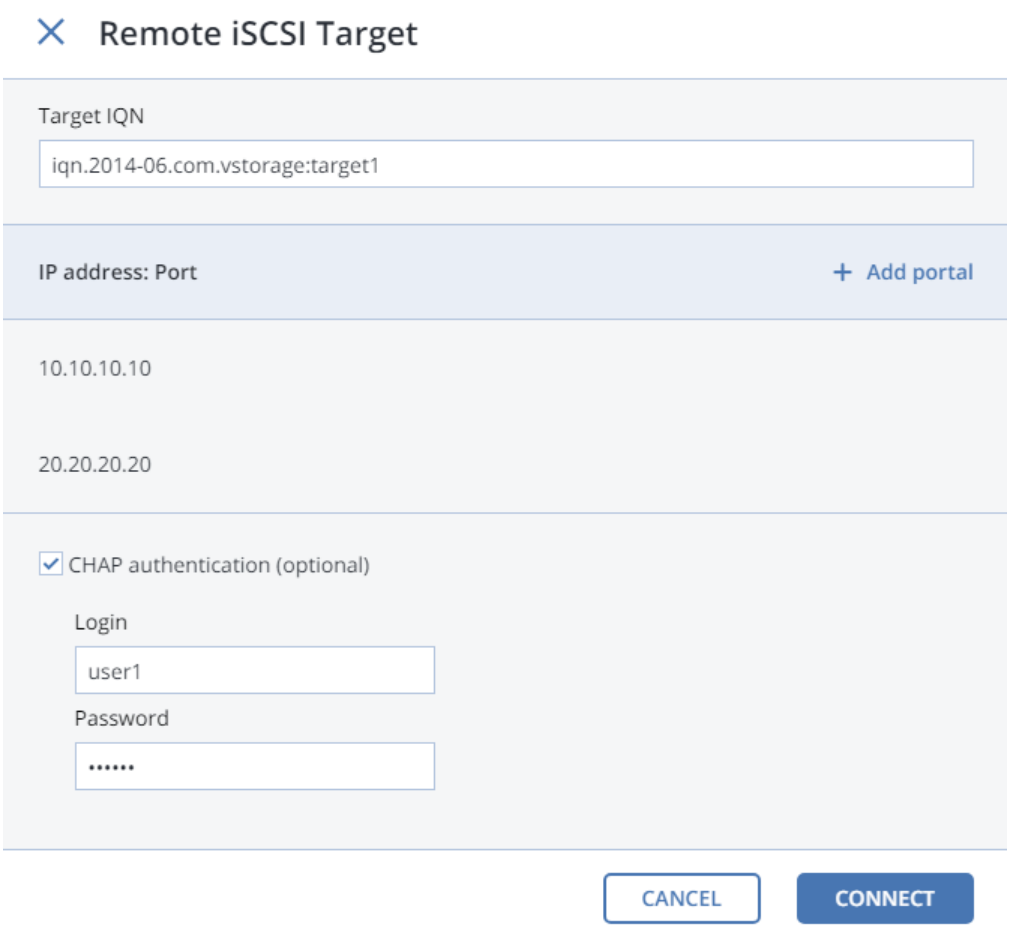
6. Click **PROCEED**. You can monitor disk configuration progress in the **HEALTHY** list of the **INFRASTRUCTURE** > **Nodes** screen.

2.4 Connecting Remote iSCSI Devices to Storage Cluster Nodes

Acronis Cyber Infrastructure allows you to connect remote iSCSI devices to nodes and perceives their LUNs as storage disks. You can connect iSCSI devices to nodes at any time.

To connect a remote iSCSI device to a node, do the following:

1. On the **INFRASTRUCTURE** > **Nodes** screen, select a node, open its **DISKS** tab, and click **iSCSI target**.



2. In the **Remote iSCSI Target** window, do the following:
    1. Specify the IQN of the target.
    2. In the **Portal** and **Port** fields, specify the target's IP address and port (optional) and click the check icon.
    3. (Optional) If the target has multiple paths, click **Add portal** and configure it as in the previous step.
    4. (Optional) If necessary, check **CHAP authentication** and specify the credentials.
    5. Click **Connect**.

Acronis Cyber Infrastructure will connect the target (i.e. all its LUNs) and initiate it. Devices of the **iSCSI** type will appear in the node's **DISKS** list.

To remove the iSCSI target, click **iSCSI Target**, **DELETE CONNECTION**, and **DELETE**.

2.4.1 Assigning Disk Roles To Remote iSCSI Devices

If the node had already been in the cluster before you connected the iSCSI device to it, assign disk roles to all its LUNs. To do this:

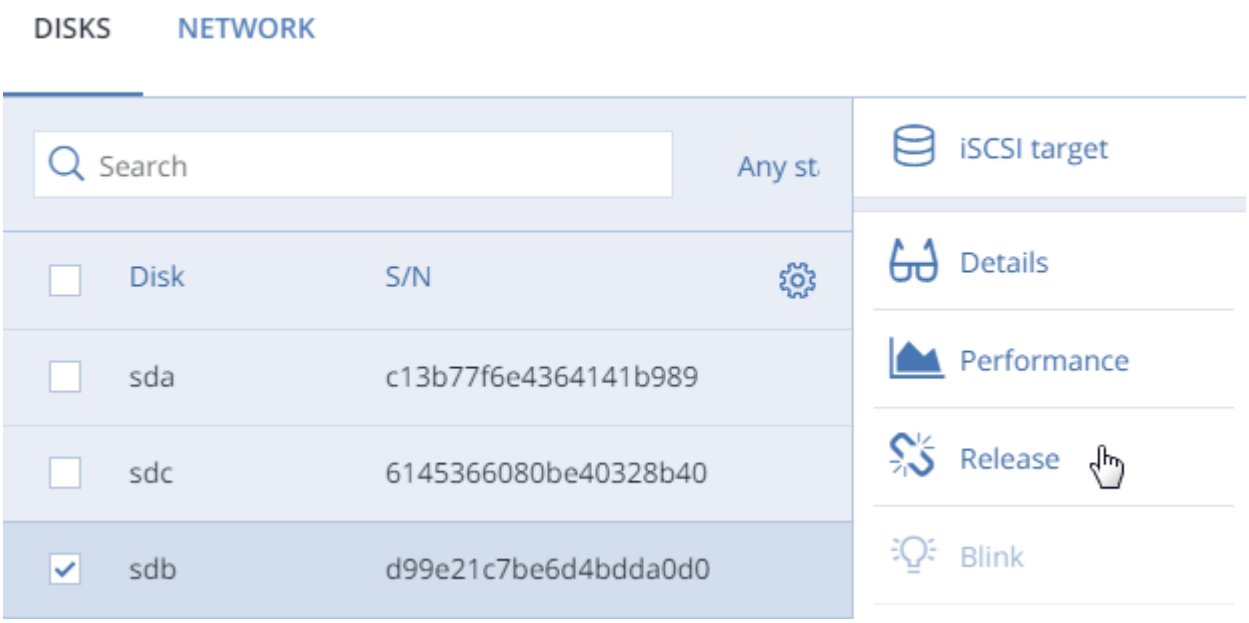
1. Select a disk with the **iSCSI** type and click **Assign**.
2. In the **Choose role** window, select **Storage** and click **Done**.
3. Repeat the above steps for every disk with the **iSCSI** type.

Even though you can assign **Metadata** or **Cache** roles to such disks, it is recommended only for single-node ABGW installations with SAN-provided redundancy. For more information on disk roles, see *Assigning Disk Roles Manually* (page 16).

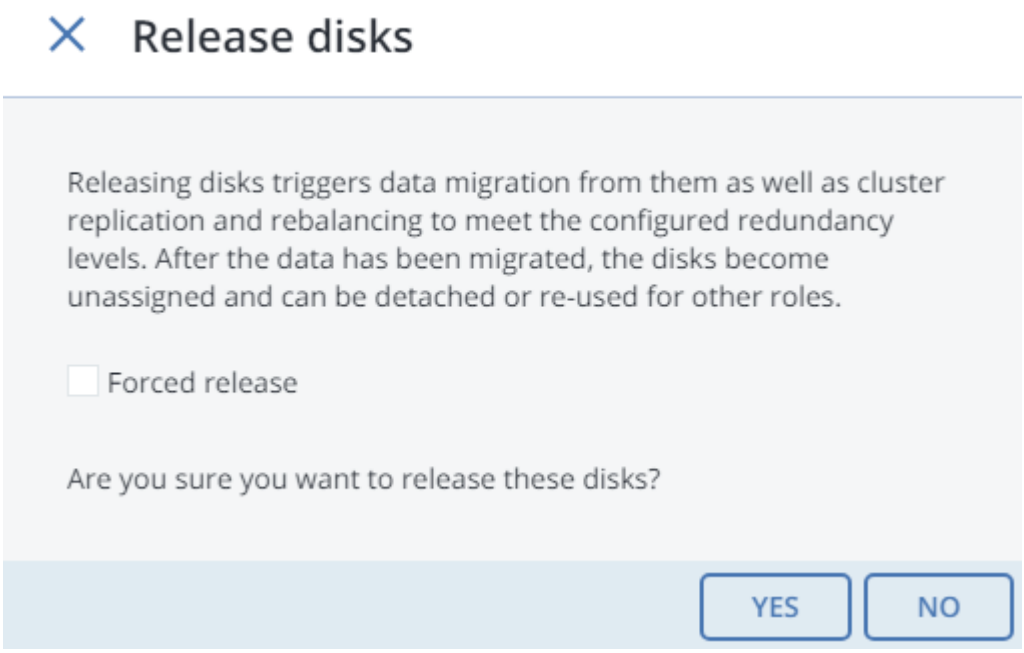
2.5 Replacing Node Disks

If a disk installed in a storage cluster node fails, replace it as follows:

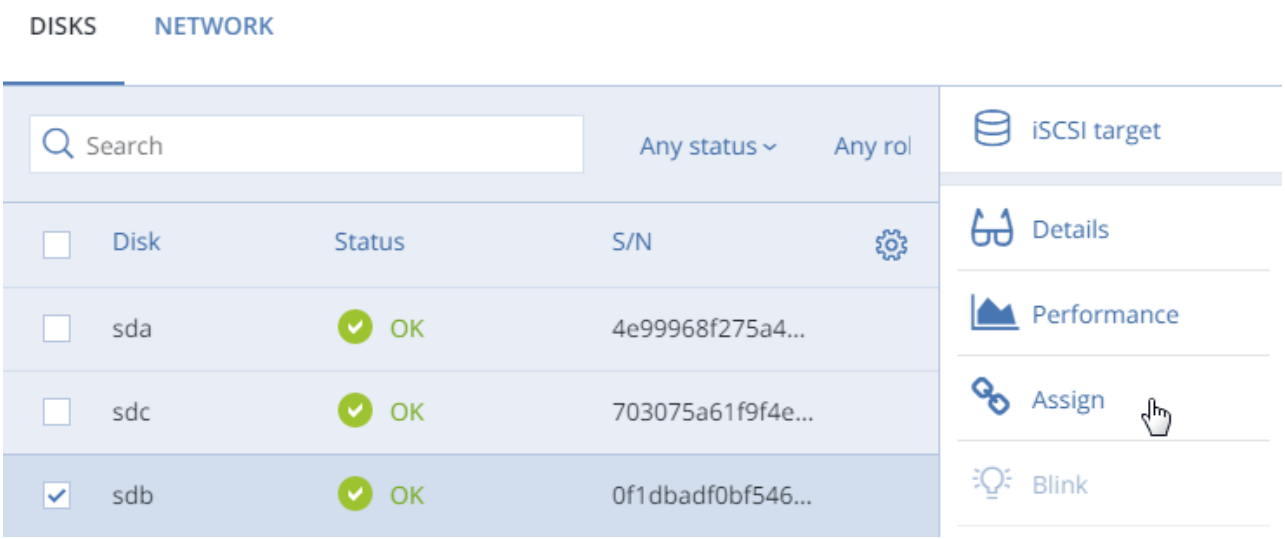
1. Open **INFRASTRUCTURE** > **Nodes** > <node> > **Disks**.
2. Select the failed disk, click **Release**.



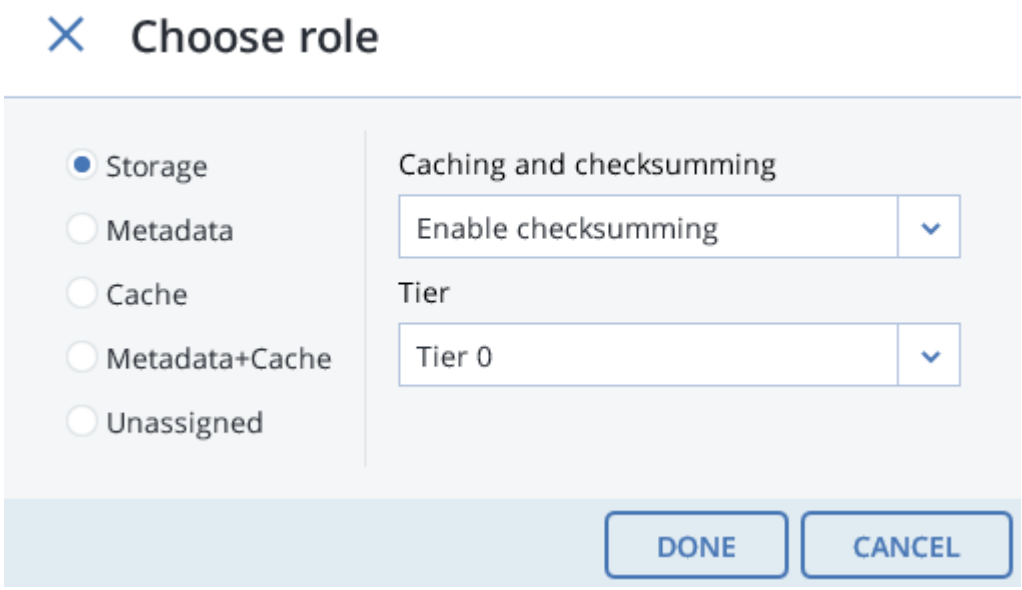
3. In the **Release disk** window, click **YES**.



4. Replace the disk with a new one.
5. Back on **INFRASTRUCTURE** > **Nodes** > <node> > **Disks**, select the unassigned disk and click **Assign**.



6. In the **Choose role** window, select the required disk role and click **DONE**.



The disk will be assigned the chosen role and added to the cluster.

2.6 Releasing Nodes from the Storage Cluster

To release a node means to remove it from the cluster (e.g., for maintenance). As the node may be running services needed by the cluster, do the following prior to releasing it to avoid cluster degradation:

1. If the node runs one of the three required metadata services, add a metadata role to another node. You need to make sure that the cluster has at least three metadata services running at any time.
2. If the node has any access points, make sure that the same access points are configured on other nodes in the cluster as well.
3. If the node is in an iSCSI target group, remove it from the target group first.
4. If the node has an S3 gateway or ABGW, reconfigure DNS for S3 and ABGW access points to remove the node from DNS records. Next, release the node from S3 and ABGW in the corresponded sections of the **STORAGE SERVICES** screen.
5. If the node is in the compute cluster, remove it from the compute cluster first.
6. Make sure the cluster has enough storage space to accommodate the data from the released node.

Once you initiate the release, the cluster will start replicating data chunks that were stored on the released node and distributing them among other storage nodes in the cluster. Depending on the amount of data to

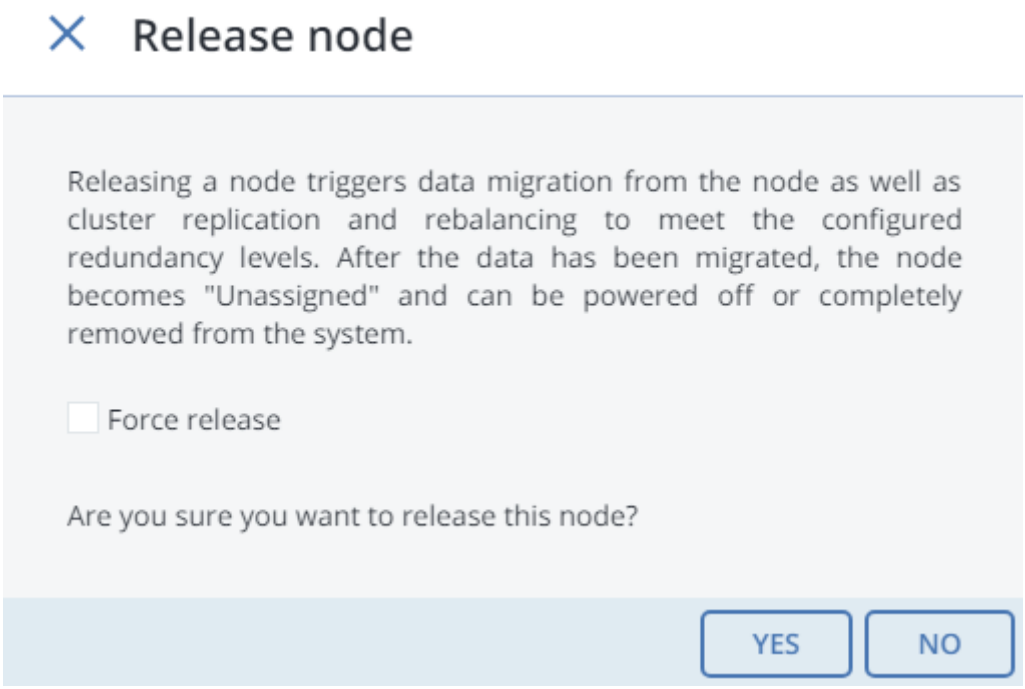
replicate, the process may take as much as several hours.

If necessary, you can also release a node forcibly, that is, without replication.

Warning: Releasing nodes forcibly may result in data loss.

To release a node from a cluster, do the following:

1. On the **INFRASTRUCTURE** > **Nodes** screen, click the node to release.
2. On the node overview screen, click **Release**.
3. If necessary, in the **Release** node window, check force to release the node forcibly (highly not recommended).
4. Click **Yes**. The released node will return to the **UNASSIGNED** list on the **INFRASTRUCTURE** > **Nodes** screen.



2.7 Removing Nodes from the Unassigned List

Nodes in the **UNASSIGNED** list can be completely removed from Acronis Cyber Infrastructure if they are not in the high availability cluster.

To completely remove a node from the admin panel, do the following:

1. Select it in the **UNASSIGNED** list on the **INFRASTRUCTURE** > **Nodes** screen and click **Remove (forget)**.
2. For security purposes, clean up node certificates and identity by deleting the following from the node:

```
# rm -rf /usr/libexec/vstorage-ui-backend/ca
# rm -rf /etc/nginx/ssl
# rm -f /etc/vstorage/host_id
# rm -f /etc/vstorage/vstorage-ui-agent.conf
```

Note: After such a cleanup, the only way to add the node back to the cluster is by re-installing Acronis Cyber Infrastructure on it from scratch.

2.8 Re-Adding Nodes to the Unassigned List

Nodes removed from Acronis Cyber Infrastructure can be re-added to the **UNASSIGNED** list in two ways:

- By logging in to the node via SSH and running `/usr/libexec/vstorage-ui-agent/bin/register-storage-node.sh -m MN_ADDRESS -t TOKEN` in the node's console (`MN_ADDRESS` is the management node IP address and `TOKEN` is the token obtained in the admin panel).

  Note: You can only do this if you have not cleaned up the node as described in *Removing Nodes from the Unassigned List* (page 25).

- By reinstalling Acronis Cyber Infrastructure on the node from scratch.

CHAPTER 3

Monitoring the Storage Cluster

Acronis Cyber Infrastructure uses the Prometheus monitoring system to monitor performance and availability of both the entire cluster and its components. It also generates alerts, which you can configure to be sent as notifications via e-mail.

3.1 Monitoring the Entire Cluster

The overall storage cluster statistics are available on the **MONITORING** > **Dashboard** screen. Pay attention to the storage cluster status that can be one of the following:

HEALTHY

All cluster components are active and operate normally.

UNAVAILABLE

Not enough information about the cluster state (e.g., because the cluster is inaccessible).

DEGRADED

Some of the cluster components are inactive or inaccessible. The cluster is trying to heal itself, data replication is scheduled or in progress.

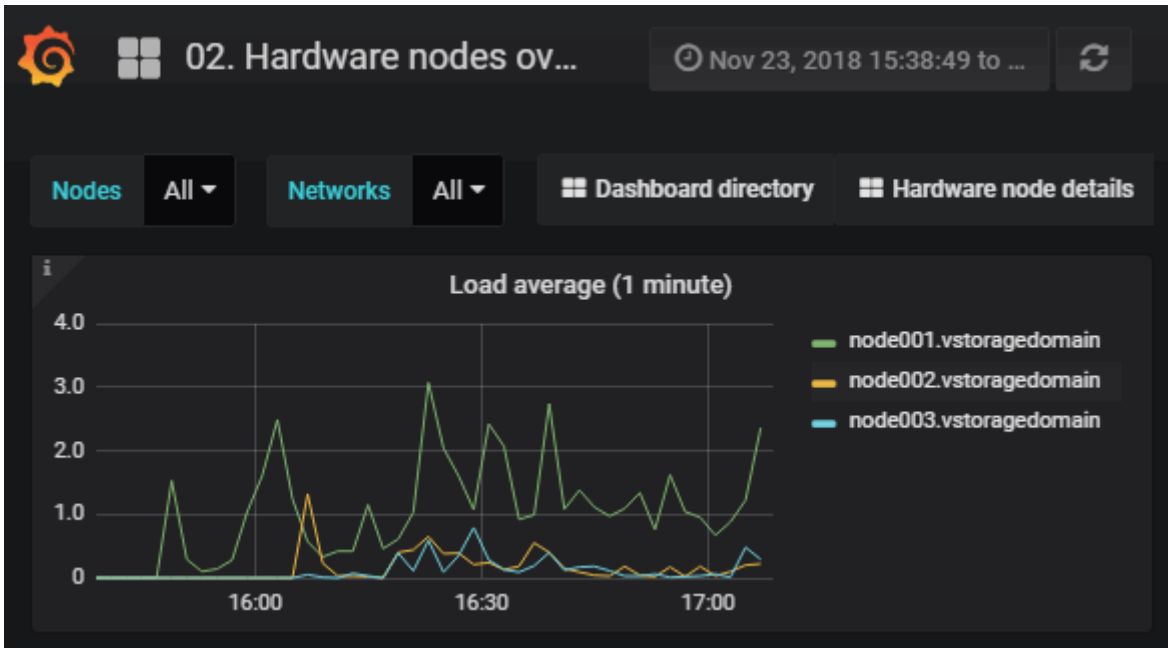
ERROR

The cluster has too many inactive services, automatic replication is disabled. If the cluster enters this state, troubleshoot the nodes or contact the support team.

To view the storage cluster statistics in full screen, click **Fullscreen mode**. To exit the fullscreen mode, press **Esc** or **Exit fullscreen mode**.

For advanced monitoring, click **Grafana dashboard**. A separate browser tab will open with preconfigured

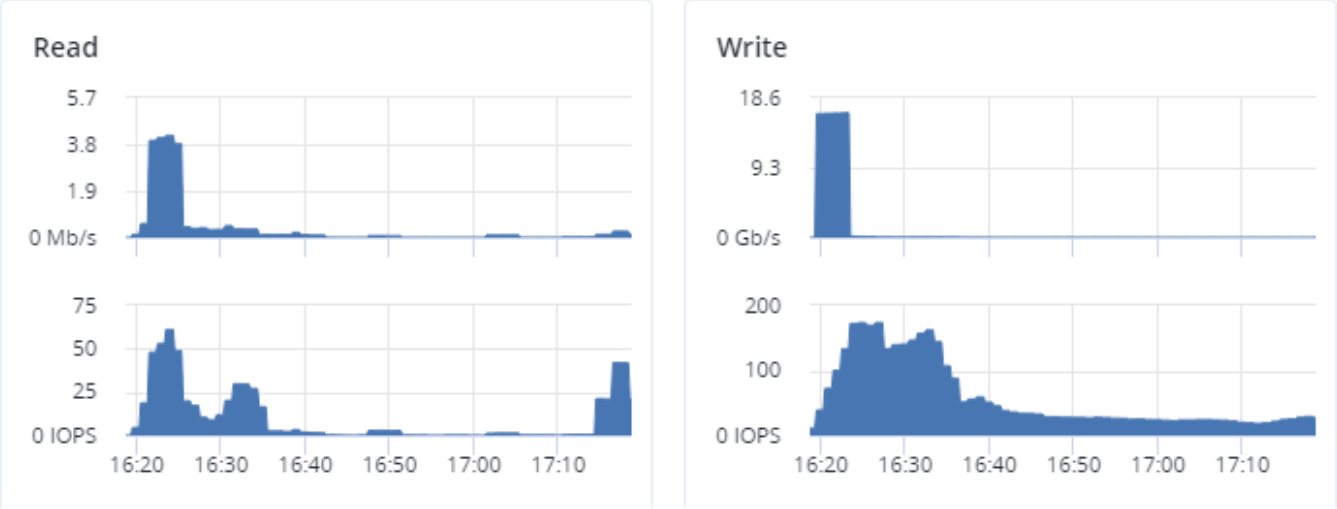
Grafana dashboards where you can manage existing dashboards, create new ones, share them between users, configure alerting, etc. For more information, refer to Grafana documentation .



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.

3.1.1 I/O Activity Charts

The **Read** and **Write** charts show the history of the cluster I/O activity as the speed of read and write I/O operations in megabytes per second and the number of read and write I/O operations per second (IOPS). For example:

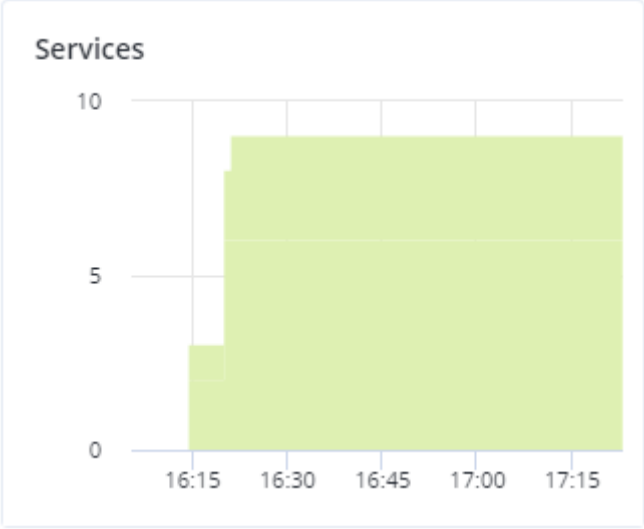


3.1.2 Services Chart

On the **Services** chart, you can monitor two types of services:

- Metadata services (MDS). The number all disks with the metadata role. Ensure that at least three MDSes are running at all times.
- Chunk services (CS). The number of all disks with the storage role.

Typical statistics may look like this:



If some of the services were not in the healthy state for some time, these time periods will be highlighted in red on the chart.

3.1.3 Chunks Chart

You can monitor the state of all chunks in the cluster on the **Chunks** chart. Chunks can be in the following states:

Healthy

Number and percentage of chunks that have enough active replicas. The normal state of chunks.

Offline

Number and percentage of chunks all replicas of which are offline. Such chunks are completely inaccessible for the cluster and cannot be replicated, read from or written to. All requests to an offline chunk are frozen until a CS that stores that chunk's replica goes online.

Get offline chunk servers back online as fast as possible to avoid losing data.

Blocked

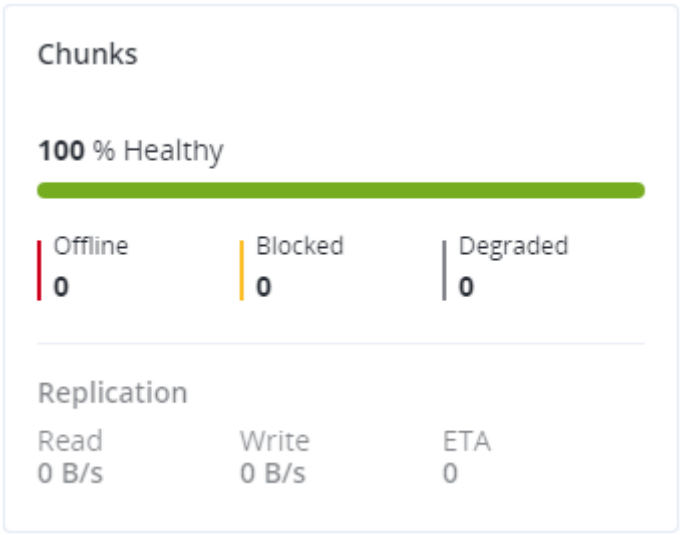
Number and percentage of chunks which have fewer active replicas than the set minimum amount. Write requests to a blocked chunk are frozen until it has at least the set minimum amount of replicas. Read requests to blocked chunks are allowed, however, as they still have some active replicas left. Blocked chunks have a higher replication priority than degraded chunks.

Having blocked chunks in the cluster increases the risk of losing data, so postpone any maintenance on working cluster nodes and get offline chunk servers back online as fast as possible.

Degraded

Number and percentage of chunks whose active replicas are few but not below the set minimum. Such chunks can be read from and written to. However, in the latter case a degraded chunk becomes urgent.

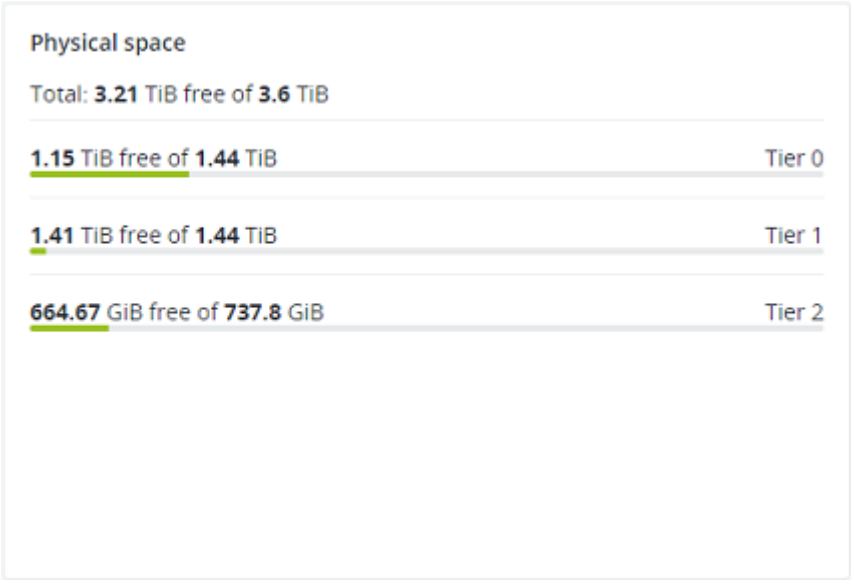
Healthy chunks are highlighted on the scale in green, offline in red, blocked in yellow, and degraded in grey. For example:



The **Replication** section shows the information about replication activity in the cluster.

3.1.4 Physical Space Chart

The **Physical space** chart shows the current usage of physical space in the entire storage cluster and on each particular tier. The used space includes the space occupied by all data chunks and their replicas plus the space occupied by any other data.



3.1.4.1 Understanding Physical Space

The total physical disk space is a total of all the disk space on all storage disks on the same tier. The used physical space is a total of all the user data on the storage disks of the same tier, considering the redundancy mode. The free disk space is the total physical space minus the used physical space.

To better understand how physical disk space is calculated, consider the following example:

Table 3.1.4.1.1: Physical space example

	Used/Total (Free), GiB		
	Tier 0, 3+2 encoding (67% overhead)	**Tier 1, 2 replicas (100% overhead)**	**Tier 2, no redundancy**
Node 1	334/1024 (690)	134/512 (378)	50/256 (206)
Node 2	334/1024 (690)	133/512 (379)	50/256 (206)
Node 3	334/1024 (690)	133/512 (379)	
Node 4	334/1024 (690)		
Node 5	334/1024 (690)		
Reported summary	1670/5120 (3450)	400/1536 (1136)	100/512 (412)

The cluster has ten disks with the storage role: five 1024 GiB disks are assigned to tier 0, three 512 GiB disks to tier 1, and two 256 GiB disk to tier 2. There is no other data on the disks (like system files, for example). Tier 0 stores 1000 GiB of user data in the 3+2 encoding mode. Tier 1 stores 200 GiB of user data in the 2 replicas mode. Tier 2 stores 100 GB of user data with no redundancy.

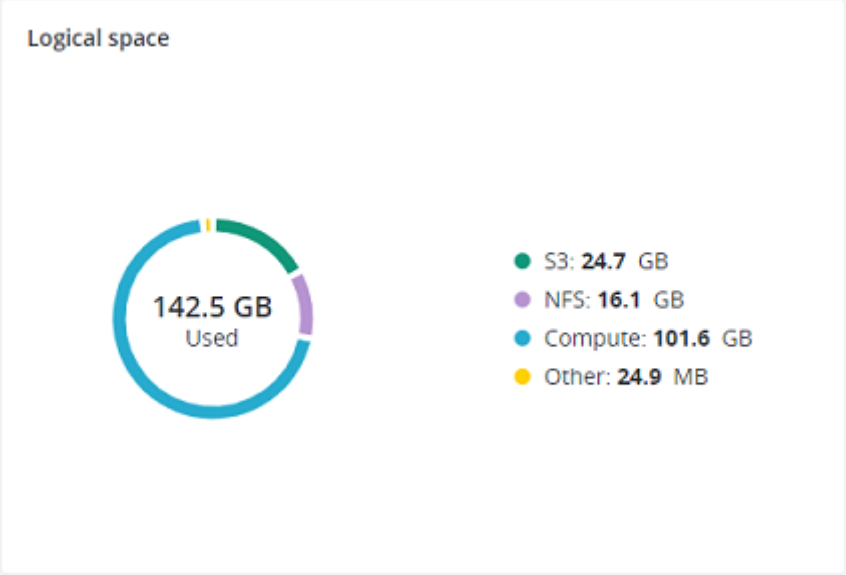
No matter what redundancy mode is used, the cluster attempts to spread data chunks evenly across disks of the same tier.

In this example, the physical disk space on each tier is reported as follows:

- On tier 0, the total disk space is 5120 GiB, the used disk space is 1670 GiB, and the free disk space is 3450 GiB;
- On tier 1, the total disk space is 1536 GiB, the used disk space is 400 GiB, and the free disk space is 1136 GiB;
- On tier 2, the total disk space is 512 GiB, the used disk space is 100 GiB, and the free disk space is 456 GiB.

3.1.5 Logical Space Chart

The **Logical space** chart represents all the space allocated to different services for storing user data. This includes the space occupied exclusively by user data. Replicas and erasure coding metadata are not taken into account.



3.1.5.1 Understanding Logical Space

When monitoring disk space information in the cluster, keep in mind that logical space is the amount of free disk space that can be used for storing user data in the form of data chunks and all their replicas. Once this space runs out, no data can be written to the cluster.

To better understand how logical disk space is calculated, consider the following example:

- The cluster has three disks with the storage role. The first disk has 200 GB of space, the second one has 500 GB, and the third one has 1 TB.
- If the redundancy mode is set to three replicas, each data chunk must be stored as three replicas on three different disks with the storage role.

In this example, the available logical disk space will be 200 GB, that is, equal to the capacity of the smallest disk with the storage role. The reason is that each replica must be stored on a different disk. So once the space on the smallest disk (i.e. 200 GB) runs out, no new chunk replicas can be created unless a new disk with the storage role is added or the redundancy mode is changed to two replicas.

With the two replicas redundancy mode, the available logical disk space would be 700 GB, because the two

smallest disks combined can hold 700 GB of data.

3.2 Monitoring Nodes

Nodes added to the infrastructure are listed on the **NODES** screen, grouped by status. If the storage cluster has not been created yet, you will only see nodes in the **UNASSIGNED** list. If the storage cluster exists, its nodes will be listed on the screen.

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.

3.2.1 Node Statuses

A node can have one of the following statuses:

HEALTHY
: All the storage services on the node are running.

OFFLINE
: The node cannot be reached from the admin panel, although it may still be up and its services may be running.

FAILED
: One or more storage services on the node have failed.

UNASSIGNED
: The node is not assigned to a cluster.

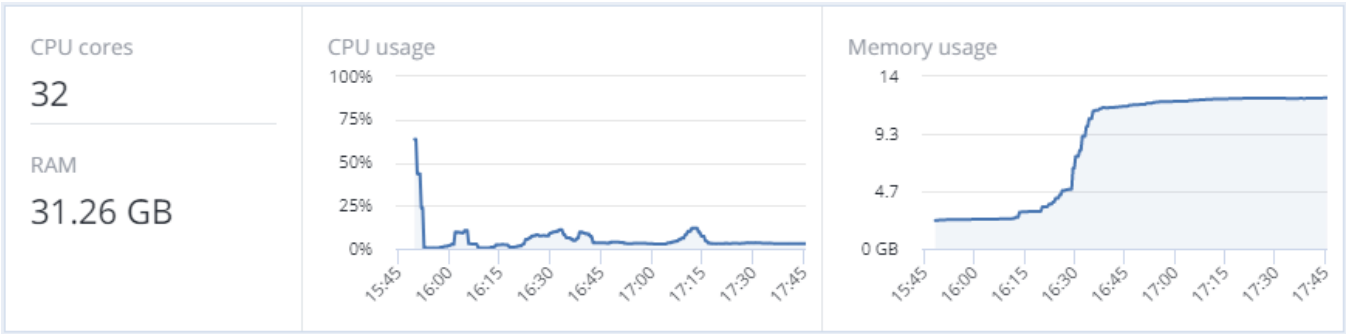
3.2.2 Monitoring Node Performance

To monitor the performance of a cluster node, open the **NODES** screen and click the node. On the node overview screen, you will see performance statistics described below.

The overall statistics include:

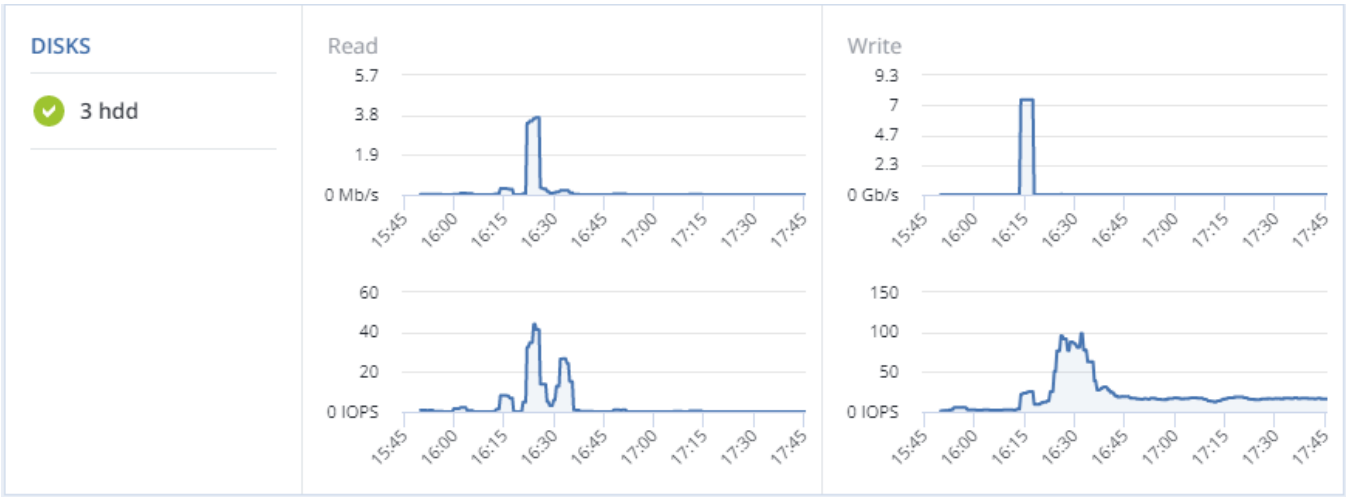
- the number of CPUs and the amount of RAM,
- CPU usage, in percent over time,

- RAM usage, in megabytes or gigabytes over time.



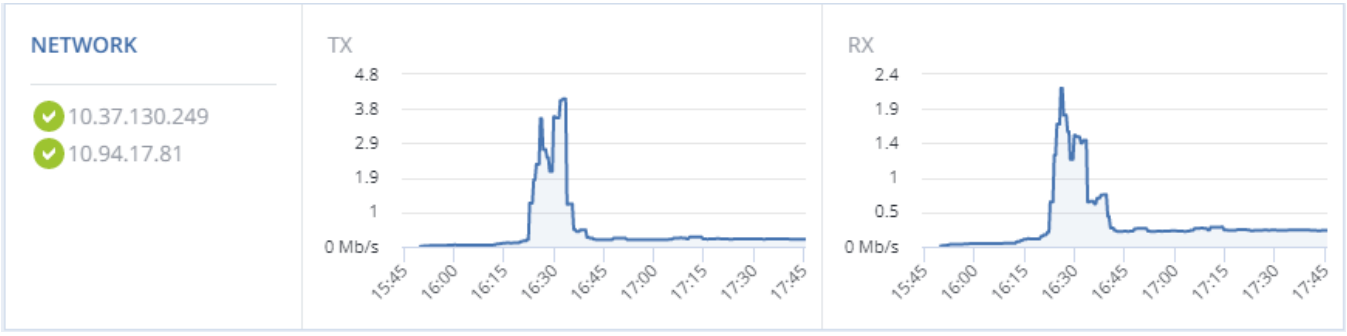
The **DISKS** section shows:

- the number of HDD and SSD drives and their statuses,
- node I/O activity over time on the read and write charts.



The **NETWORK** section shows:

- the list of network interfaces and their statuses,
- the amount of transmitted (TX) and received (RX) traffic over time.



The following sections provide more information on disk and network usage.

3.2.3 Monitoring Node Disks

To monitor the usage and status of node disks, click the **DISKS** link on the node overview screen. You will see a list of all disks on the node and their status icons.

A disk status icon shows the combined status of S.M.A.R.T. and the service corresponding to the disk role. It can be one of the following:

OK The disk and service are healthy.

Failed
: The service has failed or S.M.A.R.T. reported an error.

Releasing
: The service is being released. When the process finishes, the disk status will change to **OK**.

To monitor performance of a particular disk, select it and click **Performance**. The **Drive performance** panel will display the I/O activity of the disk.

To view information about the disk, including its S.M.A.R.T. status, click **Details**.

To have the disk blink its activity LED, select the disk, and click **Blink**. To have the disk stop blinking, click **Unblink**.

3.2.3.1 Monitoring the S.M.A.R.T. Status of Node Disks

The S.M.A.R.T. status of all disks is monitored by a tool installed along with Acronis Cyber Infrastructure. Run every 10 minutes, the tool polls all disks attached to nodes, including journaling SSDs and system disks, and reports the results to the management node.

For the tool to work, make sure the S.M.A.R.T. functionality is enabled in node's BIOS.

If a S.M.A.R.T. warning message is shown in the node status, one of that node's disks is in pre-failure condition and should be replaced. If you continue using the disk, keep in mind that it may fail or cause performance issues.

Pre-failure condition means that at least one of these S.M.A.R.T. counters is not zero:

- Reallocated Sector Count

- Reallocated Event Count
- Current Pending Sector Count
- Offline Uncorrectable

3.2.4 Monitoring Node Network

To monitor the node's network usage, click **NETWORK** on the node overview screen.

To display the performance charts of a specific network interface, select it in the list and click **Performance**. When monitoring network performance, keep in mind that if the **Receive and transmit errors** chart is not empty, the network is experiencing issues and requires attention.

To display the details of a network interface, click **Details**. The **Network details** panel shows the interface state, bandwidth, MTU, MAC address, and all IP addresses.

3.3 Monitoring Storage Cluster Objects via SNMP

You can monitor cluster objects via the Simple Network Management Protocol (SNMP). The implementation conforms to the same Structure of Management Information (SMI) rules as the data in the standard SNMP context: all objects are organized in a tree; each object identifier (OID) is a series of integers corresponding to tree nodes and separated by dots.

General information:

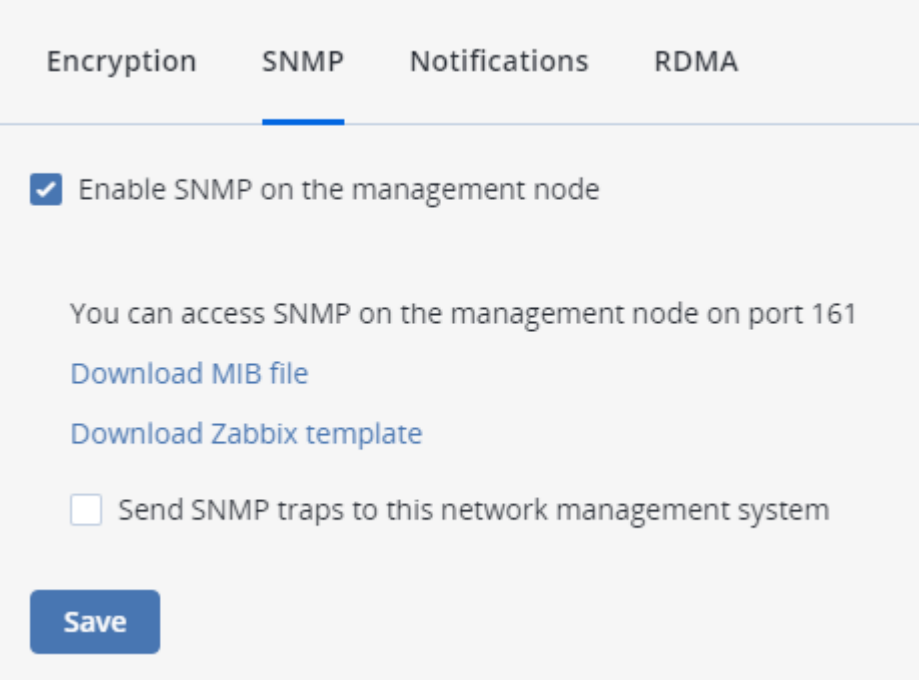
- The OID of the root subtree with all the objects you can monitor is 1.3.6.1.4.1.8072.161.1.
- The `VSTORAGE-MIB.txt` information base file is required to monitor the objects. You can download the file at `https://<admin_panel_IP>:8888/api/v2/snmp/mibs/`.

The following subsections describe ways to enable and use SNMP to monitor cluster objects.

3.3.1 Enabling SNMP Access

To monitor cluster objects, enable the SNMP access on the node. Do the following in the admin panel:

1. Open UDP port 161 on the management node as follows:
    1. On the **INFRASTRUCTURE** > **Networks** screen, click **Edit**.
    2. Add the **SNMP** traffic type to your public network by ticking the corresponding checkbox.
    3. Click **Save** to apply changes.
2. On the **SETTINGS** > **Advanced settings** > **SNMP** tab, check **Enable SNMP on management node**. The network management system (SNMP monitor) will be enabled, giving you access to the cluster via the SNMP protocol.



3. Click the provided link to download the MIB file and set it up in your SNMP monitor.
4. If required, have Acronis Cyber Infrastructure send SNMP traps to your SNMP monitor. Do the following:
    1. Check **Send SNMP traps to this network management system**.
    2. Specify the **IP address** of the system, and, if required, change the default **Port** and **Community**.
    3. If required, click **SEND TEST TRAP** to test the service.

5. Click **SAVE** to apply changes.

3.3.2 Accessing Storage Cluster Information Objects via SNMP

You can access storage cluster information objects with SNMP tools of your choice, e.g., the free Net-SNMP suite for Linux.

To obtain storage cluster information on a node with the admin panel, place the MIB file to `/usr/share/snmp/mibs` and run the `snmpwalk` command. For example:

```
# snmpwalk  -M /usr/share/snmp/mibs -m VSTORAGE-MIB -v 2c -c public \
localhost:161 VSTORAGE-MIB:cluster
```

Typical output may be the following:

```
VSTORAGE-MIB::clusterName.0 = STRING: "cluster1"
VSTORAGE-MIB::healthStatus.0 = STRING: "healthy"
VSTORAGE-MIB::usedSpace.0 = Counter64: 173732322
VSTORAGE-MIB::totalSpace.0 = Counter64: 1337665179648
VSTORAGE-MIB::freeSpace.0 = Counter64: 1318963253248
VSTORAGE-MIB::licenseStatus.0 = STRING: "unknown"
VSTORAGE-MIB::licenseCapacity.0 = Counter64: 1099511627776
VSTORAGE-MIB::licenseExpirationStatus.0 = STRING: "None"
VSTORAGE-MIB::ioReadOpS.0 = Counter64: 0
VSTORAGE-MIB::ioWriteOpS.0 = Counter64: 0
VSTORAGE-MIB::ioReads.0 = Counter64: 0
VSTORAGE-MIB::ioWrites.0 = Counter64: 0
VSTORAGE-MIB::csActive.0 = Counter64: 11
VSTORAGE-MIB::csTotal.0 = Counter64: 11
VSTORAGE-MIB::mdsAvail.0 = Counter64: 4
VSTORAGE-MIB::mdsTotal.0 = Counter64: 4
<...>
```

3.3.2.1 Listening to SNMP Traps

To start listening to SNMP traps, do the following:

1. Configure the `snmptrapd` daemon to log SNMP traps, allow them to trigger executable actions, and resend data to the network. To do this, add the following `public` community string to the `/etc/snmp/snmptrapd.conf` file:

   ```
   authCommunity log,execute,net public
   ```

2. Start the daemon and specify the MIB file:

```
# snmptrapd -M /usr/share/snmp/mibs -m VSTORAGE-MIB -n -f -Lf /tmp/traps.log
```

3. Send a test trap from the **SETTINGS** > **Advanced settings** > **SNMP** tab in the admin panel.
4. View the log file:

```
# tail -f /tmp/traps.log
2017-04-23 02:48:18 UDP: [127.0.0.1]:58266->[127.0.0.1]:162 [UDP: \
[127.0.0.1]:58266->[127.0.0.1]:162]:
SNMPv2-SMI::mib-2.1.3.0 = Timeticks: (1687405) 4:41:14.05       \
SNMPv2-SMI::snmpModules.1.1.4.1.0 = OID: VSTORAGE-MIB::generalAlert     \
VSTORAGE-MIB::trapType = STRING: Test Case      VSTORAGE-MIB::trapMsg = \
STRING: This Is Text Message to end-user    \
VSTORAGE-MIB::trapPriority = Counter64: 1
```

The test trap is considered a `generalAlert`.

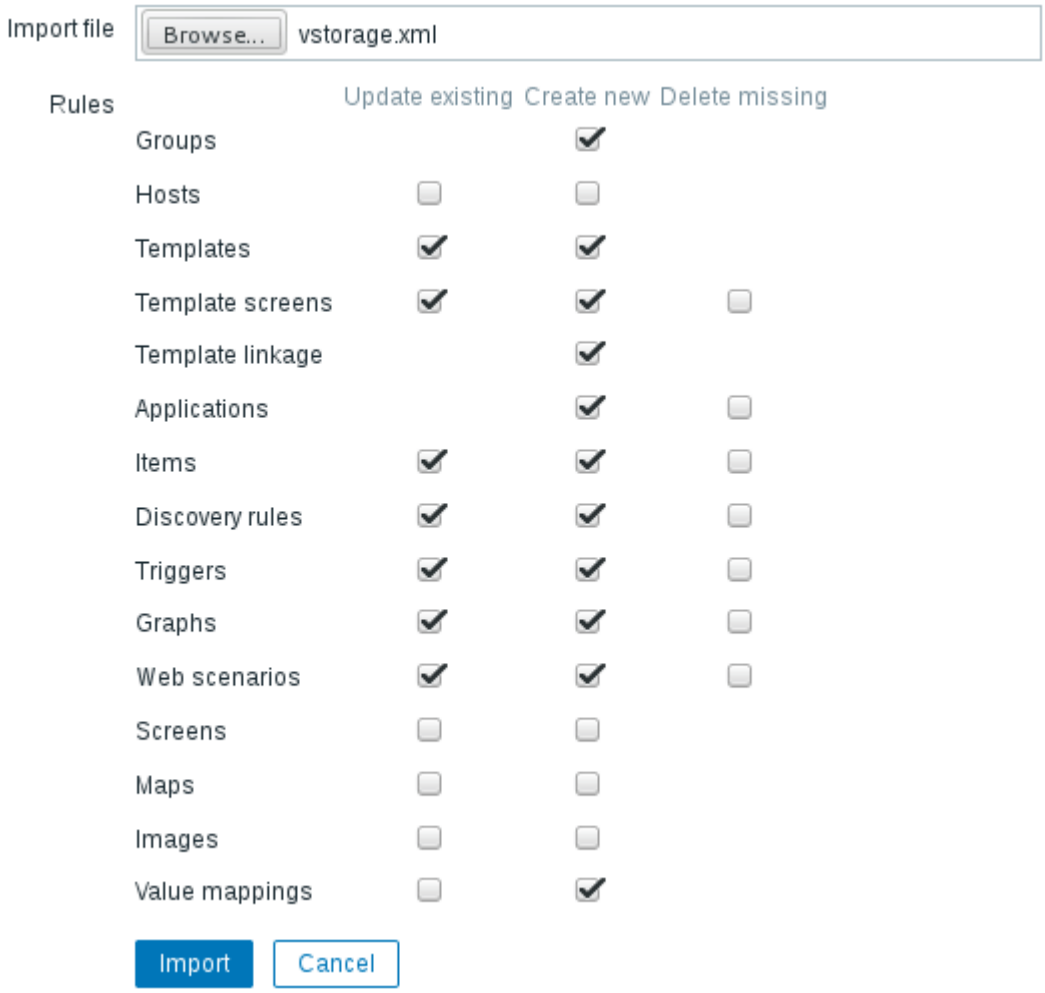
3.3.3 Monitoring the Storage Cluster with Zabbix

To configure cluster monitoring in Zabbix, do the following:

1. On the **SETTINGS** > **Advanced settings** > **SNMP** tab, click the provided link to download a template for Zabbix.

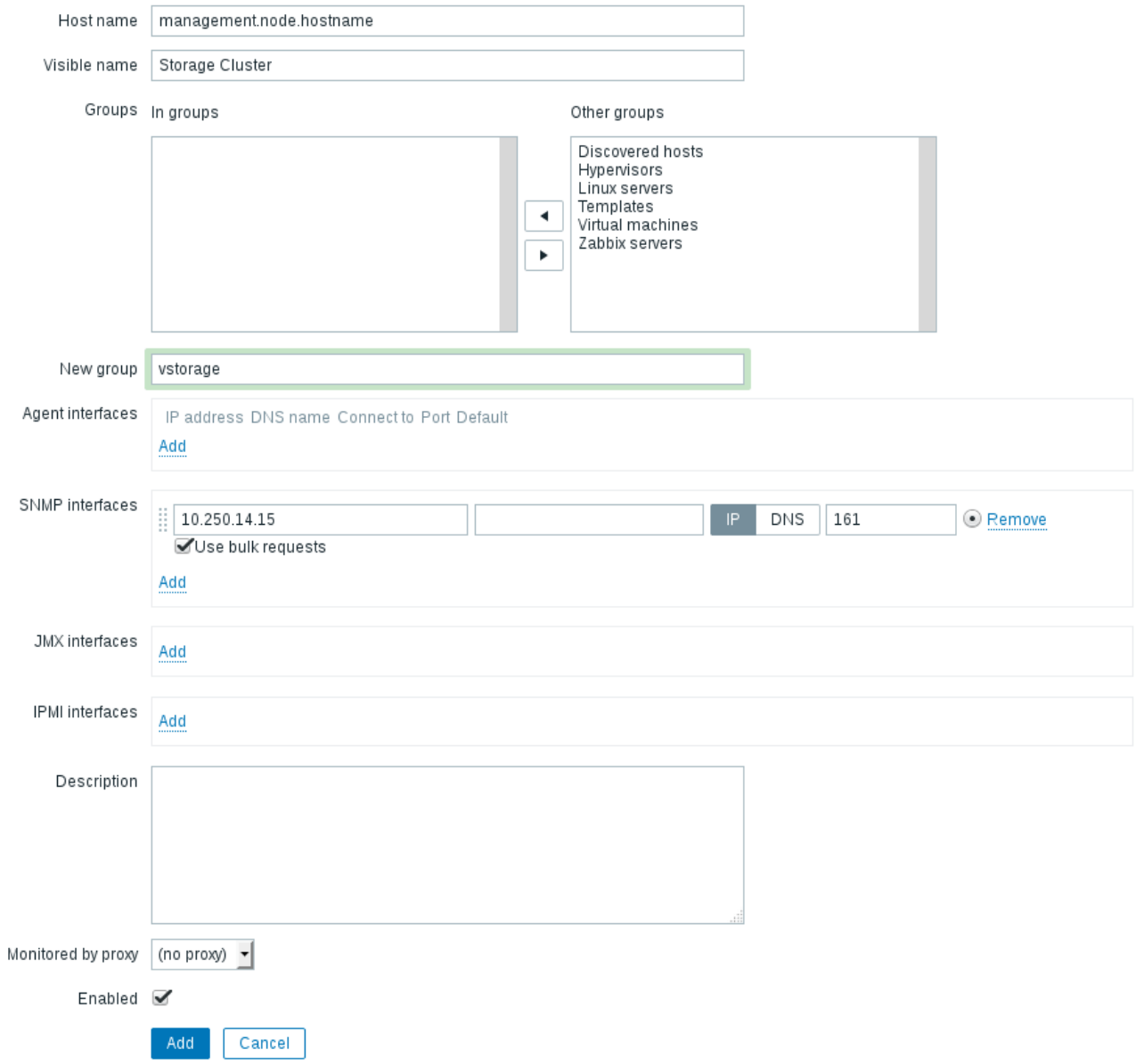
   Note: The template is compatible with Zabbix 3.x.

2. In Zabbix, click **Configuration** > **Templates** > **Import** and **Browse**.

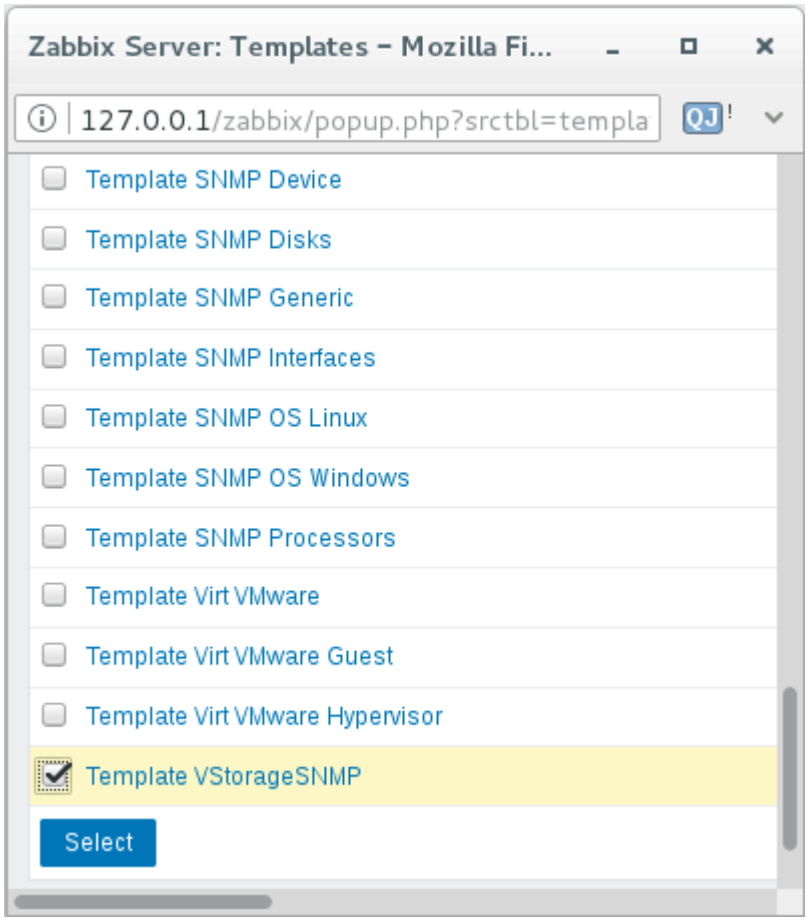


3. Navigate to the template, select it, and click **Import**.

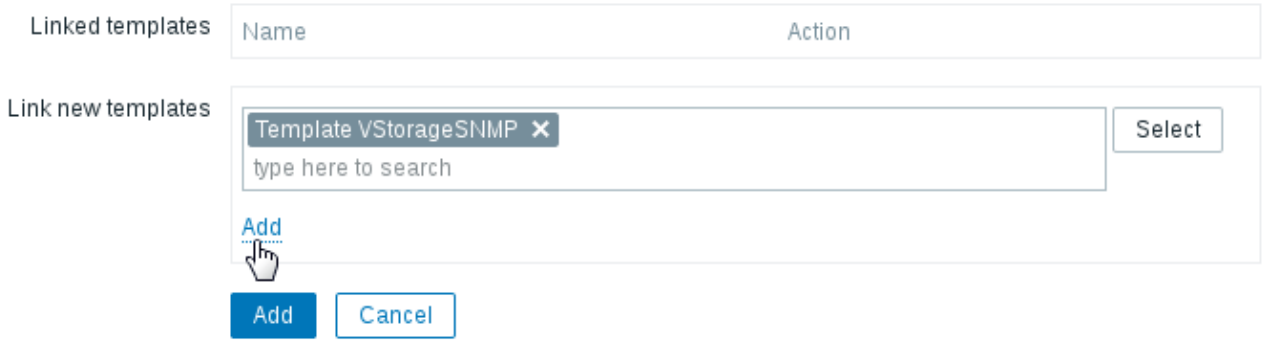
4. Click **Configuration** > **Hosts** > **Create host**.



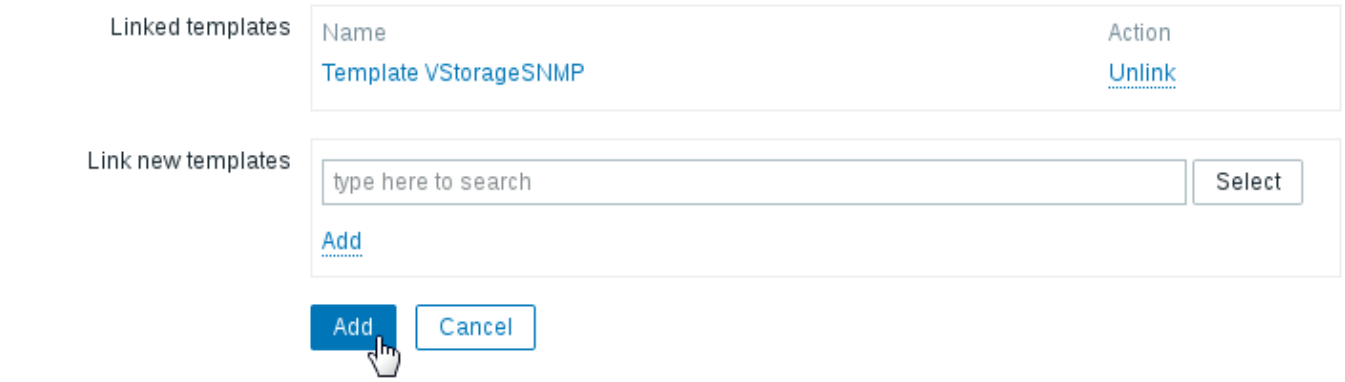
5. On the **Host** tab, do the following:
    1. Specify the **Host name** of the management node and its **Visible name** in Zabbix.
    2. Specify `vstorage` in the **New group** field.
    3. **Remove** the **Agent Interfaces** section.
    4. **Add** an **SNMP interfaces** section and specify the management node IP address.
6. On the **Templates** tab, click **Select** next to the **Link new templates** field.
7. In the **Zabbix Server: Templates** window, check the `Template VStorageSNMP` template and click **Select**.



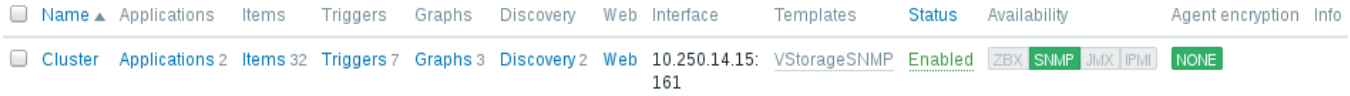
8. Back on the **Templates** tab, click the **Add** link in the **Link new templates** section. The `VStorageSNMP` template will appear in the **Linked templates** group.



9. Having configured the host and added its template, click the **Add** button.



In a few minutes, the cluster's SNMP label in the **Availability** column on the **Configuration** > **Hosts** screen will turn green.



To monitor cluster's parameters, open the **Monitoring** > **Latest data** screen, set the filter's **Host groups** to `vstorage` and click **Apply**.

You can create performance charts on the **Configuration** > **Hosts** > **<cluster>** > **Graphs** tab and a workplace for them on the **Monitoring** > **Screens** tab.

3.3.4 Storage Cluster Objects and Traps

Cluster-related objects that you can monitor:

VSTORAGE-MIB:cluster
: General cluster information.

VSTORAGE-MIB:csStatTable
: Chunk server statistics table.

VSTORAGE-MIB:mdsStatTable
: Metadata server statistics table.

VSTORAGE-MIB::clusterName
: Cluster name.

VSTORAGE-MIB::healthStatus
: Cluster health status.

VSTORAGE-MIB::usedSpace

The space occupied by all data chunks and their replicas plus the space occupied by any other data stored on cluster nodes' disks.

VSTORAGE-MIB::totalSpace

The total space on all cluster nodes' disks.

VSTORAGE-MIB::freeSpace

The unused space on all cluster nodes' disks.

VSTORAGE-MIB::licenseStatus

License status.

VSTORAGE-MIB::licenseCapacity

The maximum disk space available as defined by license.

VSTORAGE-MIB::licenseExpirationStatus

License expiration status.

VSTORAGE-MIB::ioReadOpS

Current read speed in operations per second.

VSTORAGE-MIB::ioWriteOpS

Current write speed in operations per second.

VSTORAGE-MIB::ioReads

Current read speed in bytes per second.

VSTORAGE-MIB::ioWrites

Current read write in bytes per second.

VSTORAGE-MIB::csActive

The number of active chunk servers.

VSTORAGE-MIB::csTotal

The total number of chunk servers.

VSTORAGE-MIB::mdsAvail

The number of running metadata servers.

VSTORAGE-MIB::mdsTotal

The total number of metadata servers.

VSTORAGE-MIB::s3OsAvail

The number of running S3 object servers.

VSTORAGE-MIB::s3OsTotal

The total number of S3 object servers.

VSTORAGE-MIB::s3NsAvail

The number of running S3 name servers.

VSTORAGE-MIB::s3NsTotal

The total number of S3 name servers.

VSTORAGE-MIB::s3GwAvail

The number of running S3 gateways.

VSTORAGE-MIB::s3GwTotal

The total number of S3 gateways.

CS-related objects that you can monitor:

VSTORAGE-MIB::csId

Chunk server identifier.

VSTORAGE-MIB::csStatus

Current chunk server status.

VSTORAGE-MIB::csIoReadOpS

Current read speed of a chunk server in operations per second.

VSTORAGE-MIB::csIoWriteOpS

Current write speed of a chunk server in operations per second.

VSTORAGE-MIB::csIoWait

The percentage of time spent waiting for I/O operations. Includes time spent waiting for synchronization.

VSTORAGE-MIB::csIoReadS

Current read speed of a chunk server in bytes per second.

VSTORAGE-MIB::csIoWriteS

Current write speed of a chunk server in bytes per second.

MDS-related objects you can monitor:

VSTORAGE-MIB::mdsId

Metadata server identifier.

VSTORAGE-MIB::mdsStatus

Current metadata server status.

VSTORAGE-MIB::mdsMemUsage

The amount of memory used by a metadata server.

VSTORAGE-MIB::mdsCpuUsage

The percentage of the CPU's capacity used by a metadata server.

VSTORAGE-MIB::mdsUpTime

Time since the startup of a metadata server.

SNMP traps triggered by the specified alerts:

licenseExpired

The license has expired.

tooFewClusterFreeLogicalSpace

Too few free space is left.

tooFewClusterFreePhysicalSpace

Too few physical space is left.

tooFewNodes

Too few nodes are left.

tooFewMdses

Too few MDSs are left.

generalAlert

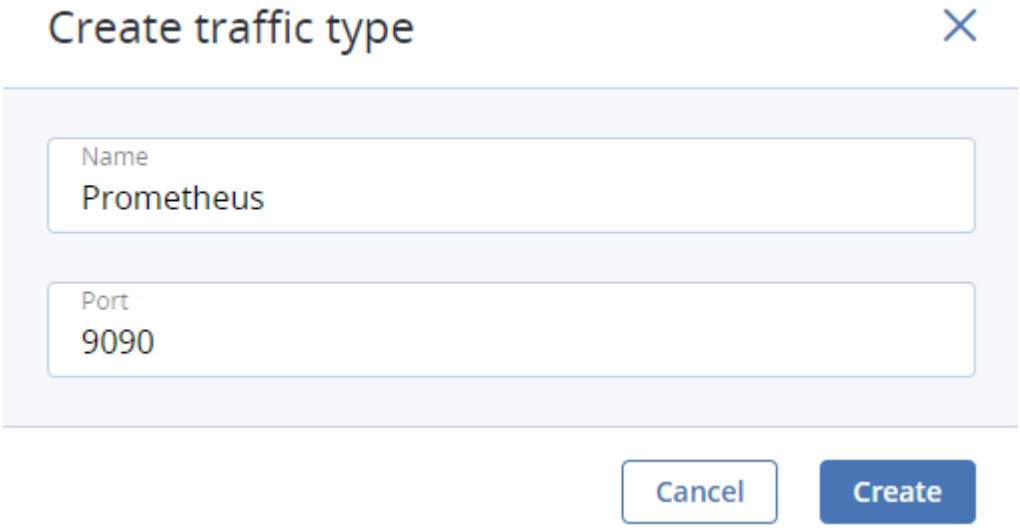
Other.

3.4 Monitoring Storage Cluster Remotely

You can monitor your storage cluster via Prometheus remotely. To do this, you need to open a TCP port for Prometheus API to be accessible from the outside.

To open a port, do the following:

1. On the **INFRASTRUCTURE** > **Networks** screen, click **Edit** and then **Create traffic type**.
2. In the **Create traffic type** window, specify a custom name in the **Name** field and `9090` in the **Port** field.



3. Click **Create**.
4. Add the newly created traffic type to your public network by ticking the corresponding checkbox.
5. Click **Save** to apply the changes.

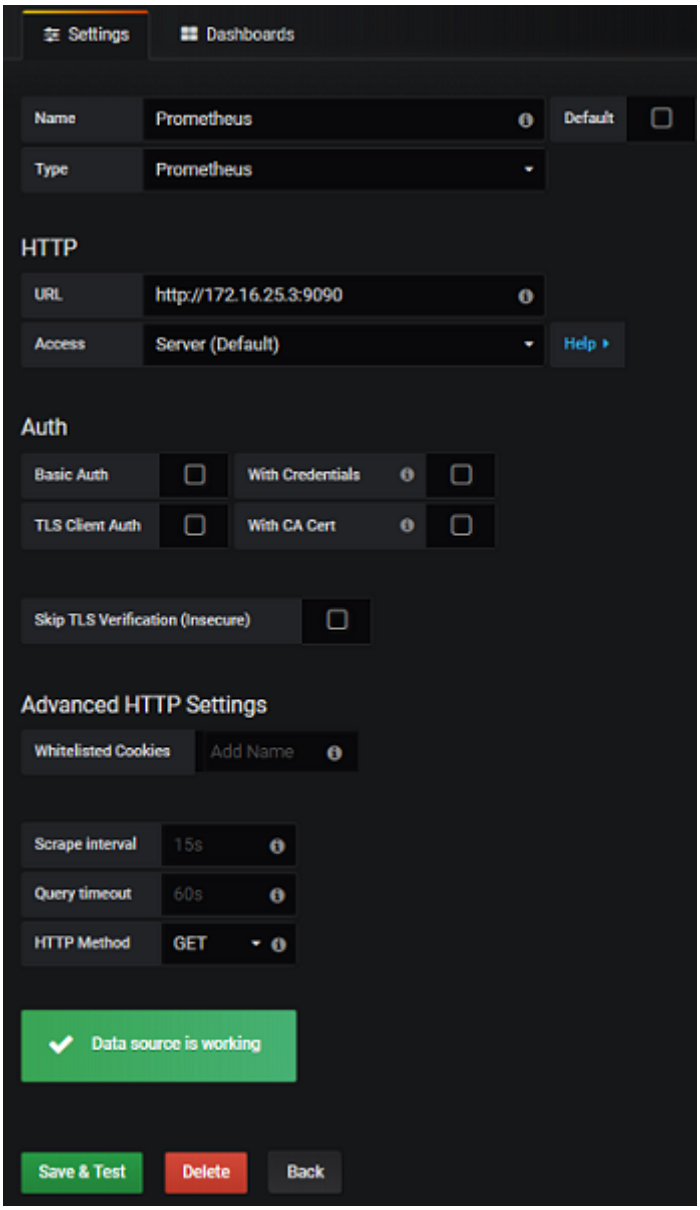
You can now access the built-in Prometheus web-based user interface at http://<admin_panel_IP_address>:9090. For more information on using Prometheus, refer to its documentation.

If you have an external Grafana account and want to use it for monitoring Acronis Cyber Infrastructure, you can add Prometheus as a data source as follows:

1. Log in into your Grafana user interface.
2. Click the cogwheel icon in the left menu and select **Data Sources**.
3. On the **Data Sources** tab, click **Add data source**.
4. On the **Data Sources / New** screen, specify the following parameters:
    1. Enter a custom data source name in the **Name** field.
    2. Set **Type** to `Prometheus`.
    3. Enter `http://<admin_panel_IP_address>:9090` in the **URL** field.

5. Click **Save & Test**.

If the specified parameters are correct, the `Data source is working` message will appear.



Using the newly added Prometheus data source, you can import the default Grafana dashboards from Acronis Cyber Infrastructure or create new ones.

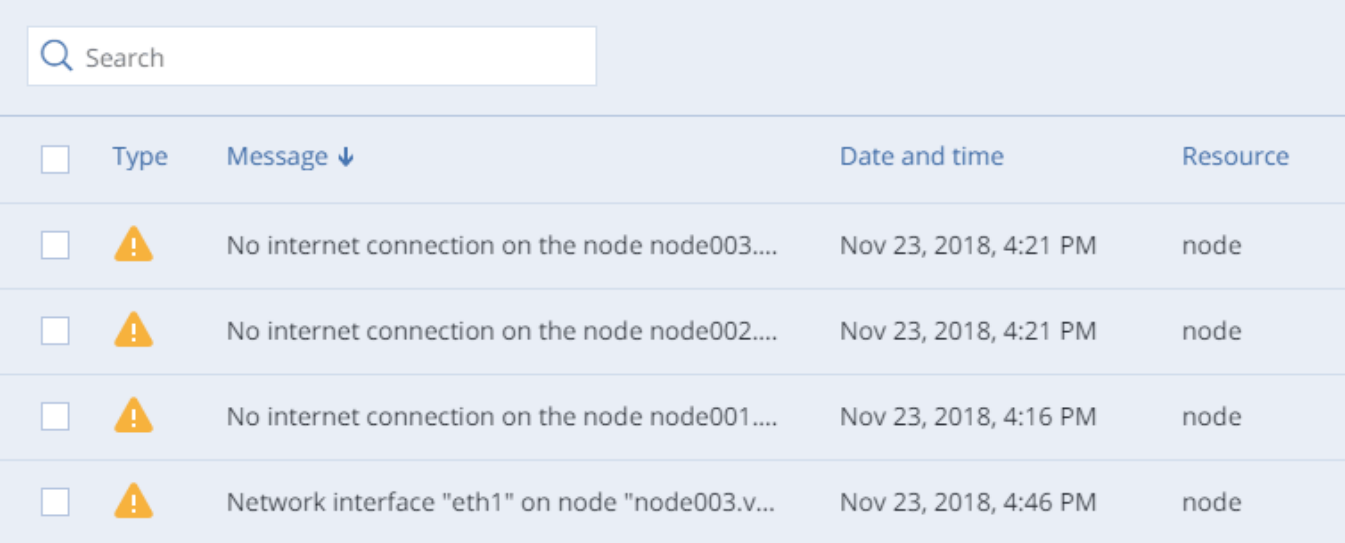
3.5 Viewing Alerts and Audit Log and Sending E-mail Notifications

This section describes Acronis Cyber Infrastructure alerts and audit log and how to send out e-mail notifications about alerts, warnings, and errors.

3.5.1 Viewing Alerts

The **Alerts** tab lists all the alerts logged by Acronis Cyber Infrastructure. An alert is generated and logged each time one of the following conditions is met or events happen:

- a critical issue has happened with a cluster, its components (CS, MDS), disks, nodes, or services;
- cluster requires configuration or more resources to build or restore its health;
- network requires configuration or is experiencing issues that may affect performance;
- license is about to expire or has expired;
- cluster is about to or has run out of available space.



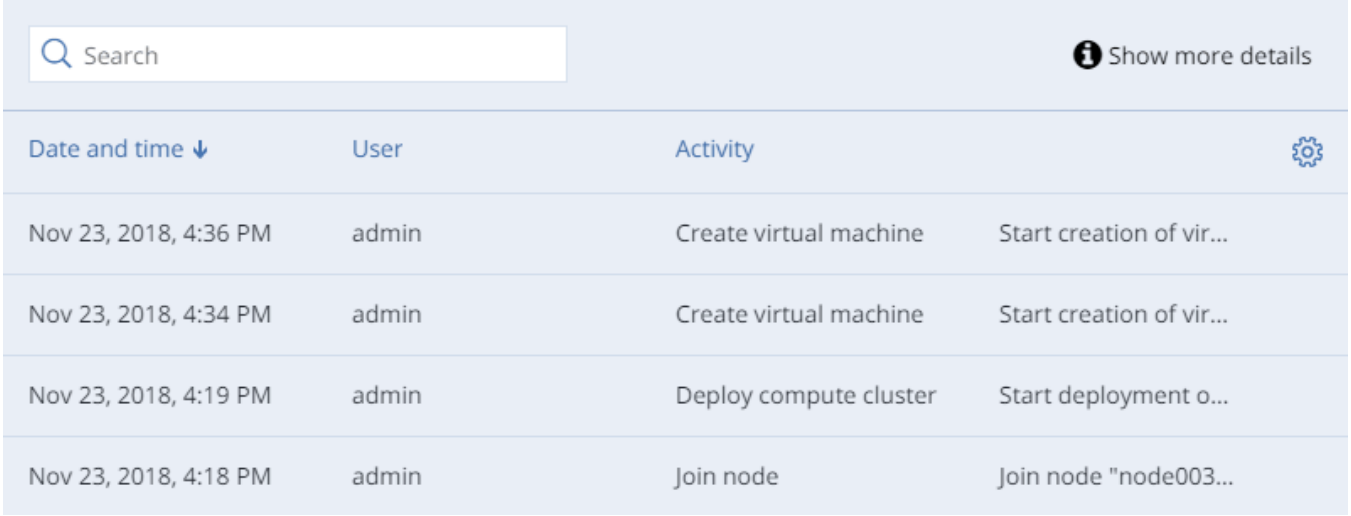
To view the details of an alert, select it on the **MONITORING** > **Alerts** screen and click **Details** in the menu on the right.

Alerts can be ignored (deleted from the alerts list) or postponed for several hours. Postponed alerts reappear in the list after some time.

To ignore or postpone an alert, select it and click the corresponding button.

3.5.2 Viewing Audit Log

The **MONITORING** > **Audit log** screen lists all management operations performed by users and their activity events.



To view detailed information on a log entry, select it and click **Show more details**.

3.5.3 Sending E-mail Notifications

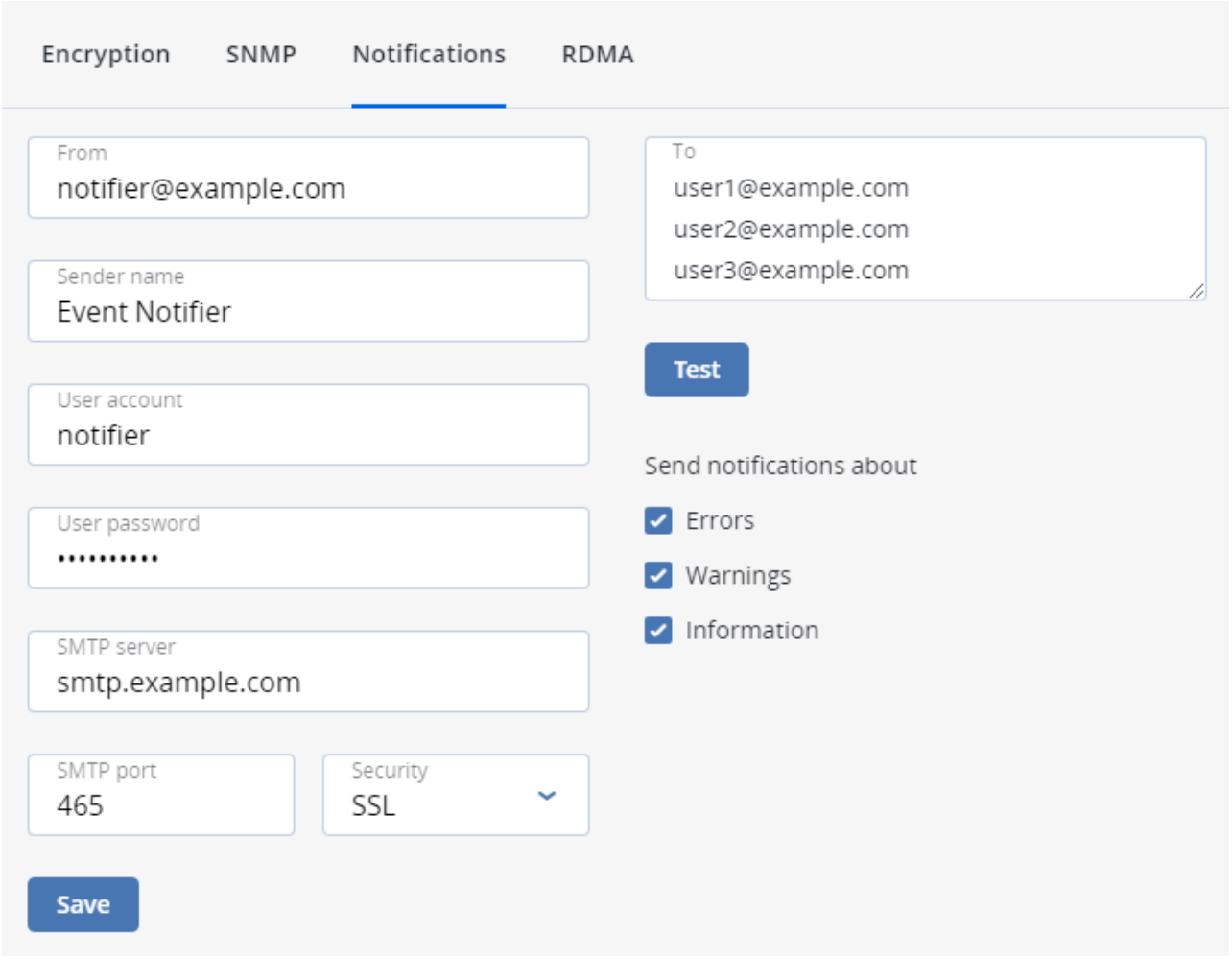
Acronis Cyber Infrastructure can send automatic e-mail notifications about errors, warnings, and alerts.

To set up e-mail notifications, do the following:

1. On the **SETTINGS** > **Advanced settings** > **NOTIFICATIONS** tab, specify the following information:
    1. In the **From** and **Sender name** fields, the notification sender's e-mail and name.
    2. In the **To** field, one or more notification recipient e-mails, one per line.
    3. In the **User account** and **User password** fields, the credentials of the notification sender registered on the SMTP server.
    4. In the **SMTP server** field, the DNS name of the SMTP server, either public (e.g., `smtp.gmail.com`) or the one in your organization.

       The management node must be able to access the SMTP server.

5. If required, a custom **SMTP port** the server uses.
6. In the **Security** field, the security protocol of the SMTP server.



2. Tick the checkboxes for alerts you want to be notified about.
3. Click **Save**.

To send a test e-mail, specify your e-mail registered on the SMTP server in both the **From** and **To** fields and click **Test**.

CHAPTER 4

Managing the Compute Cluster

4.1 Creating the Compute Cluster

Before creating a compute cluster, make sure the following requirements are met:

1. Network is set up according to recommendations in *Managing Networks and Traffic Types* (page 2). The basic requirements are: (a) the traffic types **VM private**, **VM public**, and **Compute API** must be assigned to networks; (b) the nodes to be added to the compute cluster must be connected to these networks.
2. All nodes to be added to the compute cluster are connected to the same network with the **VM public** traffic type.
3. High availability for the management node is enabled (see *Enabling High Availability* (page 202)).

Also take note of the following:

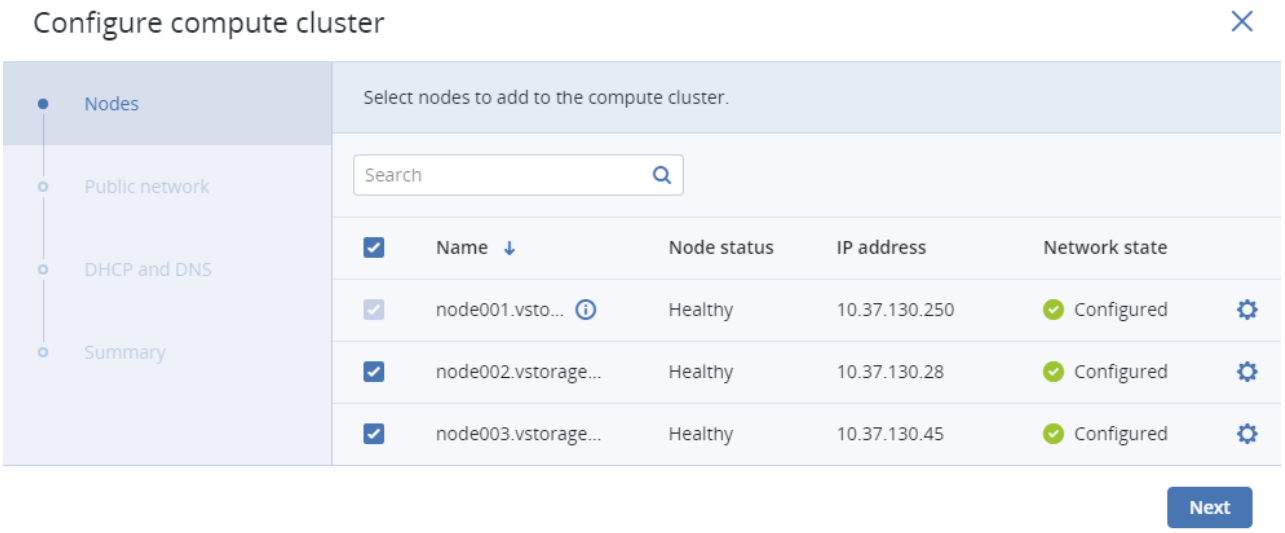
1. Creating the compute cluster prevents (and replaces) the use of the management node backup and restore feature.
2. If nodes to be added to the compute cluster have different CPU models, consult the section "Setting Virtual Machines CPU Model" in the *Administrator's Command Line Guide*.

To create the compute cluster, open the **COMPUTE** screen, click **Create compute cluster** and do the following in the **Configure compute cluster** window:

1. In the **Nodes** section, select nodes to add to the compute cluster, make sure the network state of each selected node is **Configured**, and click **Next**.

   Nodes in the management node high availability cluster are automatically selected to join the compute

cluster.



If node network interfaces are not configured, click the cogwheel icon, select networks as required, and click **Apply**.

2. In the **Public network** section, enable IP address management if needed and provide the required details for the public network.

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

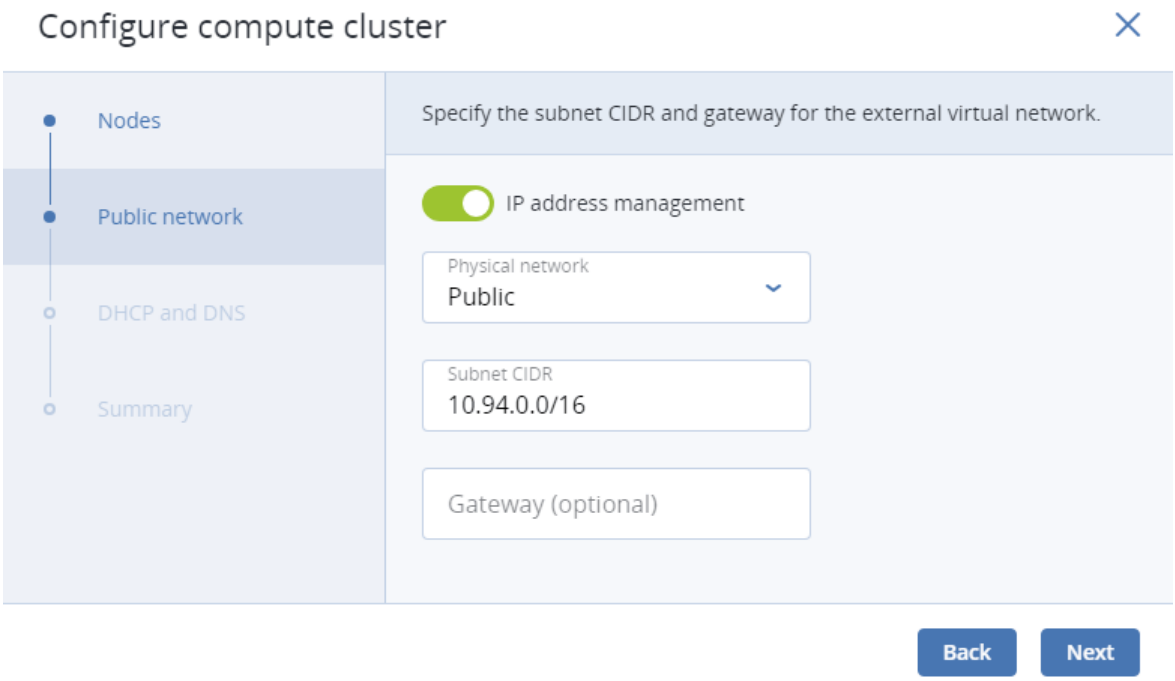
   - Allocation pools. You can specify ranges of IP addresses that will be automatically assigned to VMs.
   - Built-in DHCP server. Assigns IP addresses to virtual machines. With the DHCP server enabled, VM network interfaces will automatically be assigned IP addresses: either from allocation pools or, 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.

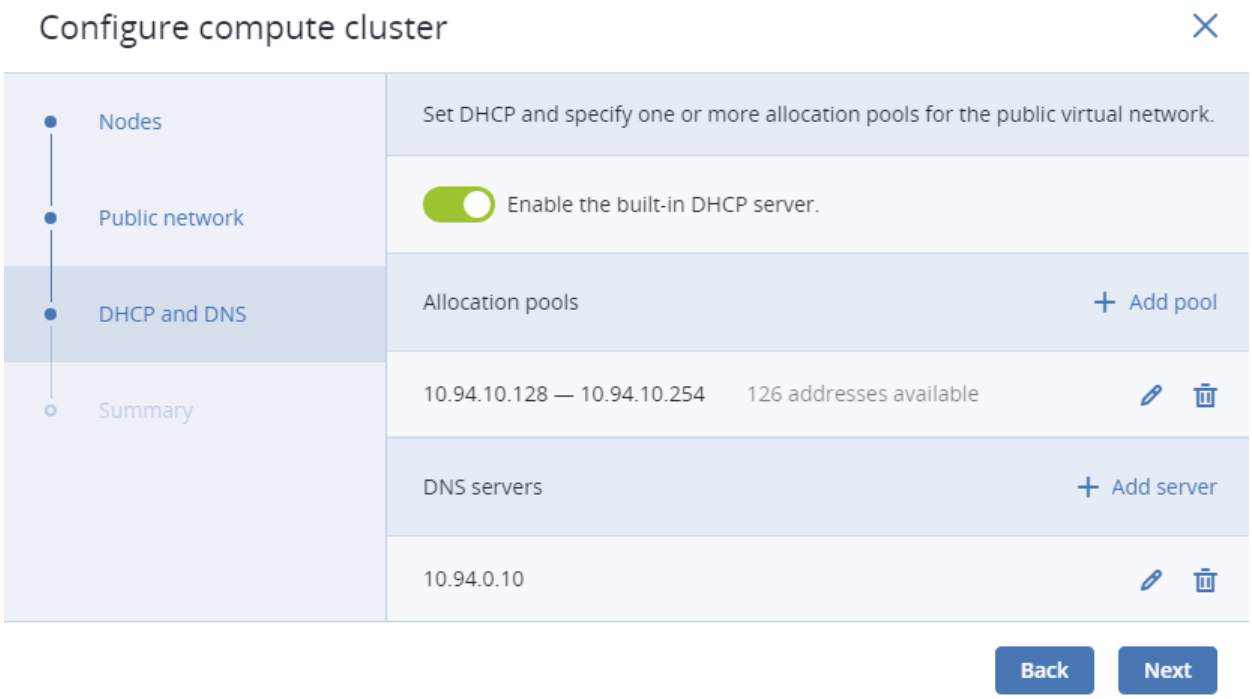
If you choose to enable IP address management, select a physical network to connect the public virtual network to and optionally specify its gateway. The subnet IP range in the CIDR format will be filled in automatically. If you choose to leave IP address management disabled, select a physical network to connect the public virtual network to.



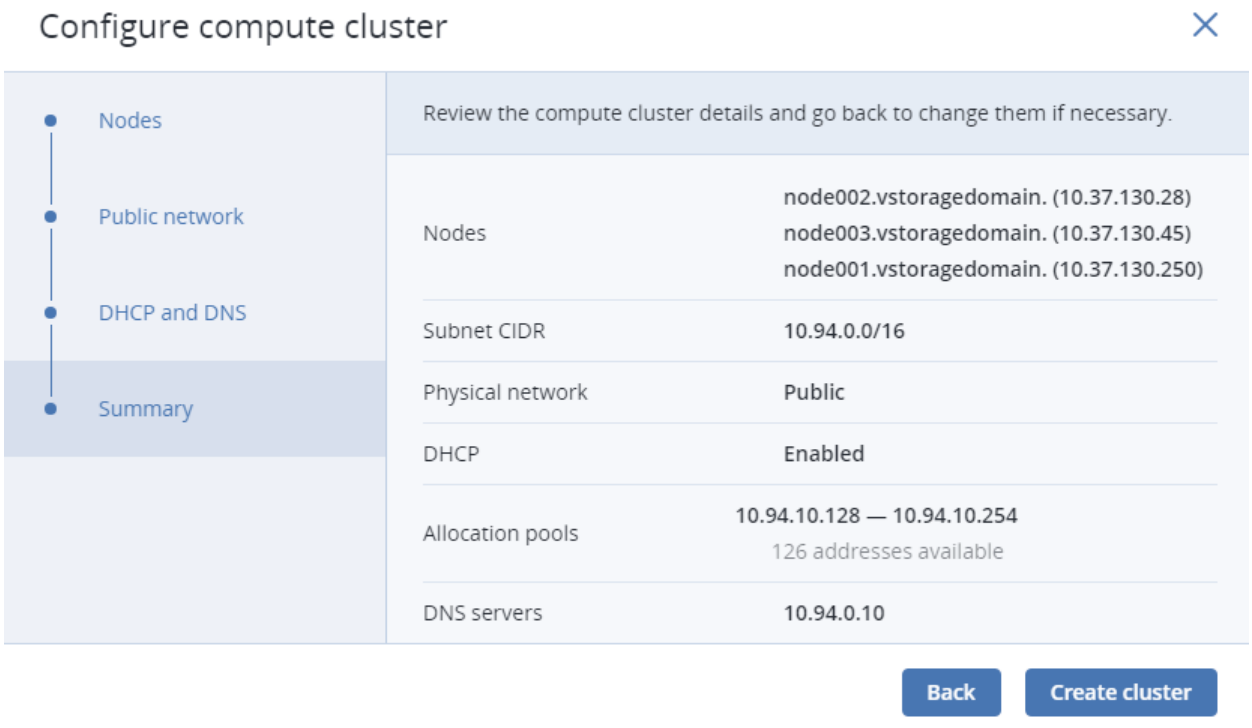
The selected public network will appear in the list of virtual networks on compute cluster's **NETWORKS** tab.

Click **Next**.

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**.



4. In the **Summary** section, review the configuration and click **Create cluster**.



You can monitor compute cluster deployment on the **Compute** screen.

4.2 Managing Compute Nodes

To make your infrastructure more resilient and redundant, you can create a high availability configuration of three nodes.

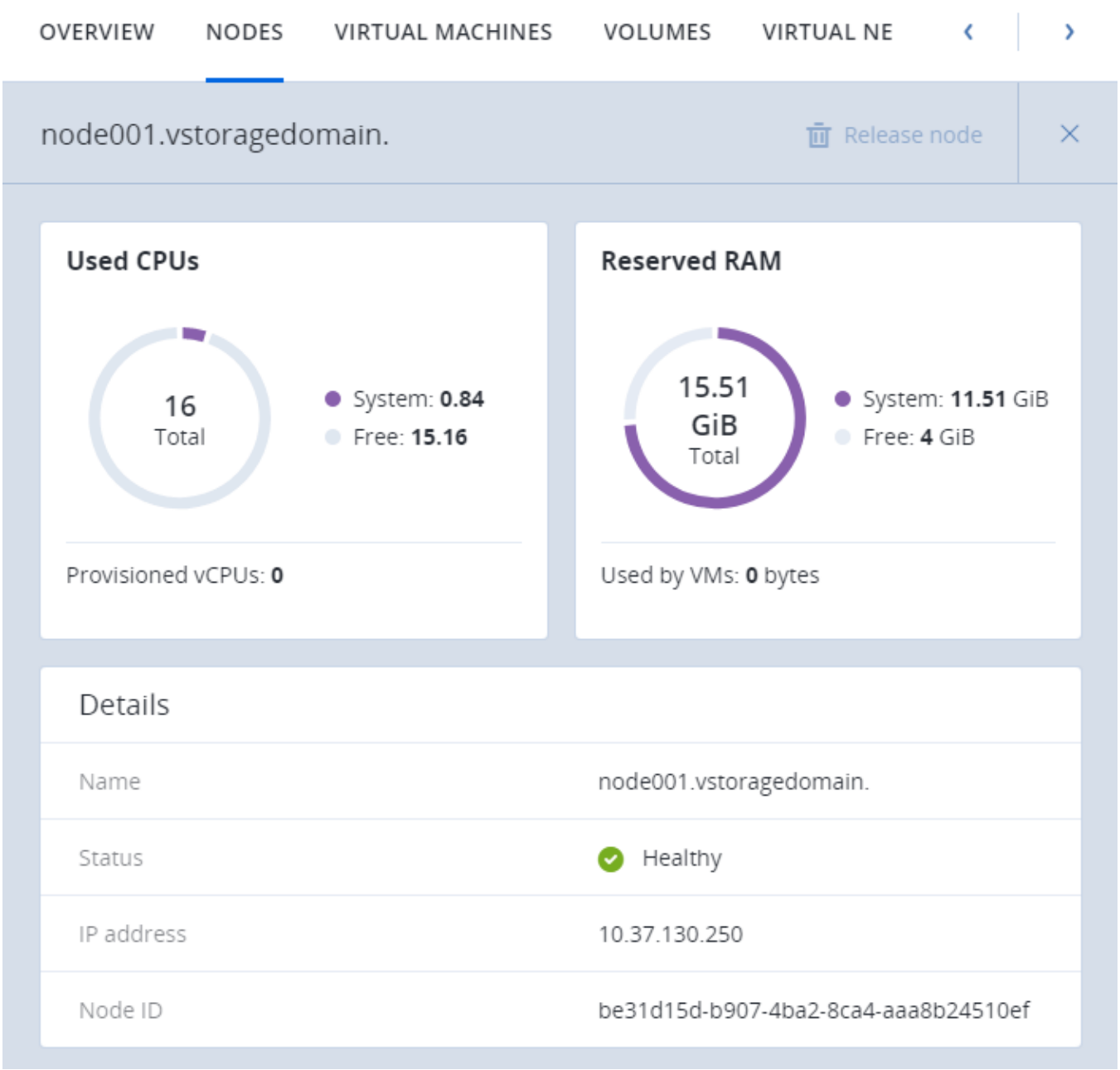
Management node HA and compute cluster are tightly coupled, so changing nodes in one usually affects the other. Take note of the following:

1. Each node in the HA configuration must meet the requirements to the management node listed in the *Installation Guide*. If the compute cluster is to be created, its hardware requirements must be added as well.
2. If the HA configuration has been created before the compute cluster, all nodes in it will be added to the compute cluster.
3. If the compute cluster has been created before HA configuration, only nodes in the compute cluster can be added to the HA configuration. For this reason, to add a node to HA configuration, add it to the compute cluster first.
4. If both the HA configuration and compute cluster include the same three nodes, single nodes cannot be removed from the compute cluster. In such a case, the compute cluster can be destroyed completely, but the HA configuration will remain. This is also true vice versa, the HA configuration can be deleted, but the compute cluster will continue working.

Nodes in the compute cluster are shown on the **Nodes** screen.

Clicking a node, you can see the following information about it:

- node CPU and RAM usage,
- node name, status, and IP address,
- hosted virtual machines and their resource consumption.



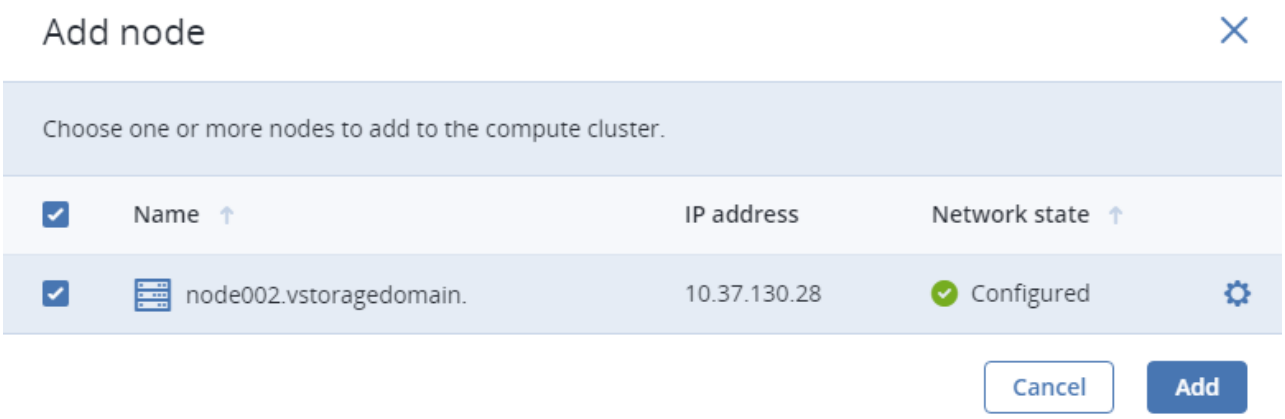
The next subsections describe how to add nodes to and remove nodes from the compute cluster.

4.2.1 Adding Nodes to Compute Cluster

Note: Before changing nodes in the compute cluster, see limitations in *Managing Compute Nodes* (page 56).

To add one or more nodes to your compute cluster, do the following:

1. Click **Add node** on the **Nodes** screen. The **Add node** window will open.
2. If required, configure network on each node not marked green: click the cogwheel icon, assign networks with the compute-related traffic types to node NICs, and click **Apply**.
3. Select nodes and click **Add**.



The added nodes will appear on the **Nodes** screen.

If several nodes are in the management node HA group, they all must be added to the compute cluster.

4.2.2 Releasing Nodes from Compute Cluster

Note: Before changing nodes in the compute cluster, see limitations in *Managing Compute Nodes* (page 56).

To release one or more nodes from the compute cluster, do the following:

1. On the **Nodes** screen, either
   - select the nodes and click **Release nodes** above the list, or
   - click the ellipsis icon next to a node and select **Release**, or
   - click a node to open its details, then click **Release node** on the top toolbar.
2. In the **Release node** window, confirm the action by clicking **Release**.

The selected nodes will disappear from the **Nodes** screen.

If the node to be released has VMs on it, they must be migrated to other nodes first.

4.3 Managing Virtual Networks

In the compute cluster, you can create and manage two types of virtual networks:

Private

VXLAN-based overlay virtual networks that can be used for intercommunication between VMs. Each private network is isolated from other private networks as well as public networks.

Public

Virtual networks that use IP address ranges of public physical networks. Such networks can be used to provide Internet access to VMs.

Each public virtual network can use IP addresses of only one physical network.

In Acronis Cyber Infrastructure, virtual networking also includes virtual routers and floating public IP addresses.

The next subsections explain the virtual network architecture and describe how to add, edit, and delete virtual networks as well as manage virtual routers and floating IP addresses.

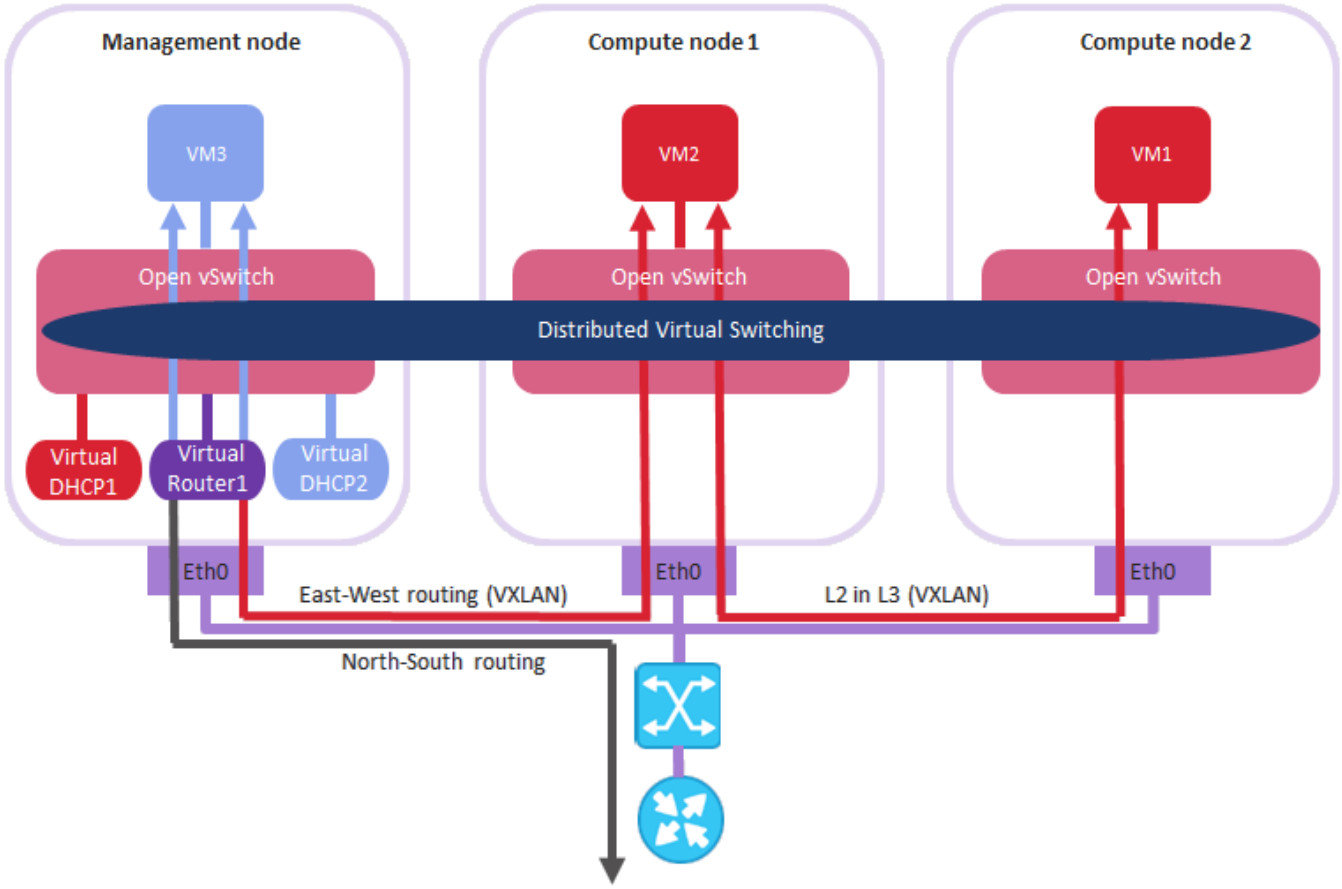
4.3.1 Virtual Network Architecture

Acronis Cyber Infrastructure supports distributed virtual switching on the basis of Open vSwitch. Open vSwitch runs on every compute node and forwards network traffic between virtual machines on the same node and between virtual machines and physical networks. Distributed virtual switching provides centralized management and monitoring of virtual network configuration across all nodes in a compute cluster.

4.3.1.1 Private Network Connectivity

VXLAN technology used for private virtual networks allows creating logical L2 networks in L3 networks by encapsulating (tunneling) Ethernet frames over UDP packets.

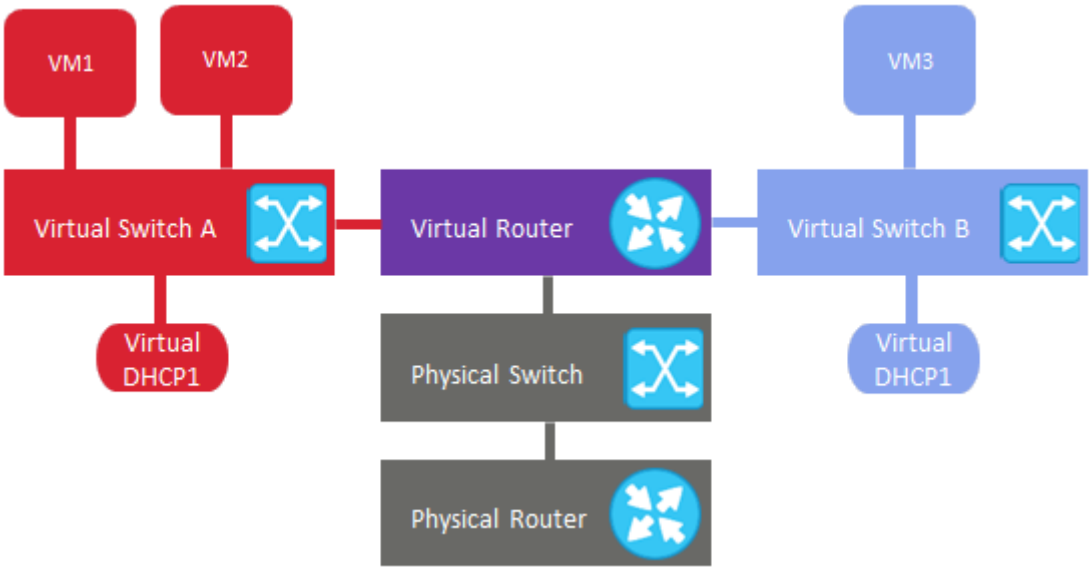
The physical representation of private network connectivity can be shown as follows:



On the figure above:

- Three virtual machines are distributed across the compute cluster and connected to two private virtual networks via two virtual switches: `VM1` and `VM2` belong to one private virtual network, `VM3` belongs to the other one.
- For each virtual network, the DHCP server runs on the management node.
- The virtual router that runs on the management node connects the two private virtual networks and the public virtual network created on top of the physical one, thus enabling connectivity between the VMs from different private virtual networks.
- The compute nodes are connected to the physical switch via the `eth0` network interfaces and reside in one L2 segment.
- The `eth0` network interfaces are connected to the physical network with the `VM private` and `VM public` traffic types.
- The physical router provides access to public networks, such as the Internet.

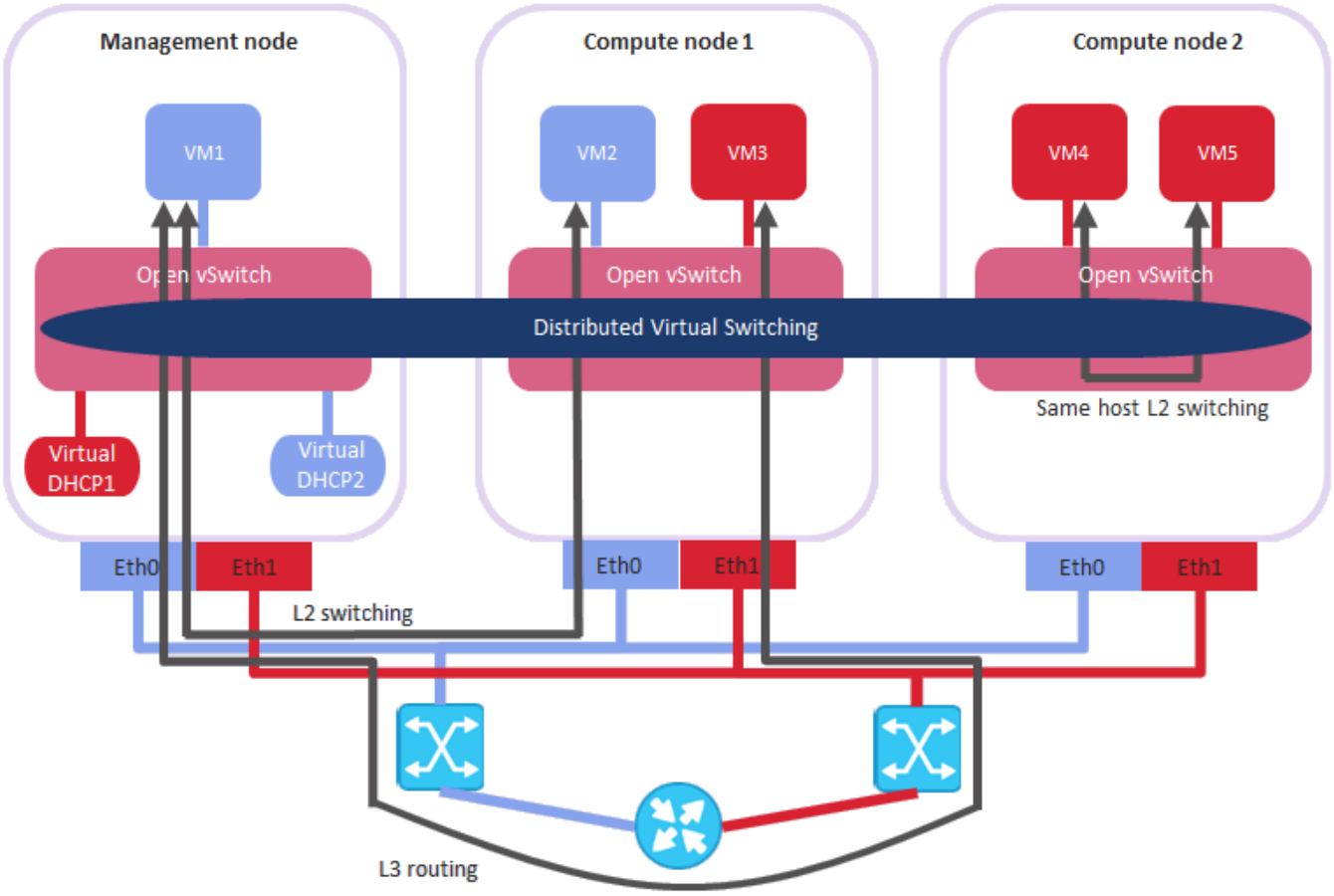
Logically the private networking scheme can be represented as follows:



4.3.1.2 Public Network Connectivity

Public virtual networks are connected to physical networks on Layer 2.

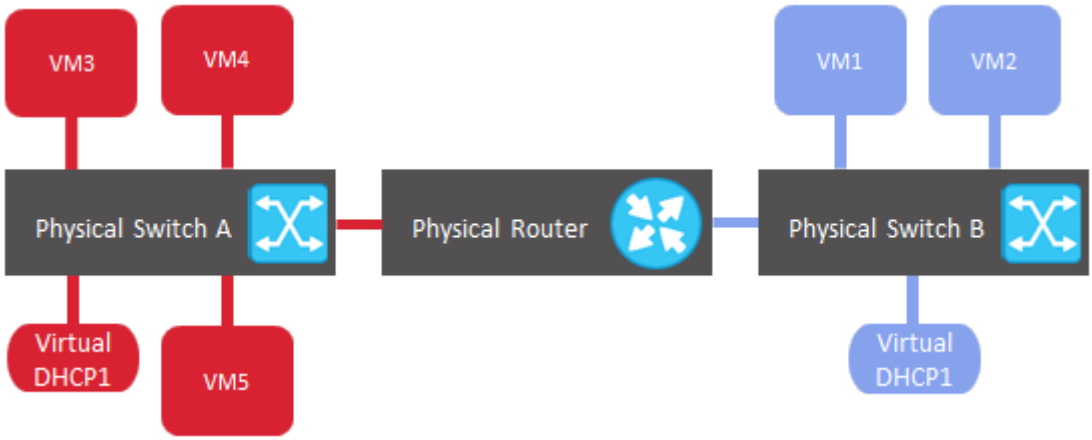
The physical representation of public network connectivity can be shown as follows:



On the figure above:

- Five virtual machines are distributed across the compute cluster and connected to two public virtual networks via two physical switches: `VM1` and `VM2` belong to one public virtual network, while `VM3`, `VM4`, and `VM5` belong to the other one.
- For each virtual network, the DHCP server runs on the management node.
- The compute nodes are connected to one physical switch via the `eth0` network interfaces and to the other physical switch via `eth1` and reside in two separate L2 segments.
- The `eth0` and `eth1` network interfaces are connected to the physical networks with the `VM public` traffic type.
- The physical router interconnects two public virtual networks created on top of the physical ones and provides access to public networks, such as the Internet.

Logically the public networking scheme can be represented as follows:



4.3.2 Creating, Editing, and Deleting Virtual Networks

To add a new virtual network, do the following:

1. On the **COMPUTE** > **Networks** > **NETWORKS** tab, 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, Acronis Cyber Infrastructure 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:

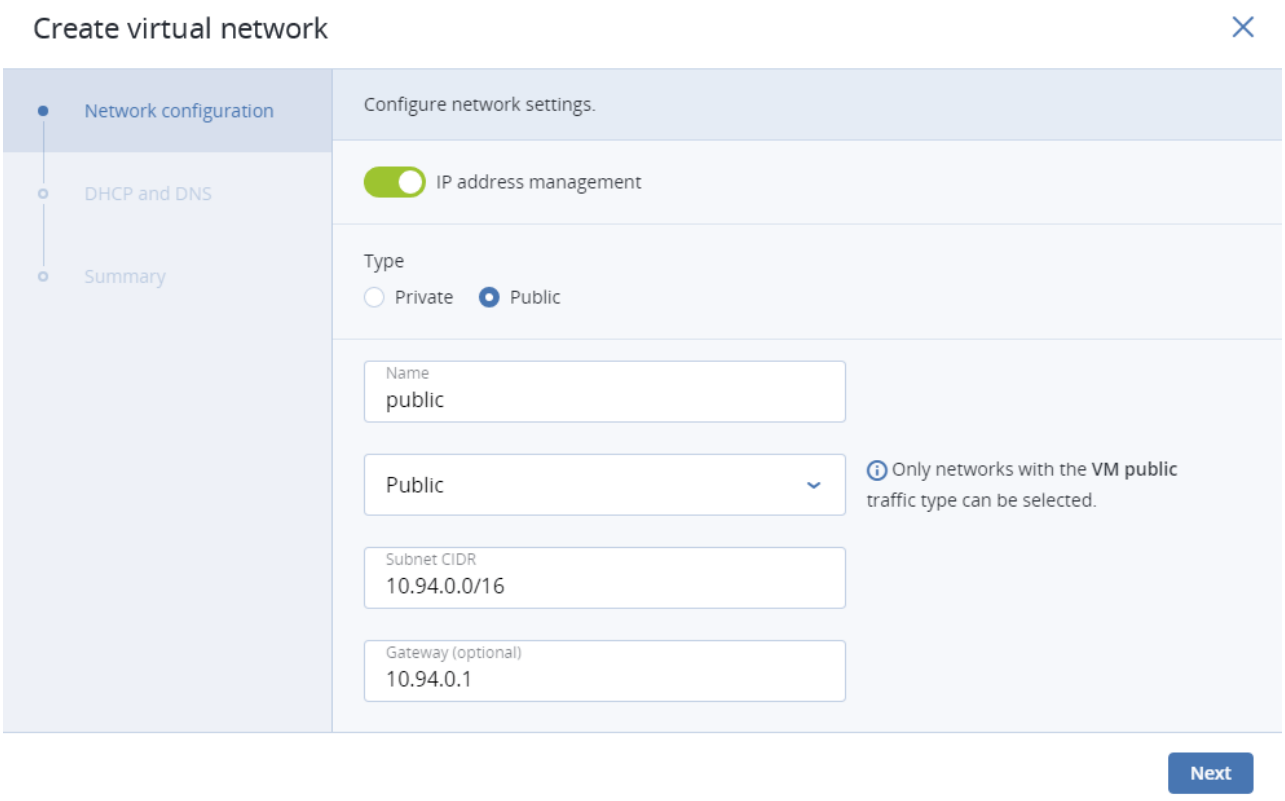
        - VMs connected to a network will be able to obtain IP addresses from DHCP servers in that network.

- 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.

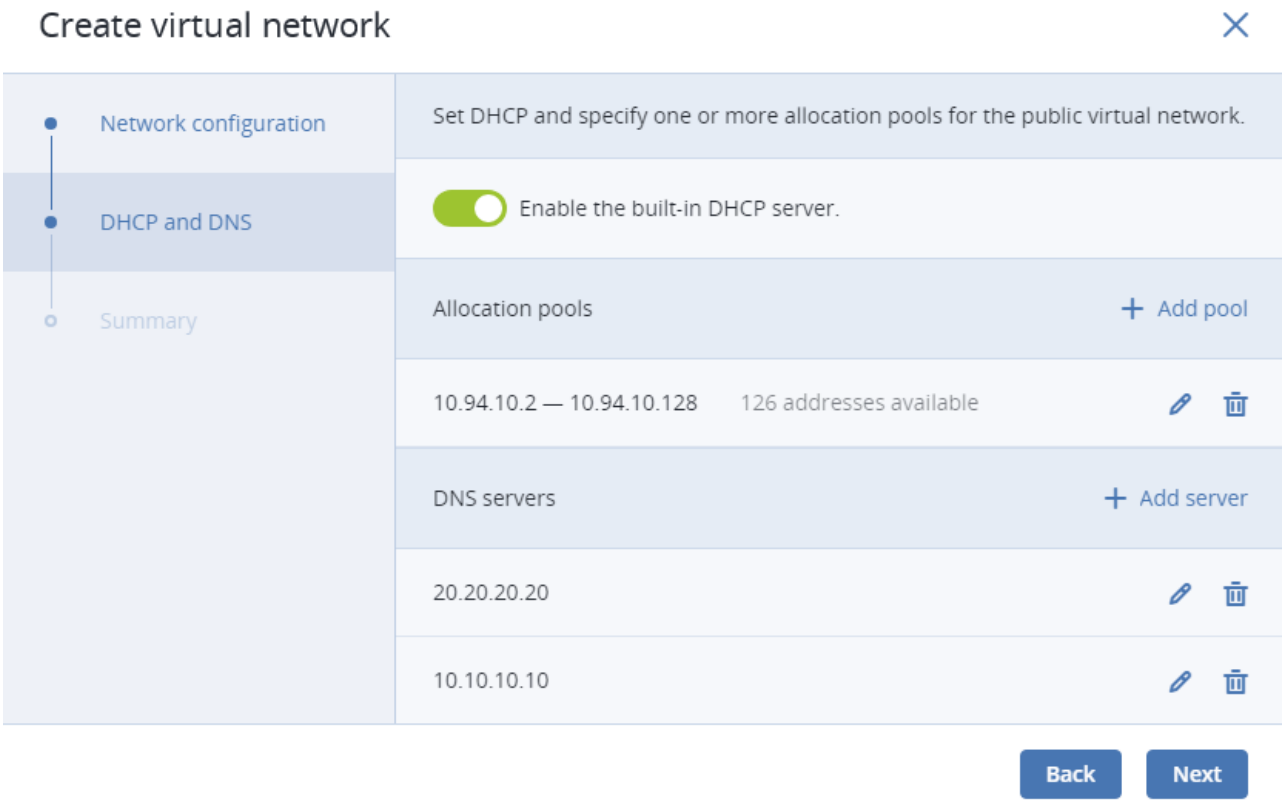
In any case, you will be able to manually assign static IP addresses from inside VMs.

2. Choose network type.
3. Provide network details depending on type:
   - For a private network, 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.
   - For a public network, specify a name and choose a physical network with the **VM public** traffic type (that is not already used by a public network). If IP address management is enabled, optionally specify a gateway. If you leave the **Gateway** field blank, the gateway will be omitted from network settings. The **Subnet CIDR** field will be filled in automatically. Optionally, select the **Share between all projects** checkbox. With the disabled option, the public network will only be available in the **admin** project of the **Default** domain.

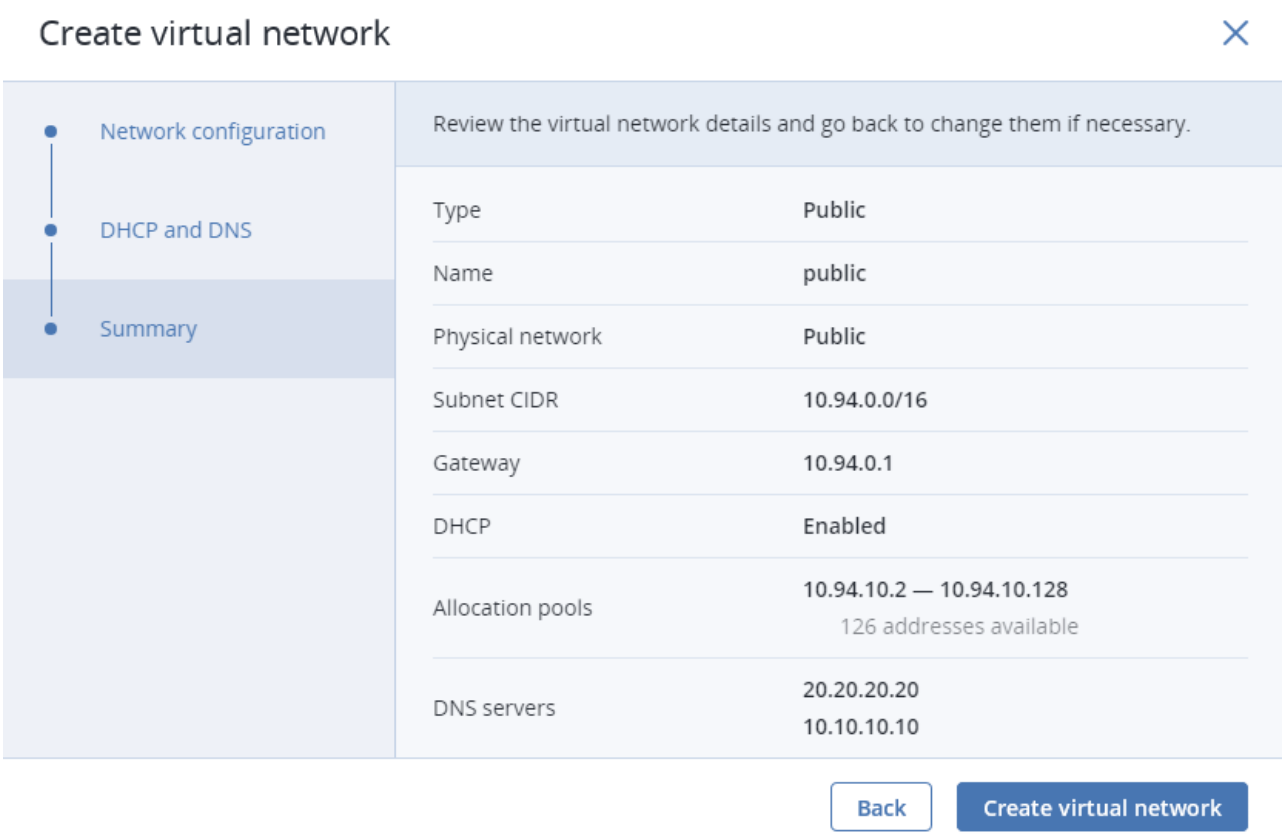
Click **Next**.



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**.



4. In the **Summary** section, review the configuration and click **Add virtual network**.



To view and edit parameters of a virtual network, click it on the **NETWORKS** tab. 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.

4.3.3 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.

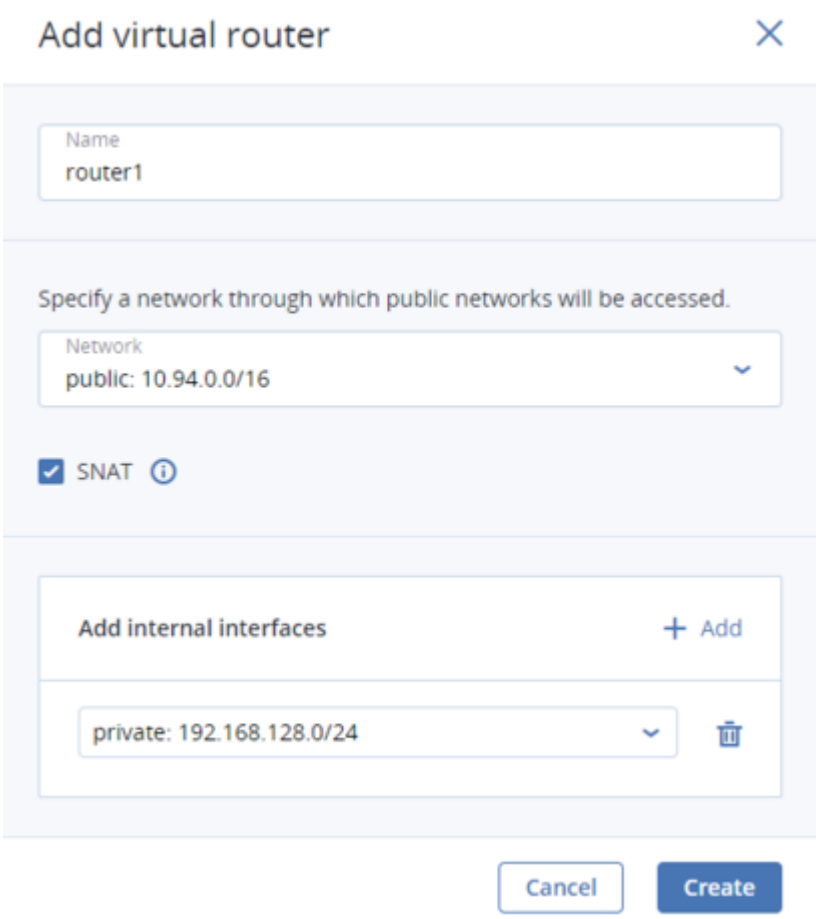
A virtual router has two types of ports:

- 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 **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.

4.3.3.1 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.

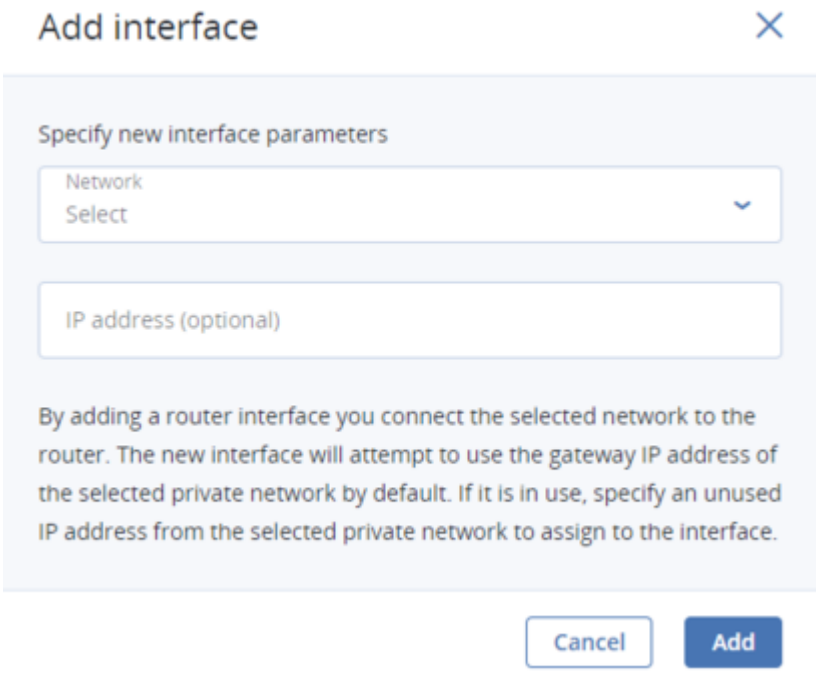
2. Click **Add**.
3. In the **Add interface** window, do the following:
    1. Choose **External gateway**.
    2. From the **Network** drop-down menu, select a public network to connect to the router. The new interface will pick an unused IP address from the selected public network. You can also provide 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**.

4.3.3.2 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.

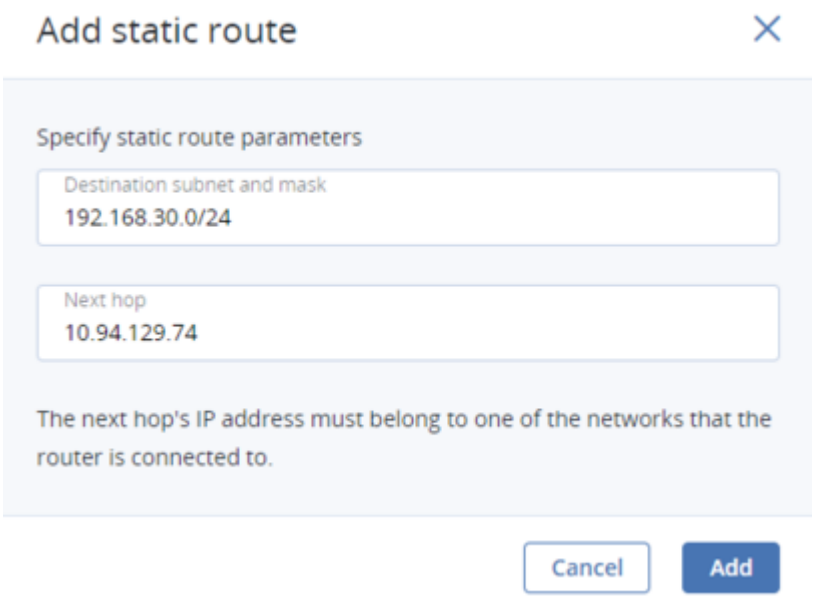
Consider the following example:

- 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 **STATIC ROUTES** tab of a virtual router, click **Add static route**.
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**.

4.3.4 Managing Floating IP Addresses

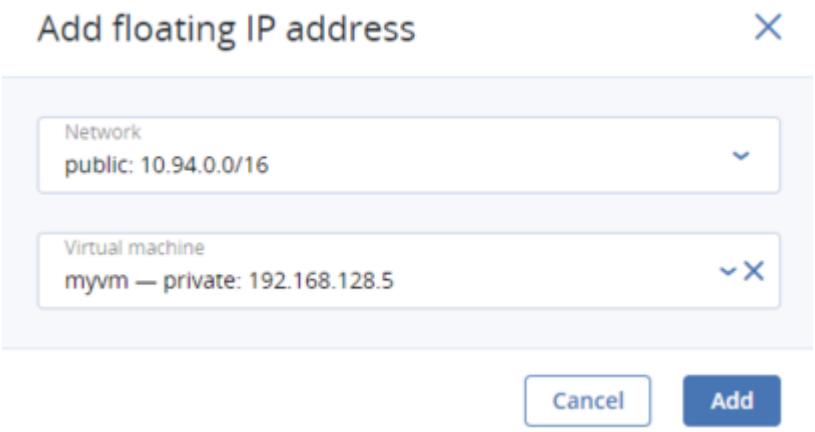
A virtual machine connected to a virtual private network can be accessed from public networks, such as the Internet, by means of a floating IP address. Such an address is picked from a public network and mapped to VM's private IP address. The floating and private IP addresses are used at the same time 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 **COMPUTE** > **Networks** > **FLOATING IPS** tab, 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**.

4.4 Managing Storage Policies

A storage policy in Acronis Cyber Infrastructure is a group of parameters that define how to store VM volumes: how redundant they must be and on what storage tier they need to be located.

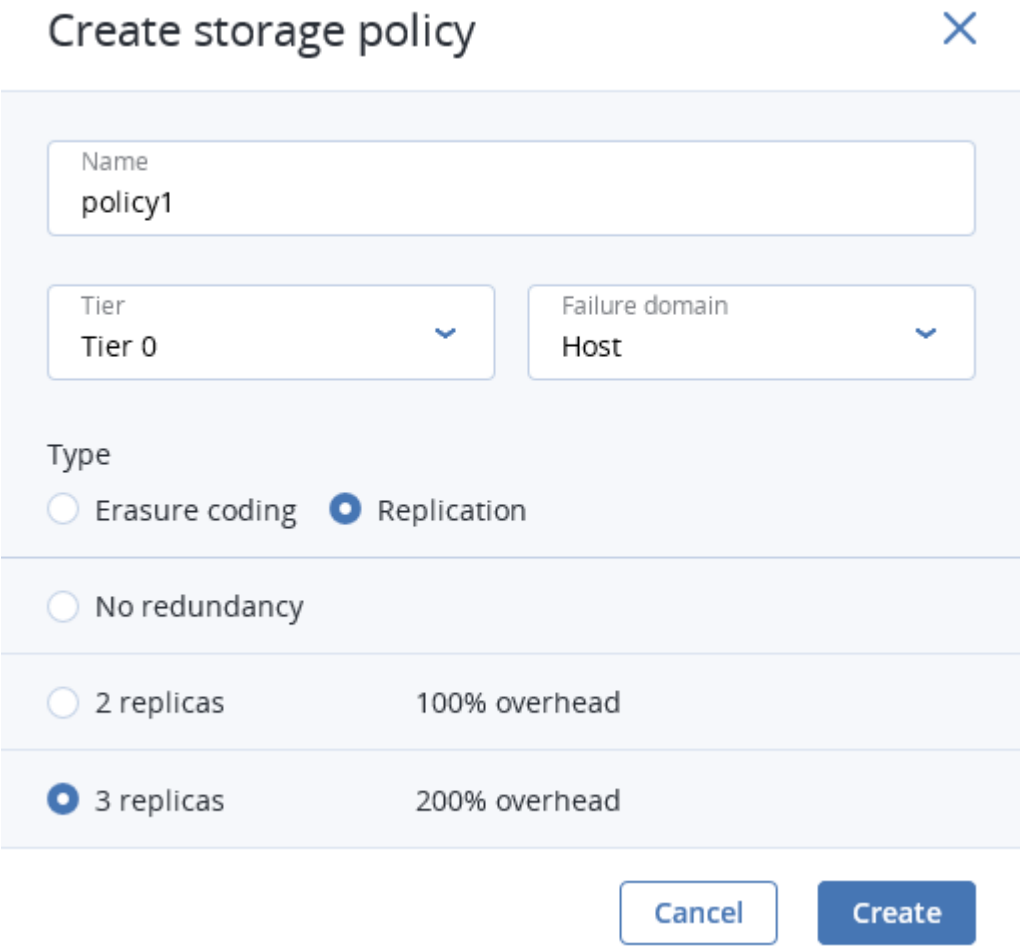
When you deploy the compute cluster, a default storage policy is created that enforces the best replication scheme allowed by the number of nodes in the storage cluster. The default policy cannot be deleted or renamed and is always applied to uploaded images and base volumes created from these images.

Note: A base volume is created from a source image when you deploy a VM. It is not used directly by a VM, but all volumes that a VM actually uses (which are listed on the **VOLUMES** tab) are in fact deltas (differences) from the base volume. It is important to keep base volumes available as VM volumes depend on them. For that, you need the default storage policy to enforce multiple replicas.

If the storage cluster does not have enough nodes to enable multiple replicas (not recommended), you can adjust the default storage policy once you add more nodes to the storage cluster. It will be applied to images and base volumes that already exist in the compute cluster.

To apply custom redundancy schemes to VM volumes, you can create custom storage policies in addition to the default one. To create a custom storage policy, do the following:

1. On the **COMPUTE** > **Storage** > **STORAGE POLICIES** tab, click **Create storage policy**.
2. In the **Create storage policy** window, specify a name and select the following:



1. In **Tier**, a tier to store volumes on.
2. In **Failure domain**, a placement policy for data pieces or replicas.
3. In **Type**, a data redundancy type and mode.

3. Click **Create**.

To edit a policy, select it and click the pencil icon next to a parameter you need to change. To change the redundancy mode of the policy, click the ellipsis button next to it and click **Edit redundancy**.

Note: You cannot change redundancy type of policies used by volumes. You can create new policies instead.

After a policy is modified, the changes are applied to every volume governed by it.

To remove a policy, select it and click **Delete policy**. A policy cannot be removed if it governs existing

volumes.

4.5 Managing Images

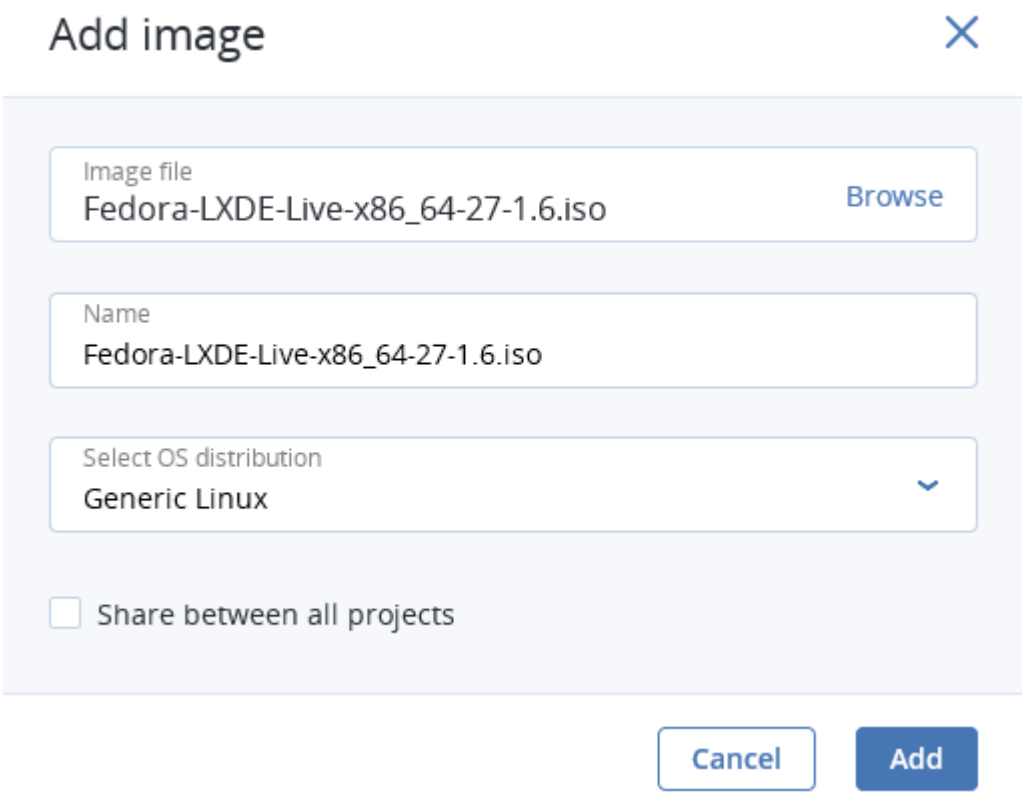
Acronis Cyber Infrastructure allows you to upload ISO images and templates that can be used to create VM volumes. An ISO image is a typical OS distribution that needs to be installed on disk. In turn, a template is a ready volume in the QCOW2 format with an installed operating system and applications 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 77).

Note: Images are stored according to the default storage policy.

To add an image, do the following:

1. On the **COMPUTE** > **Virtual machines** > **IMAGES** tab, 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.



3. Optionally, select the **Share between all projects** checkbox. With the option disabled, the image will only be available in the **admin** project of the **Default** domain.
4. Click **Add** to upload the image.

The admin panel will show the upload progress.

Important: Do not reload the page while the image is being uploaded or the process will fail.

To edit an image, select it and click the pencil icon next to a parameter you need to change.

To remove an image, click the ellipsis button next to it and **Delete**.

For information on how to create Linux templates, see the “Creating Linux Templates” section of the *Administrator’s Command Line Guide*.

4.6 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 4.6.1: Virtual machine hardware

Resource	Limit
RAM	1 TiB
CPU	48 logical CPUs
Storage	15 volumes, 512 TiB each
Network	15 NICs

A logical CPU is a core (thread) in a multicore (multithreading) processor.

4.6.1 Supported Guest Operating Systems

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

Table 4.6.1.1: Windows guest operating systems

Operating System	Edition	Architecture
Windows Server 2019	Essentials, Standard, Datacenter	x64
Windows Server 2016	Essentials, Standard, Datacenter	x64
Windows Server 2012 R2	Essentials, Standard, Datacenter	x64
Windows Server 2012	Standard, Datacenter	x64

Continued on next page

Table 4.6.1.1 – continued from previous page

Operating System	Edition	Architecture
Windows Server 2008 R2	Standard, Datacenter	x64
Windows Server 2008	Standard, Datacenter	x64
Windows 10	Home, Professional, Enterprise, Enterprise 2016 LTSB	x64
Windows 8.1	Home, Professional, Enterprise	x64
Windows 7	Home, Professional, Enterprise	x64

Table 4.6.1.2: Linux guest operating systems

Operating System	Architecture
CentOS 7.x	x64
CentOS 6.x	x64
RHEL 8.x	x64
RHEL 7.x	x64
Debian 9.x	x64
Ubuntu 18.04.x	x64
Ubuntu 16.04.x	x64

4.6.2 Creating Virtual Machines

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

- A guest OS source (see *Managing Images* (page 75)):
  - 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 93), attach it to a VM, install an operating system in it, then delete the VM.

- A storage policy for volumes (see *Managing Storage Policies* (page 73))

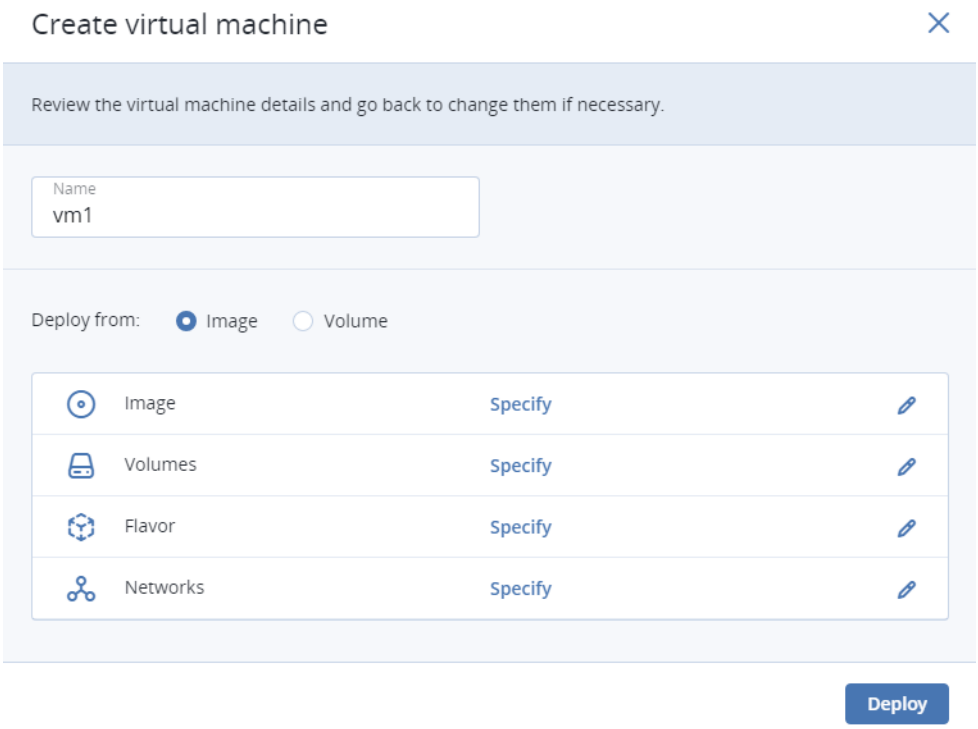
- A flavor (see *Managing Flavors* (page 100))
- One or more virtual networks (see *Managing Virtual Networks* (page 59))
- An SSH key (see *Managing SSH Keys* (page 101))

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 **COMPUTE** > **Virtual machines** > **VIRTUAL MACHINES** tab, click **Create virtual machine**. A window will open where you will need to specify VM parameters.

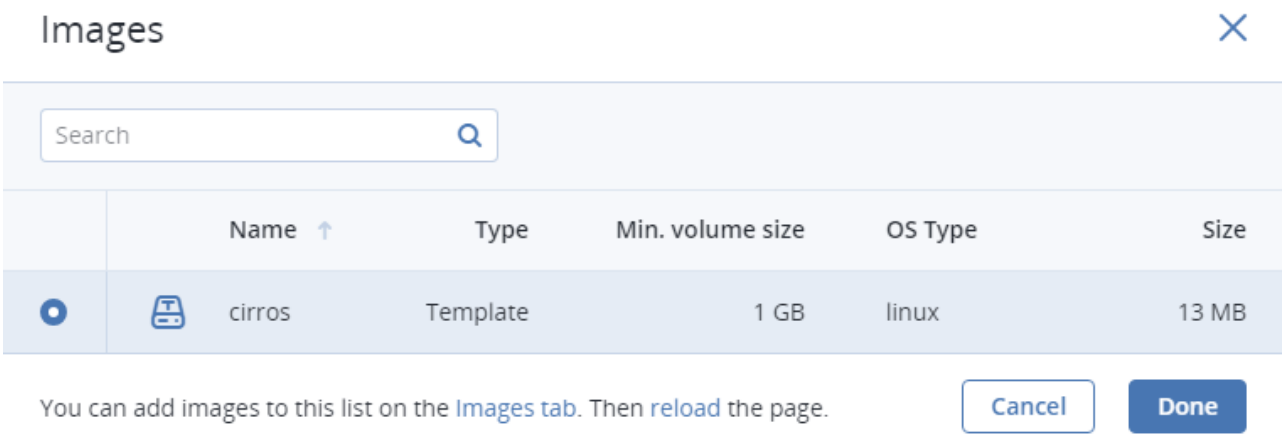


2. Specify a name for the new VM.
3. In **Deploy from**, choose **Volume** if you have a boot volume or want to create one. Otherwise, choose

Image.

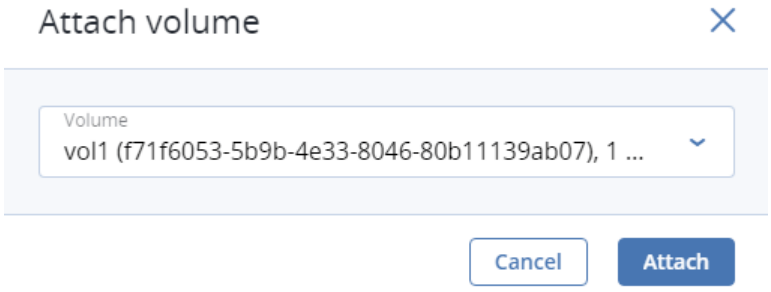
4. Depending on your choice, click the pencil icon in the **Volumes** or **Image** section and do one of the following:

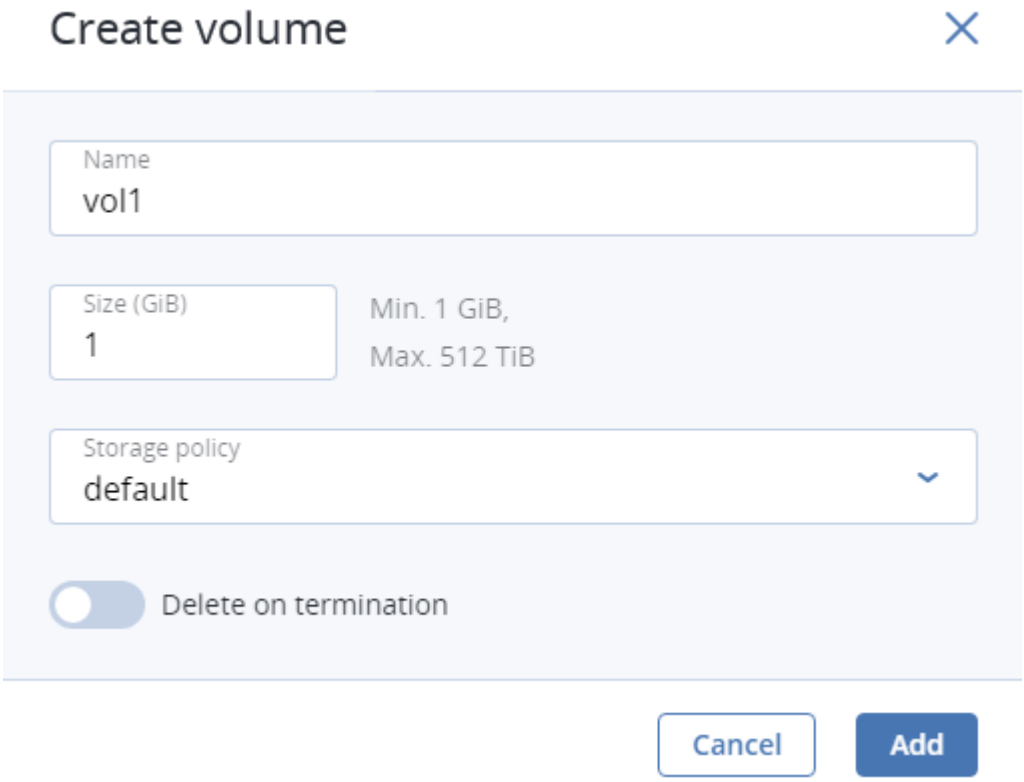
   - In the **Images** window, select the ISO image or template and click **Done**.



   - In the **Volumes** window, do one of the following:

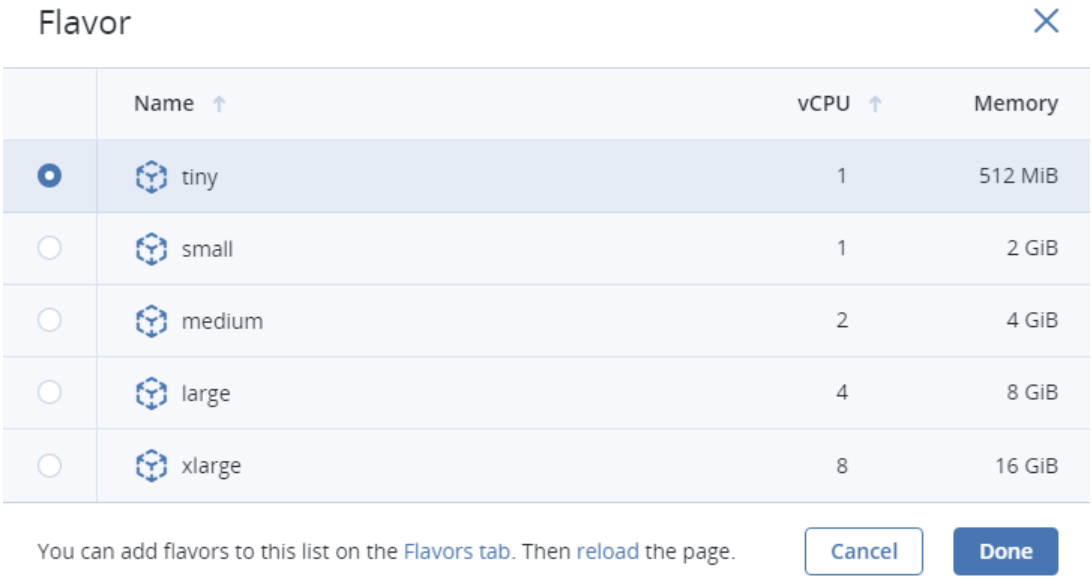
     - If you have prepared a volume with an installed guest OS, click **Attach**, find and select the volume, and click **Done**.



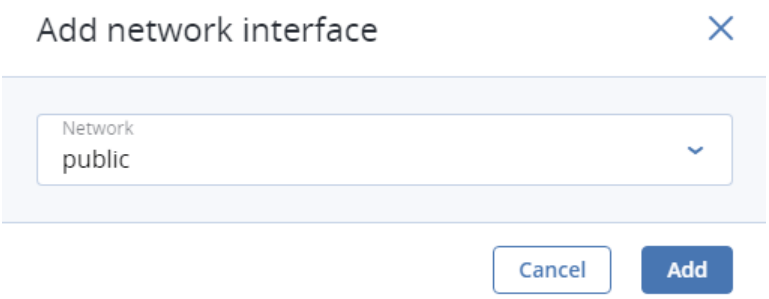


5. Optionally, in the **Volumes** window, click **Add** or **Attach** to create or attach any other volumes you need. To select a volume as bootable, place it first in the list by clicking the up arrow button next to it.

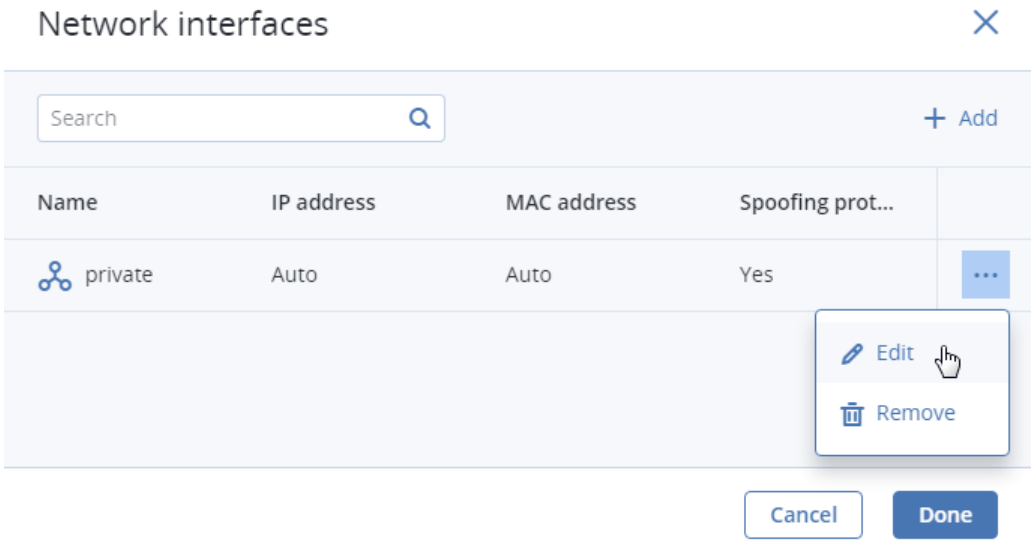
6. In the **Flavor** window, choose a flavor and click **Done**.



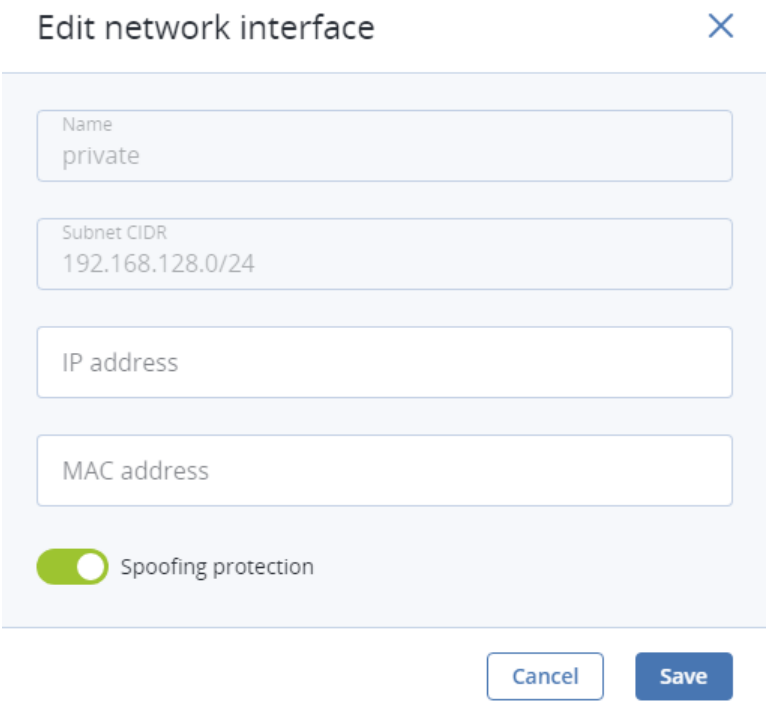
7. In the network window, click **Add**, select a virtual network interface and click **Add**. It will appear in the **Network interfaces** list.



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.



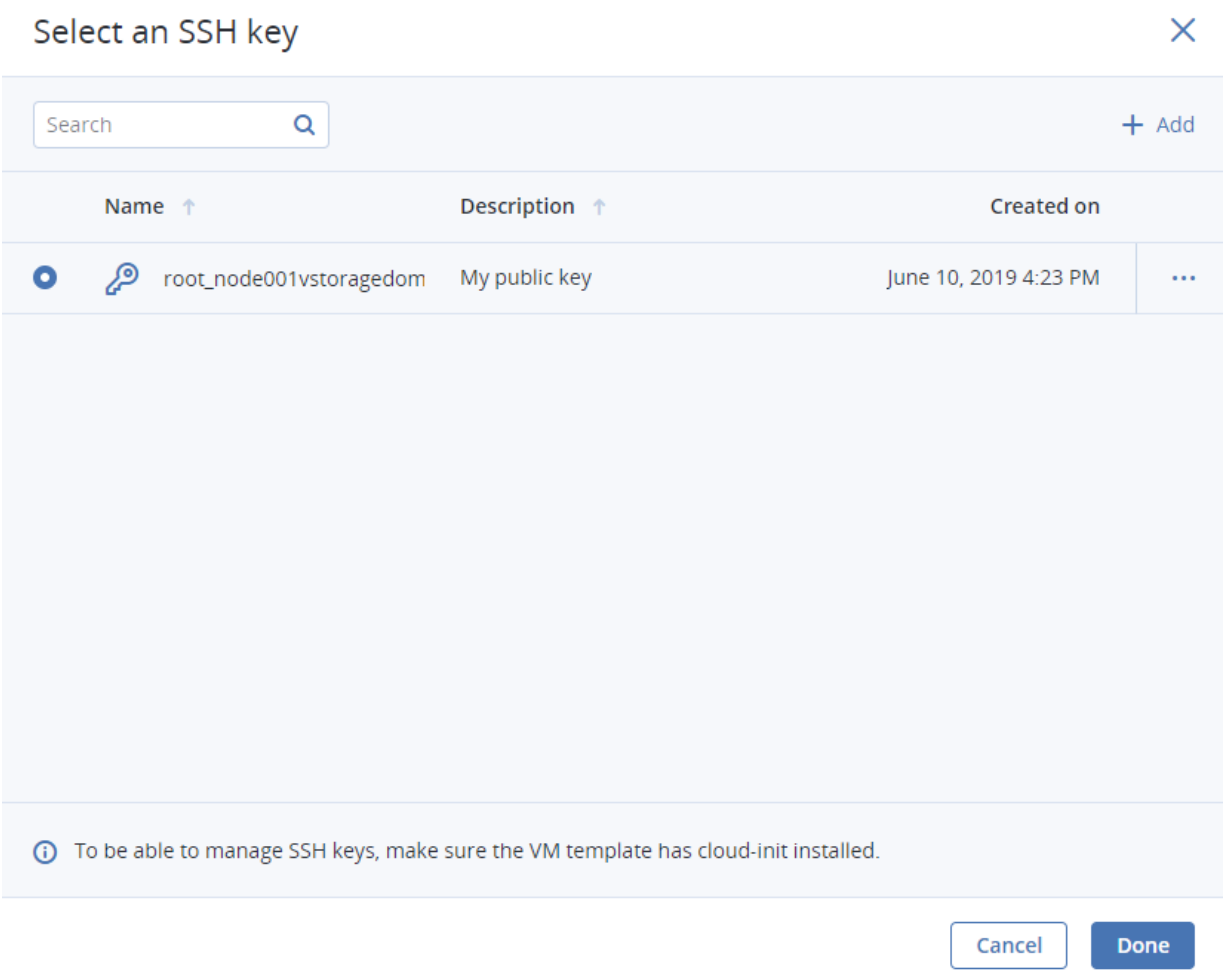
You will not be able to edit these parameters later. Instead, you will be able to delete the old network interface and replace it with a new one.



Click **Done**.

8. (Optional) If you are deploying the VM from a template or boot volume (not an ISO image), you can specify the following:

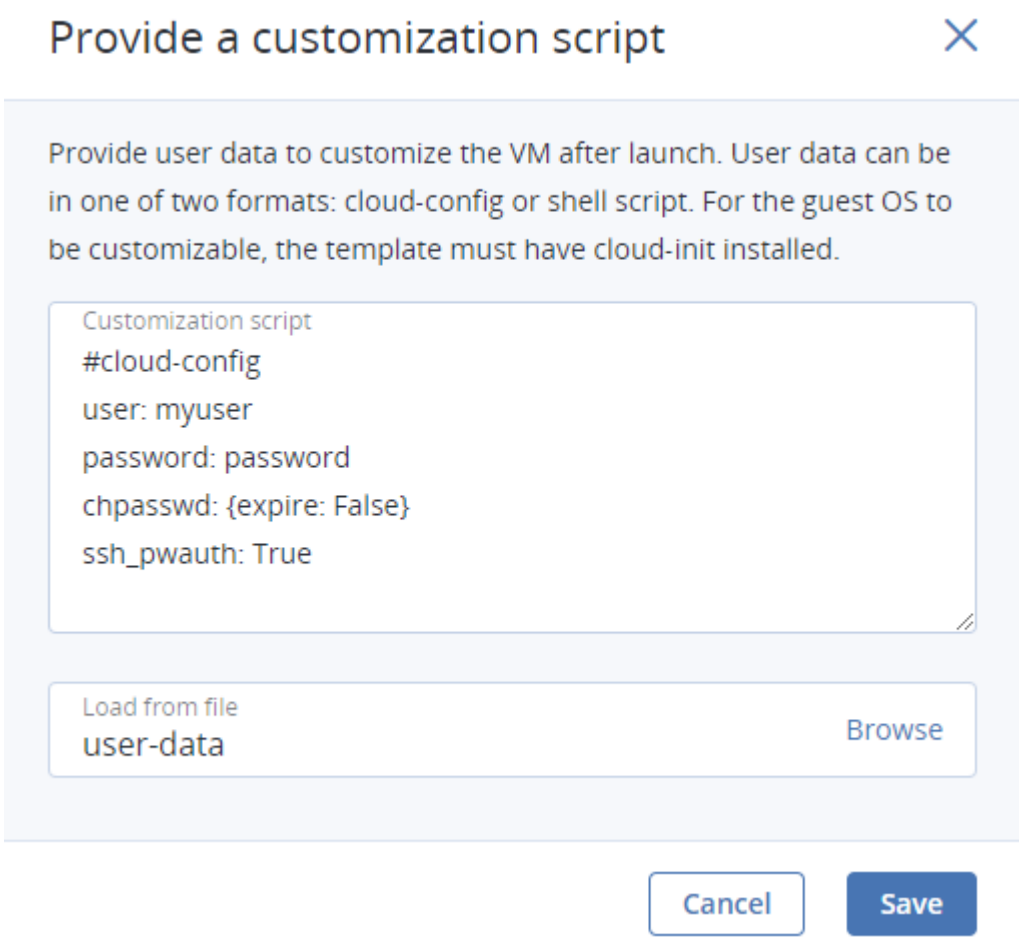
    - An SSH key to be injected into the VM. To do it, select an SSH key in the **Select an SSH key** window, and click **Done**.



Note: To be able to connect to the VM via SSH, make sure the VM template or boot volume has cloud-init and OpenSSH installed (see the "Creating SSH-Enabled Templates" section in the *Administrator's Command Line 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.

9. Back in the **Create virtual machine** window, click **Deploy** to create and boot the VM.
10. 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.
11. (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:

```
# ssh myuser@10.10.10.10
```

4.6.3 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 87)).

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.
- **Migrate** moves a VM to another node in the compute cluster (for more information, see *Migrating Virtual Machines* (page 88)).

4.6.4 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

   ```
   # grub-mkconfig -o /boot/grub/grub.cfg
   ```

   or

   ```
   # 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:

   ```
   bcdedit /emssettings EMSPORT:1
   ```

3. Enable EMS for the current boot entry:

   ```
   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.

4.6.5 Migrating Virtual Machines

VM migration helps facilitate cluster upgrades and workload balancing between compute nodes. Acronis Cyber Infrastructure allows you to perform two types of migration:

- **Cold migration** for stopped and suspended virtual machines
- **Hot migration** for running virtual machines (allows you to avoid VM downtime)

For both migration types, a virtual machine is migrated between compute nodes using shared storage, so no block device migration takes place.

Hot migration consists of the following steps:

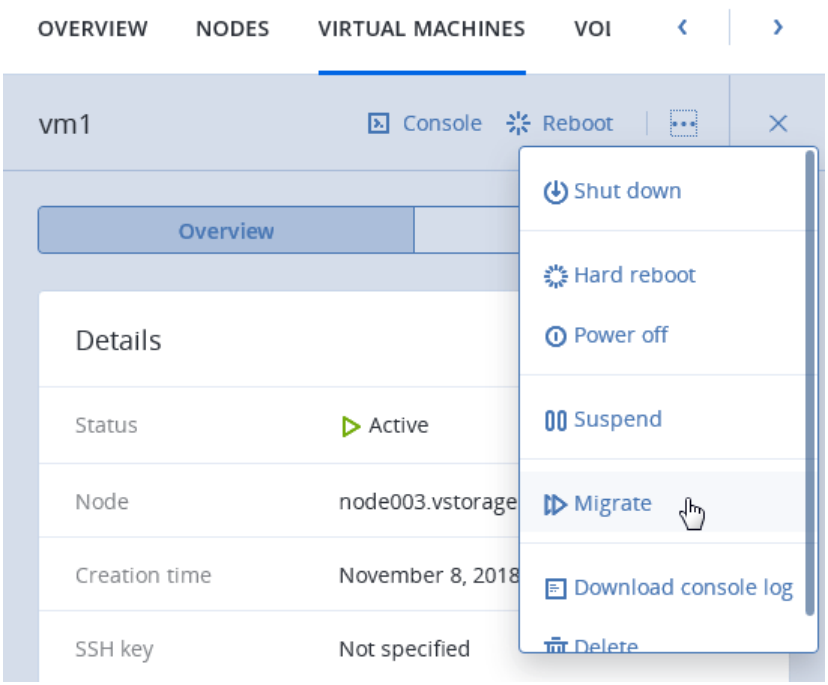
1. All VM memory is copied to the destination node while the virtual machine keeps running on the source node. If a VM memory page changes, it is copied again.
2. When only a few memory pages are left to copy, the VM is stopped on the source node, the remaining pages are transferred, and the VM is restarted on the destination node.

Large virtual machines with write-intensive workloads write to memory faster than memory changes can be transferred to the destination node, thus preventing migration from converging. For such VMs, the auto-converge mechanism is used. When a lack of convergence is detected during live migration, VM's vCPU execution speed is throttled down, which also slows down writing to VM memory. Initially, virtual machine's vCPU is throttled by 20% and then by 10% during each iteration. This process continues until writing to VM memory slows down enough for migration to complete or the VM vCPU is throttled by 99%.

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*.

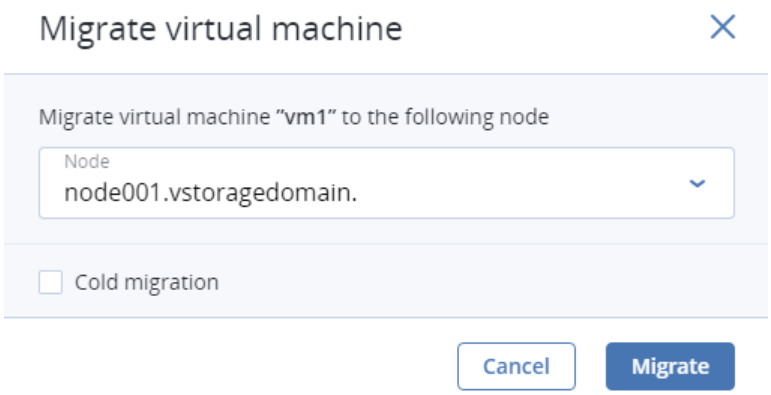
To migrate a VM, do the following:

1. On the **COMPUTE** > **Virtual machines** > **VIRTUAL MACHINES** tab, click a VM to migrate, click the ellipsis button and choose **Migrate**.



2. In the new window, specify the destination node:

   - **Auto**. Automatically select the optimal destination among cluster nodes based on available CPU and RAM resources.
   - Select the destination node manually from the drop-down list.



3. By default, running VMs are migrated live. You can change the migration mode to offline by ticking the **Cold migration** checkbox. A VM will be stopped and restarted on the destination node after migration.
4. Click **Migrate** to reserve resources on the destination node and start migration.

The admin panel will show the migration progress.

4.6.6 Reconfiguring and Monitoring Virtual Machines

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

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
- Change the flavor for running and shelved VMs

4.6.7 Configuring Virtual Machine High Availability

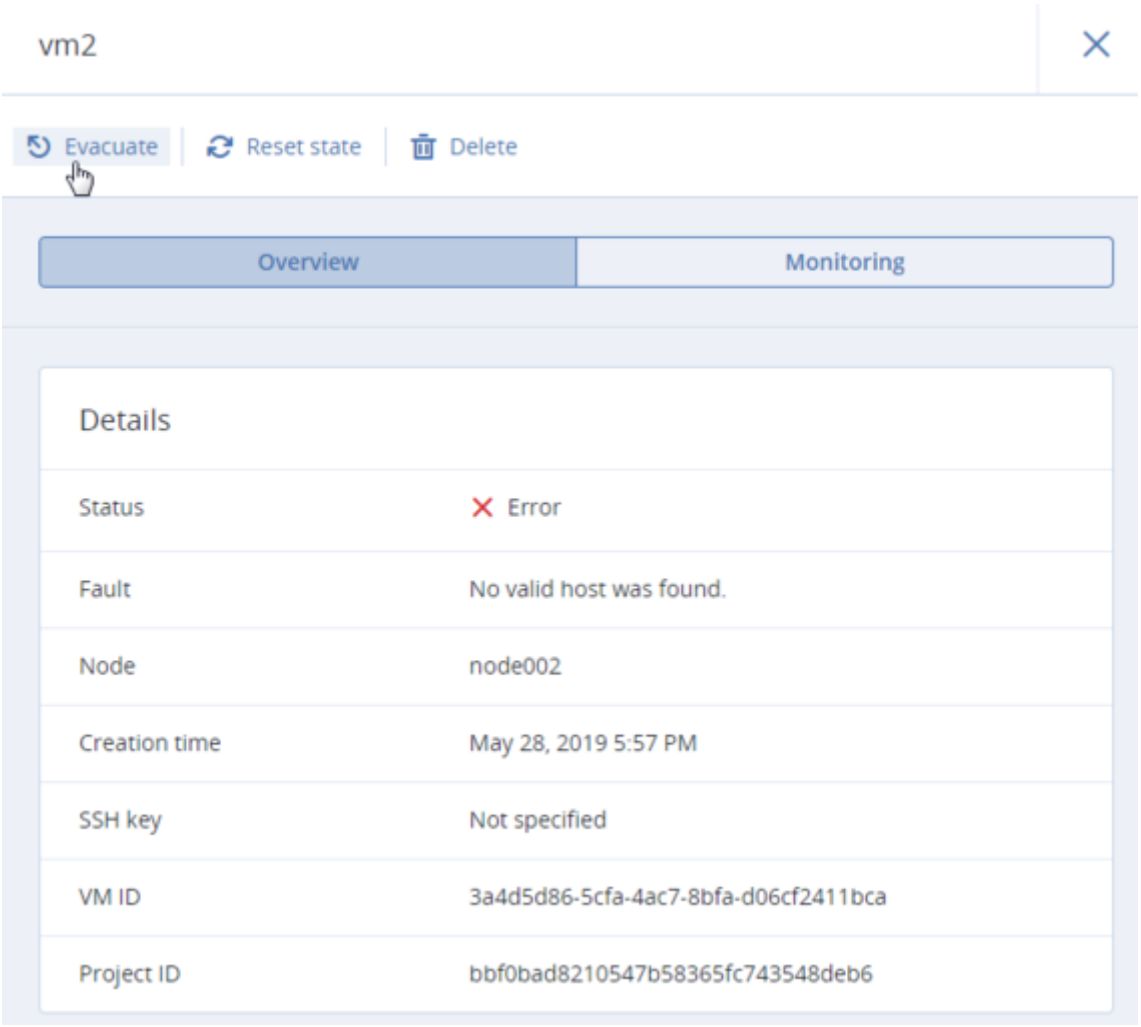
High availability keeps virtual machines operational if the node they are located on fails due to kernel crash, power outage and such or becomes unreachable over the network. Graceful shutdown is not considered a failure event.

Important: The compute cluster can survive the failure of only one node.

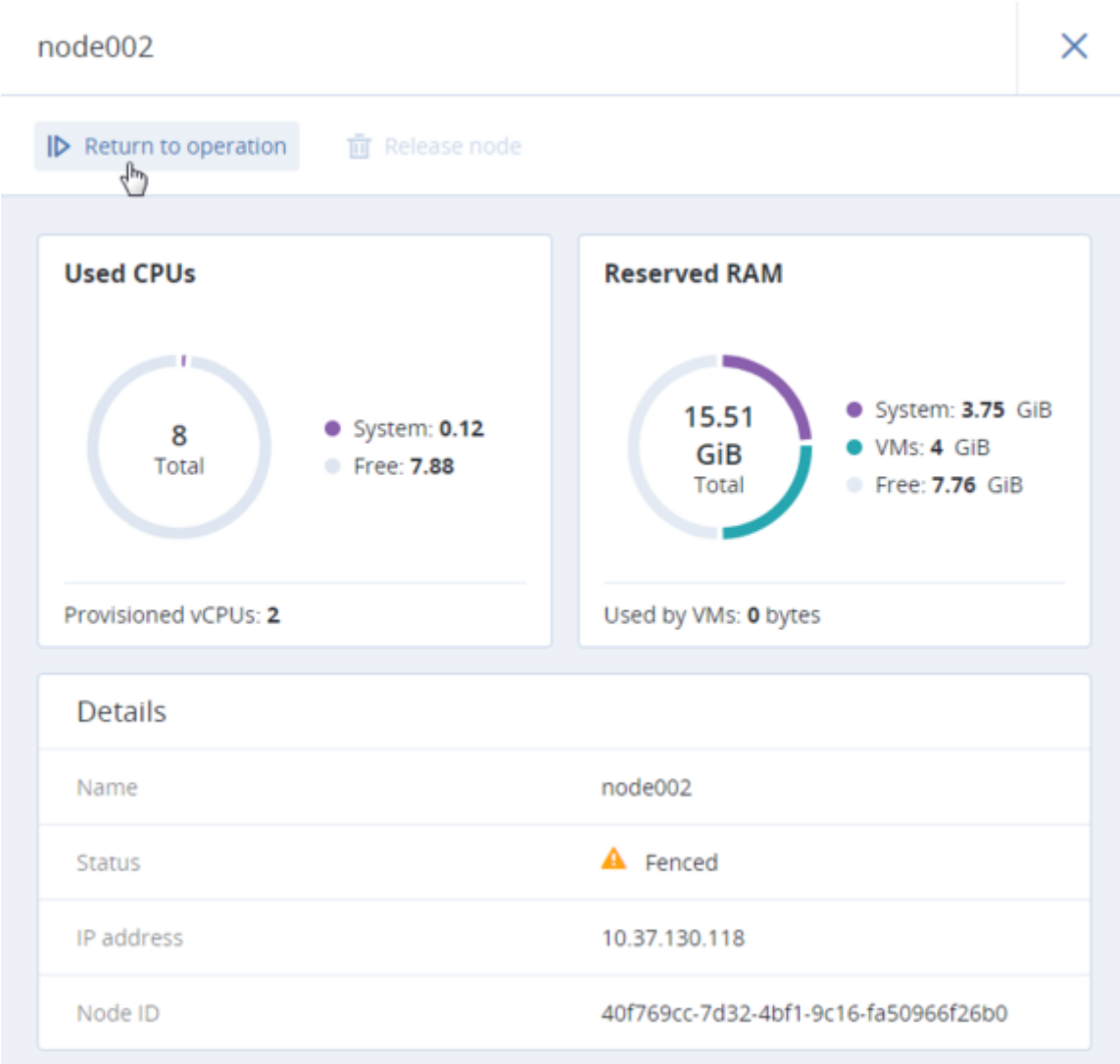
In the event of failure, the system will attempt to evacuate affected VMs automatically, that is, migrate them offline with auto-scheduling to other healthy compute nodes in the following order:

- VMs with the "Active" status are evacuated first and automatically started.
- VMs with the "Shut down" status are evacuated next and remain stopped.
- All other VMs are ignored and left on the failed node.

If something blocks the evacuation, for example, destination compute nodes lack resources to host the affected VMs, these VMs remain on the failed node and receive the "Error" status. You can evacuate them manually after solving the issue (providing sufficient resources, joining new nodes to the cluster, etc.). To do this, click the ellipsis button next to such a VM or open its panel and click **Evacuate**.

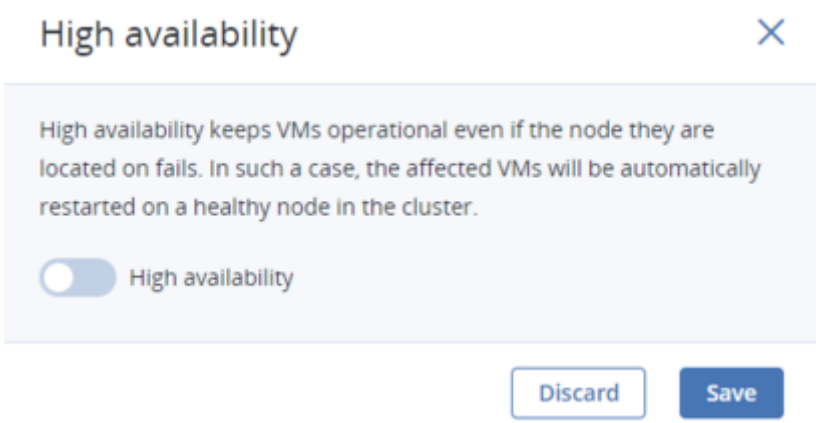


When the failed node becomes available again, it is fenced from scheduling new VMs on it and can be returned to operation manually. To do it, click the ellipsis button next to the fenced node or open its panel and then click **Return to operation**.



By default, high availability for virtual machines is enabled automatically after creating the compute cluster. If required, you can disable it manually as follows:

1. Click the VM for which you wish to disable HA.
2. On the VM panel, click the pencil icon next to the **High availability** parameter.
3. In the **High availability** window, disable HA for the VM and click **Save**.



Virtual machines with disabled HA will not be evacuated to healthy nodes in case of failover.

4.7 Managing Volumes

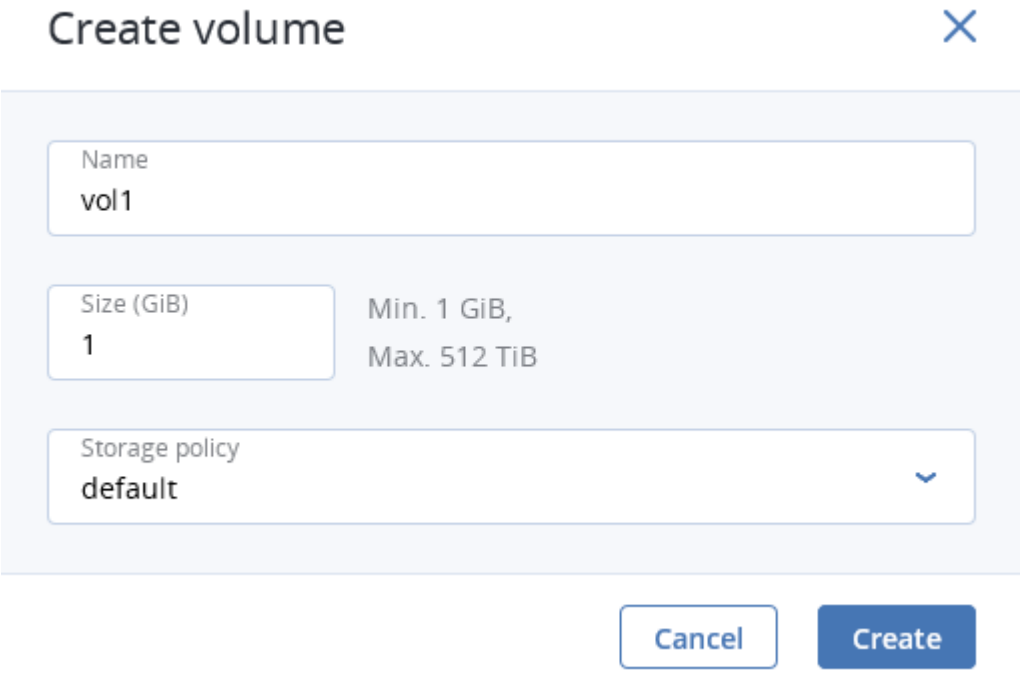
A volume in Acronis Cyber Infrastructure is a virtual disk drive that can be attached to a VM. The integrity of data in volumes is protected by a redundancy mode specified in a storage policy.

Note: Additional virtual disks attached to VMs need to be initialized inside the guest OS by standard means before they can be used.

4.7.1 Creating, Editing, and Removing Volumes

To create a volume, do the following:

1. On the **COMPUTE** > **Storage** > **VOLUMES** tab, click **Create volume**.



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

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.

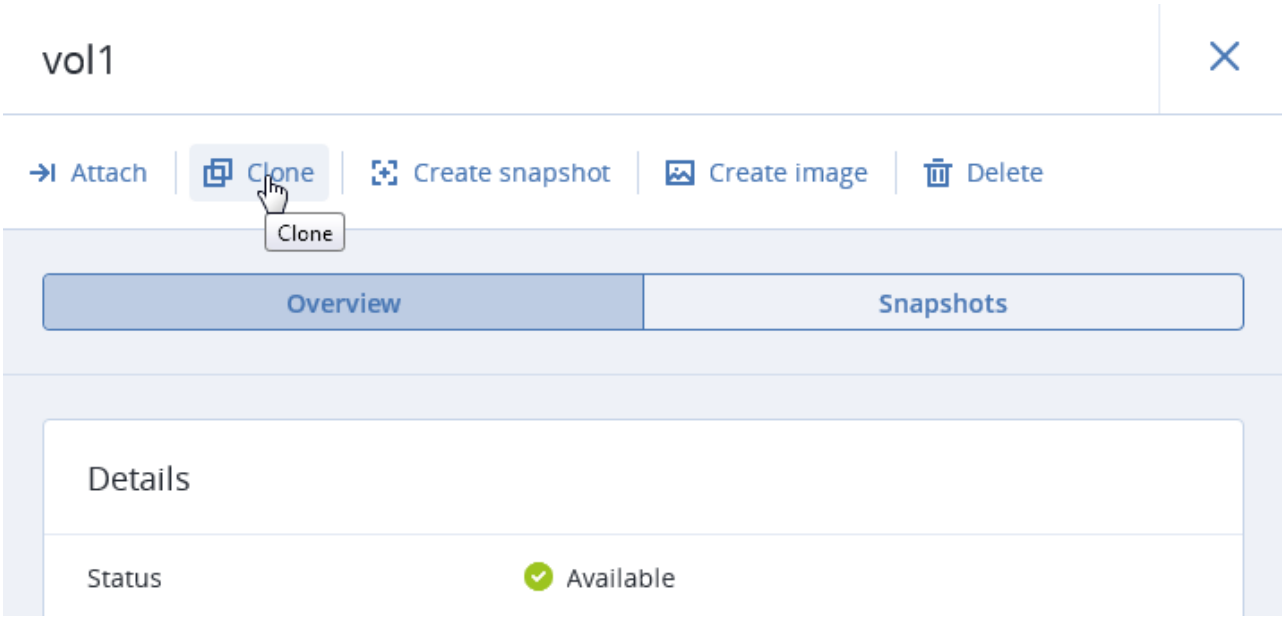
To remove a volume, click its ellipsis button then click **Delete**. To remove multiple volumes at once, select them and click **Delete**. To remove a volume that is in use, detach it first.

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

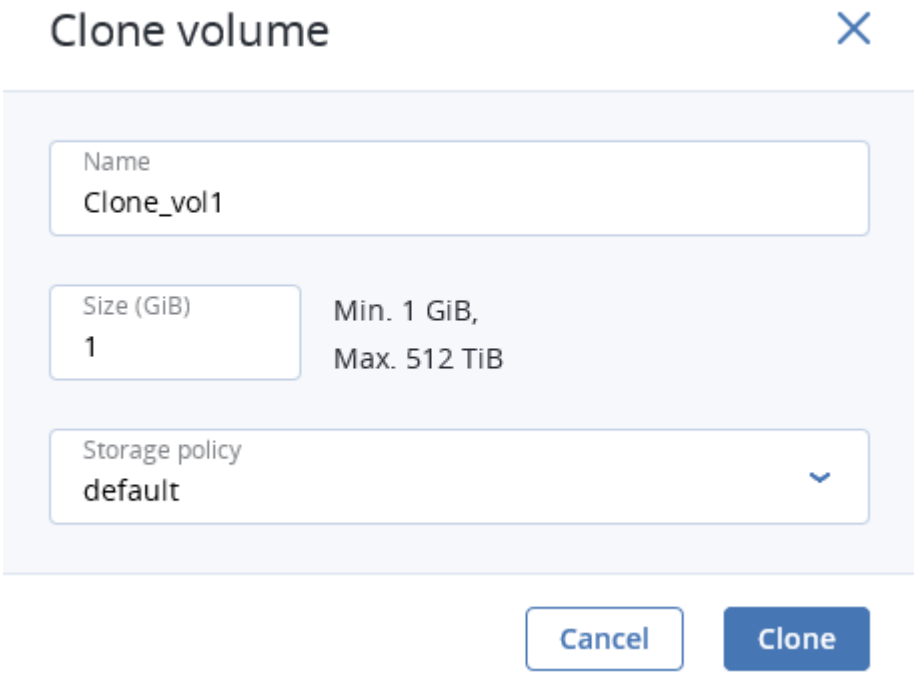
4.7.2 Cloning Volumes

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 **COMPUTE** > **Storage** > **VOLUMES** tab, click a volume.
2. In volume details that opens, click **Clone**.



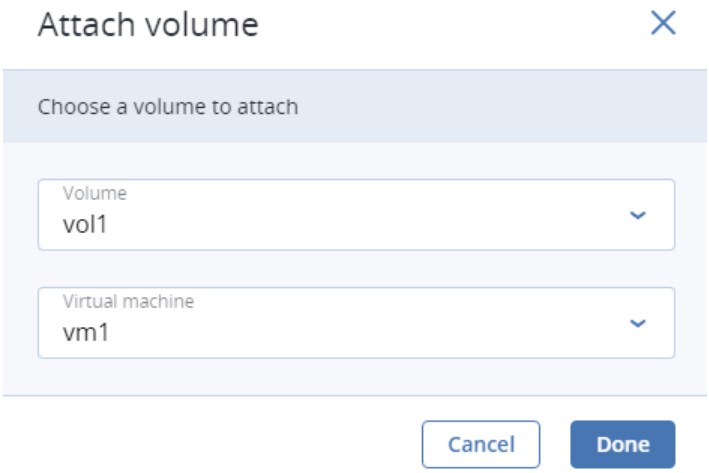
3. In the **Clone volume** window that opens, specify a volume name, size, and storage policy. Click **Clone**.



4.7.3 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 **COMPUTE** > **Storage** > **VOLUMES** tab, 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:

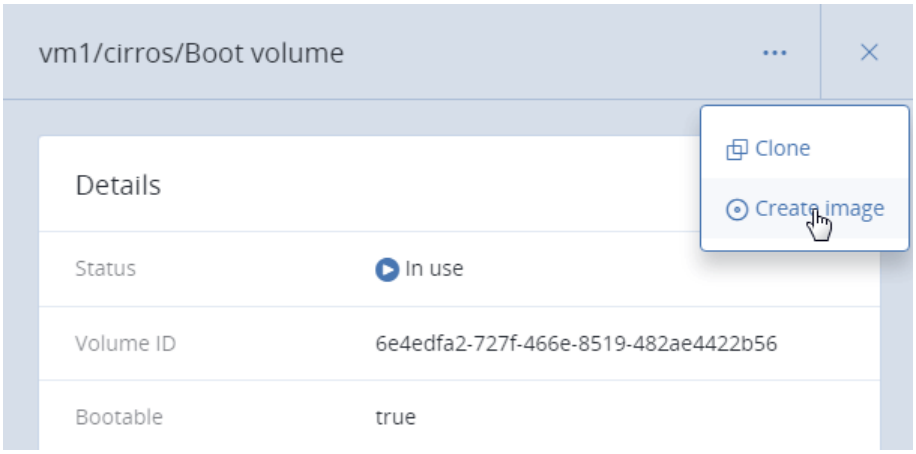
1. Click the ellipsis button next to the volume that is in use.
2. If the VM is not running, click **Detach**. If the VM is running, you can only click **Force detach** to immediately detach the volume with a risk of data loss.

4.7.4 Creating Images from Volumes

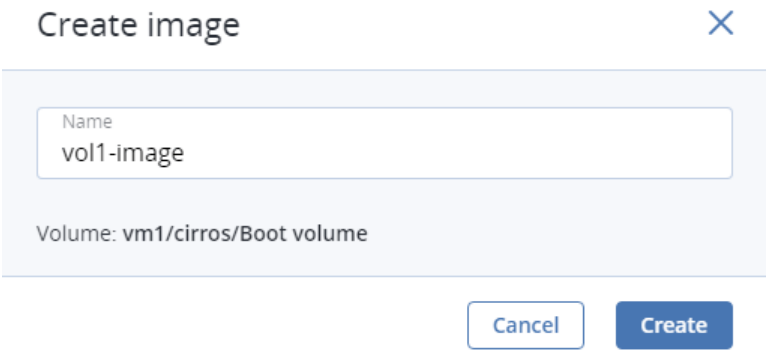
To create multiple VMs with the same boot volume, you can create an image from an existing boot volume and deploy VMs from it. Make sure to install cloud-init in the volume before creating the image.

Do the following:

1. Power off the VM that the original volume is attached to.
2. Switch to the **COMPUTE** > **Storage** > **VOLUMES** tab, click volume's ellipsis button and choose **Create image**.



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



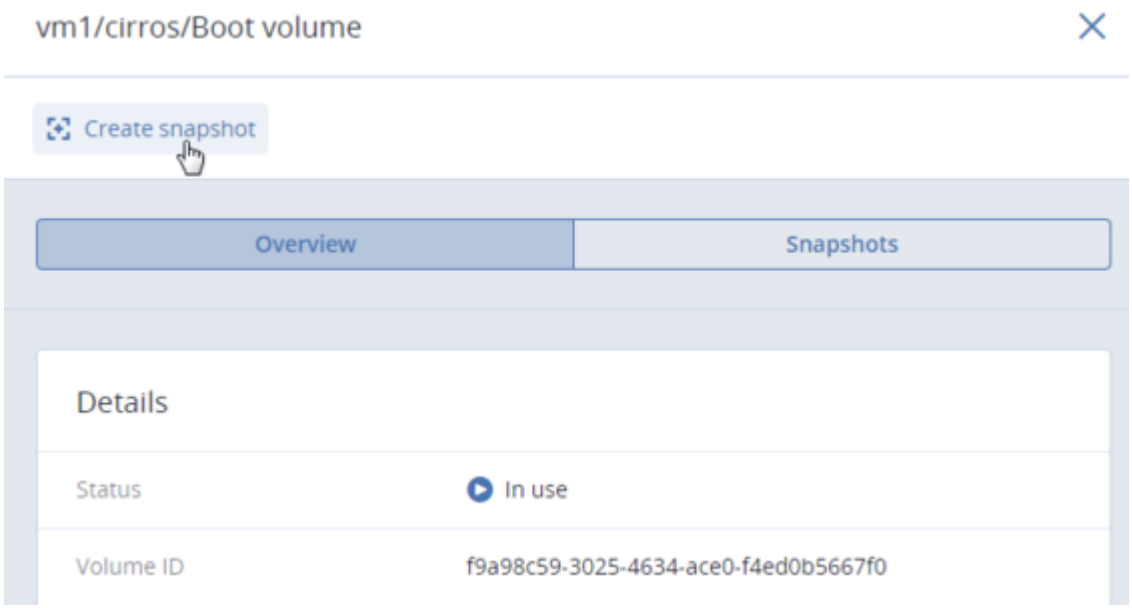
The new image will appear on the **IMAGES** tab.

4.7.5 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.

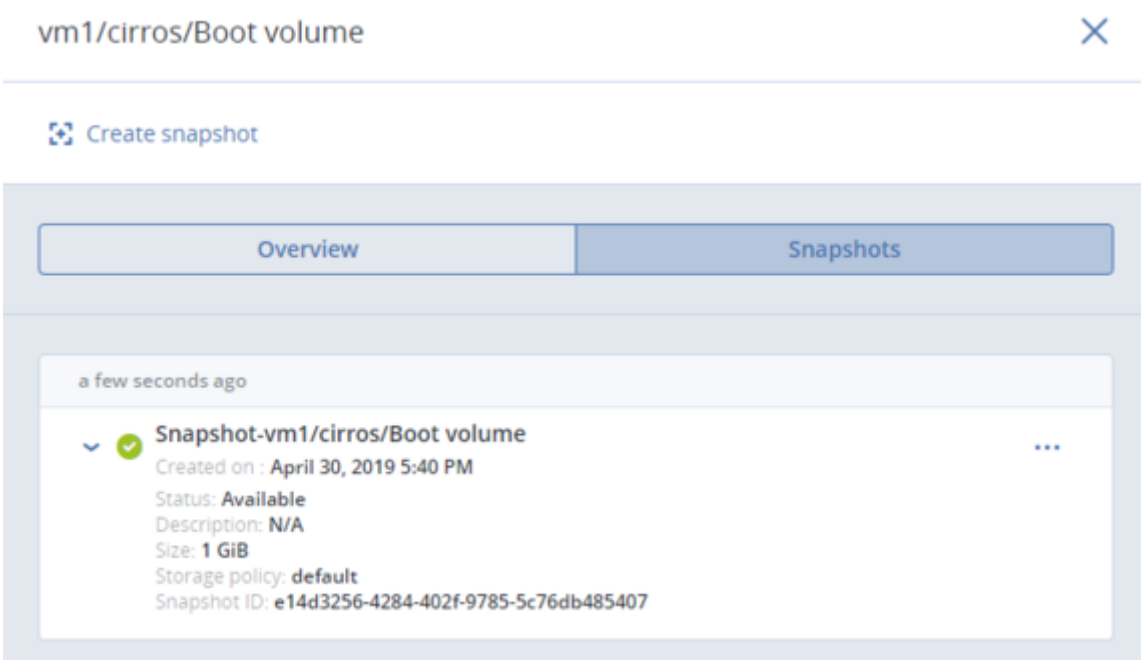
To create a snapshot of a volume, do the following:

1. On the **COMPUTE** > **Storage** > **VOLUMES** tab, click a volume.
2. In the volume panel that opens, switch to **Snapshots** and click **Create snapshot**.



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.

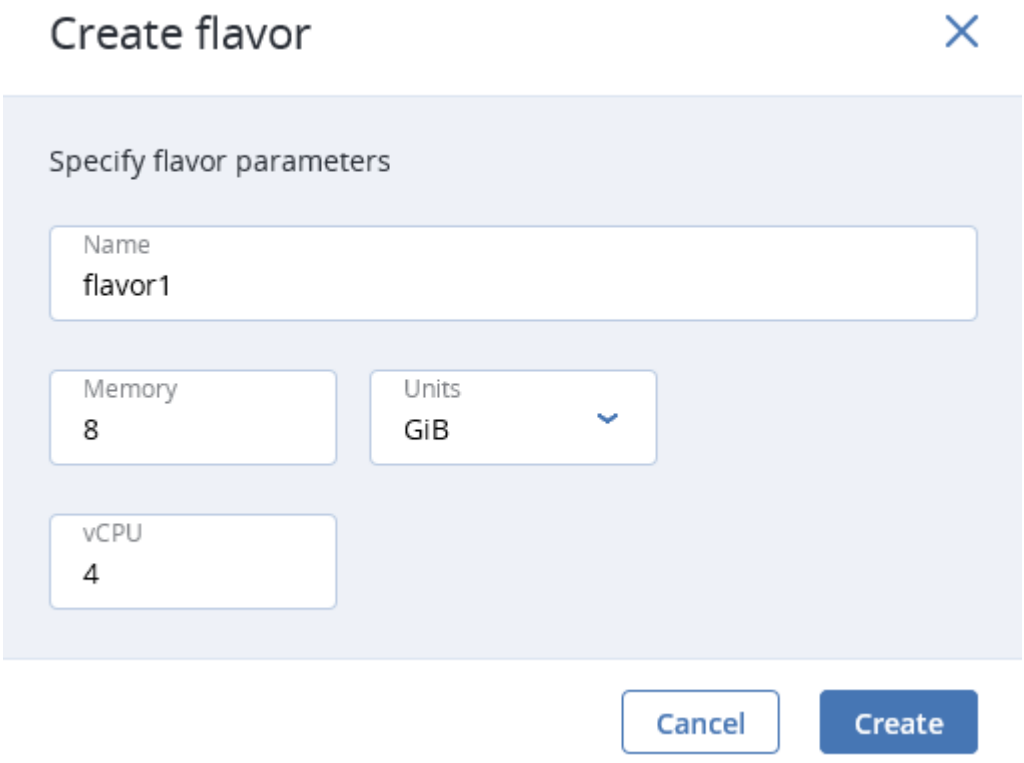
4.8 Managing Flavors

A flavor in Acronis Cyber Infrastructure is a configuration template that simplifies VM deployment. It allows you to set the number of virtual CPU cores and the amount of RAM a virtual machine will use.

Important: When choosing a flavor for a VM, make sure it satisfies the hardware requirements of the guest OS. For more information on VM hardware, see *Managing Virtual Machines* (page 77).

To create a flavor, do the following:

1. On the **Compute** > **Virtual machines** > **FLAVORS** tab, click **Create flavor**.
2. In the **Create flavor** window, specify a flavor name, a number of virtual CPU cores, an amount of RAM and click **Create**.



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

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 Acronis Cyber Infrastructure 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.

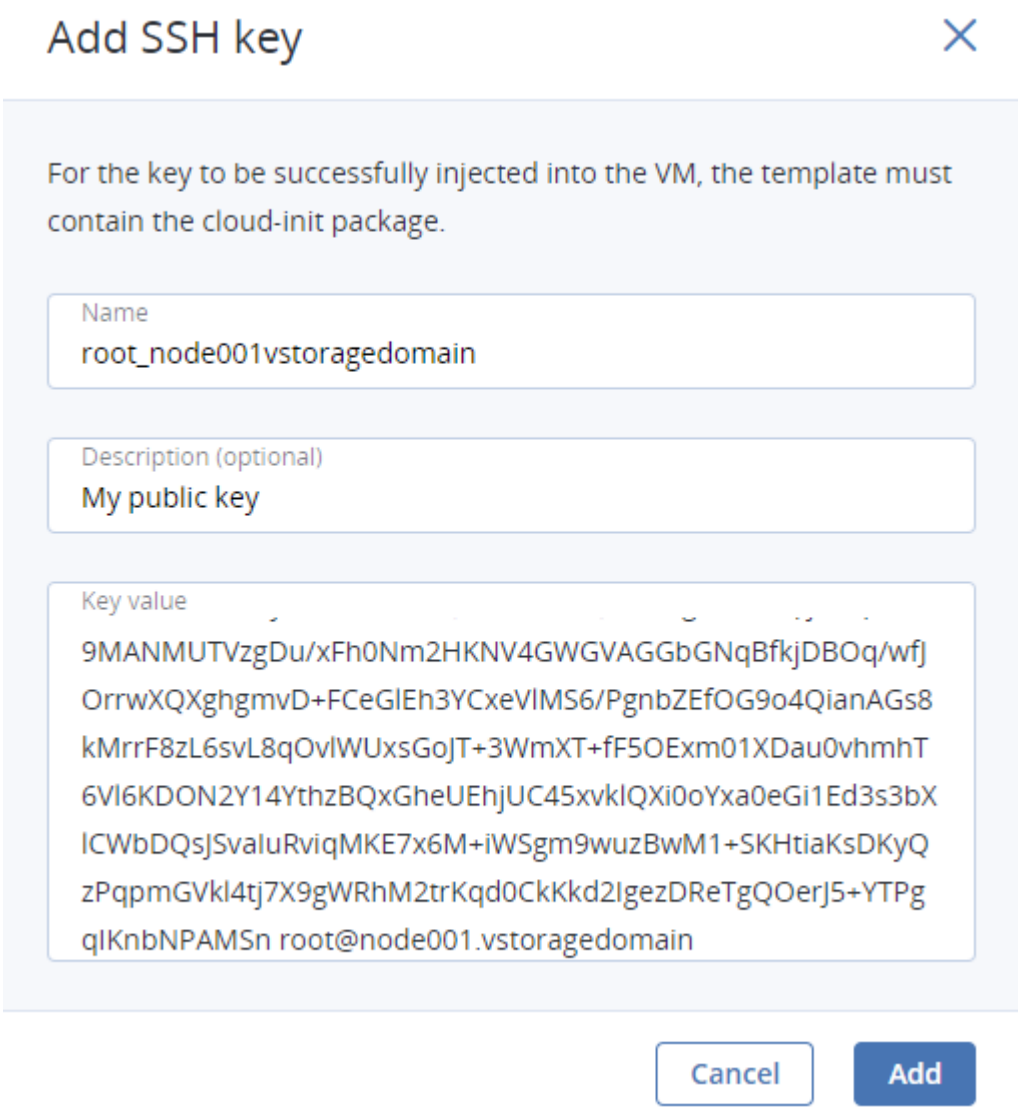
For the instructions on preparing templates or boot volumes, see the "Creating SSH-Enabled Templates" section of the *Administrator's Command Line Guide*.

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 **Compute** > **Virtual machines** > **SSH KEYS** tab, 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.



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.

4.10 Monitoring the Compute Cluster

After you create the compute cluster, you can monitor it on the **COMPUTE** > **Overview** screen.

The compute cluster status is displayed on top of the screen and can be one of the following:

HEALTHY
: All compute cluster components and nodes operate normally.

CONFIGURING
: The compute cluster configuration (the default CPU model for VMs or the number of compute nodes) is changing.

WARNING
: The compute cluster operates normally but some issues have been detected.

CRITICAL
: The compute cluster has encountered a critical problem and is not operatonal.

The charts show the information on CPU, RAM, and storage usage; the number of virtual machines grouped by status and resource consumption; and compute-related alerts.

4.10.1 Used CPUs Chart

This chart displays CPU utilization of the compute cluster. The following statistics are available:

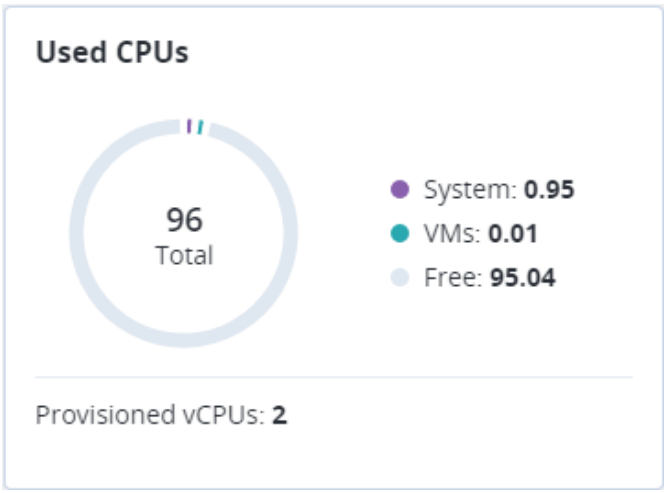
System
: The number of logical cores used by system and storage services on all nodes in the compute cluster.

VMs The number of logical cores used by virtual machines on all nodes in the compute cluster.

Free The number of unused logical cores on all nodes in the compute cluster.

Total
: The total number of logical cores on all nodes in the compute cluster.

Provisioned vCPUs
: The number of vCPUs provisioned for all VMs in the compute cluster.



A similar chart is available for each individual node in the compute cluster.

4.10.2 Reserved RAM Chart

This chart displays RAM utilization of the compute cluster. The following statistics are available:

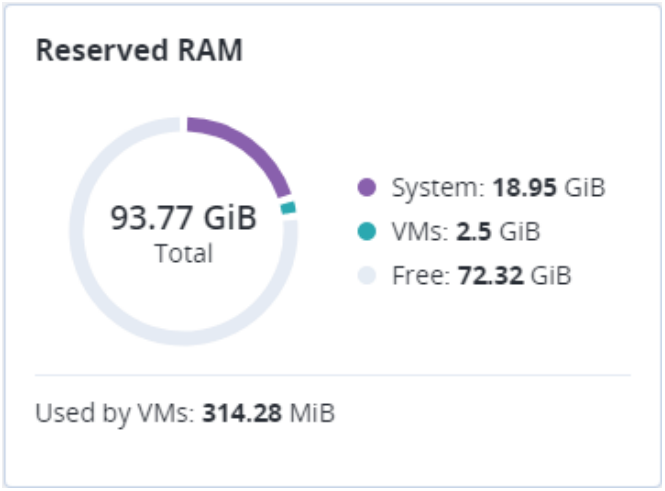
System
: The amount of RAM reserved for system and storage services on all nodes in the compute cluster.

VMs The amount of RAM provisioned for all VMs in the compute cluster.

Free The amount of free RAM on all nodes in the compute cluster.

Total
: The total amount of RAM on all nodes in the compute cluster.

Used by VMs
: The amount of RAM actually used by all VMs in the compute cluster.



A similar chart is available for each individual node in the compute cluster.

4.10.3 Provisioned Storage Chart

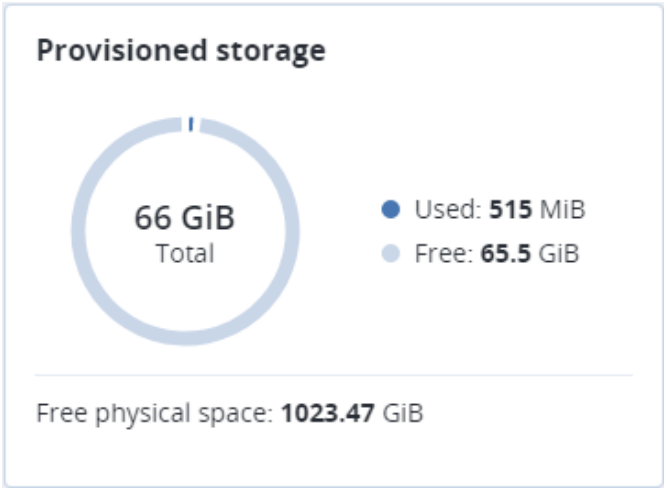
This chart shows usage of storage space by the compute cluster. The following statistics are available:

Used
: The amount of storage space actually occupied by data in all volumes provisioned in the compute cluster.

Free The amount of unused space in all volumes provisioned in the compute cluster.

Total
: The total size of volumes provisioned in the compute cluster.

Free physical space
: The amount of physical space available in the storage cluster.



4.10.4 VM Status Chart

The **VMs status** chart shows the total number of virtual machines in the compute cluster and groups them by status, which can be the following:

Running

The number of virtual machines that are up and running.

In progress

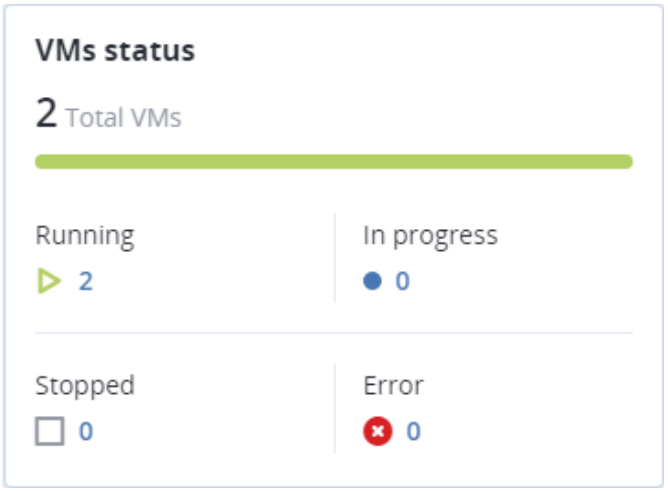
The number of virtual machines that are in a transitional state: building, restarting, migrating, etc.

Stopped

The number of virtual machines that are suspended or powered off.

Error

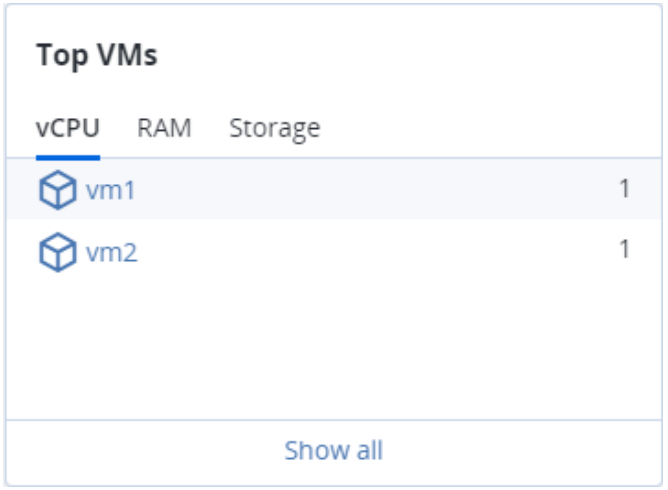
The number of virtual machines that have failed. Try troubleshooting such VMs via the console or rebuild them.



To see a full list of virtual machines filtered by the chosen status, click the number next to the status icon.

4.10.5 Top VMs Chart

The **Top VMs** chart lists virtual machines with the highest resource consumption sorted by **CPU**, **RAM**, or **Storage** in descending order. To switch between lists, click the desired resource.



To see a full list of virtual machines in the compute cluster, click **Show all**.

4.10.6 Alerts Chart

The **Alerts** chart lists all the alerts related to the compute cluster sorted by severity. Alerts include the following:

Critical

The compute cluster has encountered a critical problem. For example, one or more of its components have been unavailable for more than 10 seconds or some resource has exceeded its soft limit.

Warning

The compute cluster is experiencing issues that may affect its performance. For example, one or more of its components operate slowly or some resource is approaching its soft limit.

Other

Some other issue has happened with the compute cluster. For example, its license is about to expire or has expired.

To see a full list of compute-related alerts, click **Show all**.

4.10.7 Per-VM Charts

You can monitor performance individual VMs on the **COMPUTE** > **Virtual machines** > **VIRTUAL MACHINES** > VM > **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.

4.11 Destroying the Compute Cluster

To destroy the compute cluster, do the following:

1. Delete all virtual machines from all nodes.
2. Release the compute nodes. To do this, select all nodes on the **COMPUTE** > **Nodes** screen and click **Release nodes**. Regular (non-management) nodes will be released first. Management nodes will follow. Releasing the management nodes will destroy the compute cluster.

CHAPTER 5

Exporting Storage Cluster Data

Acronis Cyber Infrastructure allows you to export storage space as:

- Block storage via iSCSI for virtualization, databases and other needs.
- Object storage for storing unlimited number of files via an Amazon S3 compatible protocol. You can store data like media files, backups, Open Xchange files and access the storage using Dropbox-like applications. You can build your own Amazon S3 compatible object storage services as a part of your cloud offering or for internal needs.
- A back-end for Acronis Backup Cloud and Acronis Backup Advanced backups.
- NFS exports.

5.1 Exporting Storage via iSCSI

Acronis Cyber Infrastructure allows you to export cluster disk space to external operating systems and third-party virtualization solutions in the form of LUN block devices over iSCSI in a SAN-like manner.

Note: Acronis Cyber Infrastructure is certified by VMware for iSCSI scenarios as stated in the VMware Compatibility Guide.

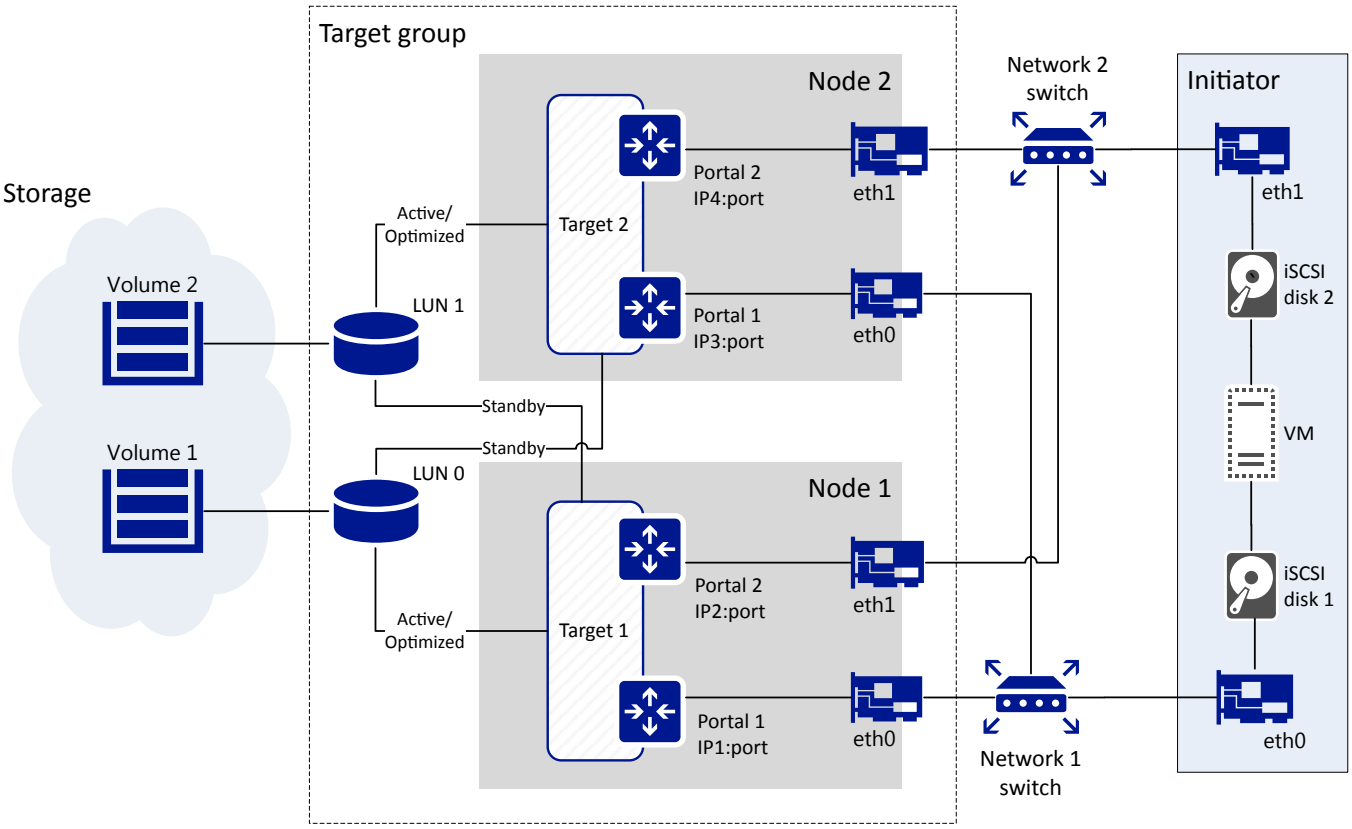
In Acronis Cyber Infrastructure, you can create groups of redundant targets running on different storage nodes. To each target group you can attach multiple storage volumes with their own redundancy provided by the storage layer. These volumes are exported by targets as LUNs.

Each node in a target group can host a single target for that group if Ethernet is used, or one target per FC

port if Fibre Channel is used. If one of the nodes in a target group fails along with its target(s), healthy targets from the same group continue to provide access to the LUNs previously serviced by the failed target(s).

You can create multiple target groups on same nodes. A volume, however, may only be attached to one target group at any moment of time.

The figure below shows a typical setup for exporting Acronis Cyber Infrastructure disk space via iSCSI.



The figure shows two volumes located on redundant storage provided by Acronis Cyber Infrastructure. The volumes are attached as LUNs to a group of two targets running on Acronis Cyber Infrastructure nodes. Each target has two portals, one per network interface with the iSCSI traffic type, which makes a total of four discoverable endpoints with different IP addresses. Each target provides access to all LUNs attached to the group. Targets work in the ALUA mode, so one path to the volume is preferred and considered Active/Optimized while the other is Standby. Network interfaces `eth0` and `eth1` on each node are connected to different switches for redundancy. The initiator, e.g., VMware ESXi, is connected to both switches as well and provides volumes as iSCSI disks 1 and 2 to a VM via different network paths. If the Active/Optimized path becomes unavailable for some reason (e.g., the node with the target or network switch fails), the Standby path through the other target will be used instead to connect to the volume. When the Active/Optimized path is restored, it will be used again.

5.1.1 iSCSI Workflow Overview

The typical workflow of exporting volumes via iSCSI is as follows:

1. Assign the network with the traffic type **iSCSI** to a network interface on each node that you will add to a target group. See *Managing Networks and Traffic Types* (page 2).
2. Create a target group on chosen nodes. See *Creating Target Groups* (page 113).
3. Create volumes and attach them to the target group as LUNs. Typically you do this while creating the target group. However, you can also do this later as described in *Managing Volumes* (page 120).
4. Optionally, enable CHAP and ACL authorization for the target group: create CHAP accounts and assign them to the target group, populate group's access control list. Typically, you do this while creating the target group. However, you can also do this later as described in *Restricting Access to Target Groups* (page 126).
5. Connect initiators to targets using standard tools of your operating system or product (consult the *User's Guide*). To view target IQNs, click the target group name.

5.1.1.1 Managing Legacy iSCSI Targets

After the upgrade to Acronis Cyber Infrastructure 2.5, you can run older iSCSI targets created on version 2.4 alongside new targets. For each older target, a target group is automatically created and iSCSI LUNs are moved to iSCSI volumes. Such a target group have a name in the format `group:<target_name>`. For example, the iSCSI target with the IQN `iqn.2014-06.com.vstorage:target1` will be placed in the target group named `group:target1`.

In the admin panel, you can manage older targets only by deleting them and detaching volumes from them. The full functionality is available using the `vstorage-iscsi` utility and described in the Acronis Storage 2.4 Administrator's Command Line Guide.

As older iSCSI targets do not support the ALUA mode, their LUNs are not highly available. To enable high availablity for them, detach a volume from an older target group and attach it to a newly created one as described in *Detaching Volumes* (page 125) and *Attaching Volumes to Target Groups* (page 122).

5.1.2 Managing Target Groups

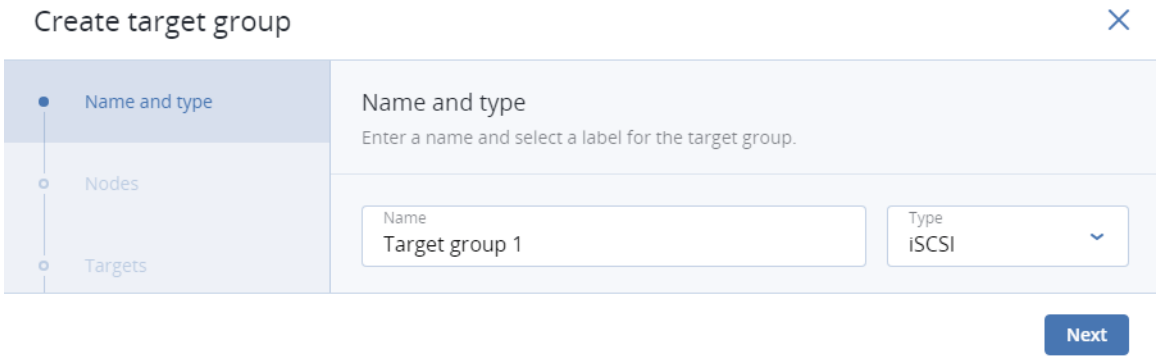
This section explains how to create and manage groups of iSCSI targets.

5.1.2.1 Creating Target Groups

Before you create any target groups, assign the network with the iSCSI traffic type to a network interface on each node that you will add to a target group.

To create a target group, open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS** and click **Create target group**. A wizard will open where you need to do the following:

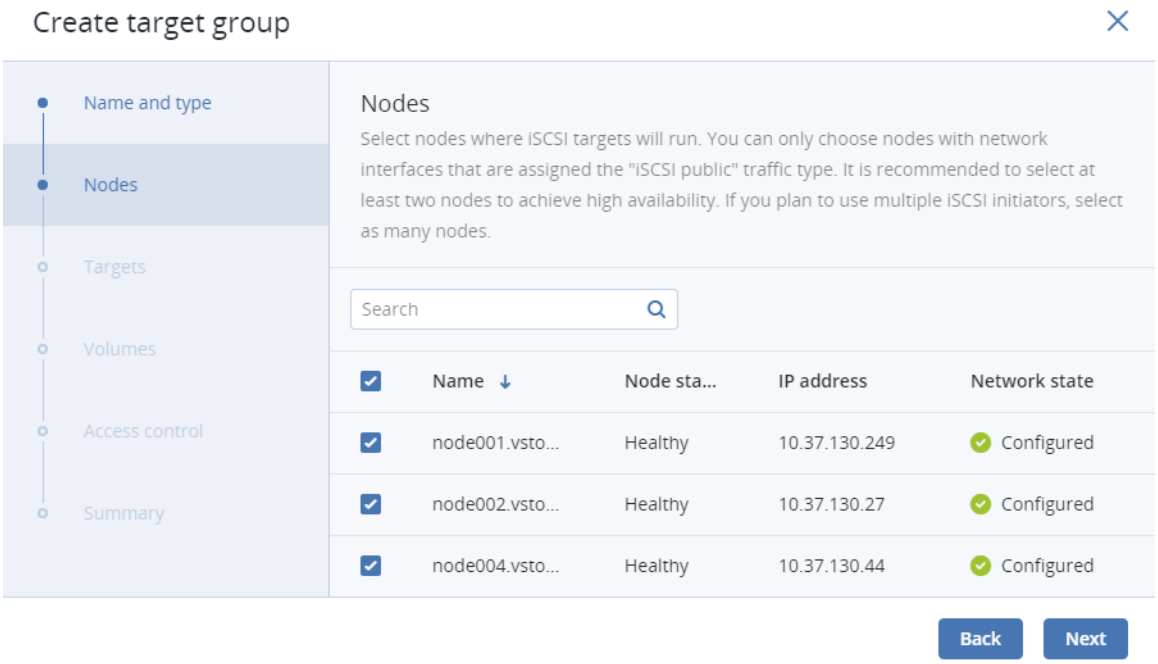
1. On **Name and type**, enter a target group name and select a type: iSCSI or Fibre Channel.



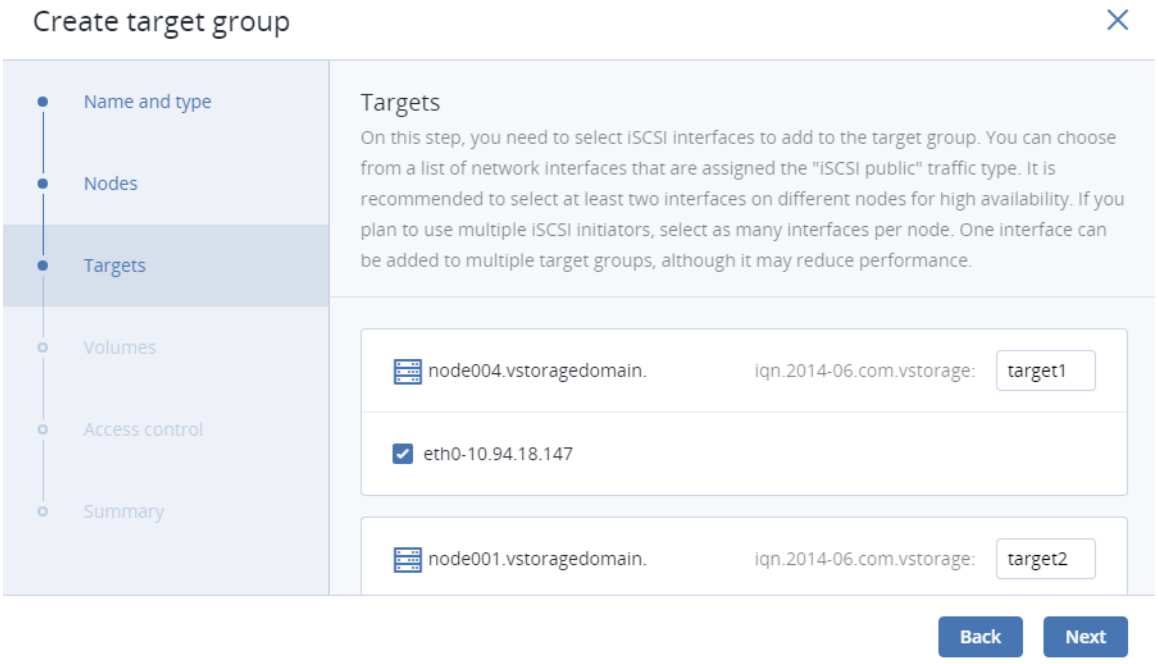
2. On **Nodes**, select nodes to add to the target group. On these nodes, iSCSI targets will run. You can only choose nodes with network interfaces that are assigned the **iSCSI** traffic type. It is recommended to have at least two nodes in the target group to achieve high availability. If you plan to use multiple iSCSI initiators, you should have as many nodes in the target group.

   The optimal way is to create a single target per node if you use the iSCSI protocol and one target per FC port if you use the FC protocol.

   If node network interfaces are not configured, click the cogwheel icon, select networks as required, and click **Apply**.

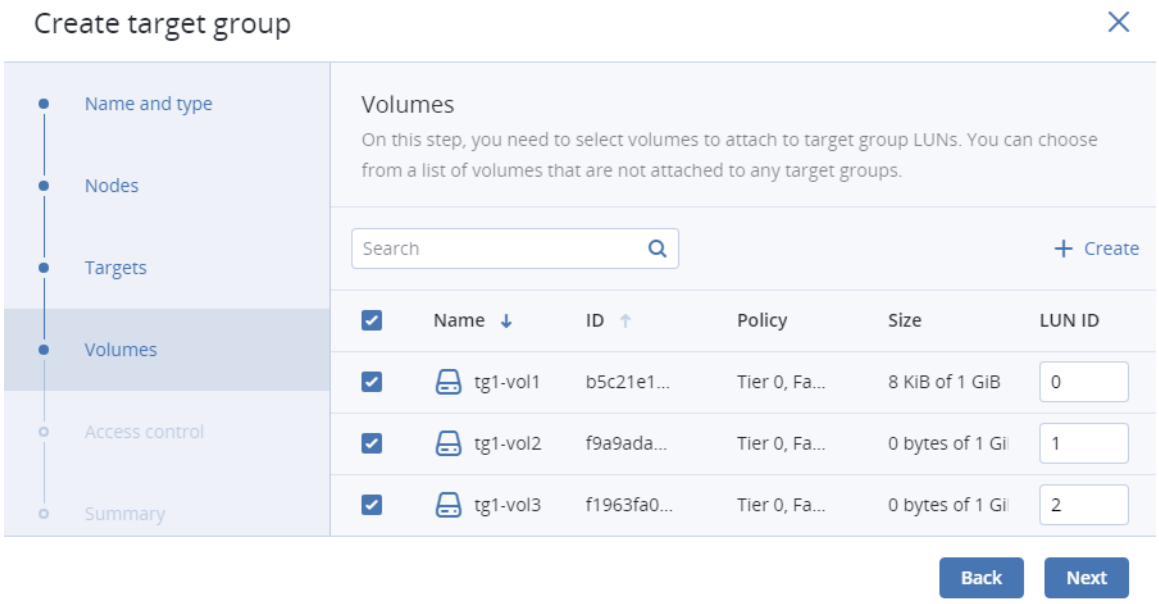


3. On **Targets**, select iSCSI interfaces to add to the target group. You can choose from a list of network interfaces that are assigned the **iSCSI** traffic type. If you plan to use multiple iSCSI initiators, you should select as many interfaces per node. One interface can be added to multiple target groups, although it may reduce performance.

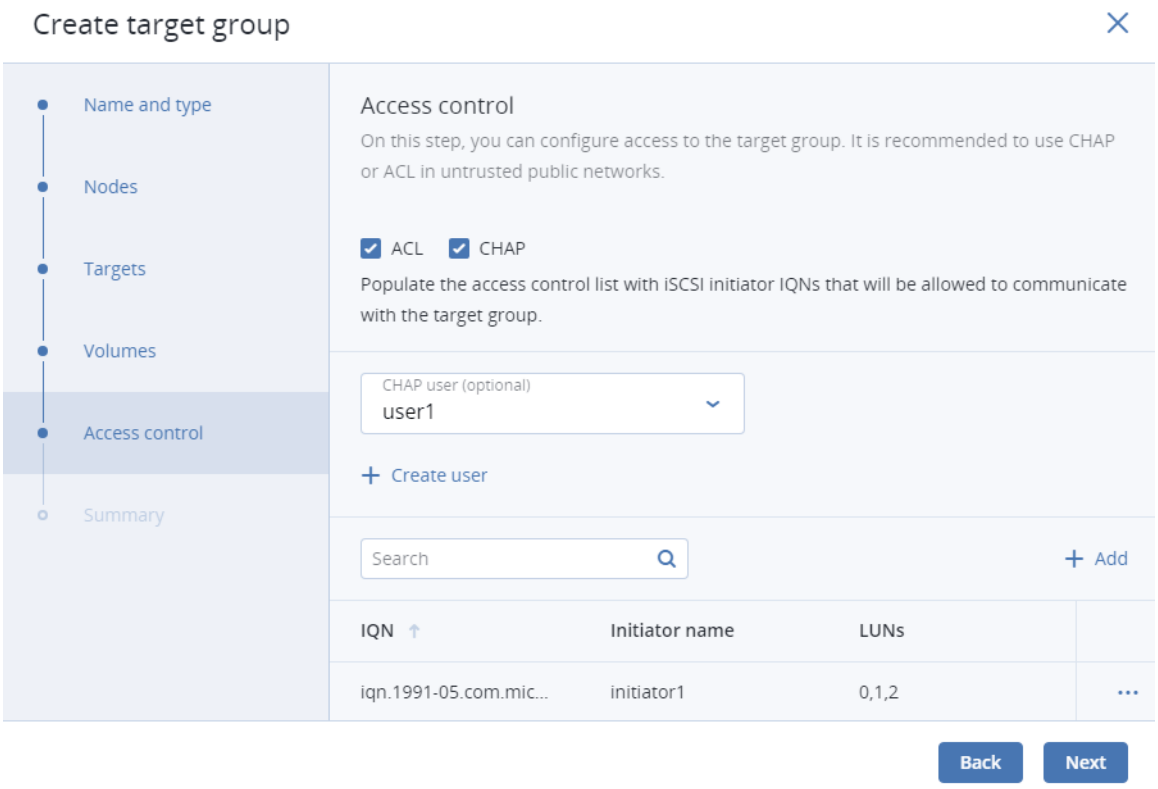


4. On **Volumes**, select volumes to attach to target group LUNs. You can choose from a list of volumes that

are not attached to any target groups. If no volumes are available, you can create them on this step so they are attached to the target group automatically or later and attach them manually.



5. On **Access control**, configure access to the target group. It is recommended to use CHAP or ACL in untrusted public networks. Without access control, any connections to the target group are allowed. For more information, see *Restricting Access to Target Groups* (page 126).



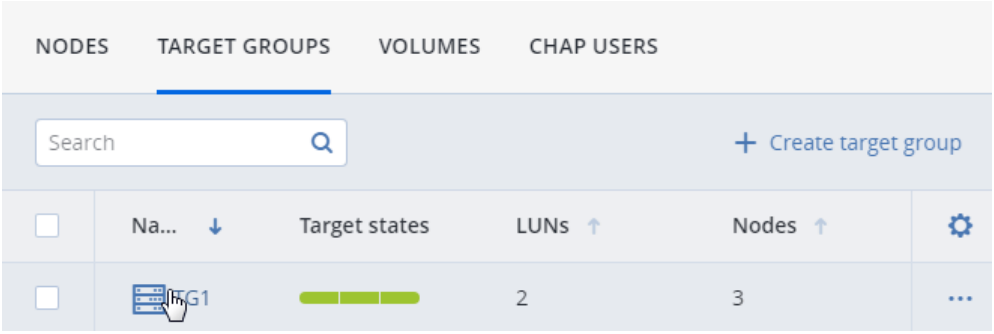
6. On **Summary**, review the target group details. You can go back to change them if necessary. Click **Create**.

The created target group will appear on the **TARGET GROUPS** tab. Its targets will start automatically.

5.1.2.2 Adding Targets

To add a target to a target group, do the following:

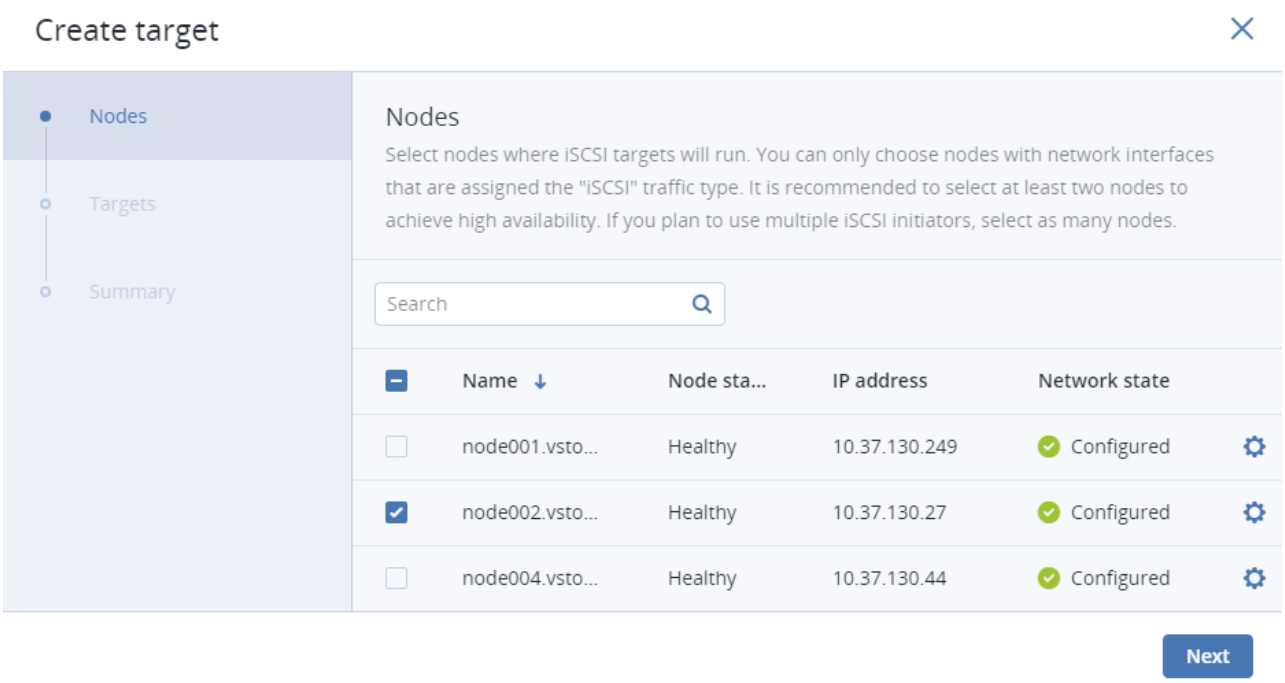
1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the name of the desired target group to open it.



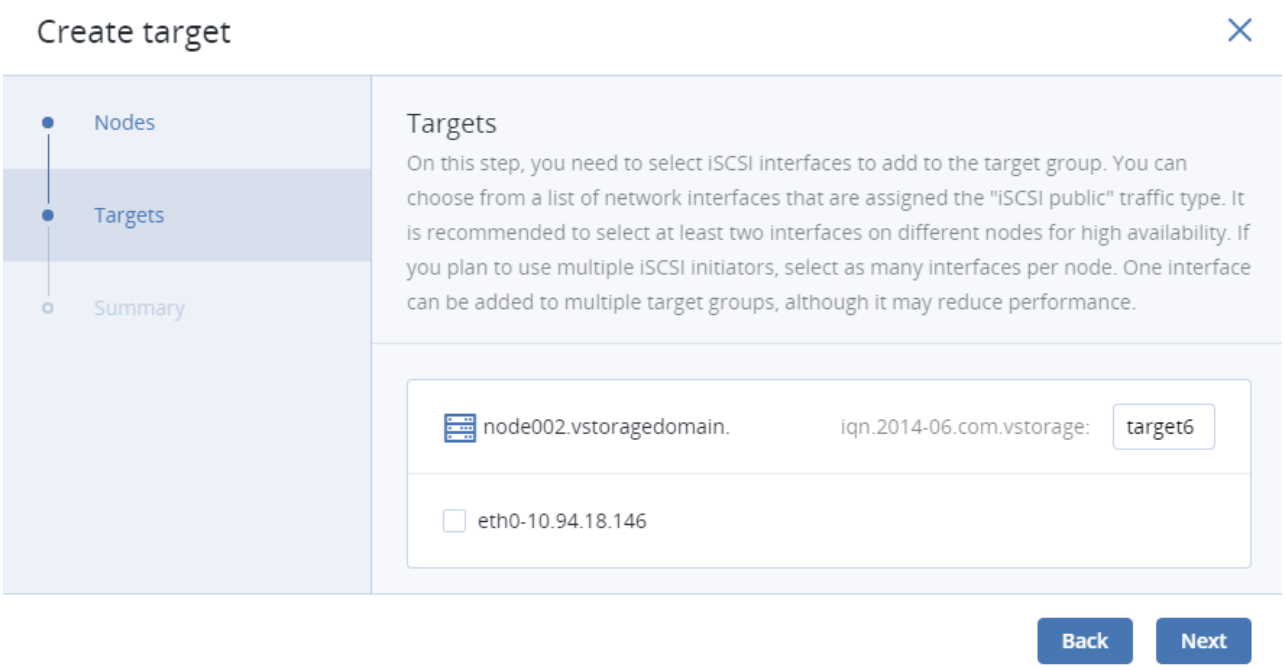
2. On the **TARGETS** tab, click **Add target**. The **Create target** wizard will open.
3. On **Nodes**, select nodes to add to the target group. On these nodes, iSCSI targets will run. You can only choose nodes with network interfaces that are assigned the **iSCSI** traffic type. It is recommended to have at least two nodes in the target group to achieve high availability. If you plan to use multiple iSCSI initiators, you should have as many nodes in the target group.

   The optimal way is to create a single target per node if you use the iSCSI protocol and one target per FC port if you use the FC protocol.

   If node network interfaces are not configured, click the cogwheel icon, select networks as required, and click **Apply**.



4. On **Targets**, select iSCSI interfaces to add to the target group. You can choose from a list of network interfaces that are assigned the **iSCSI** traffic type. If you plan to use multiple iSCSI initiators, you should select as many interfaces per node. One interface can be added to multiple target groups, although it may reduce performance.

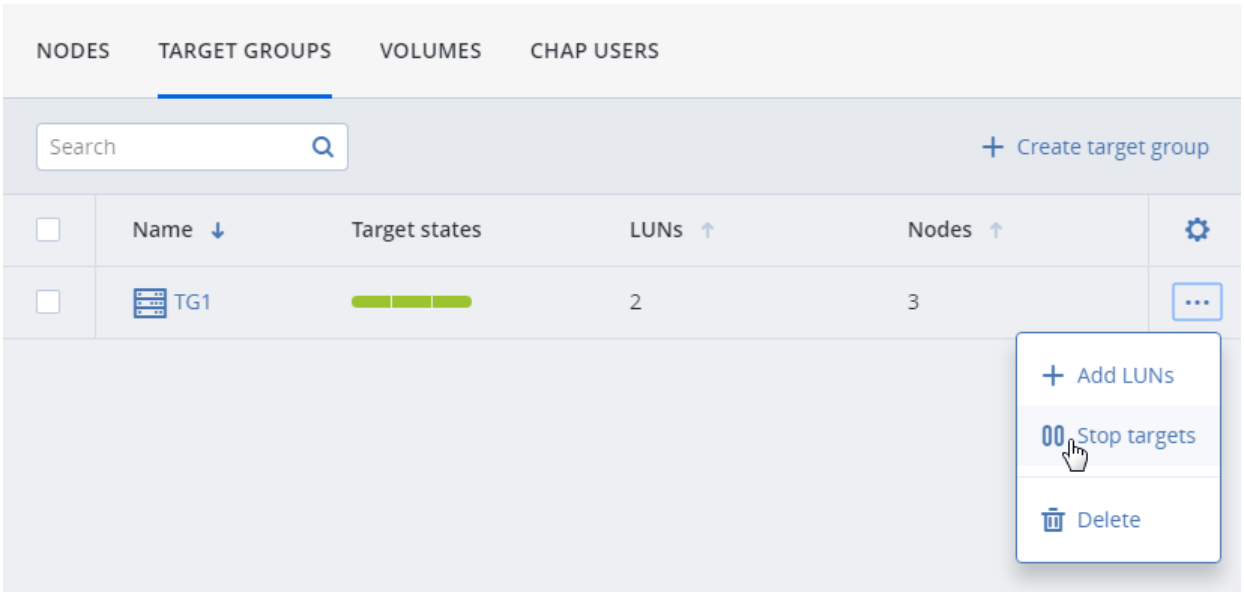


5. On **Summary**, review the target details. You can go back to change them if necessary. Click **Next**.

The created target will appear on the **Targets** tab.

5.1.2.3 Starting and Stopping Targets

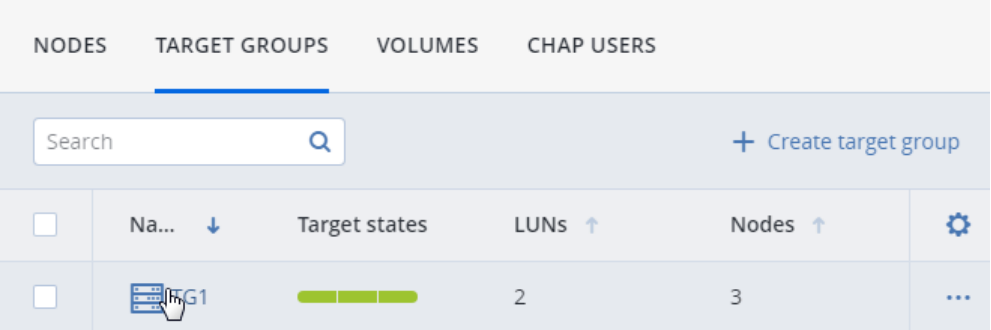
To start or stop all targets in a target group, open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the ellipsis icon of the desired target group, and click **Start targets** or **Stop targets**, respectively.



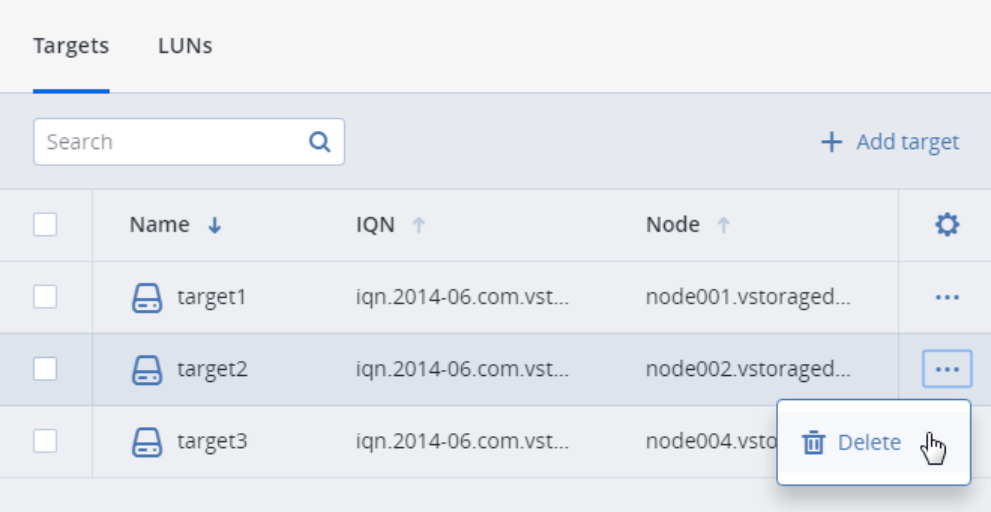
5.1.2.4 Deleting Targets

To delete a target from a target group, do the following:

1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the name of the desired target group to open it.



2. On the **Targets** tab, click the ellipsis button of the desired target then click **Delete**.

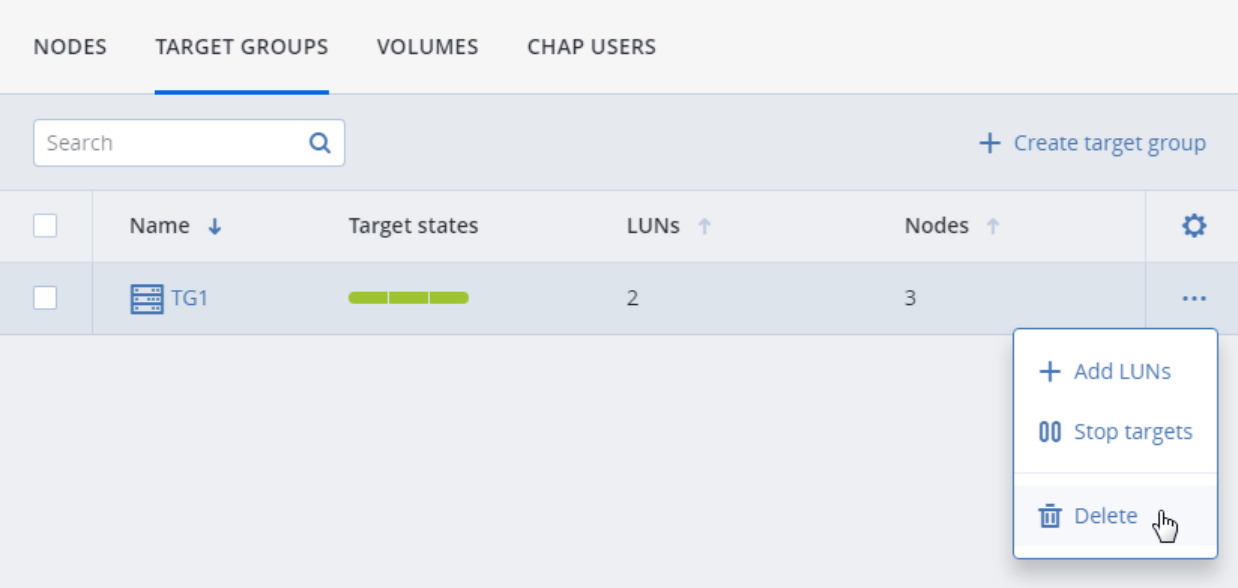


3. Click **Delete** in the confirmation window. Check the **Force** box to delete a target with active connections.

If you delete a target on the Active/Optimized path (indicated in LUN details), said path will switch to another target.

5.1.2.5 Deleting Target Groups

To delete a target group, open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the ellipsis icon of the desired target group, and click **Delete**.



Click **Delete** in the confirmation window. Check the **Force** box to delete a target group with active connections.

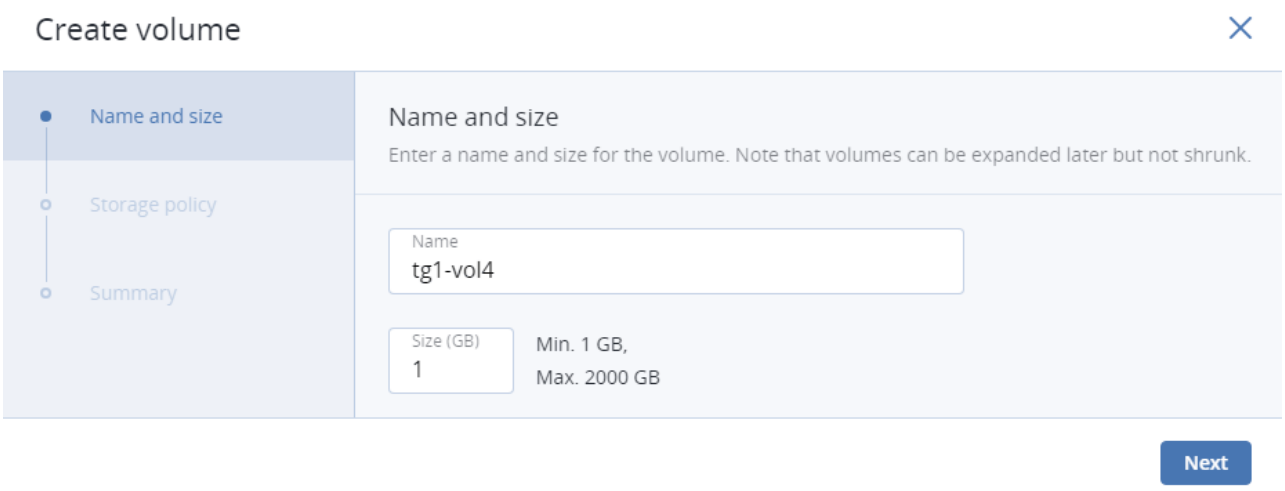
5.1.3 Managing Volumes

This section describes how to create and manage volumes to be exported via iSCSI.

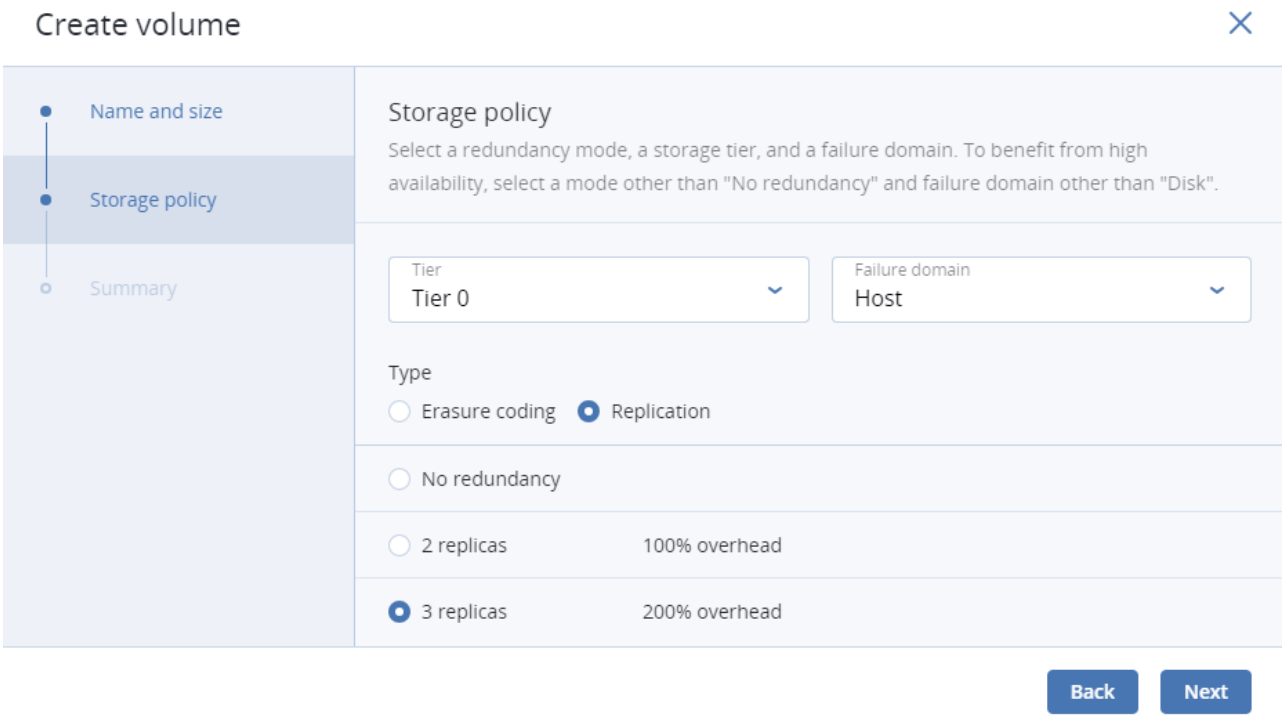
5.1.3.1 Creating Volumes

While it is convenient to create desired volumes while creating a target group, you can also do this at any time afterwards:

1. Open **STORAGE SERVICES** > **Block storage** > **VOLUMES** and click **Create volume**. A wizard will open.
2. On **Name and size**, enter a volume name and specify a size in gigabytes. Note that volumes can be extended later but not shrunk.



3. On **Storage policy**, select a redundancy mode, a storage tier, and a failure domain. To benefit from high availability, select a mode other than **No redundancy** and failure domain other than **Disk**.

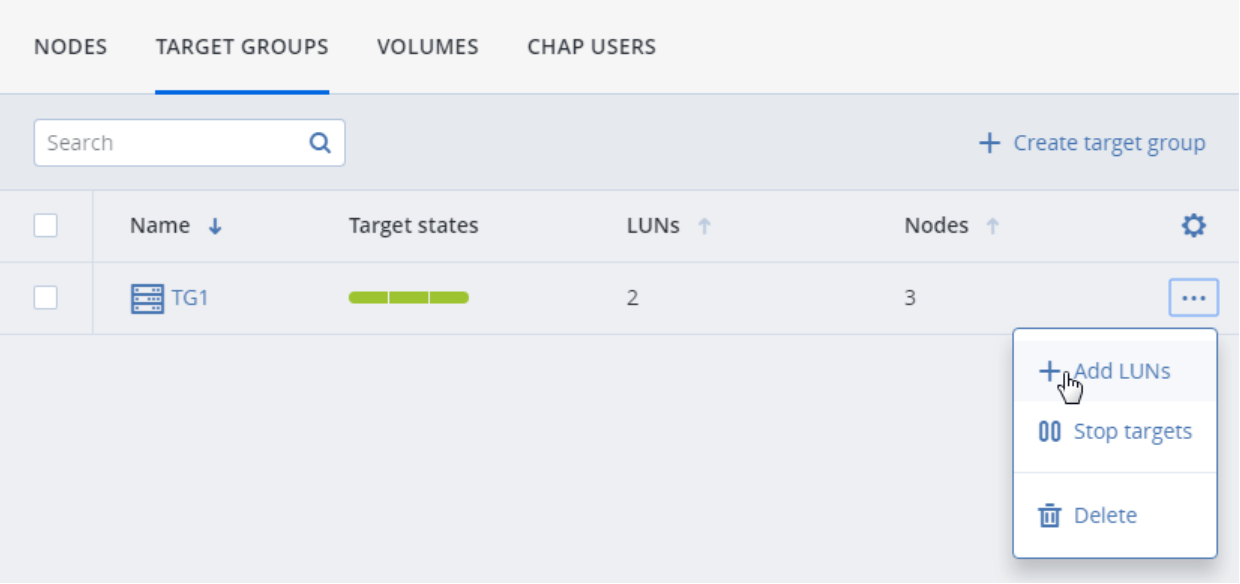


4. On **Summary**, review the volume details. You can go back to change them if necessary. Click **Create**.

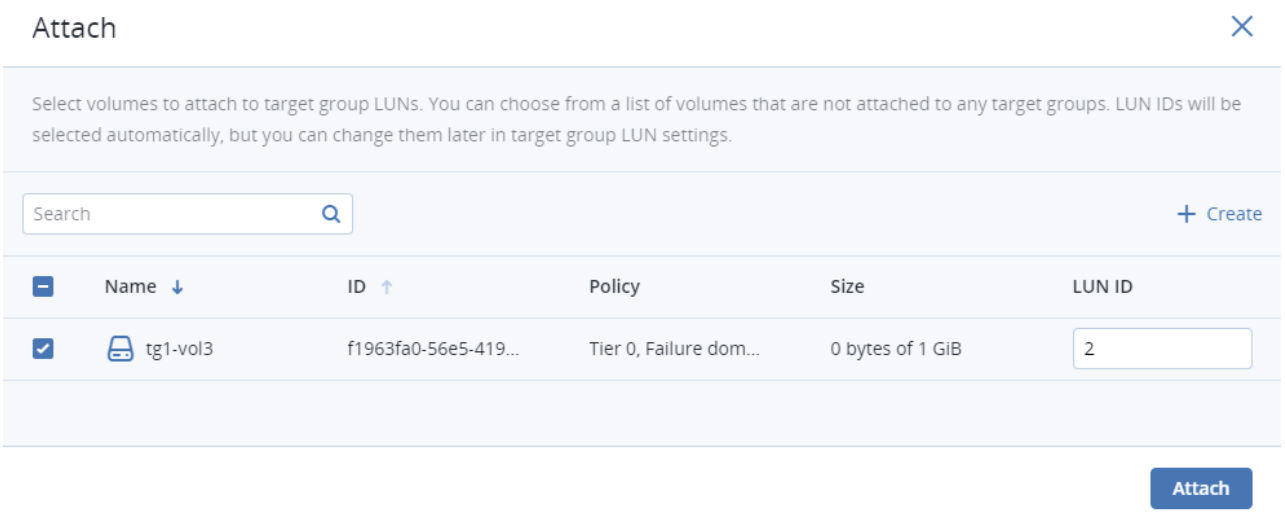
5.1.3.2 Attaching Volumes to Target Groups

To add a volume as a LUN to a target group, do the following:

1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the ellipsis icon of the desired target group, and click **Add LUNs**.

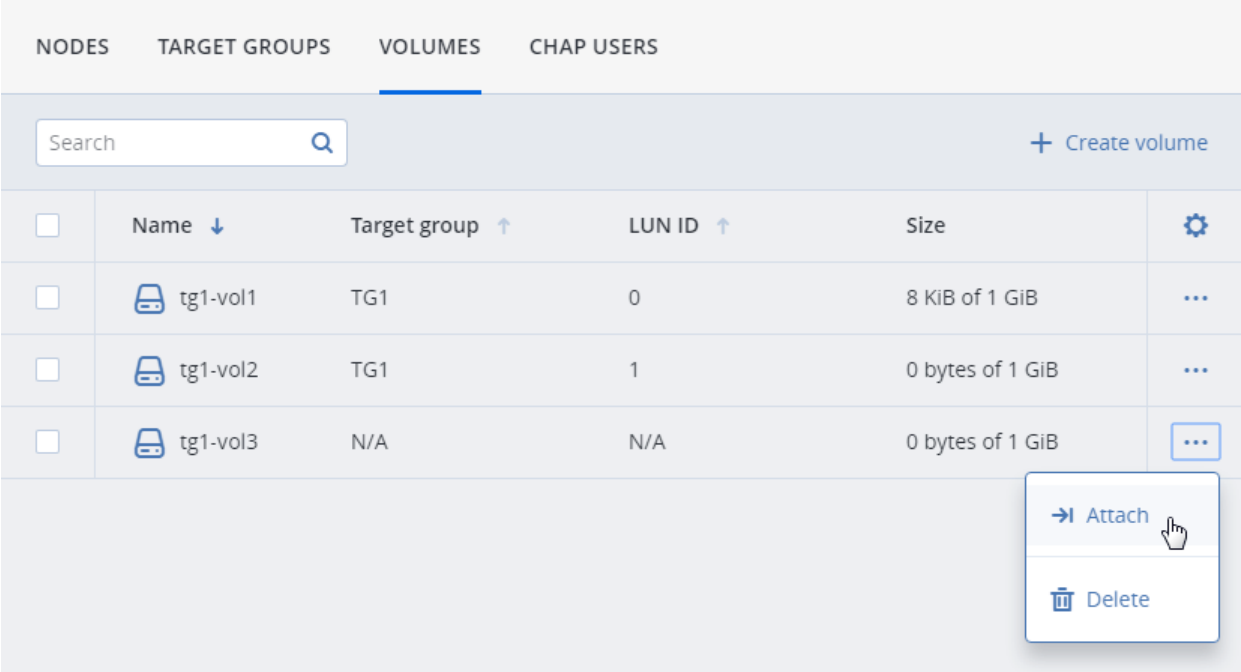


2. In the **Attach** window that opens, select volumes to attach to the target group (create them if needed) and click **Attach**.



Alternatively, you can do the same on the **VOLUMES** tab:

1. Click the ellipsis icon of the desired volume then click **Attach**.

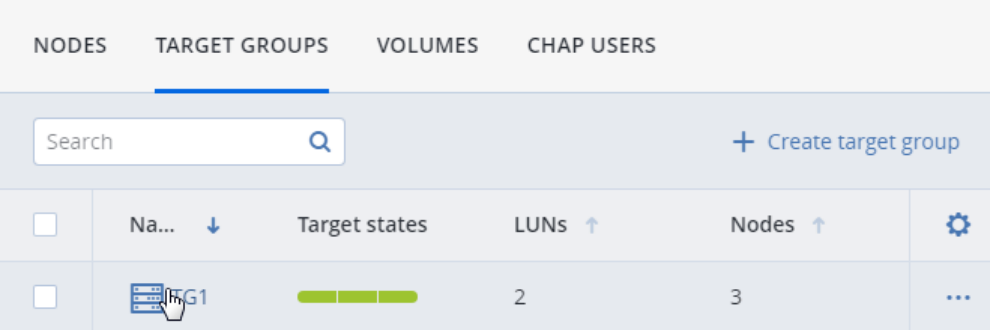


2. In the **Attach** window that opens, select a target group and click **Attach**.

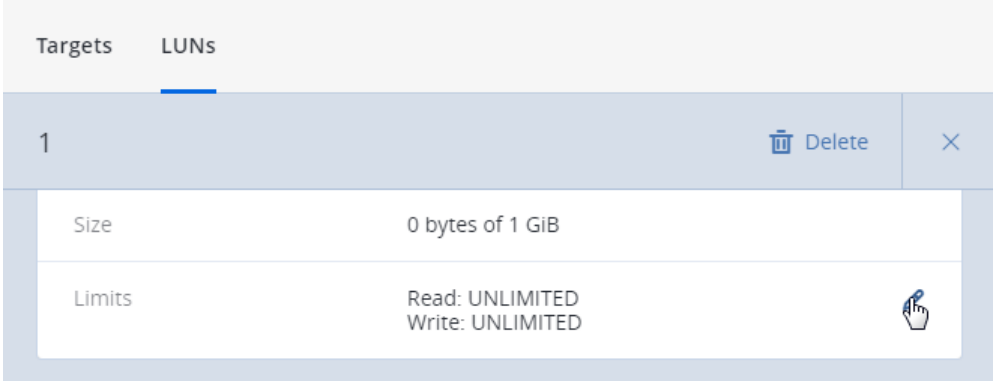
5.1.3.3 Setting LUN Limits

To set a read/write limit for a volume attached to a target group as a LUN, do the following:

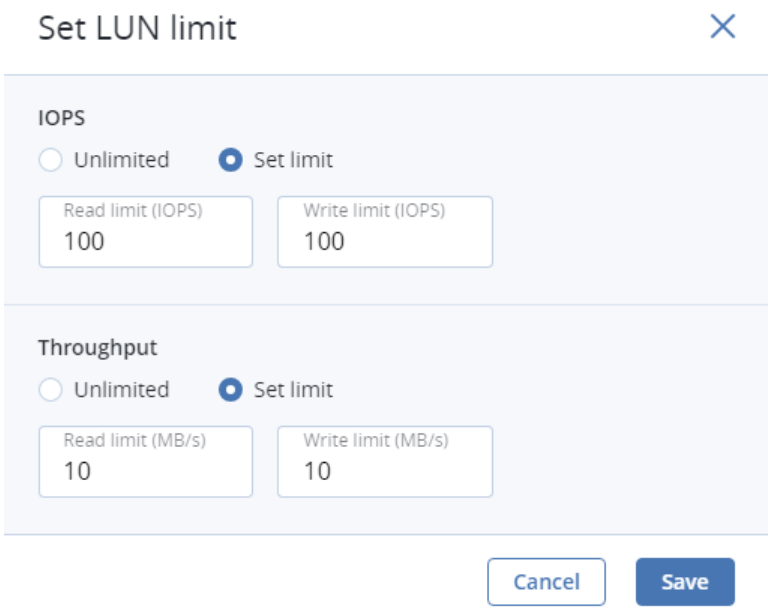
1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the name of the desired target group to open it, and switch to **LUNs**.



2. Click the desired LUN to open its details, then click the **Limits** pencil icon.



3. In the **Set LUN limit** window that opens, enter limit values and click **Save**.

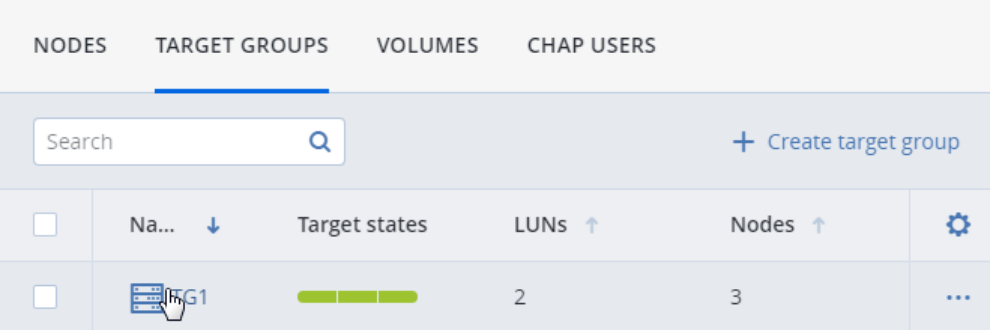


Set limits will be shown in LUN details.

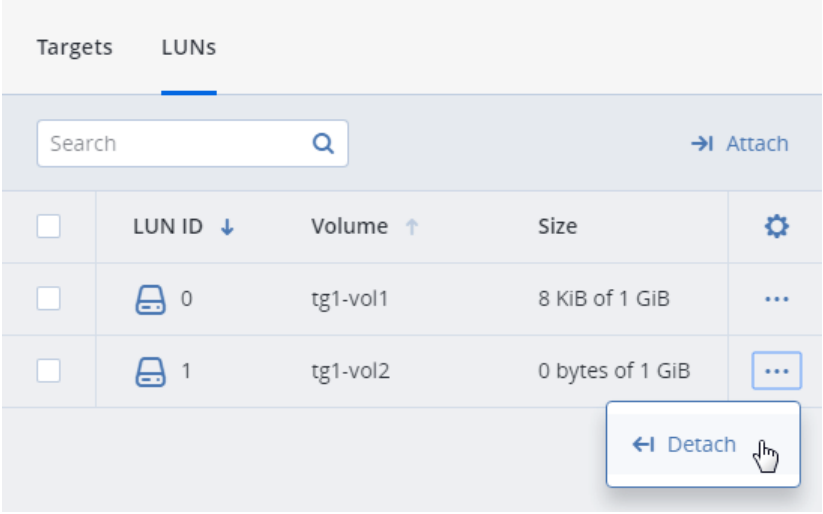
5.1.3.4 Detaching Volumes

To detach a volume from a target group, do the following:

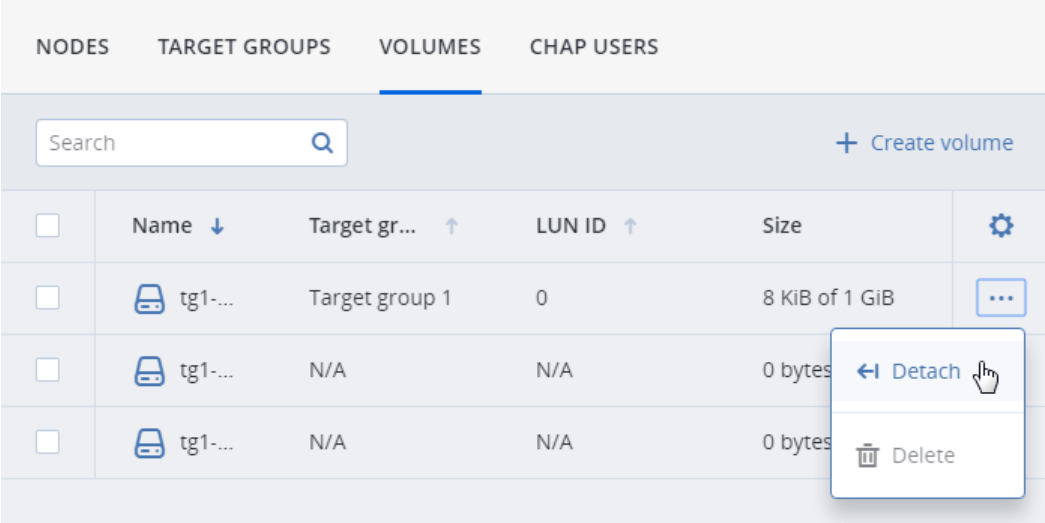
1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS**, click the name of the desired target group to open it, and switch to **LUNs**.



2. Click the ellipsis button of the desired LUN then click **Detach**.

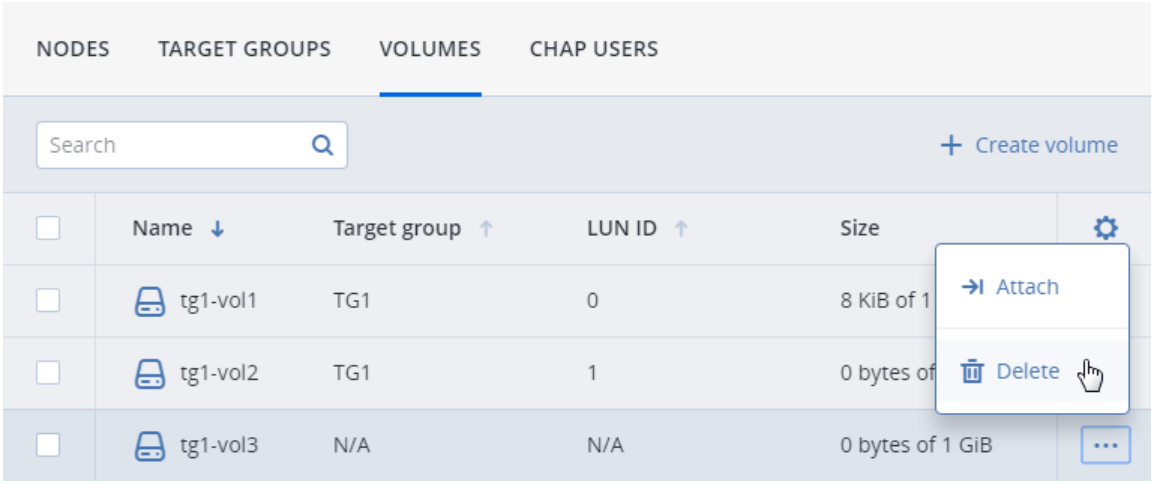


Alternatively, you can open **STORAGE SERVICES** > **Block storage** > **VOLUMES**, click the ellipsis icon of the desired volume, and click **Detach**.



5.1.3.5 Deleting Volumes

To delete a volume that is not attached to a target group, open **STORAGE SERVICES** > **Block storage** > **VOLUMES**, click the ellipsis icon of the desired volume, and click **Delete**.



5.1.4 Restricting Access to Target Groups

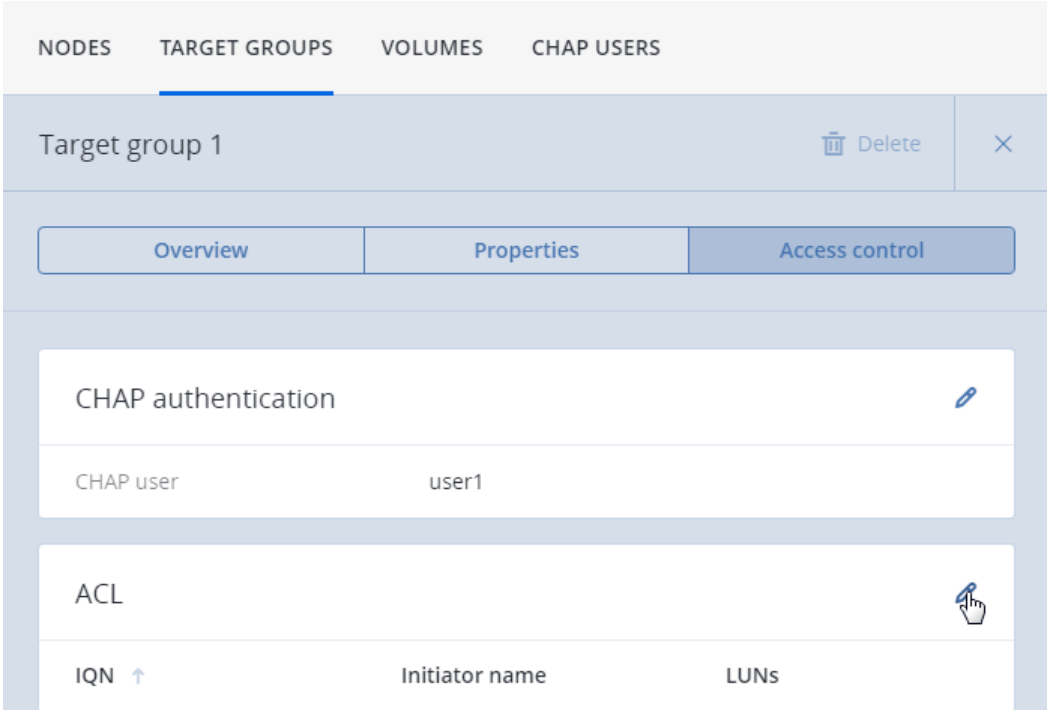
You can restrict access to entire target groups (and all volumes attached to them) by way of ACL-based authorization as well as password-based authentication (CHAP).

5.1.4.1 Managing Access Control Lists

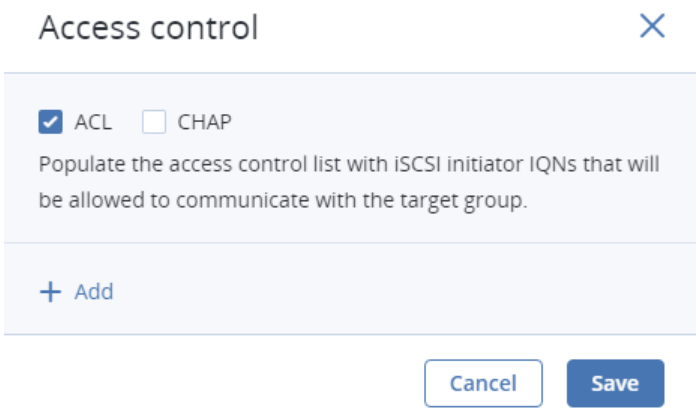
An access control list (ACL) limits access to chosen LUNs for specific initiators. Initiators not on the list have access to all LUNs in iSCSI target groups. Volumes exported via Fibre Channel target groups, however, can only be accessed by initiators that are added to group ACL.

To add an initiator to a target group's ACL, do the following:

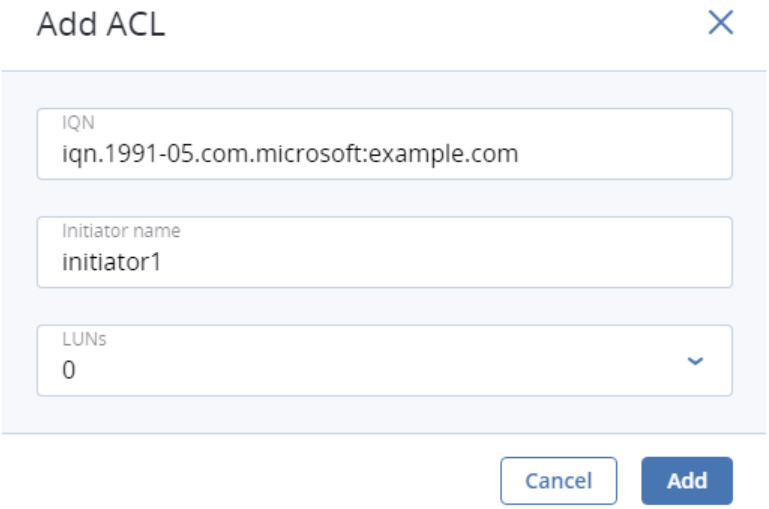
1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS** and click the desired target group in the list (anywhere except group's name).
2. In group details that open, click **Access control** and then click the pencil icon.



3. In the **Access control** window that opens, check the **ACL** box and click **Add**.



4. In the window that opens, specify initiator's IQN, enter an alias, select LUNs that it will be able to access. Click **Add**. The initiator will appear in the ACL.



5. Having populated the ACL with initiators, click **Save**.

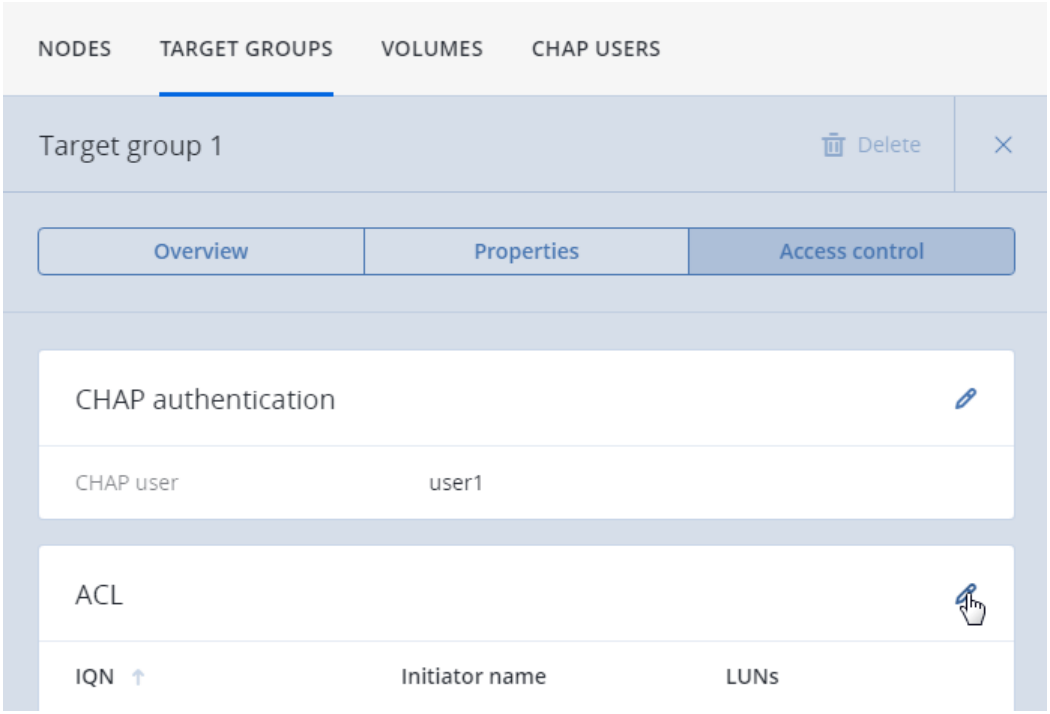
To edit or delete initiators in the ACL, click the pencil icon in target group details. In the **Access control** window that opens, click the pencil icon of the desired initiator then click **Edit** or **Delete**. Having changed the ACL, click **Save**.

5.1.4.2 Managing CHAP Users

The Challenge-Handshake Authentication Protocol (CHAP) provides a way to restrict access to targets and their LUNs by requiring a user name and a password from the initiator. CHAP accounts apply to entire target groups. Fibre Channel target groups do not use CHAP.

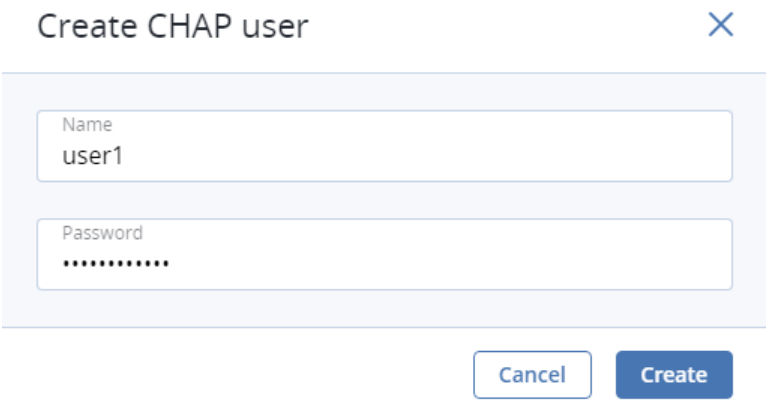
To restrict access to a target group to a specific CHAP user, do the following:

1. Open **STORAGE SERVICES** > **Block storage** > **TARGET GROUPS** and click the desired target group in the list (anywhere except group's name).
2. In group details that open, click **Access control** and then click the pencil icon.

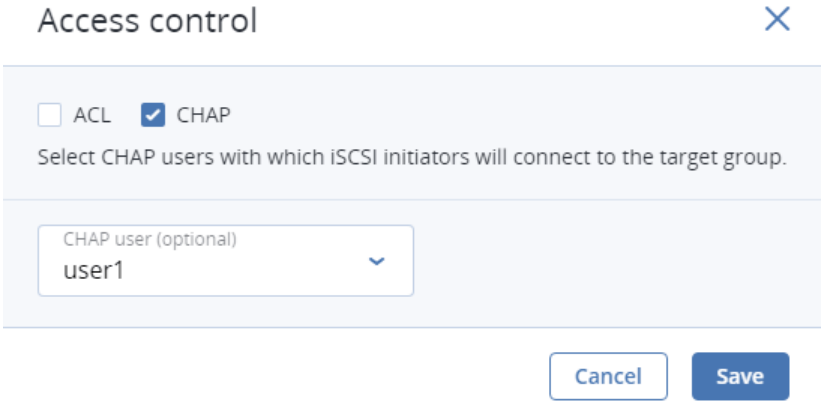


3. In the **Access control** window that opens, check the **CHAP** box and click **Create user**.

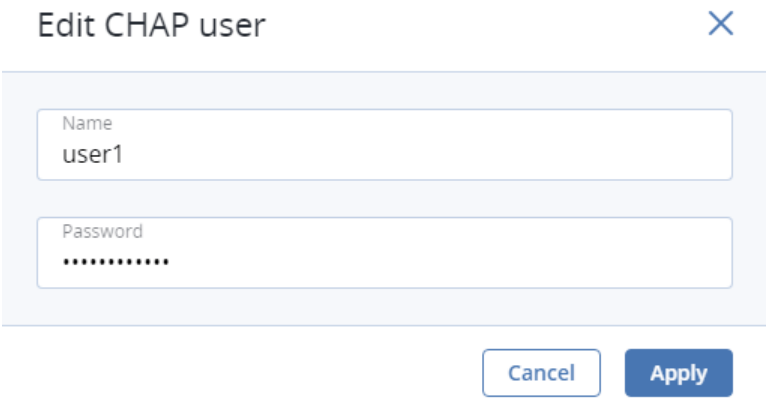
4. In the **Create CHAP user** window that opens, enter a user name and a password (12 to 16 characters long). Click **Create**.



5. Back on the **Access control** screen, select the desired CHAP user and click **Save**.

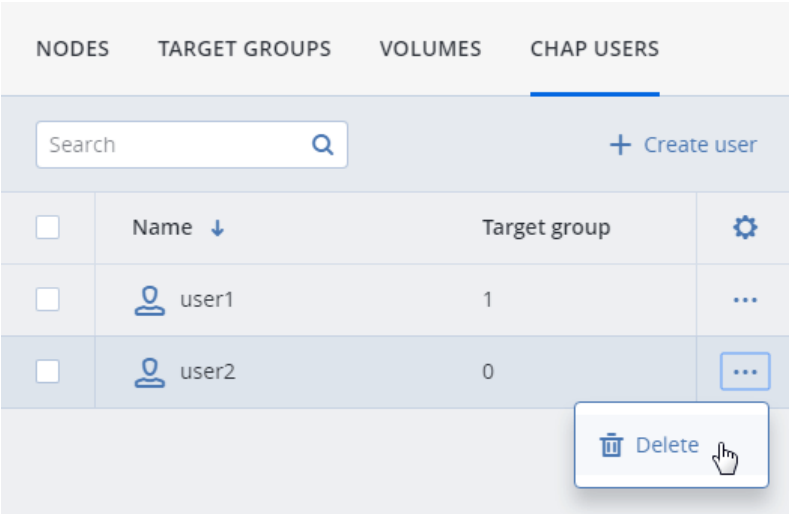


To change the password of a CHAP user, open **STORAGE SERVICES** > **Block storage** > **CHAP USERS**, click a user to open details, and click the pencil icon. In the **Edit CHAP user** window that opens, specify a new password and click **Apply**.



To delete a CHAP user that is not added to any ACLs, open **STORAGE SERVICES** > **Block storage** > **CHAP**

USERS, click the ellipsis icon of the user, and click **Delete**.



5.2 Exporting Data via S3

Acronis Cyber Infrastructure allows you to export cluster disk space to customers in the form of an S3-like object-based storage.

Acronis Cyber Infrastructure is implemented as an Amazon S3-like API, which is one of the most common object storage APIs. End users can work with Acronis Cyber Infrastructure as they work with Amazon S3. You can use the usual applications for S3 and continue working with it after the data migration from Amazon S3 to Acronis Cyber Infrastructure.

Object storage is a storage architecture that enables managing data as objects (like in a key-value storage) as opposed to files in file systems or blocks in a block storage. Except for the data, each object has metadata that describes it as well as a unique identifier that allows finding the object in the storage. Object storage is optimized for storing billions of objects, in particular for application storage, static web content hosting, online storage services, big data, and backups. All of these uses are enabled by object storage thanks to a combination of very high scalability and data availability and consistency.

Compared to other types of storage, the key difference of object storage is that parts of an object cannot be modified, so if the object changes a new version of it is spawned instead. This approach is extremely important for maintaining data availability and consistency. First of all, changing an object as a whole eliminates the issue of conflicts. That is, the object with the latest timestamp is considered to be the current version and that is it. As a result, objects are always consistent, i.e. their state is relevant and appropriate.

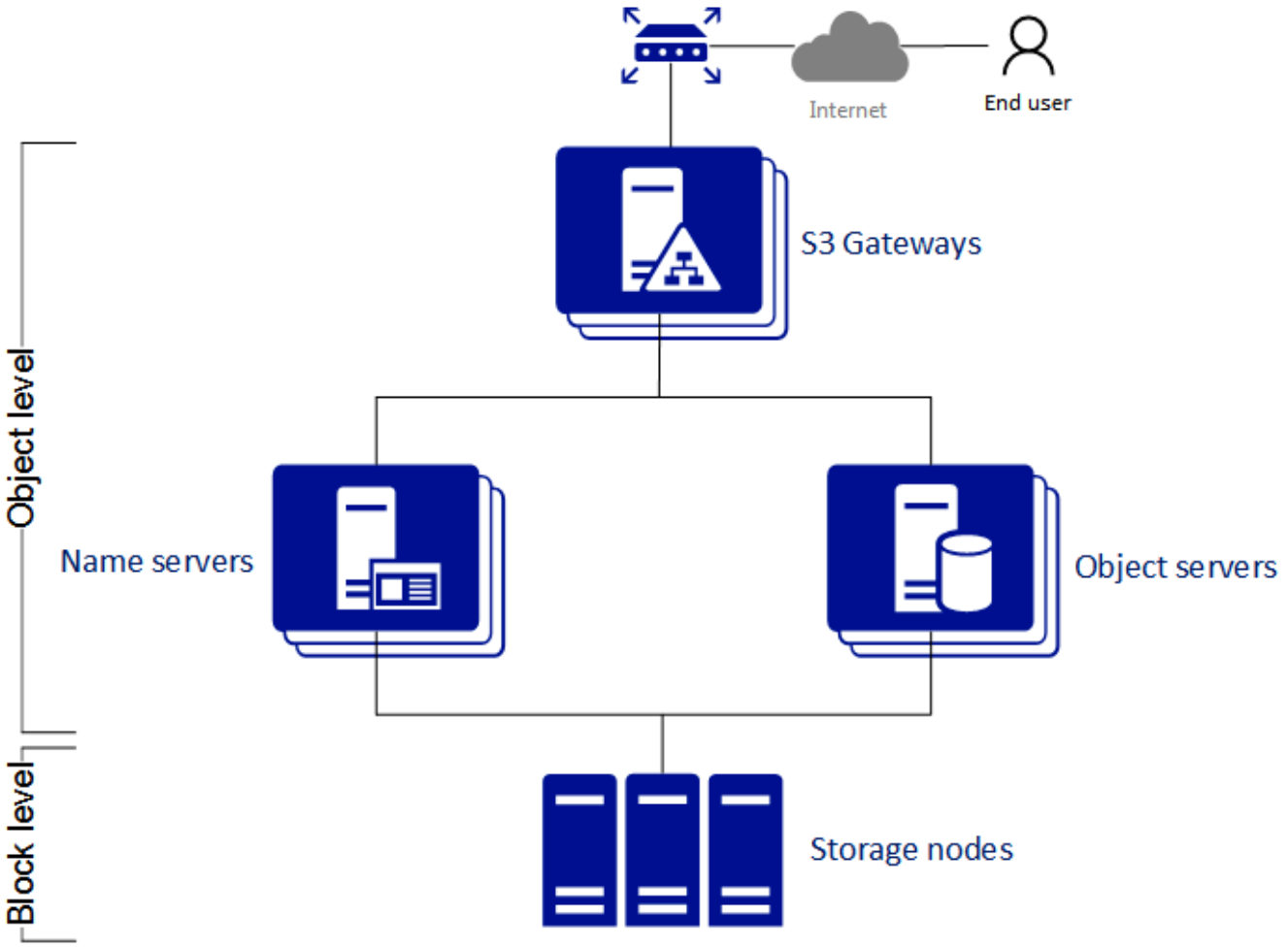
Another feature of object storage is eventual consistency. Eventual consistency does not guarantee that

reads are to return the new state after the write has been completed. Readers can observe the old state for an undefined period of time until the write is propagated to all the replicas (copies). This is very important for storage availability as geographically distant data centers may not be able to perform data update synchronously (e.g., due to network issues) and the update itself may also be slow as awaiting acknowledges from all the data replicas over long distances can take hundreds of milliseconds. So eventual consistency helps hide communication latencies on writes at the cost of the probable old state observed by readers. However, many use cases can easily tolerate it.

5.2.1 S3 Storage Infrastructure Overview

The object storage infrastructure consists of the following entities: object servers (OS), name servers (NS), S3 gateways (GW), and the block-level backend.

These entities run as services on the Acronis Cyber Infrastructure nodes. Each service should be deployed on multiple Acronis Cyber Infrastructure nodes for high availability.



- An object server stores actual object data received from S3 gateway. The data is packed into special containers to achieve high performance. The containers are redundant, you can specify the redundancy mode while configuring object storage. An object server also stores its own data in block storage with built-in high availability.
- A name server stores object metadata received from S3 gateway. Metadata includes object name, size, ACL (access control list), location, owner, and such. Name server (NS) also stores its own data in block storage with built-in high availability.
- An S3 gateway is a data proxy between object storage services and end users. It receives and handles Amazon S3 protocol requests and S3 user authentication and ACL checks. The S3 gateway uses the NGINX web server for external connections and has no data of its own (i.e. is stateless).
- The block-level backend is block storage with high availability of services and data. Since all object storage services run on hosts, no virtual environments (and hence licenses) are required for object storage.

5.2.2 Planning the S3 Cluster

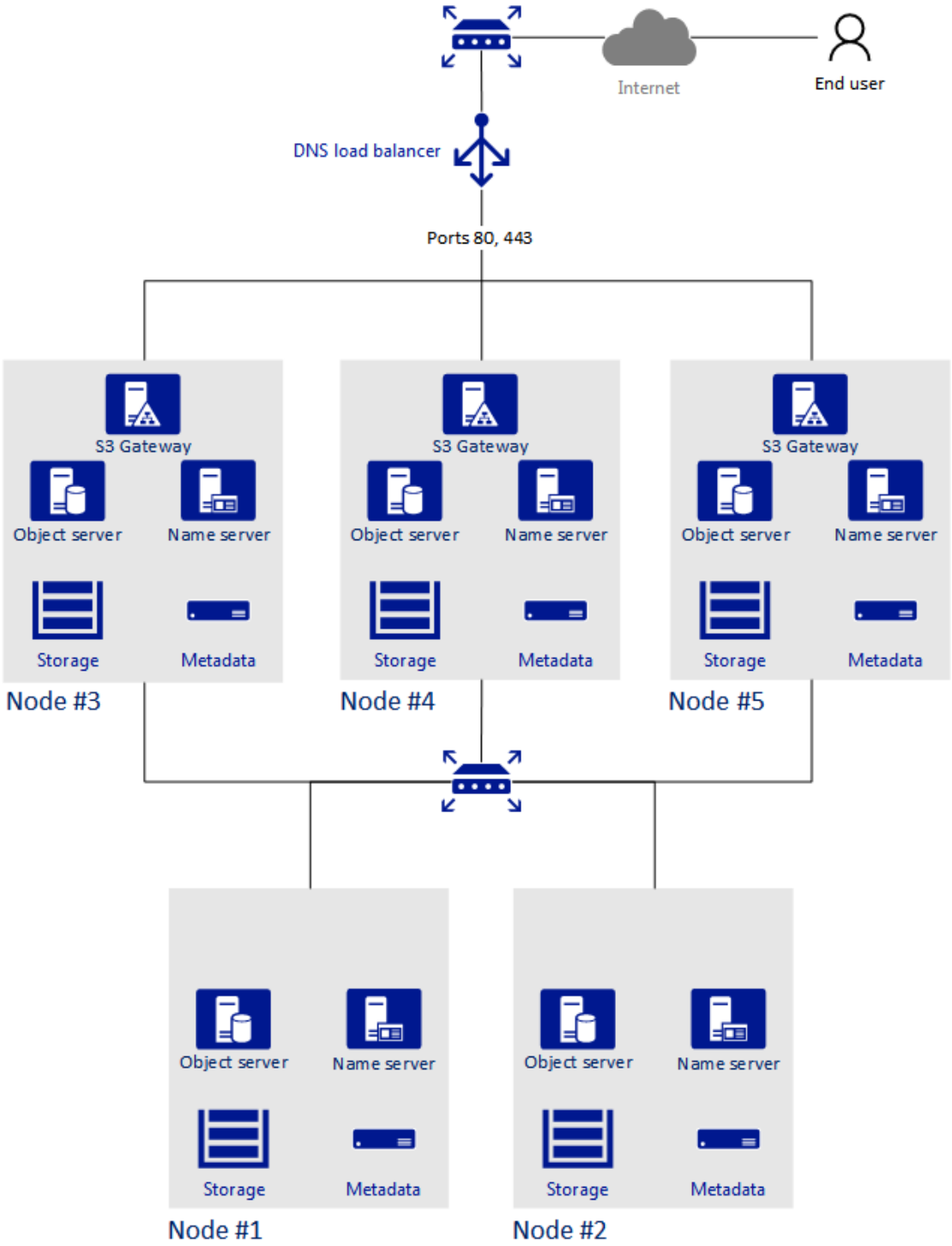
Before creating an S3 cluster, do the following:

1. Define which nodes of the storage cluster will run the S3 storage access point services. It is recommended to have all nodes available in Acronis Cyber Infrastructure run these services.
2. Configure the network so that the following is achieved:
    - All components of the S3 cluster communicate with each other via the S3 private network. All nodes of an S3 cluster must be connected to the S3 private network. Acronis Cyber Infrastructure internal network can be used for this purpose.
    - The nodes running S3 gateways must have access to the public network.
    - The public network for the S3 gateways must be balanced by an external DNS load balancer.

    For more details on network configuration, refer to the *Installation Guide*.
3. All components of the S3 cluster should run on multiple nodes for high-availability. Name server and object server components in the S3 cluster are automatically balanced and migrated between S3 nodes. S3 gateways are not automatically migrated; their high availability is based on DNS records. You need to maintain the DNS records manually when adding or removing S3 gateways.

5.2.3 Sample S3 Storage

This section shows a sample object storage deployed on top of a storage cluster of five nodes that run various services. The final setup is shown on the figure below.

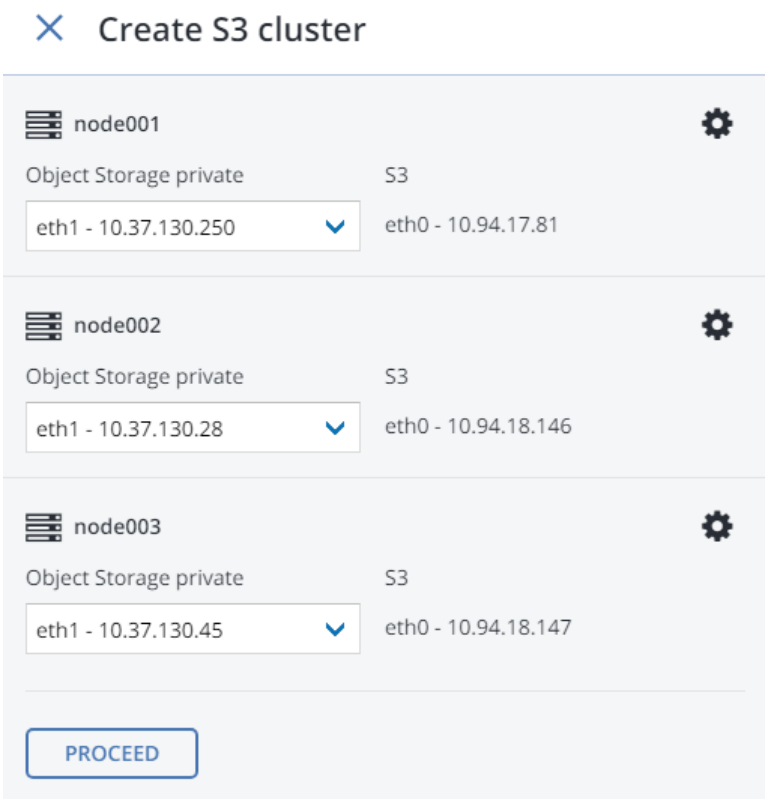


5.2.4 Creating the S3 Cluster

To set up object storage services on a cluster node, do the following:

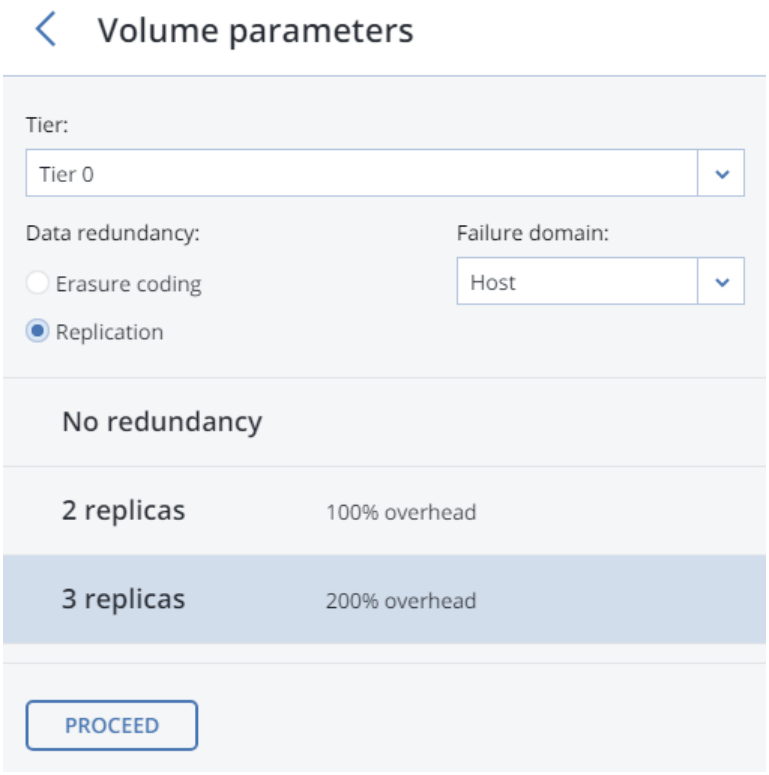
1. On the **INFRASTRUCTURE** > **Networks** screen, make sure that the **OSTOR private** and **S3 public** traffic types are added to your networks.
2. In the left menu, click **STORAGE SERVICES** > **S3**.
3. Select one or more nodes and click **Create S3 cluster** in the right menu. To create a highly available S3 cluster, select at least three nodes. It is also recommended to enable HA for the management node prior to creating the S3 cluster. See *Enabling High Availability* (page 202) for more details.
4. Make sure the correct network interface is selected in the drop-down list.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.



   Click **Proceed**.
5. In **Tier**, select the storage tier that will be used for the object storage.

6. In **Failure domain**, choose a placement policy for replicas.
7. In **Data redundancy**, select the redundancy mode that the object storage will use.

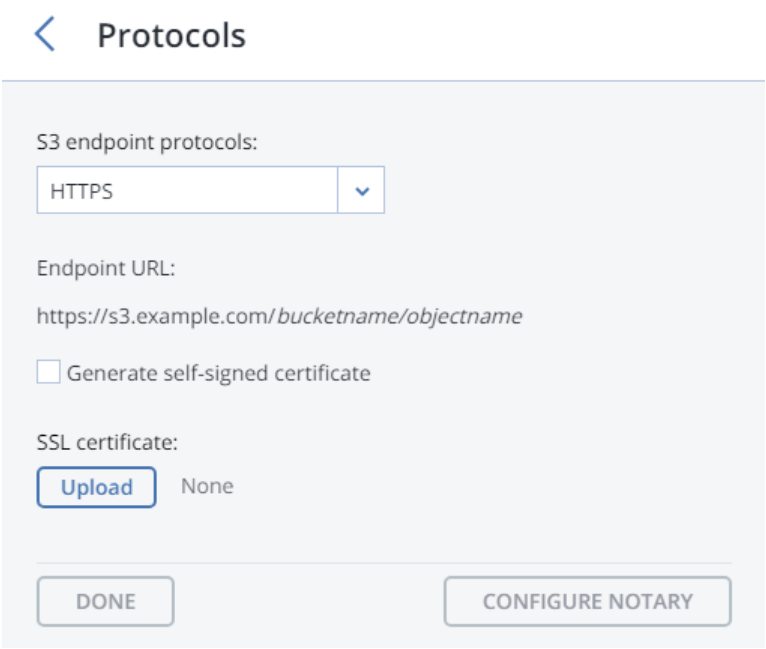


You can change the redundancy mode later on the **S3** > **OVERVIEW** > **Settings** panel. Click **Proceed**.

8. Specify the external (publicly resolvable) DNS name for the S3 endpoint that will be used by the end users to access the object storage. For example, `s3.example.com`. Click **Proceed**.

Important: Configure your DNS server according to the example suggested in the admin panel.

9. From the drop-down list, select an S3 endpoint protocol: HTTP, HTTPS or both.



It is recommended to use only HTTPS for production deployments.

If you have selected HTTPS, do one of the following:

- Check **Generate self-signed certificate** to get a self-signed certificate for HTTPS evaluation purposes.

  Take note of the following:

  - S3 geo-replication requires a certificate from a trusted authority. It does not work with self-signed certificates.
  - To access the data in the S3 cluster via a browser, add the self-signed certificate to browser's exceptions.

- Acquire a key and a trusted wildcard SSL certificate for endpoint's bottom-level domain. For example, the endpoint `s3.storage.example.com` would need a wildcard certificate for `*.s3.storage.example.com` with the subject alternative name `s3.storage.example.com`.

  If you acquired an SSL certificate from an intermediate certificate authority (CA), you should have an end-user certificate along with a CA bundle that contains the root and intermediate certificates. To be able to use these certificates, you need to merge them into a chain first. A certificate chain includes the end-user certificate, the certificates of intermediate CAs, and the certificate of a trusted root CA. In this case, an SSL certificate can only be trusted if every certificate in the chain is properly issued and valid.

For example, if you have an end-user certificate, two intermediate CA certificates, and a root CA certificate, create a new certificate file and add all certificates to it in the following order:

```
# End-user certificate issued by the intermediate CA 1
-----BEGIN CERTIFICATE-----
MIICiDCCAg2gAwIBAgIQNfwmXNmET8k9Jj1X<...>
-----END CERTIFICATE-----
# Intermediate CA 1 certificate issued by the intermediate CA 2
-----BEGIN CERTIFICATE-----
MIIEIDCCAwigAwIBAgIQNE7VVyDV7exJ9ON9<...>
-----END CERTIFICATE-----
# Intermediate CA 2 certificate issued by the root CA
-----BEGIN CERTIFICATE-----
MIIC8jCCAdqgAwIBAgICZngwDQYJKoZIhvcN<...>
-----END CERTIFICATE-----
# Root CA certificate
-----BEGIN CERTIFICATE-----
MIIDODCCAiCgAwIBAgIGIAYFFnACMA0GCSqG<...>
-----END CERTIFICATE-----
```

Upload the prepared certificate, and, depending on its type, do one of the following:

- specify the passphrase (PKCS#12 files);
- upload the SSL key.

You can change the redundancy mode later on the **S3** > **OVERVIEW** > **Protocol settings** panel. Click **Proceed**.

10. If required, click **Configure Acronis Notary** and specify **Notary DNS name** and **Notary user key**.
11. Click **Done** to create an S3 cluster.

After the S3 cluster is created, open the **S3 Overview** screen to view cluster status, hostname, used disk capacity, the number of users, I/O activity, and the state of S3 services.

To check if the S3 cluster is successfully deployed and can be accessed by users, visit https://<S3_DNS_name> or http://<S3_DNS_name> in your browser. You should receive the following XML response:

```
<Error>
<Code>AccessDenied</Code>
<Message/>
</Error>
```

To start using the S3 storage, you will also need to create at least one S3 user.

5.2.5 Managing S3 Users

The concept of S3 user is one of the base concepts of object storage along with those of object and bucket (container for storing objects). The Amazon S3 protocol uses a permission model based on access control lists (ACLs) where each bucket and each object is assigned an ACL that lists all users with access to the given resource and the type of this access (read, write, read ACL, write ACL). The list of users includes the entity owner assigned to every object and bucket at creation. The entity owner has extra rights compared to other users. For example, the bucket owner is the only one who can delete that bucket.

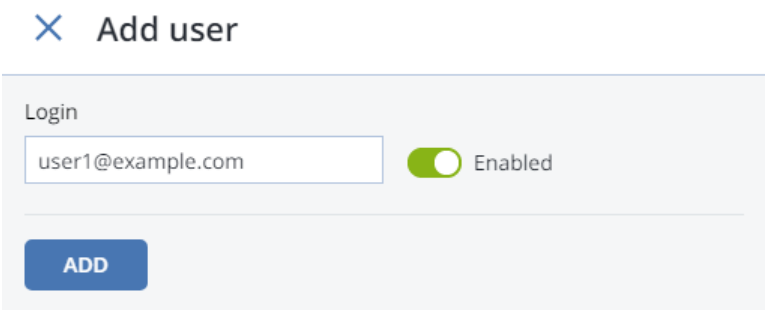
User model and access policies implemented in Acronis Cyber Infrastructure comply with the Amazon S3 user model and access policies.

User management scenarios in Acronis Cyber Infrastructure are largely based on the Amazon Web Services user management and include the following operations: create, query, and delete users as well as generate and revoke user access key pairs.

5.2.5.1 Adding S3 Users

To add an S3 user, do the following:

1. On the **STORAGE SERVICES** > **S3** > **USERS** screen, click **ADD USER**.
2. Specify a valid email address as login for the user and click **ADD**.



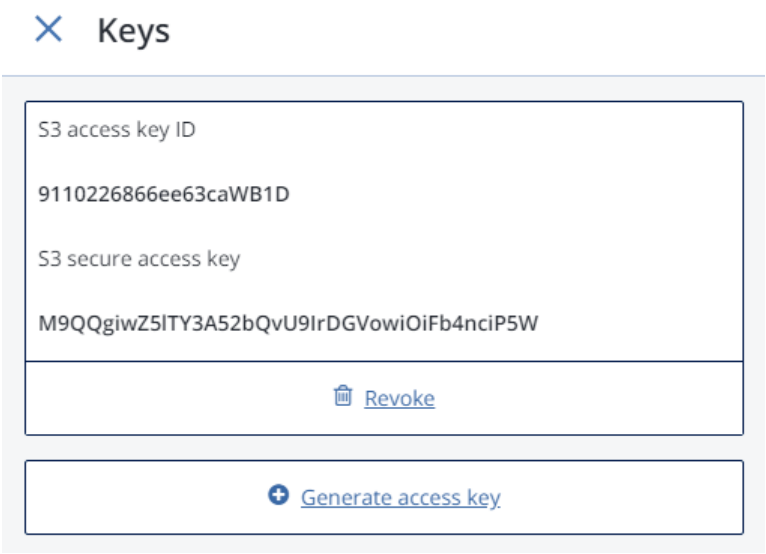
5.2.5.2 Managing S3 Access Key Pairs

Each S3 user has one or two key pairs (access key and secret key) for accessing the S3 cloud. You can think of the access key as login and the secret key as password. (For more information about S3 key pairs, refer to the Amazon documentation.) The access keys are generated and stored locally in the storage cluster on S3 name servers. Each user can have up to two key pairs. It is recommended to periodically revoke old and

generate new access key pairs.

To view, add, or revoke the S3 access key pairs for an S3 user, do the following:

1. Select a user in the list and click **Keys**.



2. The existing keys will be shown on the **Keys** panel.
   - To revoke a key, click **Revoke**.
   - To add a new key, click **Generate access key**.

To access a bucket, a user will need the following information:

- admin panel IP address,
- DNS name of the S3 cluster specified during configuration,
- S3 access key ID,
- S3 secret access key,
- SSL certificate if the HTTPS protocol was chosen during configuration.

  The certificate file can be found in the `/etc/nginx/ssl/` directory on any node hosting the S3 gateway service.

To automatically log in to S3 with user credentials using the generated keys, select a user and click **Browse**.

To **Browse** using an SSL certificate, make sure it is valid or, in case of a self-signed one, add it to browser's exceptions.

5.2.6 Managing S3 Buckets

All objects in Amazon S3-like storage are stored in containers called “buckets”. Buckets are addressed by names that are unique in the given object storage, so an S3 user of that object storage cannot create a bucket that has the same name as a different bucket in the same object storage. Buckets are used to:

- group and isolate objects from those in other buckets,
- provide ACL management mechanisms for objects in them,
- set per-bucket access policies, for example, versioning in the bucket.

In the current version of Acronis Cyber Infrastructure, you can enable and disable Acronis Notary for object storage buckets and monitor the space used by them on the **STORAGE SERVICES** > **S3** > **Buckets** screen. You cannot create and manage object storage buckets from Acronis Cyber Infrastructure admin panel. However, you can do it via the Acronis Cyber Infrastructure user panel or by using a third-party application. For example, the applications listed below allow you to perform the following actions:

- CyberDuck: create and manage buckets and their contents.
- MountainDuck: mount object storage as a disk drive and manage buckets and their contents.
- Backup Exec: store backups in the object storage.

5.2.6.1 Listing S3 Bucket Contents

You can list bucket contents with a web browser. To do this, visit the URL that consists of the external DNS name for the S3 endpoint that you specified when creating the S3 cluster and the bucket name. For example, `mys3storage.example.com/mybucket` or `mybucket.mys3storage.example.com` (depending on DNS configuration).

You can also copy the link to bucket contents by right-clicking it in CyberDuck, and then selecting **Copy URL**.

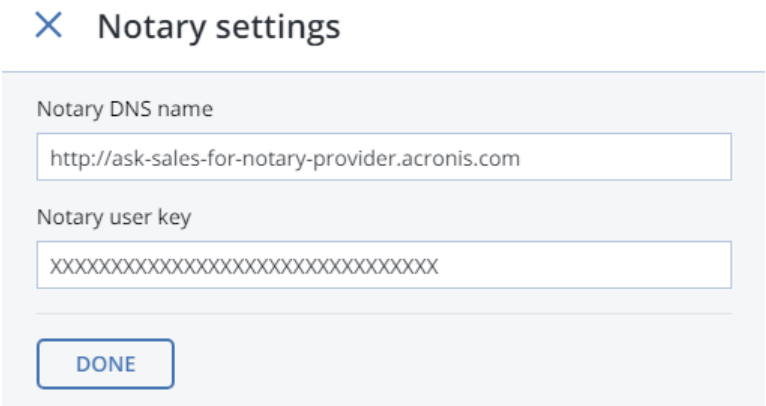
5.2.6.2 Managing Acronis Notary in S3 Buckets

Acronis Cyber Infrastructure offers integration with the Acronis Notary service to leverage blockchain notarization and ensure the immutability of data saved in object storage clusters. To use Acronis Notary in user buckets, you need to set it up in the S3 cluster and enable it for said buckets.

To set up Acronis Notary, do the following:

1. Get the DNS name and the user key for the notary service from your sales contact.

2. On the **STORAGE SERVICES** > **S3** screen, click **Notary settings**.
3. On the **Notary Settings** screen, specify the DNS name and user key in the respective fields and click **Done**.



To enable or disable blockchain notarization for a bucket, select a bucket on the **STORAGE SERVICES** > **S3** > **Buckets** screen and click **Enable Notary** or **Disable Notary**, respectively.

Notarization is disabled for new buckets by default.

Once you enable notarization for a bucket, certificates are created automatically only for the newly uploaded files. The previously uploaded files are left unnotarized. Once a file was notarized, it will remain notarized even if you disable notarization later.

5.2.7 Best Practices for Using S3 in Acronis Cyber Infrastructure

This section offers recommendations on how to best use the S3 feature of Acronis Cyber Infrastructure.

5.2.7.1 S3 Bucket and Key Naming Policies

It is recommended to use bucket names that comply with DNS naming conventions:

- can be from 3 to 63 characters long,
- must start and end with a lowercase letter or number,
- can contain lowercase letters, numbers, periods (.), hyphens (-), and underscores (_),
- can be a series of valid name parts (described previously) separated by periods.

An object key can be a string of any UTF-8 encoded characters up to 1024 bytes long.

5.2.7.2 Improving Performance of PUT Operations

Object storage supports uploading objects as large as 5 GB per single PUT request (5 TB via multipart upload). Upload performance can be improved by splitting large objects into pieces and uploading them concurrently (thus dividing the load between multiple OS services) with multipart upload API.

It is recommended to use multipart uploads for objects larger than 5 MB.

5.2.8 Replicating S3 Data Between Datacenters

Acronis Cyber Infrastructure can store replicas of S3 cluster data and keep them up-to-date in multiple geographically distributed datacenters with S3 clusters based on Acronis Cyber Infrastructure.
Geo-replication reduces the response time for local S3 users accessing the data in a remote S3 cluster or remote S3 users accessing the data in a local S3 cluster as they do not need to have an Internet connection.

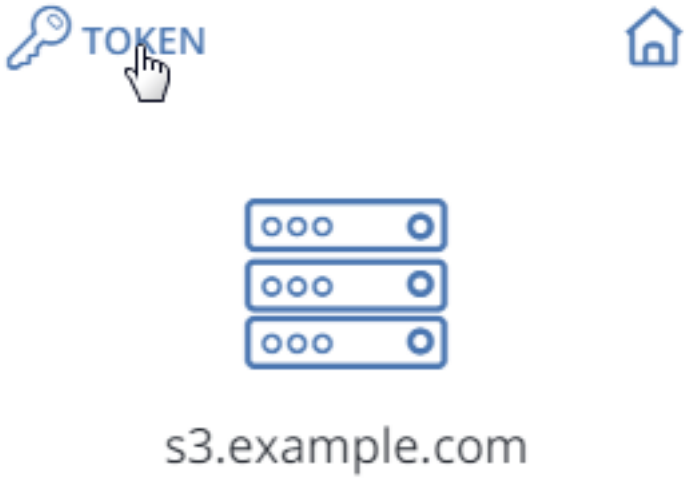
Geo-replication schedules the update of the replicas as soon as any data is modified. Geo-replication performance depends on the speed of Internet connection, the redundancy mode, and cluster performance.

If you have multiple datacenters with enough free space, it is recommended to set up geo-replication between S3 clusters residing in these datacenters.

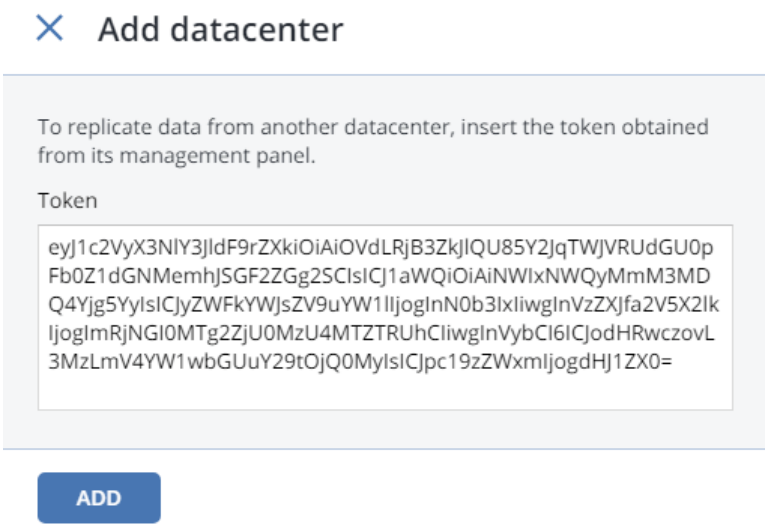
Important: Each cluster must have its own SSL certificate signed by a global certificate authority.

To set up geo-replication between S3 clusters, exchange tokens between datacenters as follows:

1. In the admin panel of a remote datacenter, open the **STORAGE SERVICES** > **S3** > **GEO-REPLICATION** screen.



2. In the section of the home S3 cluster, click **TOKEN** and, on the **Get token** panel, copy the token.
3. In the admin panel of the local datacenter, open the **STORAGE SERVICES** > **S3** > **GEO-REPLICATION** screen and click **ADD DATACENTER**.



4. Enter the copied token and click **Done**.
5. Configure the remote S3 cluster the same way.

5.2.9 Monitoring S3 Access Points

The S3 monitoring screen enables you to inspect the availability of each S3 component as well as the performance of NS and OS services (which are highly available).

If you see that some of the NS or OS services are offline, it means that the S3 access point does not function properly, and you should contact support consult the CLI guide for low-level troubleshooting. S3 gateways are not highly available, but DNS load balancing should be enough to avoid downtime if the gateway fails.

The performance charts represent the number of operations that the OS/NS services are performing.

5.2.10 Releasing Nodes from S3 Clusters

Before releasing a node, make sure that the cluster has enough nodes running name and object servers as well as gateways left.

> **Warning:** When the last node in the S3 cluster is removed, the cluster is destroyed, and all the data is deleted.

To release a node from an S3 cluster, do the following:

1. On the **STORAGE SERVICES** > **S3** > **Nodes** screen, check the box of the node to release.
2. Click **Release**.

5.2.11 Supported Amazon S3 Features

This section lists Amazon S3 operations, headers, and authentication schemes supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol.

5.2.11.1 Supported Amazon S3 REST Operations

The following Amazon S3 REST operations are currently supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol:

Supported service operations: GET Service.

Supported bucket operations:

- DELETE/HEAD/PUT Bucket
- GET Bucket (List Objects)
- GET/PUT Bucket acl
- GET Bucket location (returns `US East`)
- GET Bucket Object versions
- GET/PUT Bucket versioning
- List Multipart Uploads

Supported object operations:

- DELETE/GET/HEAD/POST/PUT Object
- Delete Multiple Objects
- PUT Object - Copy
- GET/PUT Object acl
- Delete Multiple Objects
- Abort Multipart Upload
- Complete Multipart Upload
- Initiate Multipart Upload
- List Parts
- Upload Part

Note: For more information on Amazon S3 REST operations, see Amazon S3 REST API documentation.

5.2.11.2 Supported Amazon Request Headers

The following Amazon S3 REST request headers are currently supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol:

- Authorization
- Content-Length
- Content-Type
- Content-MD5
- Date
- Host
- x-amz-content-sha256
- x-amz-date
- x-amz-security-token

The following Amazon S3 REST request headers are ignored:

- Expect
- x-amz-security-token

Note: For more information on Amazon S3 REST request headers, see the Amazon S3 REST API documentation.

5.2.11.3 Supported Amazon Response Headers

The following Amazon S3 REST response headers are currently supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol:

- Content-Length
- Content-Type
- Connection
- Date
- ETag
- x-amz-delete-marker
- x-amz-request-id

- x-amz-version-id

The following Amazon S3 REST response headers are not used:

- Server
- x-amz-id-2

Note: For more information on Amazon S3 REST response headers, see the Amazon S3 REST API documentation.

5.2.11.4 Supported Amazon Error Response Headers

The following Amazon S3 REST error response headers are currently supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol:

- Code
- Error
- Message
- RequestId
- Resource

The following Amazon S3 REST error response headers are not supported:

- RequestId (not used)
- Resource

Note: For more information on Amazon S3 REST response headers, see the Amazon S3 REST API documentation.

5.2.11.5 Supported Authentication Scheme

The following authentication scheme is supported by the Acronis Cyber Infrastructure implementation of the Amazon S3 protocol:

- Signature Version 2.

5.3 Exporting Data via NFS

Acronis Cyber Infrastructure allows you to organize nodes into a highly available NFS cluster in which you can create NFS shares. In Acronis Cyber Infrastructure terms, an NFS share is an access point for a volume and as such it can be assigned an IP address or DNS name. The volume, in turn, can be assigned the usual properties: redundancy type, tier, and failure domain. In each share you can create multiple NFS exports which are actual exported directories for user data. Each export has, among other properties, a path that, combined with share's IP address, uniquely identifies the export on the network and allows you to mount it using standard commands.

On the technical side, NFS volumes are based on object storage. Aside from offering high availability and scalability, object storage eliminates the limit on the amount of files and the size of data you can keep in the NFS cluster. Each share is perfect for keeping billions of files of any size. However, such scalability implies IO overhead that is wasted on file size changes and rewrites. For this reason, an NFS cluster makes a perfect cold and warm file storage but is not recommended for hot and high performance, often rewritten data (like running virtual machines). Integration of Acronis Cyber Infrastructure with solutions from VMware, for example, is best done via iSCSI to achieve better performance.

Note: Acronis Cyber Infrastructure only supports NFS version 4 and newer, including pNFS.

5.3.1 Setting Up an NFS Cluster

Since NFS is based on object storage, creating an NFS cluster is similar to creating an S3 one. Do the following:

1. On the **INFRASTRUCTURE** > **Networks** screen, make sure that the **OSTOR private** and **NFS** traffic types are added to your networks.
2. In the left menu, click **STORAGE SERVICES** > **NFS**.

3. Select one or more nodes and click **Create NFS cluster** in the right menu.
4. Make sure the correct network interface is selected in the drop-down list.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.
5. Click **CREATE**.

After the NFS cluster has been created, you can proceed to creating NFS shares.

5.3.2 Creating NFS Shares

To create an NFS share, do the following:

1. On the **STORAGE SERVICES** > **NFS** > **SHARES** screen, click **ADD NFS SHARE**.
2. On the **Add NFS Share** panel, specify a unique name and an IP address, which must be unused and, if authentication is enabled, domain-resolvable. Click **PROCEED**.
3. In **Share size**, specify the size of the share in gigabytes. For users accessing exports, this value will be the filesystem size.
4. Select the desired tier, failure domain, and data redundancy type. For more details on these volume properties, see the *Installation Guide*.

   You will be able to change the redundancy mode later.
5. Click **DONE**.

After the share has been created, you can proceed to creating NFS exports.

5.3.3 Creating NFS Exports

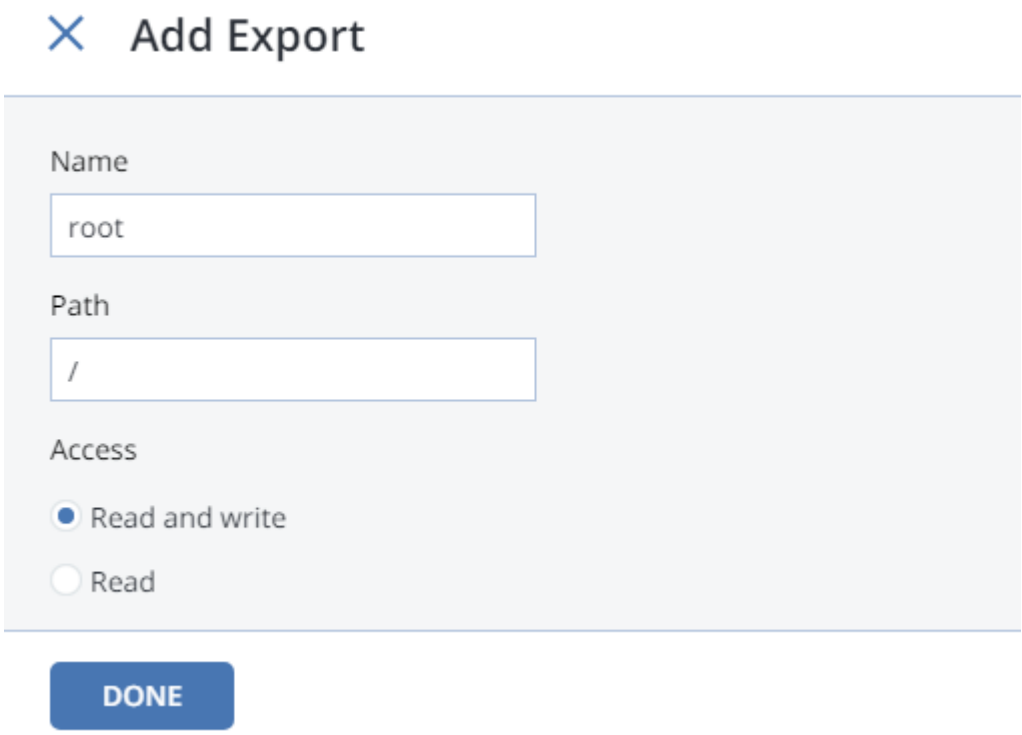
The process of creating NFS exports includes the following steps:

1. Creating a root export that will contain user exports.
2. Mounting the root export.
3. Creating user exports in the mounted root export.

5.3.3.1 Creating the Root Export

To create a root NFS export, do the following:

1. On the **STORAGE SERVICES** > **NFS** > **SHARES** screen, click the number in the **Exports** column in the row of the desired share. This will open the share screen.
2. On the share screen, click **ADD EXPORT**, specify `root` as the export name and `/` as path and select the `read and write` access mode.



This will create a directory with a default path that designates export location inside the share and is used (alongside share's IP address) to mount the export.

Important: Do not give the users access to the root export.

The root export will be shown in the export list.

After creating the root export, mount it as described in the *User's Guide*.

Warning: Do not mount NFS shares on cluster nodes. It may lead to node freeze.

5.3.3.2 Creating User Exports

After creating and mounting the root export, you can proceed to creating user NFS exports. To do this:

1. In the mounted root export, create a subdirectory for a user export, e.g., `export1`.
2. On the share screen, click **ADD EXPORT**, enter a user export name, specify `/export1` as path, and select the access mode.
3. Click **Done**.

The user export will appear in the export list.

5.3.4 Setting Up User Authentication and Authorization

Acronis Cyber Infrastructure allows you to authenticate users for access to specific NFS shares via Kerberos and authorize them to access specific NFS exports inside these shares via LDAP.

5.3.4.1 Authenticating NFS Share Users with Kerberos

To enable user authentication in an NFS share, do the following:

1. Assign a forward and reverse resolvable FQDN (fully qualified domain name) to share's IP address.
2. On the **SETTINGS** > **Security** > **KERBEROS** tab, specify the following Kerberos information:
    1. In **Realm**, your DNS name in uppercase letters.
    2. In **KDC service**, the DNS name or IP address of the host running the realm's KDC (key distribution center) service.
    3. In **KDC administration service**, the DNS name or IP address of the host running the realm's KDC administration service.

       Usually, the KDC and its administration service run on the same host.
3. On the Kerberos server, perform these steps:
    1. Log in as administrator to the Kerberos database administration program.

2. Add a principal for the share with the command `addprinc -randkey nfs/<share_FQDN>@<realm>`. For example:

```
# addprinc -randkey nfs/share1.example.com@example.com
```

3. Generate a keytab (key table) for the principal and save it to a directory you can upload from. For example:

```
# ktadd -k /tmp/krb5.keytab nfs/share1.example.com@example.com
```

4. On the **STORAGE SERVICES** > **NFS** > **SHARE** tab, select a share and click **Authentication**.
5. Upload the keytab file and click **SAVE**.

Important: Each share and client (user that mounts the export) must have their own principal and keytab.

5.3.4.2 Authorizing NFS Export Users with LDAP

By configuring access to a user directory via LDAP, you can control which users can access which NFS exports. You will need a directory of user accounts with desired NFS access parameters.

To configure access to an LDAP server, do the following:

1. On the **SETTINGS** > **Security** > **LDAP** tab, specify the following information:
   - **Address**, the IP address of the LDAP server;
   - **Base DN**, the distinguished name of the search starting point;
2. Click **Save**.

5.4 Connecting Acronis Backup Software to Storage Backends via Backup Gateway

The Backup Gateway storage access point (also called “gateway”) is intended for service providers who use Acronis Backup Cloud and/or Acronis Backup Advanced and want to organize an on-premise storage for their clients’ backed-up data.

Backup Gateway enables a service provider to easily configure storage for the proprietary

deduplication-friendly data format used by Acronis.

Backup Gateway supports the following storage backends:

- storage clusters with software redundancy by means of erasure coding
- NFS shares
- public clouds, including a number of S3 solutions as well as Microsoft Azure, OpenStack Swift, and Google Cloud Platform

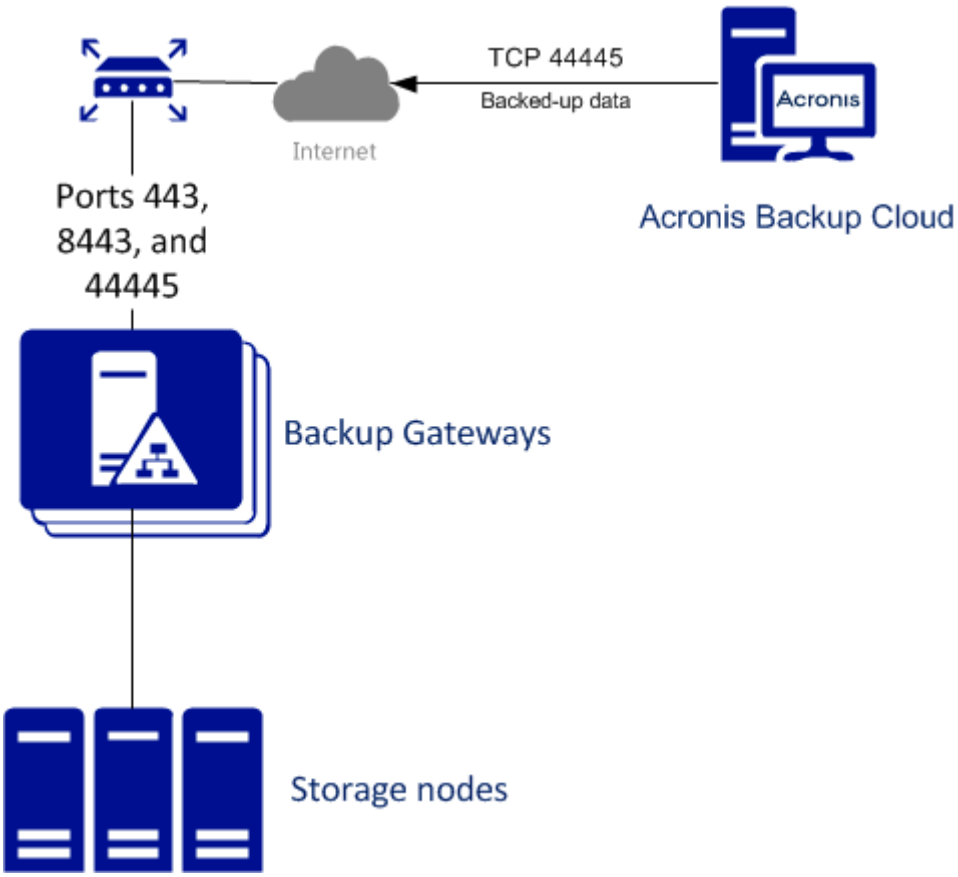
While your choice should depend on scenario and requirements, it is recommended to keep Acronis backup data in the local storage cluster. In this case, you can have the best performance due to WAN optimizations and data locality. Keeping backups in an NFS share or a public cloud implies the unavoidable data transfer and other overhead, which reduces overall performance.

Take note of the following:

- When configuring Backup Gateway, you will need to provide the credentials of your administrator account in the Acronis backup software.
- In cases when not local but external storage (e.g., NFS) is used with Backup Gateway, redundancy has to be provided by the said external storage. Backup Gateway does not provide data redundancy or perform data deduplication itself.

5.4.1 Understanding the Infrastructure

The Backup Gateway storage access point runs as services on the Acronis Cyber Infrastructure nodes. It is recommended to deploy it on two or more nodes for high availability.



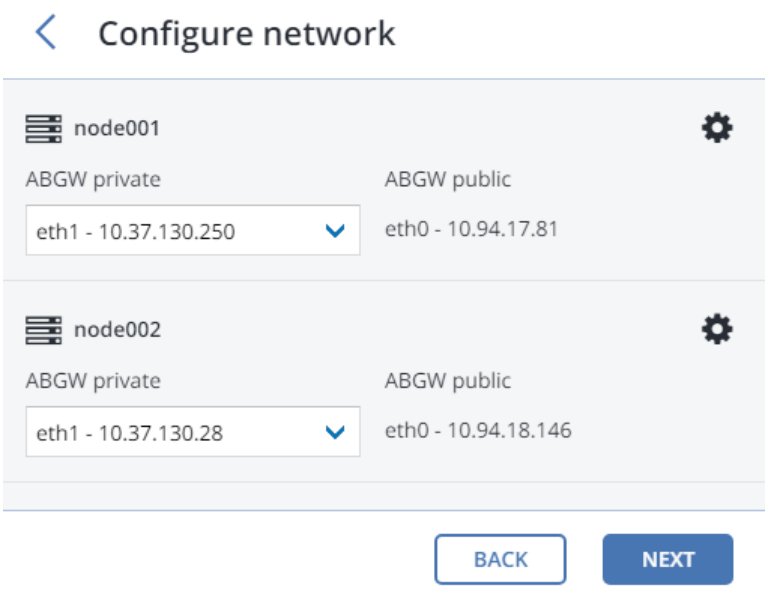
5.4.2 Connecting to the Local Storage Cluster via Backup Gateway

Before you proceed, make sure that the destination storage has enough space for both existing and new backups.

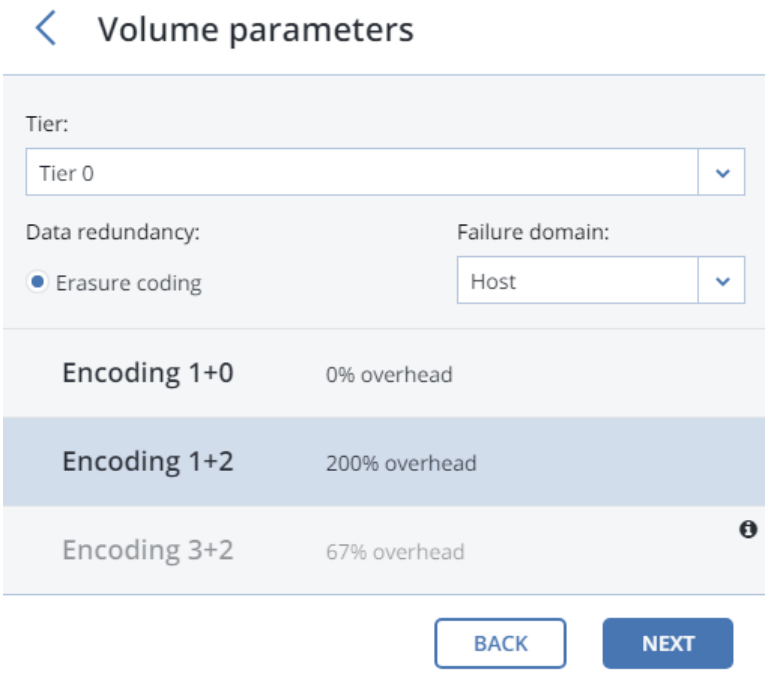
To set up Backup Gateway, do the following:

1. On the **INFRASTRUCTURE** > **Networks** screen, make sure that the **ABGW private** and **ABGW public** traffic types are added to your networks.
2. In the left menu, click **STORAGE SERVICES** > **Backup storage**.
3. Select the node(s) to run the gateway services on and click **Create gateway** in the right menu.
4. Select **This Acronis cluster** as storage type.
5. Make sure the correct network interface is selected in the drop-down list. Click **NEXT**.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.



6. On the **Volume Parameters** tab, select the desired tier, failure domain, and data redundancy mode.



Redundancy by replication is not supported for Backup Gateway.

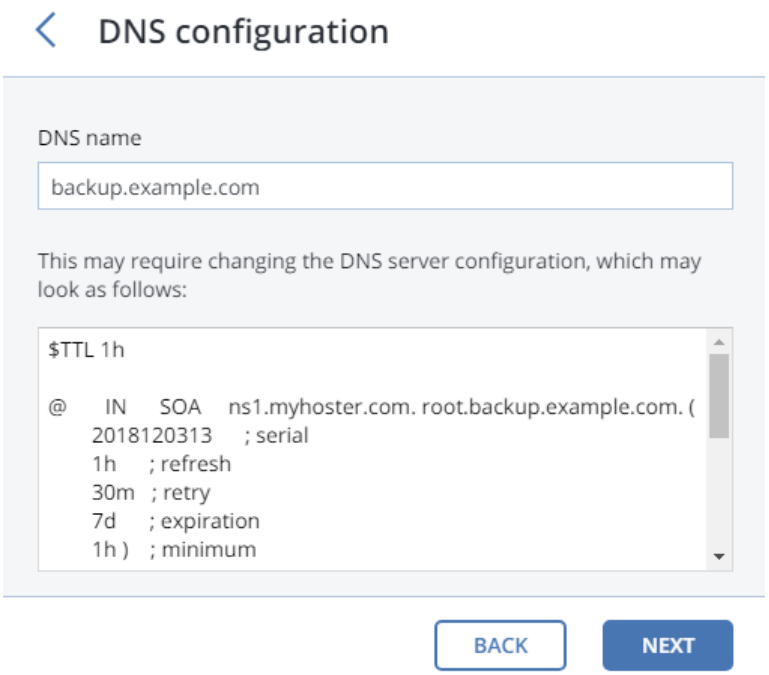
You can later change the erasure coding mode on the **Backup** > **Parameters** panel.

7. On the **DNS Configuration** tab, specify the external DNS name for this gateway, e.g, `backupgateway.example.com`. Make sure that each node running the gateway service has a port open for

outgoing Internet connections and incoming connections from your Acronis backup software. Backup agents will use this address and port to upload the backup data.

Important: Configure your DNS server according to the example suggested in the admin panel.

Important: Each time you change nodes in the Backup Gateway cluster, adjust the DNS settings accordingly.



Click **Next**.

8. On the **Register in backup software** pane, specify the following information for your Acronis product:
   - In **Address**, specify the address of the Acronis Backup Cloud management portal (e.g., https://cloud.acronis.com/) or the hostname/IP address and port of the Acronis Backup Advanced management server (e.g., http://192.168.1.2:9877).
   - In **Account**, specify the credentials of a partner account in the cloud or of an organization administrator on the local management server.
9. Finally, click **DONE**.

5.4.3 Connecting to External NFS Shares via Backup Gateway

Take note of these limitations:

- Acronis Cyber Infrastructure does not provide data redundancy on top of NFS volumes. Depending on the implementation, NFS shares may use their own hardware or software redundancy.
- In the current version of Acronis Cyber Infrastructure, only one cluster node may store backups on an NFS volume.

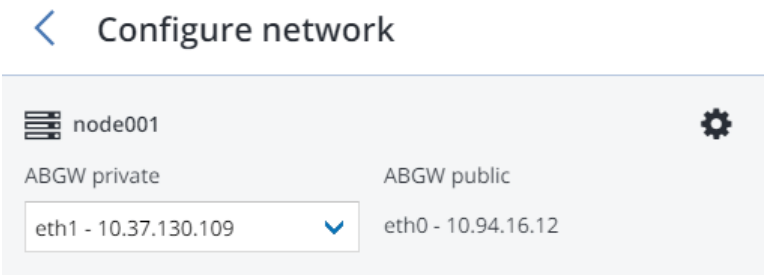
Before you proceed, make sure that:

1. The NFS share has enough space for backups.
2. Each NFS export is used by only one gateway. In particular, do not configure two Acronis Cyber Infrastructure installations to use the same NFS export for backup storage.

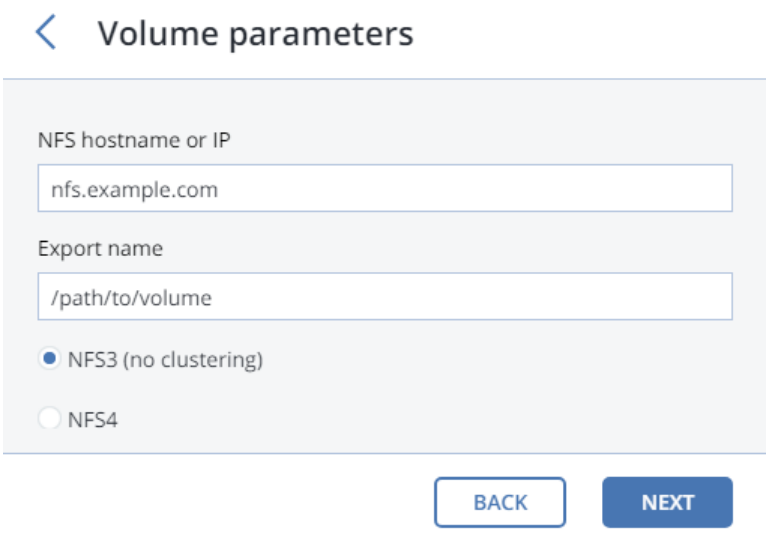
To set up Backup Gateway, do the following:

1. On the **INFRASTRUCTURE** > **Networks** screen, make sure that the **ABGW private** and **ABGW public** traffic types are added to your networks.
2. In the left menu, click **STORAGE SERVICES** > **Backup storage**.
3. Select the node(s) to run the gateway services on and click **Create gateway** in the right menu.
4. Select **Network File System** as storage type.
5. Make sure the correct network interface is selected in the drop-down list. Click **NEXT**.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.



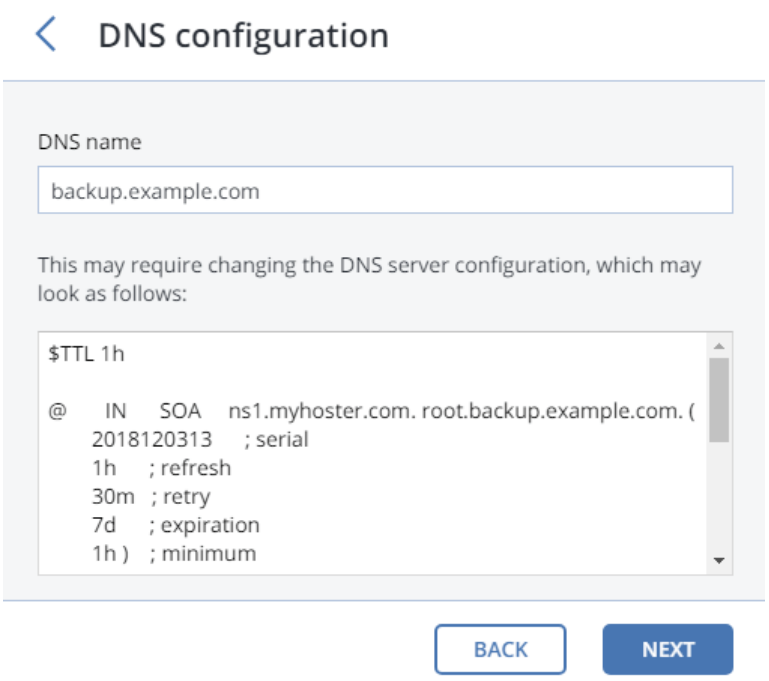
6. On the **Volume Parameters** tab, specify the hostname or IP address of the NFS share as well as the export name. Click **NEXT**.



7. On the **DNS Configuration** tab, specify the external DNS name for this gateway, e.g, `backupgateway.example.com`. Make sure that each node running the gateway service has a port open for outgoing Internet connections and incoming connections from your Acronis backup software. Backup agents will use this address and port to upload the backup data.

Important: Configure your DNS server according to the example suggested in the admin panel.

Important: Each time you change nodes in the Backup Gateway cluster, adjust the DNS settings accordingly.



Click **Next**.

8. On the **Register in backup software** pane, specify the following information for your Acronis product:
   - In **Address**, specify the address of the Acronis Backup Cloud management portal (e.g., https://cloud.acronis.com/) or the hostname/IP address and port of the Acronis Backup Advanced management server (e.g., http://192.168.1.2:9877).
   - In **Account**, specify the credentials of a partner account in the cloud or of an organization administrator on the local management server.
9. Finally, click **DONE**.

5.4.4 Connecting to Public Cloud Storage via Backup Gateway

With Backup Gateway, you can have Acronis Backup Cloud or Acronis Backup Advanced store backups in a number of public clouds: Amazon S3, IBM Cloud, Alibaba Cloud, IIJ, Cleversafe, Microsoft Azure, Swift object storage, Softlayer (Swift), Google Cloud Platform, Wasabi, as well as solutions using S3 with the older AuthV2-compatible authentication methods. However, compared to the local storage cluster, storing backup data in a public cloud increases the latency of all I/O requests to backups and reduces performance. For this reason, it is recommended to use the local storage cluster as storage backend.

Since backups are cold data with specific access rights, it is cost-efficient to use storage classes that are intended for long-term storage of infrequently accessed data. The recommended storage classes include the following:

- Infrequent Access for Amazon S3
- Cool Blob Storage for Microsoft Azure
- Nearline and Coldline Storage for Google Cloud Platform

Note that real data storage costs may be 10-20% higher due to additional fees for operations like data retrieval and early deletion.

5.4.4.1 Important Requirements and Restrictions

- When working with public clouds, Backup Gateway uses the local storage as the staging area as well as to keep service information. It means that the data to be uploaded to a public cloud is first stored locally and only then sent to the destination. For this reason, it is vital that the local storage is persistent and redundant so the data does not get lost. There are multiple ways to ensure the persistence and redundancy of local storage. You can deploy Backup Gateway on multiple cluster nodes and select a good redundancy mode. If Acronis Cyber Infrastructure with the gateway is deployed on a single physical node, you can make the local storage redundant by replicating it among local disks. If Acronis Cyber Infrastructure with the gateway is deployed in a virtual machine, make sure it is made redundant by the virtualization solution it runs on.
- Make sure the local storage cluster has plenty of logical space for staging. For example, if you perform backup daily, provide enough space for at least 1.5 days' worth of backups. If the daily backup total is 2TB, provide at least 3TB of logical space. The required raw storage will vary depending on the encoding mode: 9TB (3TB per node) in the 1+2 mode, 5TB (1TB per node) in the 3+2 mode, etc.
- If you are to store backups in an Amazon S3 cloud, keep in mind that Backup Gateway may sometimes block access to such backups due to the eventual consistency of Amazon S3. It means that Amazon S3 may occasionally return stale data as it needs time to render the most recent version of the data accessible. Backup Gateway detects such delays and protects backup integrity by blocking access until the cloud updates.
- Use a separate object container for each Backup Gateway cluster.

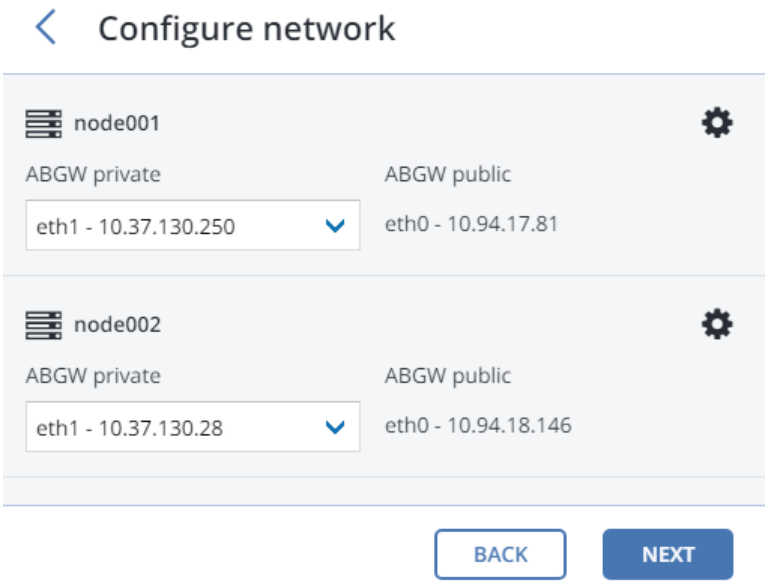
5.4.4.2 Setting Up Backup Gateway

Before you proceed, make sure that the destination storage has enough space for both existing and new backups.

To set up Backup Gateway, do the following:

1. On the **INFRASTRUCTURE** > **Networks** screen, make sure that the **ABGW private** and **ABGW public** traffic types are added to your networks.
2. In the left menu, click **STORAGE SERVICES** > **Backup storage**.
3. Select the node(s) to run the gateway services on and click **Create gateway** in the right menu.
4. Select **Public Cloud** as storage type.
5. Make sure the correct network interface is selected in the drop-down list. Click **NEXT**.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.



6. On the **Public cloud parameters** pane, do the following:
   1. Select a public cloud provider. If your provider is S3-compatible but not in the list, try **AuthV2 compatible**.
   2. Depending on the provider, specify **Region**, **Authentication (keystone) URL**, or **Endpoint URL**.

3. In case of Swift object storage, specify the authentication protocol version and attributes required by it.
4. Specify user credentials. In case of Google Cloud, select a JSON file with keys to upload.
5. Specify the folder (bucket, container) to store backups in. The folder must be writeable.

   Use a separate object container for each Backup Gateway cluster.

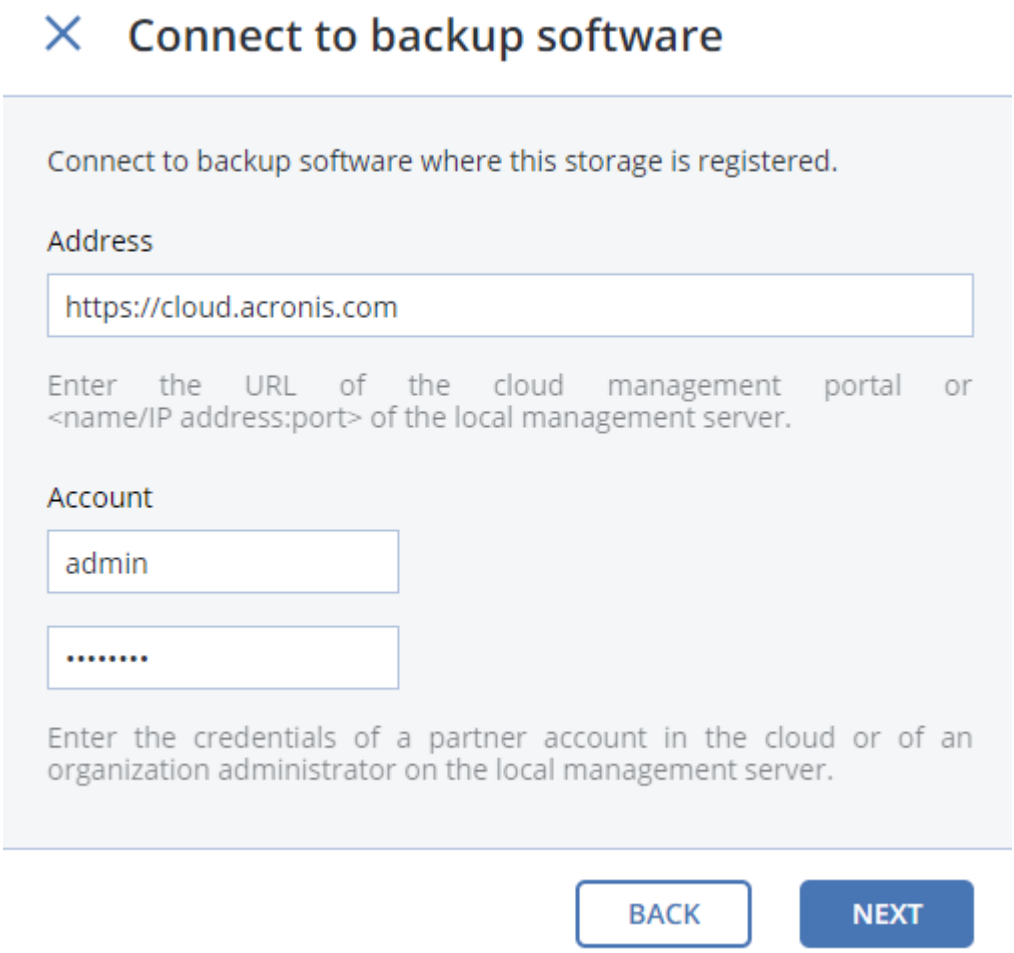
Click **NEXT**.

7. On the **Register in backup software** pane, specify the following information for your Acronis product:
   - In **Address**, specify the address of the Acronis Backup Cloud management portal (e.g., https://cloud.acronis.com/) or the hostname/IP address and port of the Acronis Backup Advanced management server (e.g., http://192.168.1.2:9877).
   - In **Account**, specify the credentials of a partner account in the cloud or of an organization administrator on the local management server.
8. Finally, click **DONE**.

5.4.5 Updating certificate for Backup Gateway

When you register a Backup Gateway in Acronis Backup Cloud or Acronis Backup Advanced, they exchange certificates that are valid for one year. One and a half months before expiration, you will be alerted about the expiring certificate in the admin panel. To update the certificate, you need to connect to your backup software and renew the certificate. Do the following:

1. On the **STORAGE SERVICES** > **Backup storage** screen, click **Update certificate**.
2. On the **Connect to backup software** pane, specify the following information for your Acronis product:
   - In **Address**, specify the address of the Acronis Backup Cloud management portal (e.g., https://cloud.acronis.com/) or the hostname/IP address and port of the Acronis Backup Advanced management server (e.g., http://192.168.1.2:9877).
   - In **Account**, specify the credentials of a partner account in the cloud or of an organization administrator on the local management server.



3. Click **NEXT**.
4. On all nodes included into the ABGW cluster, restart the service:

```
# systemctl restart vstorage-abgw
```

5.4.6 Re-registering Backup Gateway in a New Acronis Backup Advanced

To switch a configured Backup Gateway to a different Acronis Backup Advanced instance, re-register the gateway with that instance. To do this:

1. On the **STORAGE SERVICES** > **Backup storage** screen, click **Re-register**.
2. On the **Re-registration in Acronis Backup** tab, specify the following:
   - In **Address**, specify the hostname/IP address of the target management server and the port 9877 (e.g., http://192.168.1.2:9877). Note that the address must be provided using the HTTP protocol,

not HTTPS.

- In **Account**, specify the credentials of the management server administrator account.

3. Click **DONE**.

5.4.7 Migrating Backups from Older Acronis Solutions

By means of Backup Gateway, you can migrate backups from Acronis Storage 1.5 and Acronis Storage Gateway 1.6 and 1.7 to a storage backend of your choice: the local storage cluster, external NFS, or public cloud.

Migration to NFS backends is not available, however, if multiple nodes are selected as Backup Gateway.

Important: Before you proceed, make sure that the destination storage has enough space for both existing and new backups.

The migration procedure can be described as follows:

1. Root credentials for SSH access to the chosen source storage are provided to Backup Gateway.
2. Backup Gateway sets up a proxy on the source storage that starts redirecting requests incoming from Acronis Backup Agents from the source storage to Backup Gateway.
3. Backup Gateway starts relocating backups to the chosen storage backend. The data that remains to be migrated is shown in the **Migration Backlog** section on the Backup Gateway **Overview** screen. When the backlog empties, all data has been migrated.

   After the migration has started, the data of new and incremental backups is stored on the destination storage. Backups from the source storage are pulled in the background. The entire process is transparent to backup agents, which continue working uninterrupted.
4. To be able to dispose of the source storage after migration completes, requests from Acronis Backup Agents are directed straight to Backup Gateway, bypassing the proxy on the source storage. Steps that you need to take depend on how the source storage is registered in Acronis Backup Cloud: under the IP address or DNS name.

   - If the source storage is already registered under the DNS name, you need to change the IP address behind it to those of the Backup Gateway nodes.

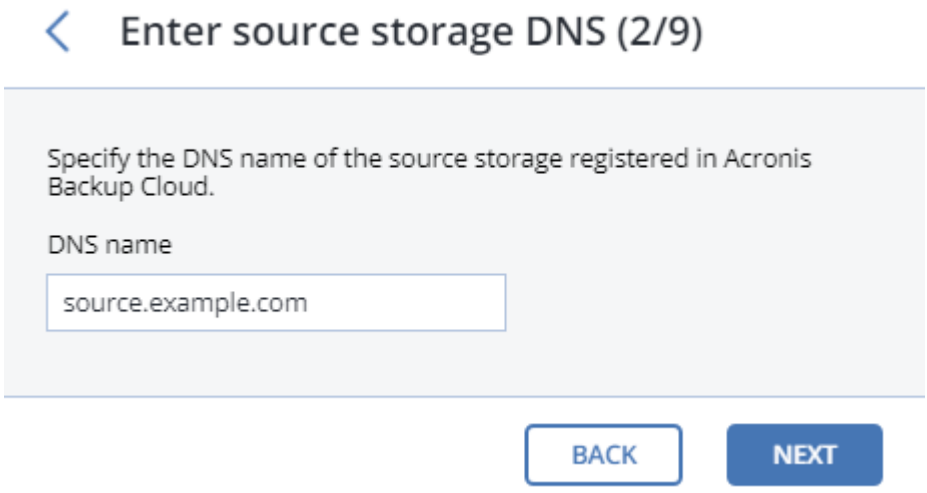
- If the source storage is registered under the IP address, it is strongly recommended to re-register Backup Gateway in Acronis Backup Cloud under a DNS name that resolves into the IP addresses of Backup Gateway nodes. Using a DNS name will provide a smoother transition and you will not need to reconfigure Acronis Backup Cloud even if you change nodes in the Backup Gateway (you will still need to adjust the IP addresses behind the DNS name accordingly).

  Alternatively, if you do not want to use a DNS name, you need to wait for the migration to complete, shut down both the source and destination machines, and reconfigure your network so that the public interface of the destination machine gets the IP address of the source machine.

The concrete steps that you need to perform in the admin panel to initiate backup migration are described in the next subsections.

5.4.7.1 Migrating Backups from Acronis Storage 1.5

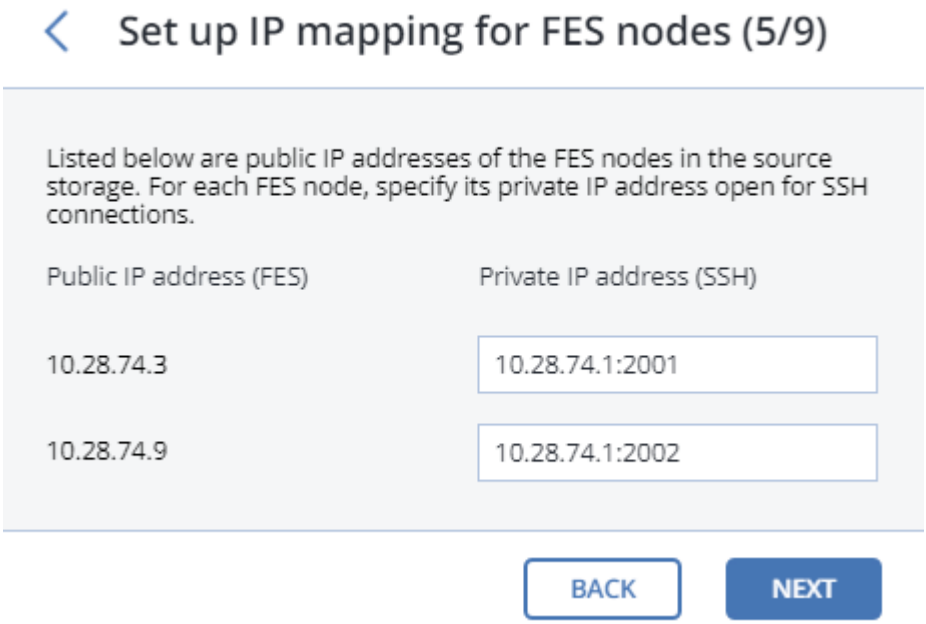
1. Update all Acronis Storage 1.5 nodes to version 1.5.65665 or newer as earlier versions are not eligible for migration. To do this, log in to the Acronis Storage web console, proceed to **SETTINGS** > **Software Update**, upload the latest ISO image, and click **Update**.
2. Log in to the new storage cluster and on the **STORAGE SERVICES** > **Backup storage** > **NODES** screen, select one or more nodes and click **Migrate**.
3. Select **Acronis Storage 1.5** and click **NEXT**.
4. Specify the DNS name of the source storage registered in Acronis Backup Cloud and click **NEXT**.



5. Provide the credentials for the cloud management portal of the Acronis Backup Cloud installation that

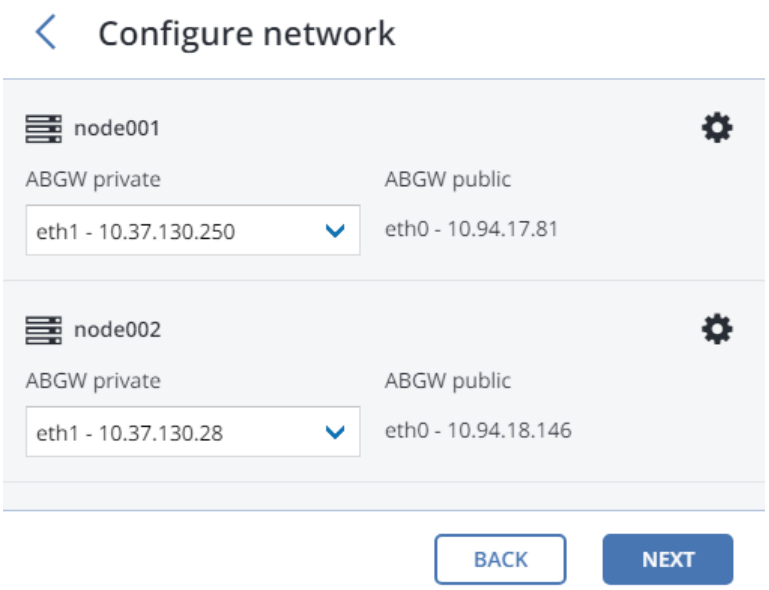
the source storage is registered in and click **NEXT**.

6. Enable SSH access on all FES nodes of Acronis Storage 1.5 as instructed and click **NEXT**.
7. Map the public IP addresses of FES nodes accessible via SSH to their private IP addresses and click **NEXT**. This step is required to access FES nodes via SSH through tunnels.



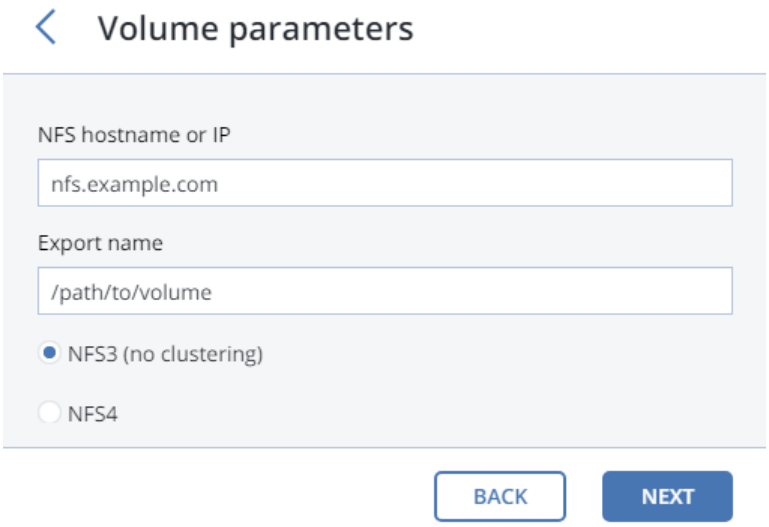
8. Choose a storage type to create a gateway to one of the destinations:
   - local storage cluster
   - external NFS
   - public cloud
9. Make sure the correct network interface is selected in the drop-down list. Click **NEXT**.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.



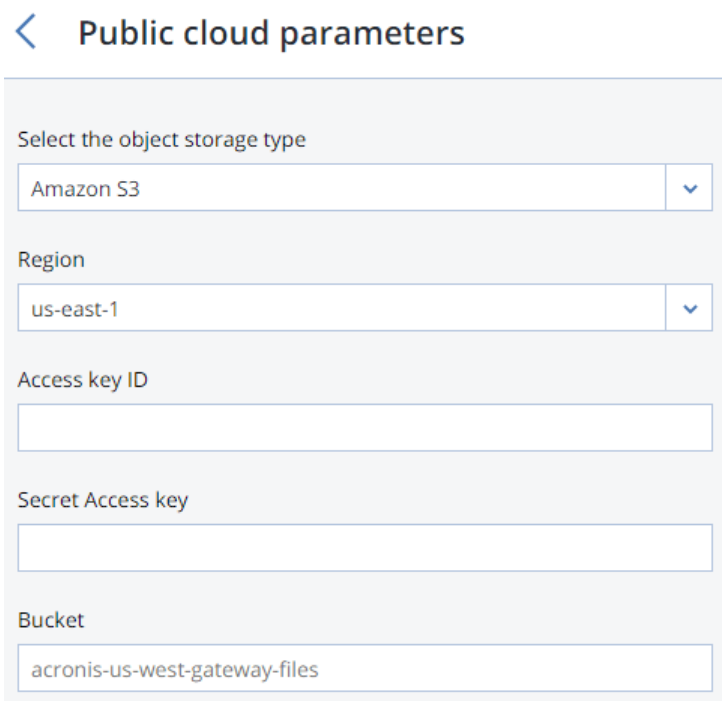
10. Configure the destination storage backend:

    - For a storage cluster, select the desired tier, failure domain, and redundancy mode.
    - For NFS, specify a hostname or IP address, an export name and path, and choose the NFS version.



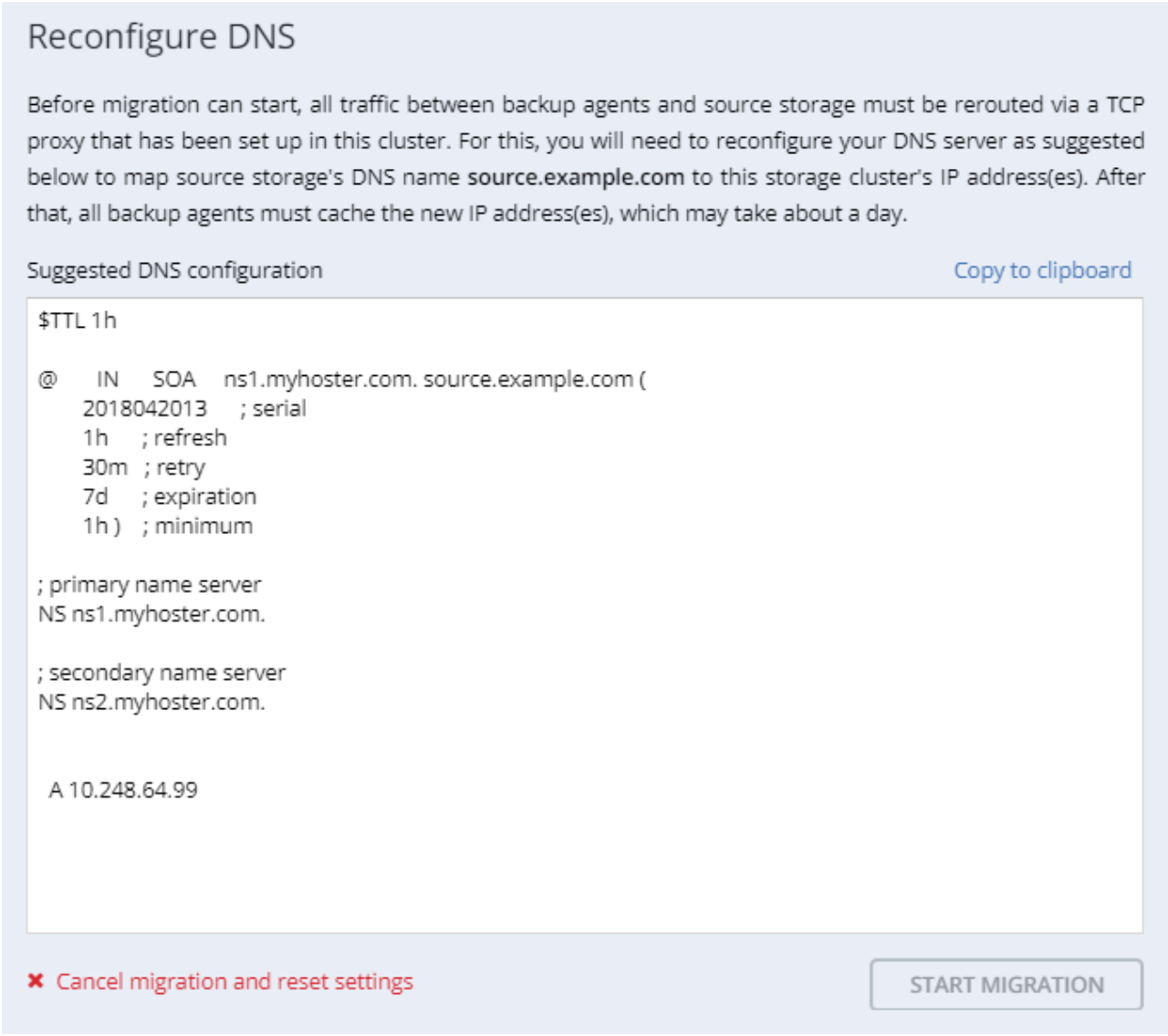
    - For a public cloud, select a public cloud provider, specify credentials, and the name of the folder (bucket, container).

      Use a separate object container for each Backup Gateway cluster.



Click **NEXT**.

11. Review the source and destination storages and click **PROCEED**.
12. On the next panel, follow the instructions to point the source storage DNS name to the IP addresses of your new storage cluster. Having updated the DNS configuration, wait for 24 hours for all backup agents to cache the new IP addresses. Until this happens, the **START MIGRATION** button will be disabled. After all backup agents have been rerouted to the new cluster, the button will become enabled and you can click it to start migration.



Depending on data size, migration may take as long as several days.

5.4.7.2 Migrating Backups from Acronis Storage Gateway 1.6 and 1.7 (NFS)

1. Disable the firewall or explicitly open TCP port 44446 on the source Acronis Storage Gateway.
   - To disable the firewall, run

     ```
     # systemctl stop firewalld
     ```

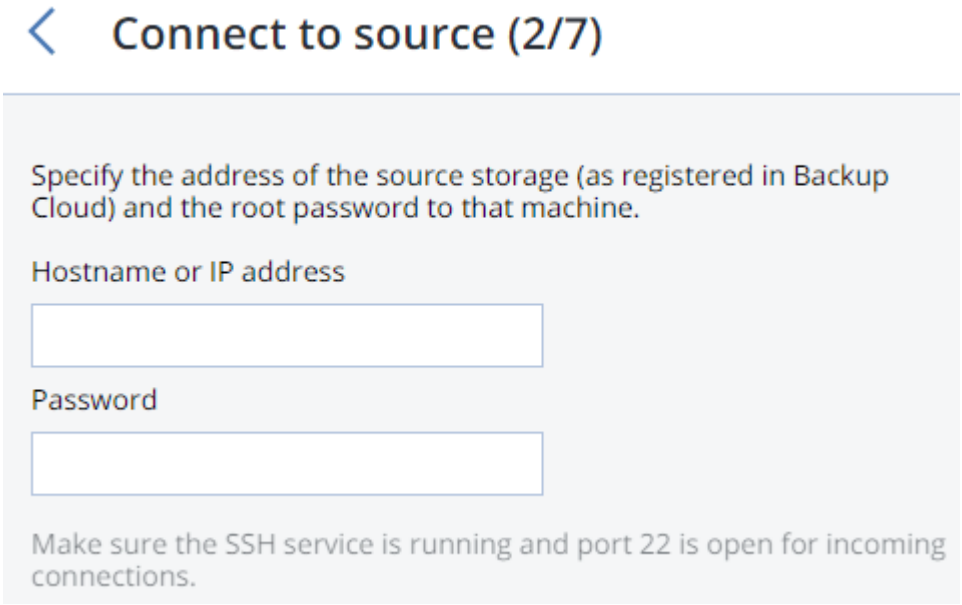
   - To open TCP port 44446 in the firewall, do the following:
     1. Find out the zone where port 44445 is open:

```
# firewall-cmd --list-all-zones | grep active
mix_eth0 (active)
```

2. Add the required port to the same zone:

```
# firewall-cmd --zone=mix_eth0 --permanent --add-port=44446/tcp
# firewall-cmd --reload
```

2. In the admin panel of the ABGW node, proceed to **STORAGE SERVICES** > **Backup storage** > **NODES**, select the node(s) to run the gateway services on, and click **Migrate**.
3. Select the source storage version and click **NEXT**.
4. Specify the connection details for the source storage and click **NEXT**.



5. Provide the credentials for the cloud management portal of the Acronis Backup Cloud installation that the source storage is registered in and click **NEXT**.
6. If the source storage is registered in Acronis Backup Cloud under an IP address, you will see the DNS configuration screen. On it, click **RE-REGISTER WITH DNS** and specify the source storage DNS name (recommended, see above). Or, if you want to keep using the IP address, click **PROCEED WITH IP**.

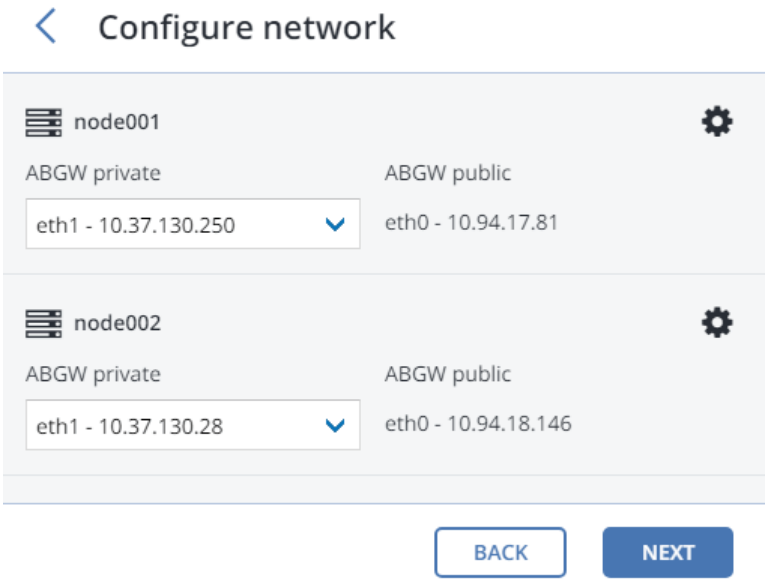
   If you specified a DNS name, configure your DNS server according to the suggested example.

Important: Each time you change nodes in the Backup Gateway cluster, adjust the DNS settings accordingly.

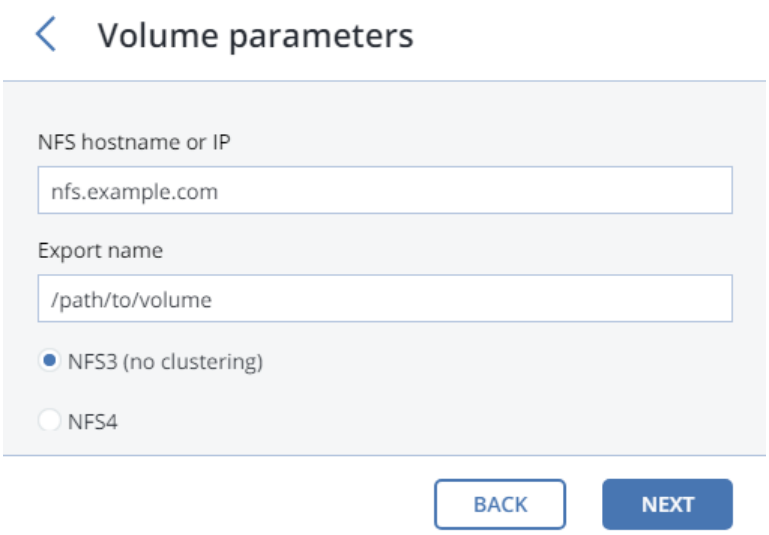
---

7. Choose a storage type to create a gateway to one of the destinations:
   - local storage cluster
   - external NFS
   - public cloud
8. Make sure the correct network interface is selected in the drop-down list. Click **NEXT**.

   If necessary, click the cogwheel icon and configure node's network interfaces on the **Network Configuration** screen.

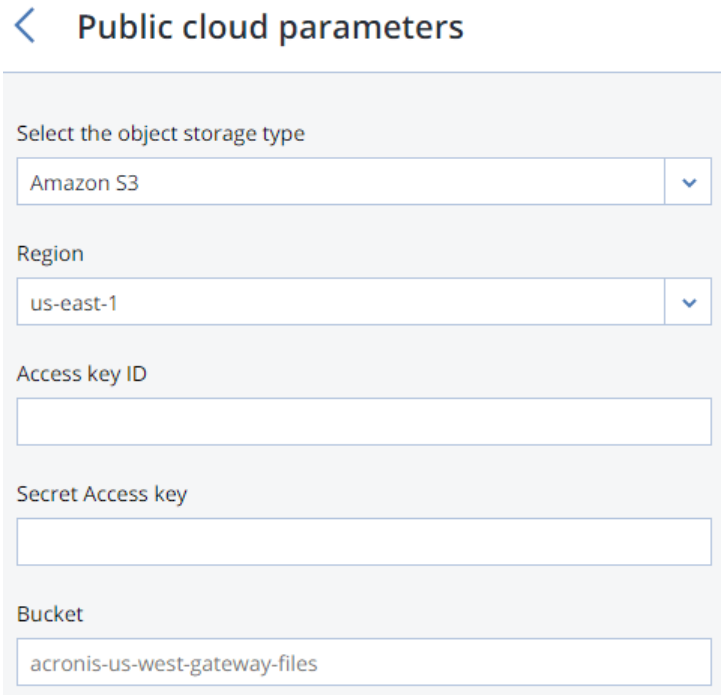


9. Configure the destination storage backend:
   - For a storage cluster, select the desired tier, failure domain, and redundancy mode.
   - For NFS, specify a hostname or IP address, an export name and path, and choose the NFS version.



- For a public cloud, select a public cloud provider, specify credentials, and the name of the folder (bucket, container).

  Use a separate object container for each Backup Gateway cluster.



Click **NEXT**.

10. Review the source and destination storages and click **START MIGRATION**.

Depending on data size, migration may take as long as several days.

5.4.8 Managing Geo-Replication for Backup Gateway

Acronis Cyber Infrastructure allows you to enable Backup Gateway replication between two geographically distributed datacenters registered in the Cloud Management Panel. It provides backup data protection against the primary datacenter failure. You can enable geo-replication for Backup Gateways that are set up on different storage backends: a local storage cluster, NFS share, or public cloud.

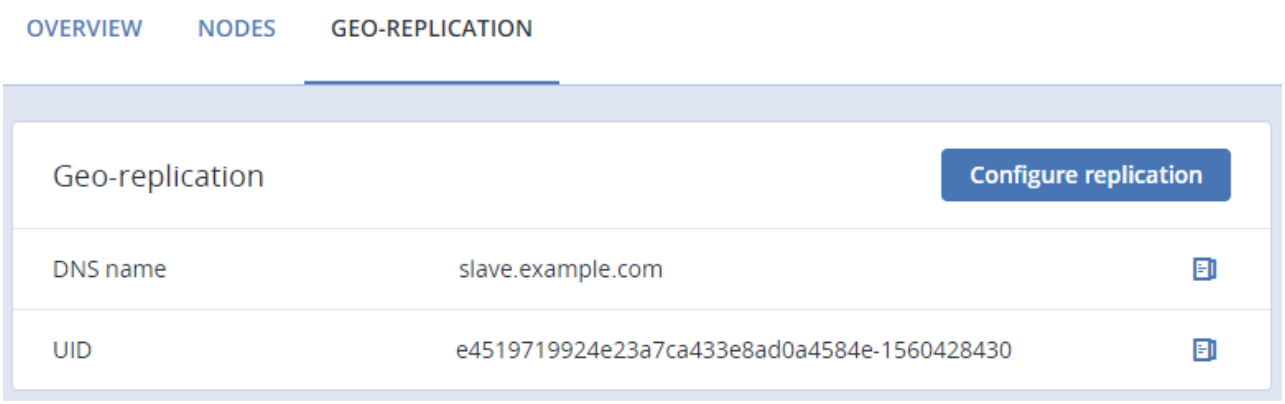
For successful geo-replication, the following requirements must be met:

- Two storage clusters with Backup Gateways are deployed.
- All storage clusters are updated to the latest version.
- All storage clusters are registered in the Cloud Management Panel.
- All storage clusters can reach each other via domain names on TCP port 44445.

5.4.8.1 Enabling Geo-Replication

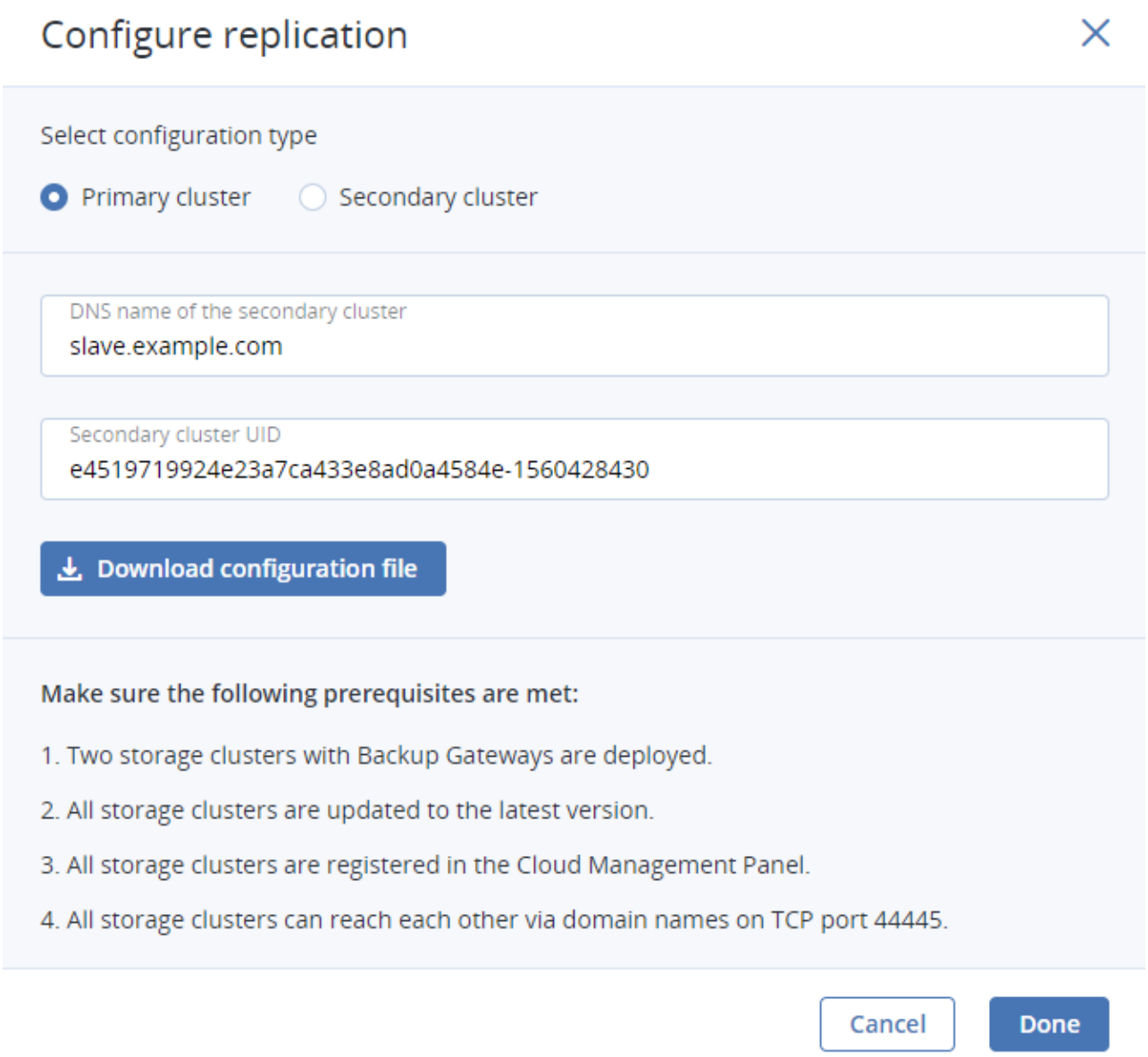
To set up geo-replication between two storage clusters, primary and secondary, do the following:

1. On the cluster that will be configured as secondary, click the copy icon next to the **DNS name** and **UID** fields to copy its DNS name and UID to clipboard.



2. On the cluster that will be configured as primary, click **Configure replication** and do the following in the **Configure replication** window:
    1. Paste the DNS name and UID of the secondary cluster into the corresponding fields.
    2. Click **Download configuration file** to download the configuration file of the primary cluster to your local server.

3. Click **Done**.

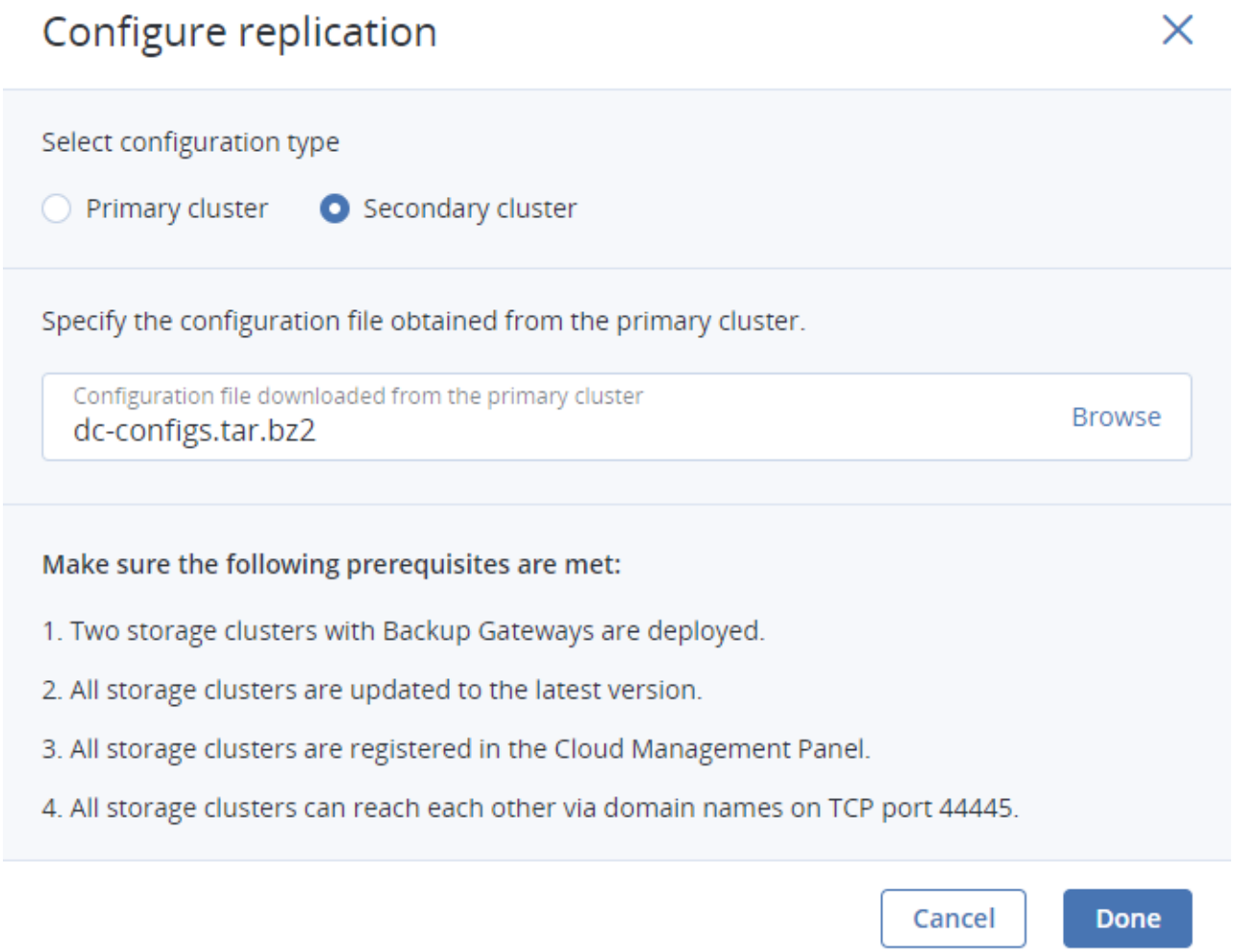


The primary cluster is now configured and ready to be connected to the secondary one, which needs to be configured next.

3. On the secondary cluster, click **Configure replication** and do the following in the **Configure replication** window:

    1. Select the **Secondary cluster** configuration type.
    2. Upload the the configuration file of the primary cluster from your local server.

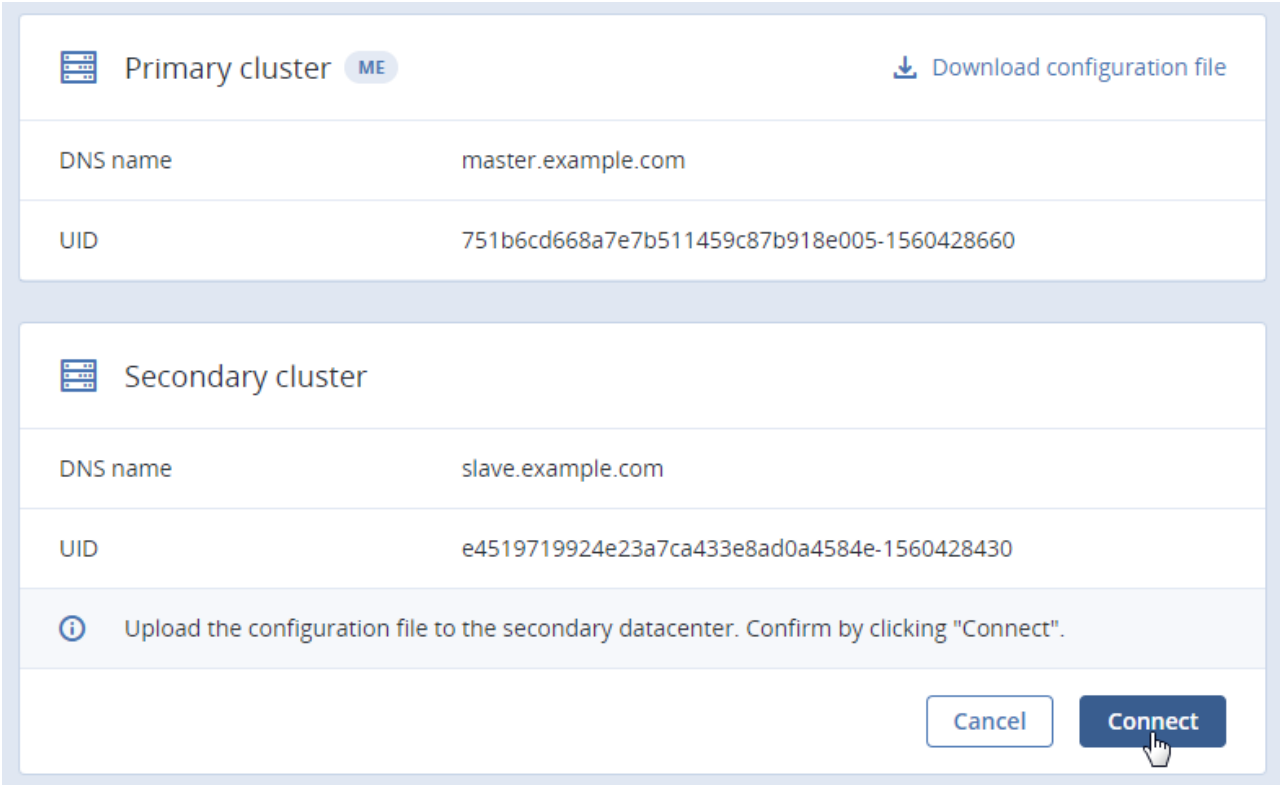
3. Click **Done**.



The secondary cluster is now also configured and ready to be connected to the primary one.

If after configuring the secondary cluster, you need to change the configuration of the primary cluster for some reason, download the new configuration and upload it to the secondary cluster by clicking the upload icon next to the **Configuration file** field. Before doing so, make sure the primary cluster UID has not been changed.

4. Back on the primary cluster, click **Connect** to enable replication between the two datacenters.



5.4.8.2 Performing a Failover

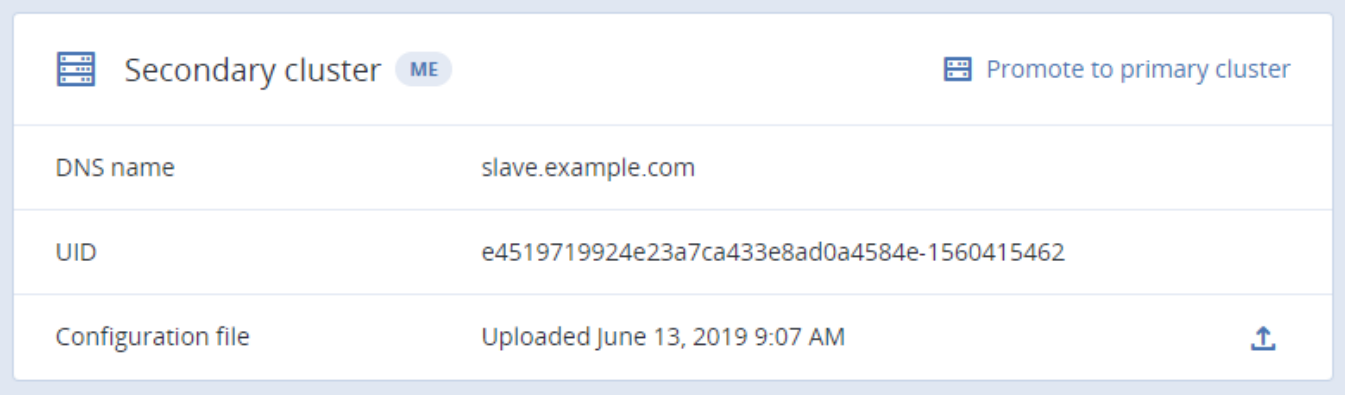
If the primary cluster becomes unavailable, you can perform a manual failover by promoting the secondary cluster to primary. This operation will switch the configuration of the secondary cluster, including its DNS name, to the configuration of the primary one. Failover of the primary cluster can be performed in the following cases:

- The current primary cluster is completely non-operational and isolated from the Internet and any backup agents.
- Backup agents are unable to communicate with the current primary cluster.
- The DNS name of the primary cluster has been reconfigured to its IP addresses.

Warning: Promoting the secondary cluster to primary is an irreversible operation that will invalidate all data on the primary cluster. Use it only in case of emergency.

To perform a failover, click **Promote to primary** on the secondary cluster and then **Failover** in the

confirmation window.



If the current primary cluster is still operational, forcibly release all its nodes from Backup Gateway first and then perform a failover.

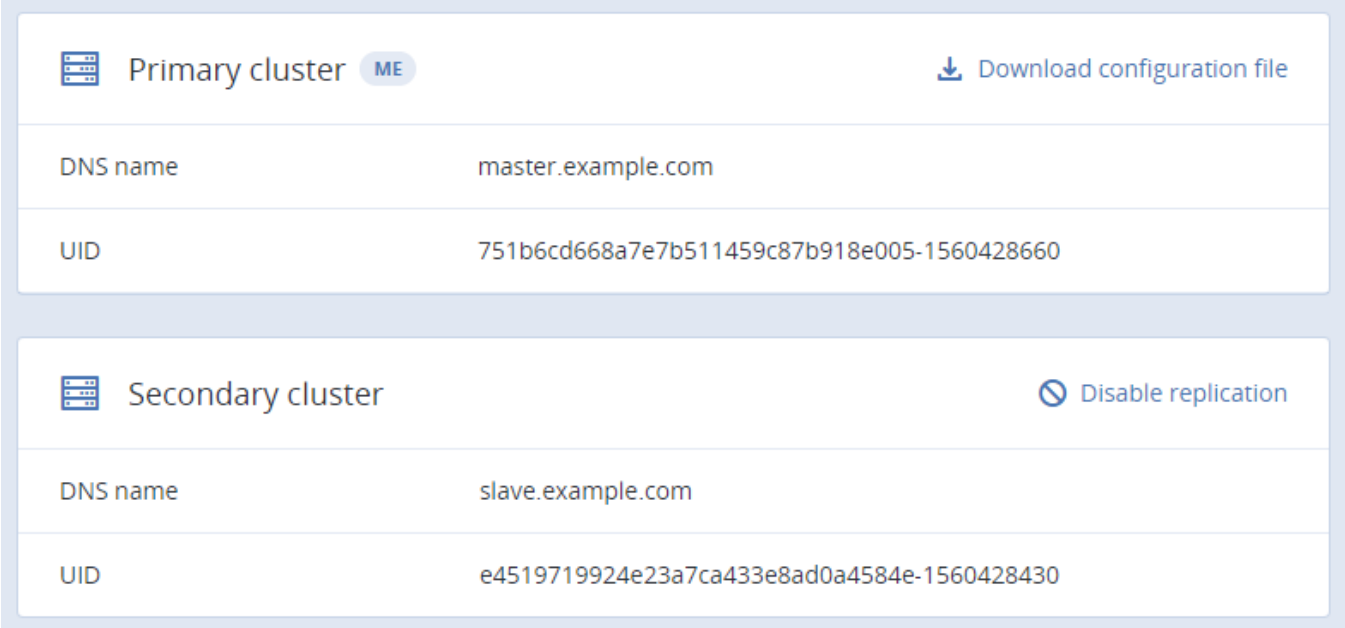
5.4.8.3 Updating the Geo-replication Configuration

Once a year you need to renew the Backup Gateway certificate. The certificate update changes the cluster configuration, which in turn requires updating the geo-replication configuration. Do the following:

1. On the primary cluster, update the certificate as described in *Updating certificate for Backup Gateway* (page 163)
2. On the primary cluster, click **Download configuration file** to download its new configuration to your local server.
3. On the secondary cluster, click the upload icon next to the **Configuration file** field to upload the new configuration to the secondary cluster.

5.4.8.4 Disabling Geo-replication

To disable geo-replication, click **Disable replication** on the primary cluster. To remove the secondary cluster from the geo-replication configuration, gracefully release all its nodes from Backup Gateway (see *Releasing Nodes from Backup Gateway* (page 183)).



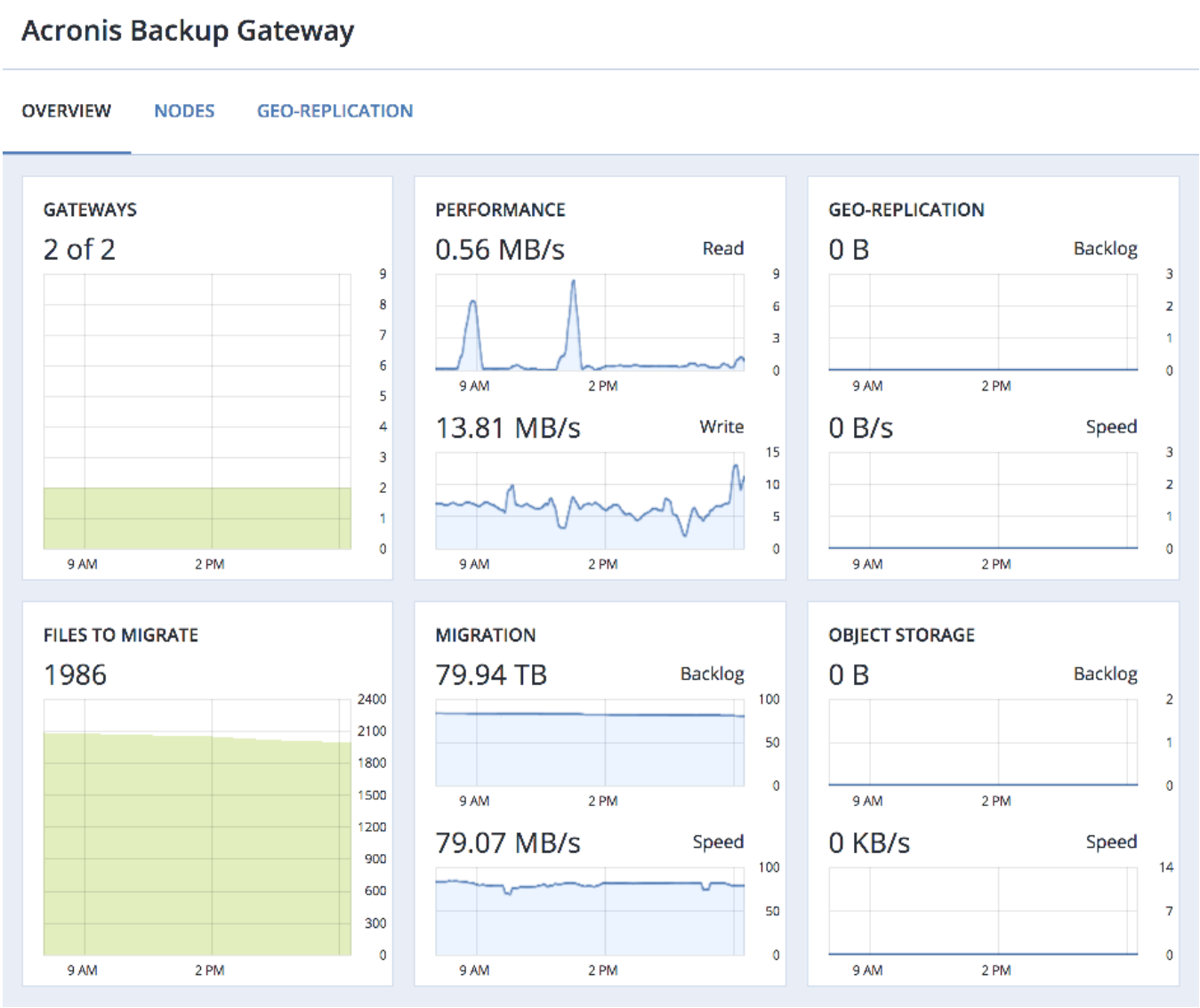
5.4.9 Monitoring Backup Gateway

After you create a Backup Gateway, you can monitor it on the **STORAGE SERVICES** > **Backup storage** > **OVERVIEW** screen. The charts show the following information:

- the performance of Backup Gateway services
- the geo-replication speed and backlog (the amount of data waiting to be replicated)
- object storage speed and backlog (the amount of data waiting to be uploaded to public cloud)
- migration speed and backlog (the amount of data waiting to be migrated)
- how many files are left in migration queue

If you migrate backups from Acronis Storage 1.5 or 1.7, migration backlog will be larger than the amount of data on the source storage. The reason is that Acronis Storage versions prior to 2.x use the old backup (FES) protocol that sends more data over network. The difference between source data size and backlog also very much depends on the retention policy utilized by the backup solution. Despite this, the resulting space occupied by migrated data on the destination will be similar to that on the source.

If backlogs do not decrease over time, it means the data cannot be replicated, migrated, or uploaded fast enough. The reason may be insufficient network transfer speed, and you may need to check or upgrade your network.



5.4.9.1 Advanced Monitoring via Grafana

For advanced monitoring of the ABGW cluster, go to the **MONITORING** > **Dashboard** screen and click **Grafana dashboard**. A separate browser tab will open with preconfigured Grafana dashboards, two of which are dedicated to Acronis Backup Gateway. To see a detailed description for each chart, click the **i** icon on its left corner.

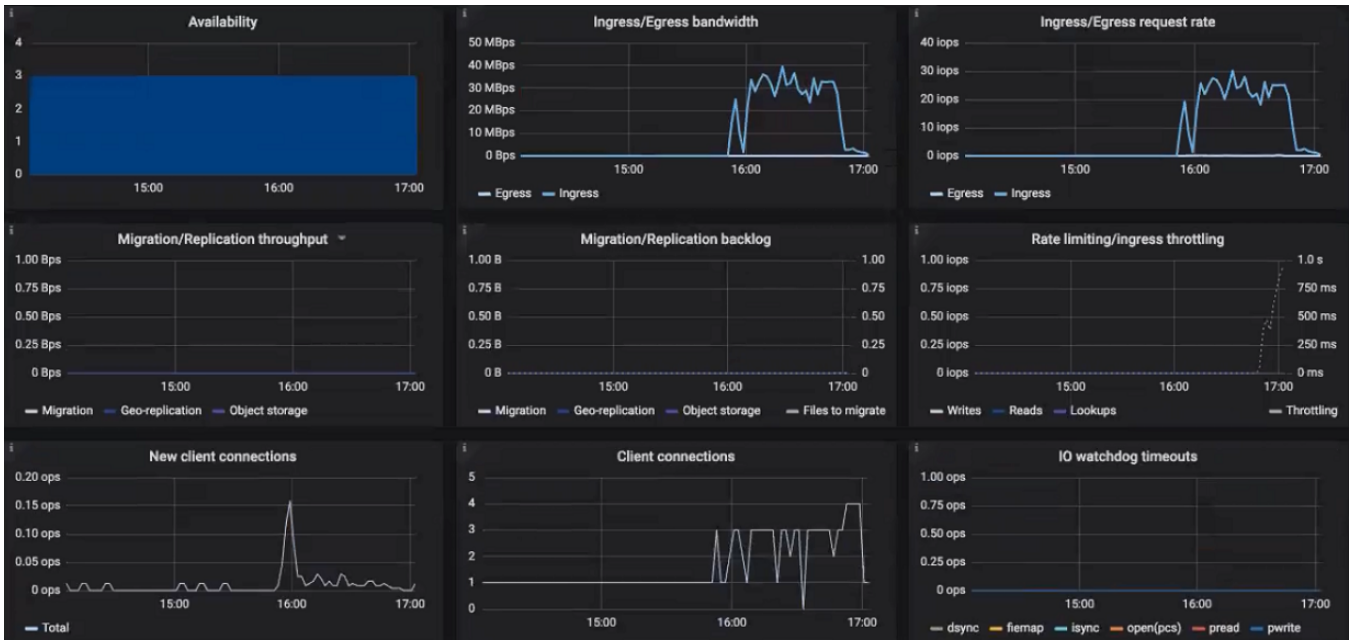
On the **Acronis Backup Gateway** dashboard, you need to pay attention to the following charts:

- **Availability**. Any time period during which the gateways have not been available will be highlighted in red. In this case, you will need to look into logs on the nodes with the failed service and report a

problem. To see the ABGW log, use the following command:

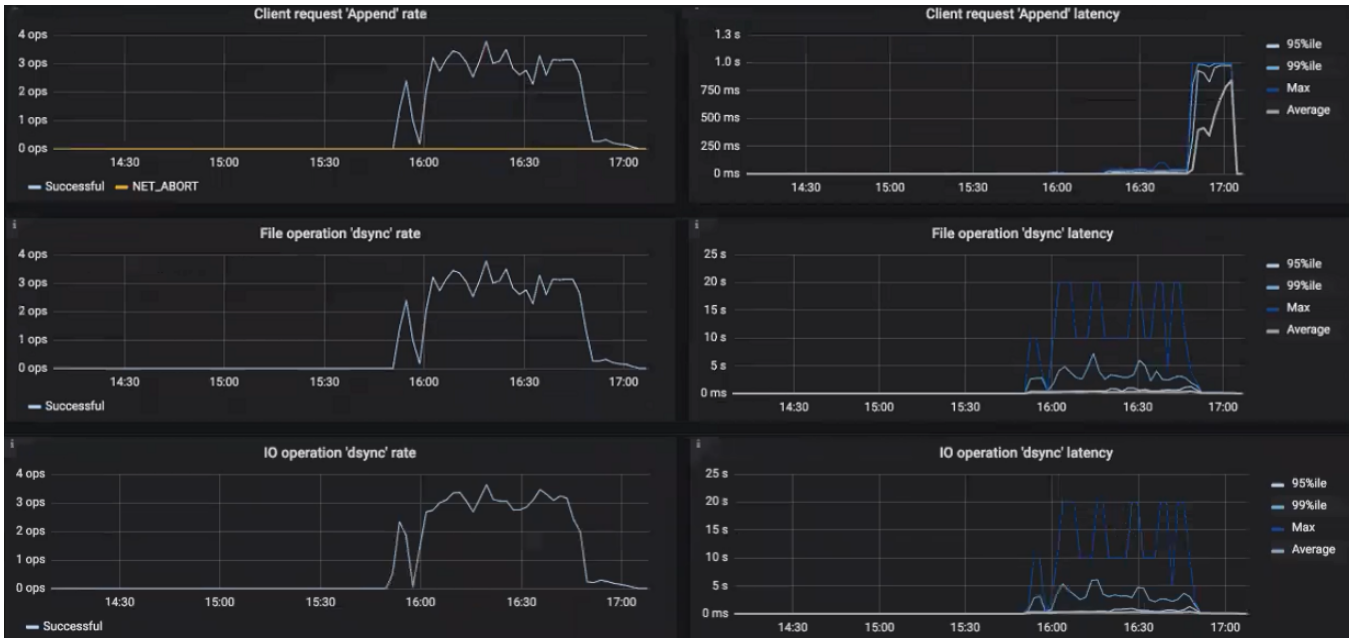
```
# zstdcat /var/log/vstorage/abgw.log.zst
```

- **Migration/Replication throughput**. The migration chart should be displayed during migration or if the cluster serves as master in a geo-replication configuration. The replication chart should mirror the ingress bandwidth chart.
- **Migration/replication backlog**. The migration chart should decrease over time. The replication chart should be near zero, high values are indicative of network issues.
- **Rate limiting/ingress throttling**. If the chart is not empty, it means the underlying storage lacks free space and the Backup Gateway is throttling user requests to slow down the data flow. Add more storage space to the cluster to solve the issue. For more information, see https://kb.acronis.com/content/62823.
- **New client connections**. A high rate of failed connections due to SSL certificate verification problems on the chart means that clients uploaded an invalid certificate chain.
- **IO watchdog timeouts**. If the chart is not empty, it means the underlying storage is not healthy and cannot deliver the required performance.

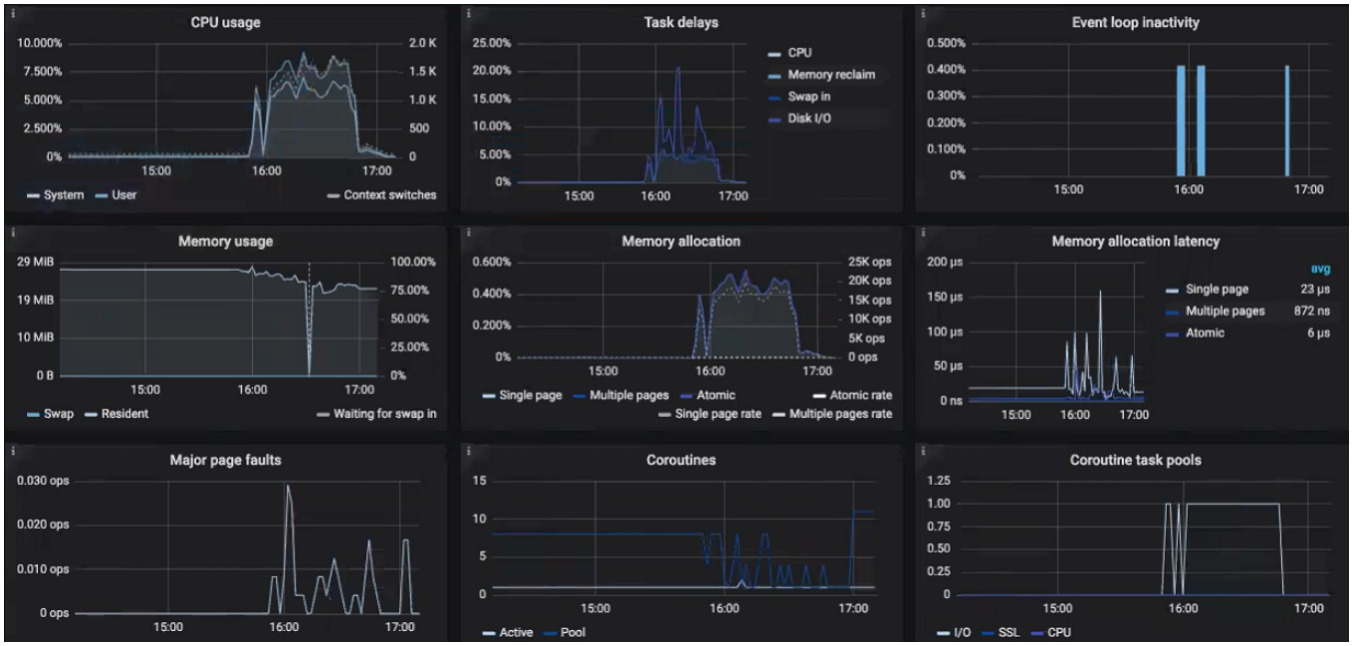


To see the charts for a particular client request, file, and I/O operation, choose them from the drop-down menus above. A high rate of failed requests or operations and high latencies on these charts indicate that the Backup Gateway experiences issues that need to be reported. For example, you can check charts for the "Append" request:

- The **Append rate** chart displays the backup data flow from Backup agents to the storage in operations per second (one operation equals one big block of backup data; blocks can be of various size).
- The **Append latency** chart shows the time spent on processing requests and should average several tens of milliseconds with peak values below one second.



The **Acronis Backup Gateway Details** dashboard is intended for low-level troubleshooting by the support team. To monitor a particular node, client request, file, and I/O operation, choose them from the drop-down menus above. On the dashboard, you can make sure the **Event loop inactivity** chart is empty. Otherwise, the Backup Gateway is not healthy on this node and the issue needs to be reported.



5.4.10 Releasing Nodes from Backup Gateway

Backup Gateway is meant to provide access to one specific storage backend. If you need to switch the backend, e.g., from a public cloud to a local storage cluster or one public cloud bucket to another, you need to delete the Backup Gateway by releasing all its nodes and create a new one.

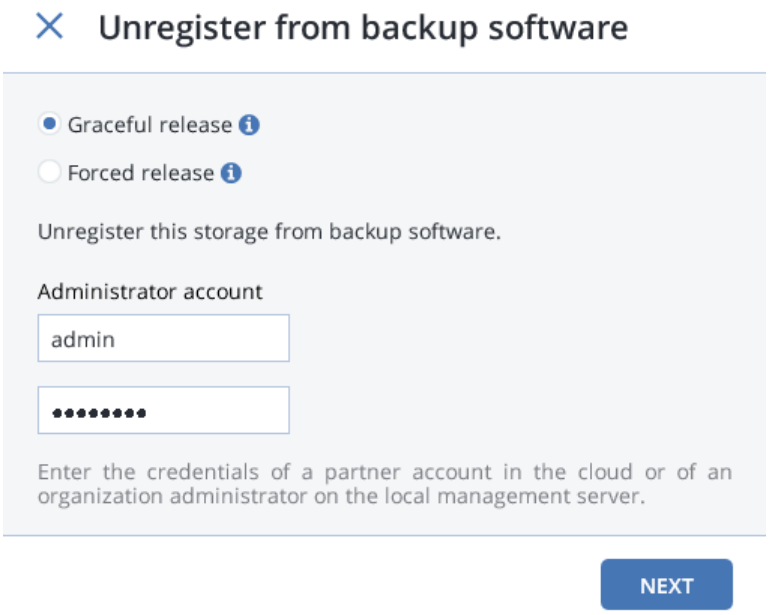
To release one or more nodes from the Backup Gateway cluster, select them on the **STORAGE SERVICES** > **Backup storage** > **NODES** screen and click **Release**. The Backup Gateway cluster will remain operational until there is at least one node in it.

When the Backup Gateway is deleted, it is also unregistered from your Acronis backup software, which loses access to the storage backend.

Do the following to release the last node in the gateway:

1. On the **STORAGE SERVICES** > **Backup storage** > **NODES** screen, select the node and click **Release**.
2. On the **Unregister from backup software** panel, choose one of the following:
   - **Graceful release** (recommended, see note below). Releases the node, deletes the Backup Gateway and unregisters it from your Acronis backup software.
   - **Force release**. Releases the node, deletes the Backup Gateway but does not unregister it from your Acronis backup software.

Important: Choose this option only if you are sure that the gateway has already been unregistered from your Acronis backup software. Otherwise, you will need to register a new gateway in your Acronis backup software and for that you will need to delete and recreate not just the Backup Gateway but also the entire storage cluster.



3. Specify the credentials of your administrator account in your Acronis backup software and click **NEXT**. In case the release is forced, simply click **NEXT**.

CHAPTER 6

Managing General Settings

This chapter describes how you can configure Acronis Cyber Infrastructure settings.

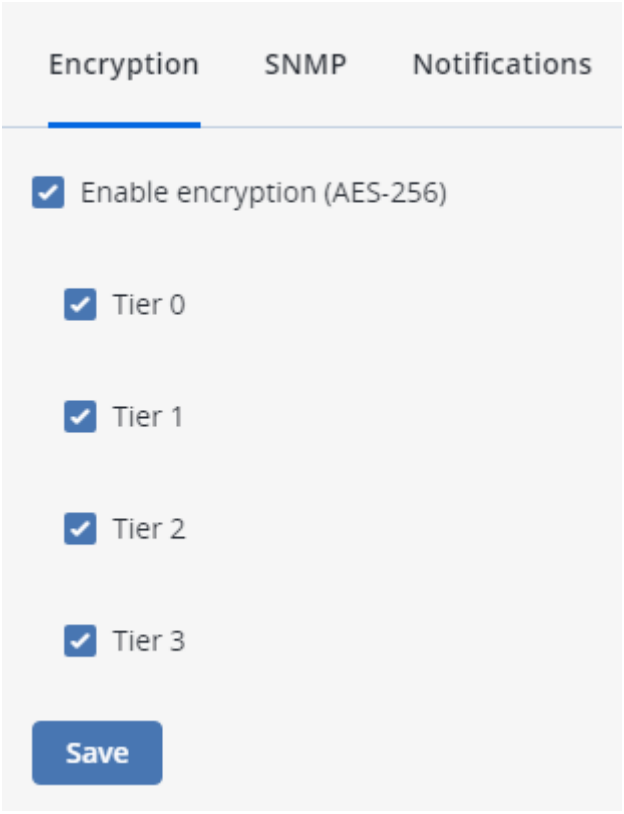
6.1 Managing Tier Encryption

Acronis Cyber Infrastructure can encrypt data stored on disks with the AES-256 standard, so if a disk gets lost or stolen the data will be safe. Acronis Cyber Infrastructure stores disk encryption keys in cluster's metadata (MDS).

Encryption can be enabled or disabled only for the newly created chunk services (CS). Once tier encryption is enabled, you can decrypt disks (CSs) by manually releasing them from encrypted tiers. Correspondingly, simply enabling encryption on the disk's tier will not encrypt its data (CS). To encrypt a disk, you must assign it to an encrypted tier.

Take note of the following:

1. Acronis Cyber Infrastructure does not encrypt data transmitted over the internal network.
2. Enabled encryption slightly decreases performance.



To enable or disable tier encryption, on the **SETTINGS** > **Advanced settings** > **ENCRYPTION** screen, select or deselect tiers and click **Save**.

6.2 Managing Domains, Users, and Projects

Acronis Cyber Infrastructure uses the administrative hierarchy of domains and projects with Role-Based Access Control (RBAC) to manage virtual objects of the compute cluster, such as virtual machines, volumes, private networks, and other. A domain is an isolated container of projects and users with assigned roles. Each project and user can only belong to one domain. A project is an isolated container of virtual objects with defined limits for virtual resources, such as vCPU, RAM, storage and floating IP addresses, and assigned users. A role is global and defines all possible tasks the user may perform at the level of the entire cluster, a specific domain, or project:

- within the cluster, you can perform system administration tasks;
- within a domain, you can create and manage projects and user accounts;
- within a project, you can create and manage virtual objects.

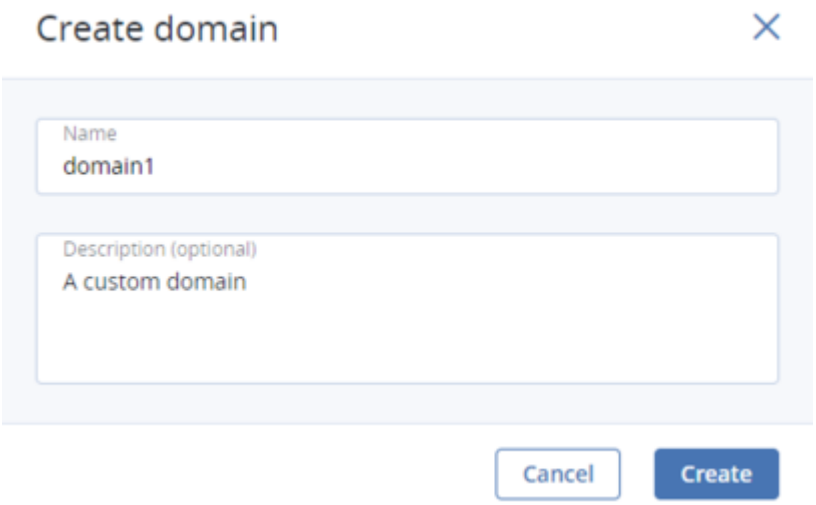
Such an implementation provides an administrative environment with own users and virtual objects and ensures their isolation from other users and virtual objects.

6.2.1 Managing Domains

During the primary node deployment, the unique **Default** domain is created along with the default user account and project. Only within this domain you can create system administrators with access to the admin panel. The default domain cannot be deleted.

To create a new domain, do the following:

1. On the **SETTINGS** > **Projects and users** screen, click **Create domain**.
2. In the **Create domain** window, specify the domain name and, optionally, description.



3. Click **Create**.

Enabling and disabling a domain means allowing and prohibiting access to it, respectively, in the self-service panel.

To edit, disable/enable, or delete a domain, click the ellipsis button next to it and select the desired action. A domain cannot be deleted if it has projects.

6.2.2 Managing Domain Users

A user can be assigned one of the following roles:

- A system administrator has access to the admin panel and can perform system administration tasks depending on assigned permissions. It is the only role that enables creating projects and defining quotas for them. Additionally, a system administrator with domain permissions can manage virtual objects in all projects within the **Default** domain as well as project and user assignment in the self-service panel.
- 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 domain administrator can only be assigned to one domain.
- 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.

Within the **Default** domain, the default administrator account is created with the unique **Superuser** permission. The user name for this account is `admin` and the password is specified during the primary node deployment. This account cannot be deleted or disabled and its permissions cannot be changed. Other than that, `admin` does not differ from a user assigned the **System administrator** role.

To view and edit existing users of a domain or create new ones, click the desired domain and go the **DOMAIN USERS** tab. Creating a user account differs slightly depending on the user role and is described in sections below.

To edit the user credentials or permissions, click the ellipsis button next to the user and then click **Edit**. Any system administrator can also change their password by clicking the user icon in the top right corner of the admin panel and then clicking **Change password**.

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

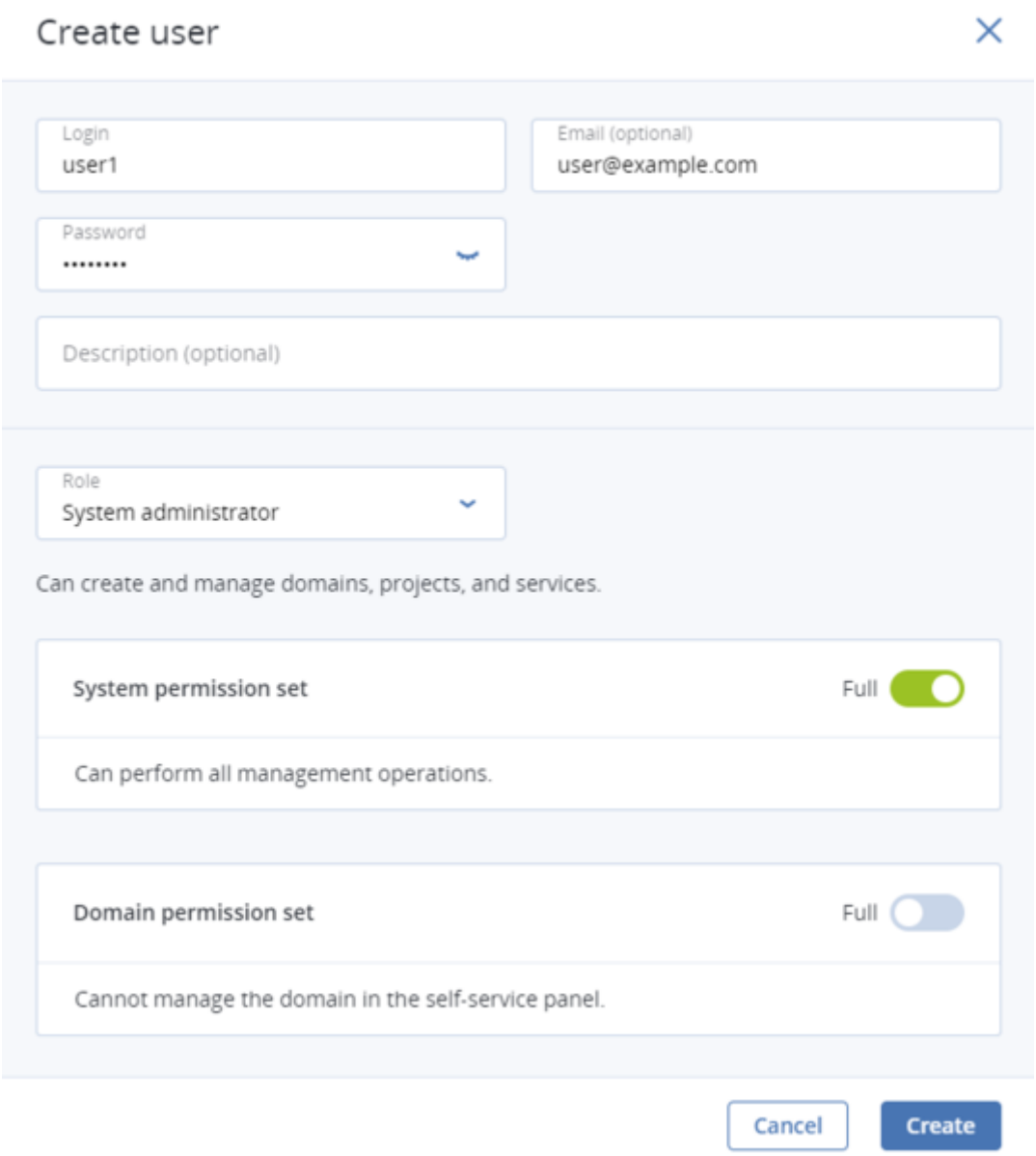
To enable/disable or remove a user, click the corresponding ellipsis button and select the desired action.

6.2.2.1 Creating System Administrators

Note: System administrators can be created only within the **Default** domain.

To create a system administrator, do as follows:

1. On the **SETTINGS** > **Projects and users** screen, click the **Default** domain.
2. Go to the **DOMAIN USERS** tab 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 **System administrator** role from the **Role** drop-down menu.
5. Choose permissions to be granted to the user account from the **System permission set** section:
    - Full (System administrator): has all permissions and can perform all management operations, including projects creation and other users management;
    - Compute: can create and manage the compute cluster;
    - ISCSI: can create and manage iSCSI targets, LUNs, and CHAP users;
    - S3: can create and manage the S3 cluster;
    - ABGW: can create and manage Backup Gateway;
    - NFS: can create and manage NFS shares and exports;
    - Cluster: can create the storage cluster, join nodes to it, and manage (assign and release) disks;
    - Network: can modify networks and traffic types;
    - Update: can install updates;
    - SSH: can add and remove SSH keys for cluster nodes access;
    - None (Viewer): can monitor cluster performance and parameters but cannot change any settings.
6. Optionally, enable the **Domain permissions set** to be able to manage virtual objects in all projects within the **Default** domain and other users in the self-service panel.
7. Click **Create**.



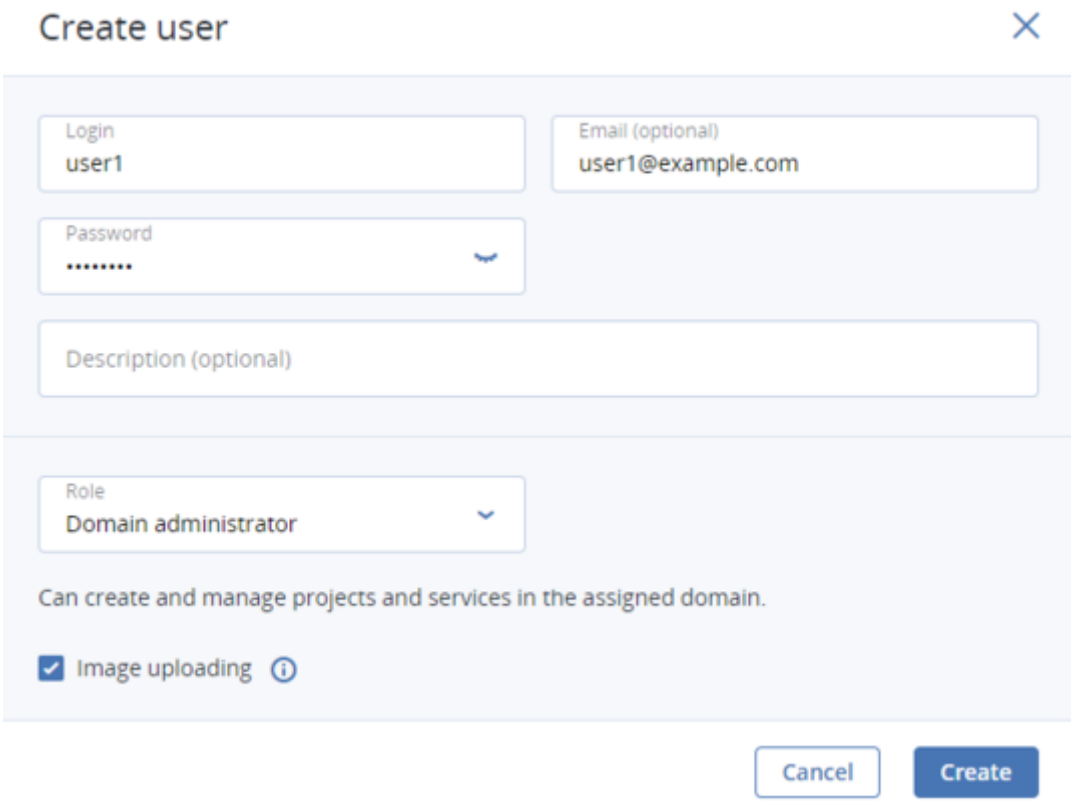
6.2.2.2 Creating Domain Administrators

To create a domain administrator, do as follows:

1. On the **SETTINGS** > **Projects and users** screen, click a domain for which the administrator will be created.
2. Go to the **DOMAIN USERS** tab 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 **Domain administrator** role from the **Role** drop-down menu.
5. Optionally, select the **Image uploading** checkbox. The state of this permission will be inherited by users created by this domain administrator.
6. Click **Create**.

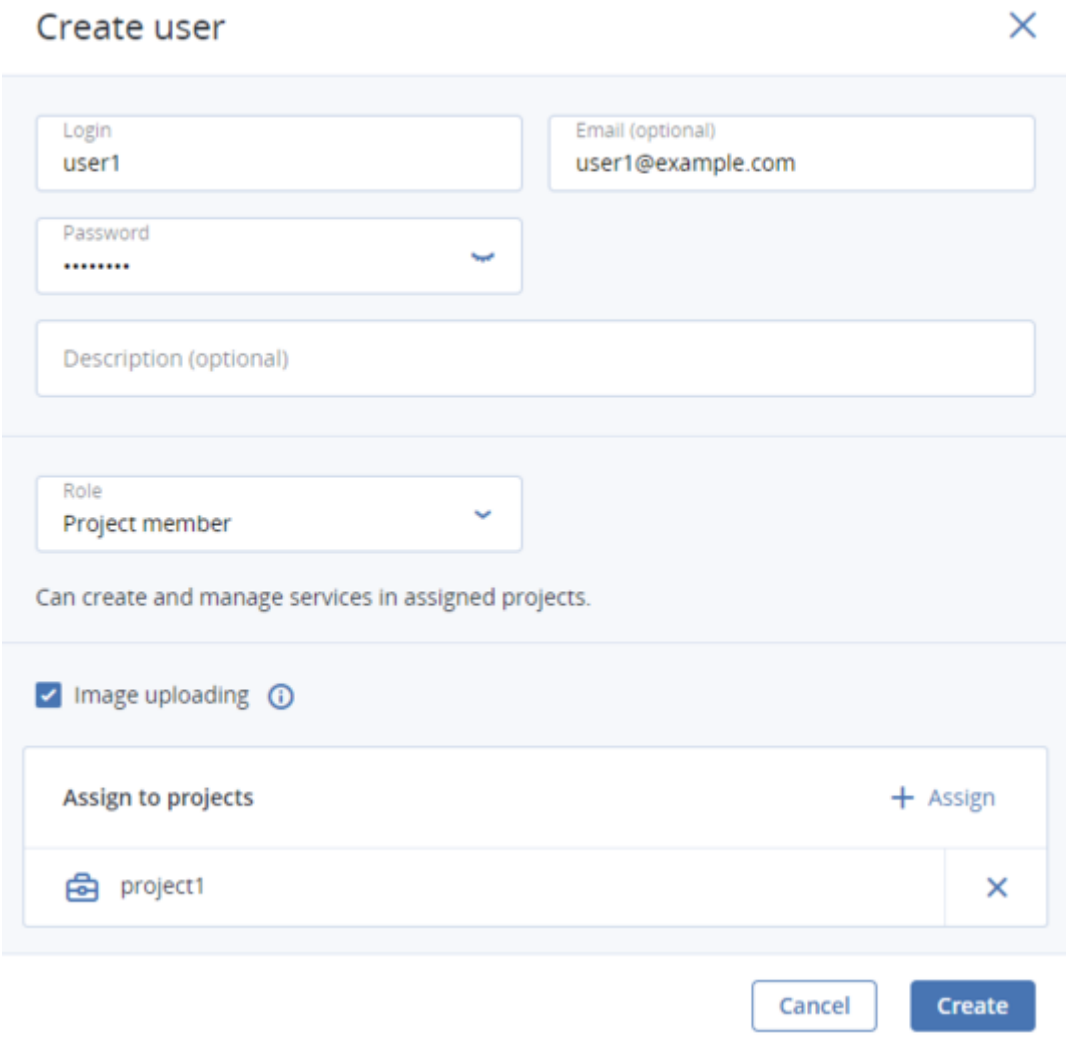


6.2.2.3 Creating Project Members

To create a project member, do as follows:

1. On the **SETTINGS** > **Projects and users** screen, click a domain within which the user will be created.
2. Go to the **DOMAIN USERS** tab 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 **Project member** role from the **Role** drop-down menu.

5. Optionally, select the **Image uploading** checkbox. If this option is disabled, this user will not be able to upload images.
6. Optionally, click **Assign** and choose a project this user will be assigned to.
7. Click **Create**.



6.2.3 Managing Projects

The **Default** domain has the default **admin** project, which is a bootstrap project for initializing the compute cloud. It cannot be deleted or renamed.

To create a new project, do the following:

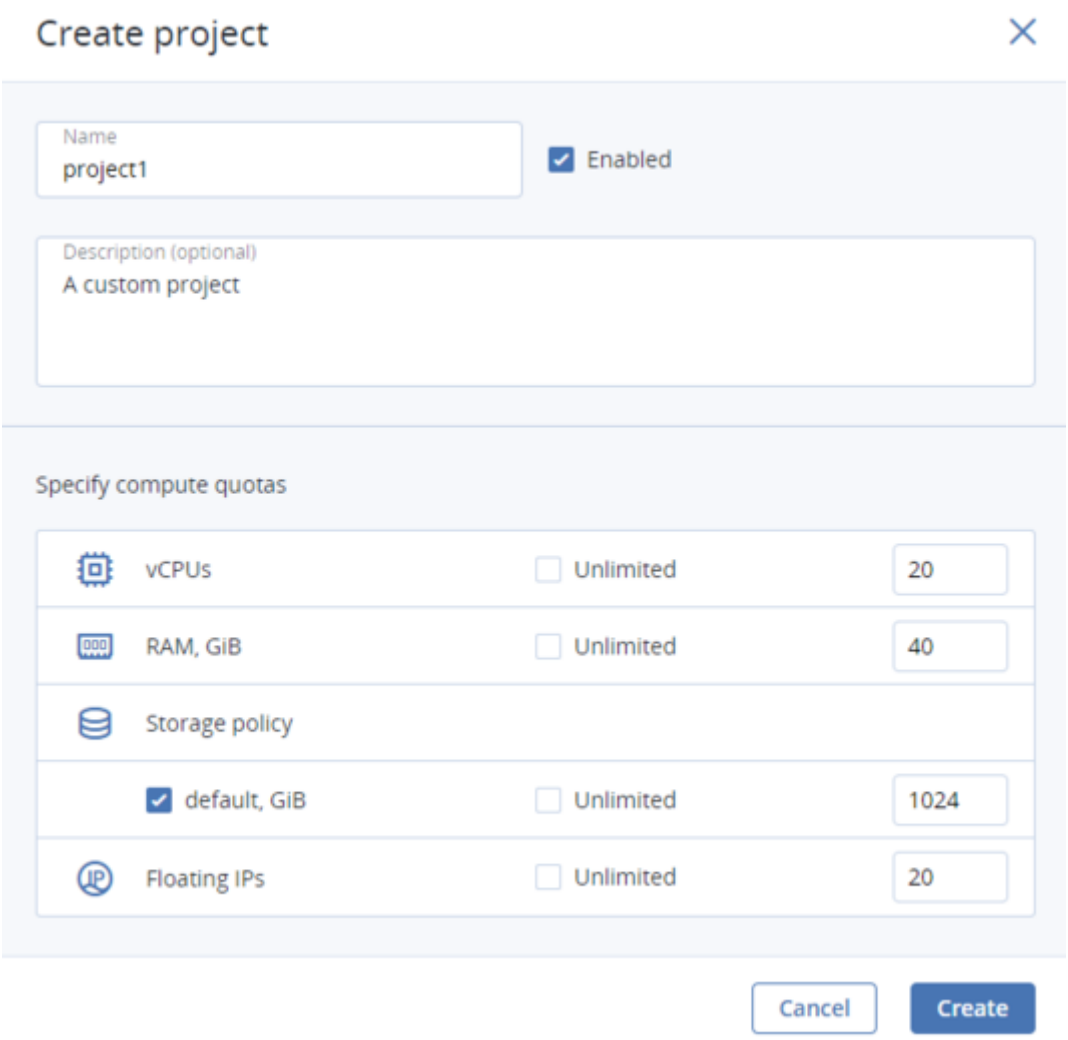
1. On the **SETTINGS** > **Projects and users** screen, click a domain within which the project will be created.

2. On the **PROJECTS** tab, click **Create project**.
3. In the **Create project** window, specify the project name and, optionally, description. The project name must be unique within a domain.
4. Optionally, deselect the **Enabled** checkbox to disable the created project.
5. Define quotas for virtual resources that will be available inside the project. To specify a certain value for a resource, deselect the **Unlimited** checkbox next to it first.

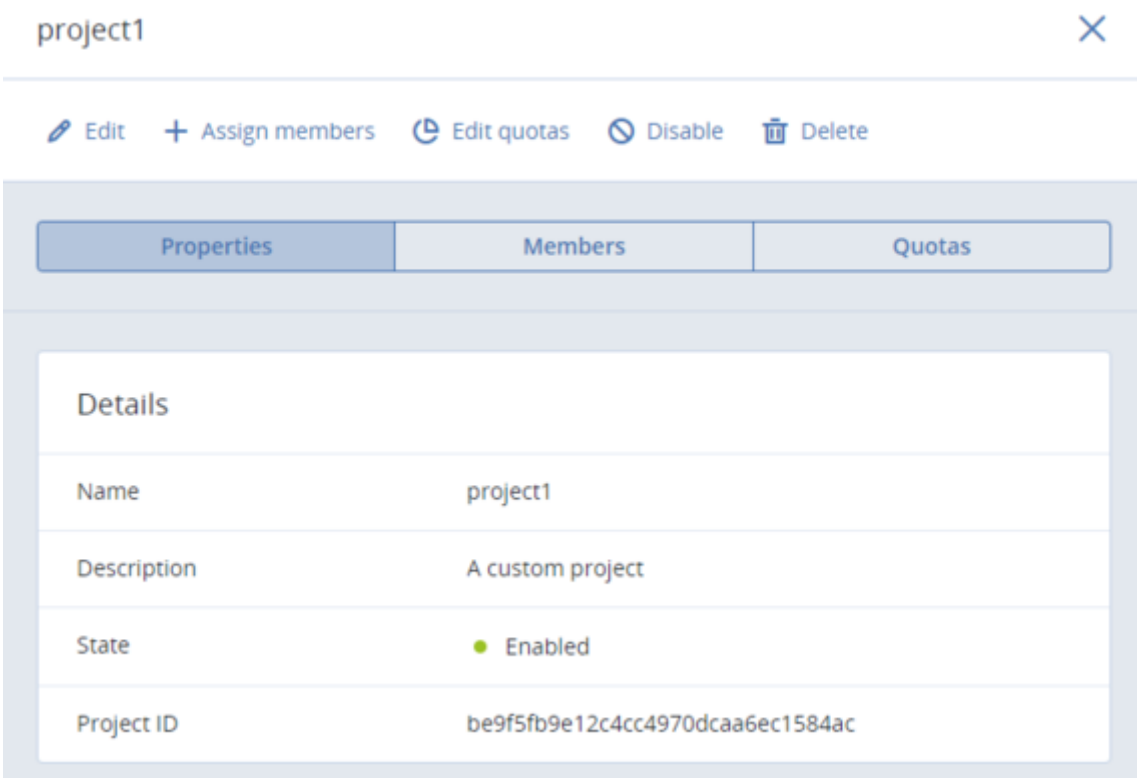
   If you have not yet deployed the compute cluster, you are not able to set project's quotas. Create the compute cluster as described in *Creating the Compute Cluster* (page 52) and return to defining project's quotas as described in *Editing Quotas for Projects* (page 198).

   Note: As quotas can exceed the existing virtual resources and virtual resources are not reserved for each project, a system administrator needs to ensure the compute cluster has enough virtual resources for all projects in all domains.

6. Click **Create**.



Once the project is created, you can open its panel to view its properties on the **Properties** tab, list its members on the **Members** tab, and monitor its resource consumption on the **Quotas** tab.



Enabling and disabling a project means allowing and prohibiting access to it, respectively, in the self-service panel.

To edit, enable/disable, or delete a project, click the ellipsis button next to it and select the desired action. A project cannot be deleted if it has virtual objects.

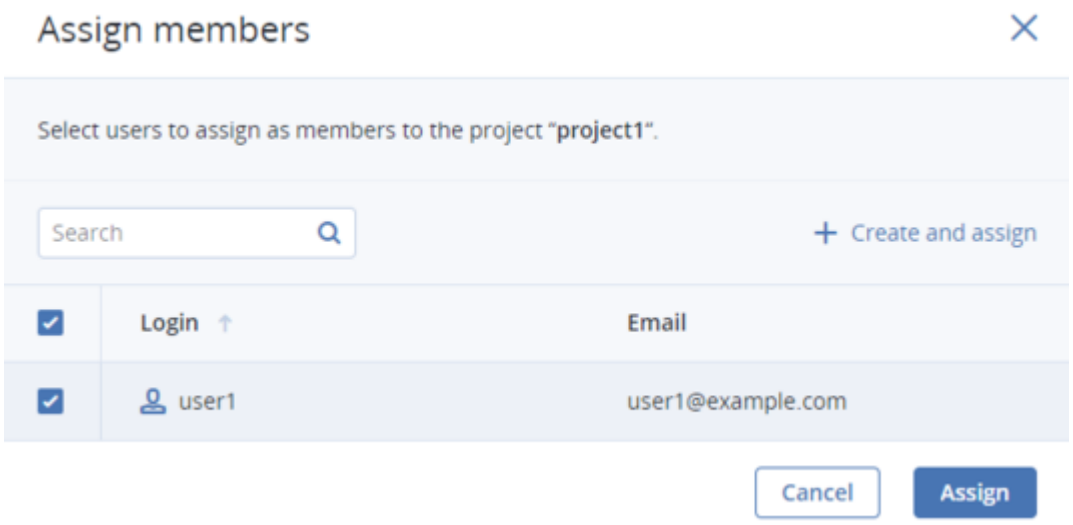
6.2.3.1 Assigning Members to Projects

You can manage project members assignment either on the **PROJECTS** tab or **DOMAIN USERS** tab.

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

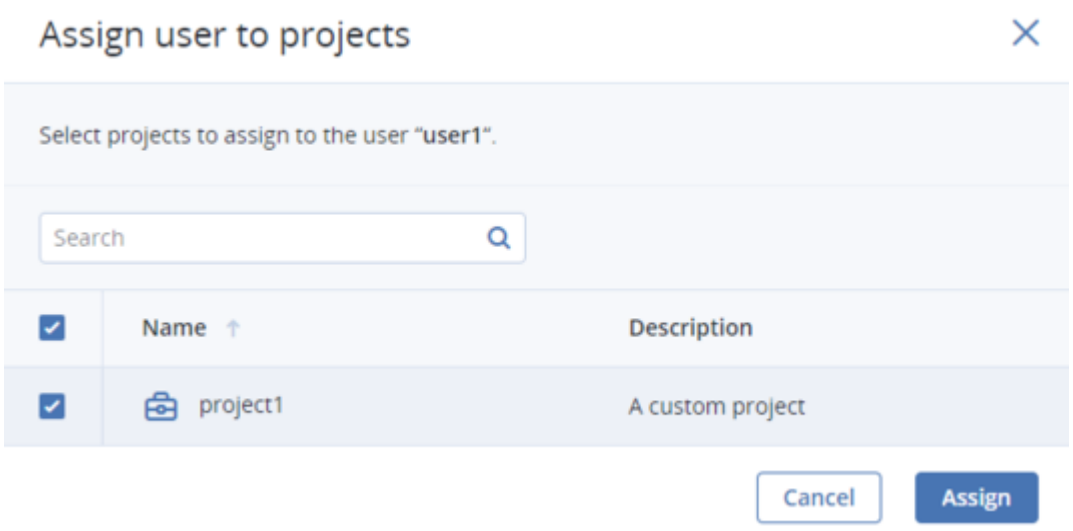
- Within the domain, open the **PROJECTS** tab:
    1. Click the project to which you want to assign users.
    2. On the project panel, click **Assign members**.
    3. In the **Assign members** window, choose one or multiple users to assign to the project. Optionally, click **Create and assign** to create a new project member in a new window. Only user accounts with the **Project member** role are displayed.

4. Click **Assign**.



- Within the domain, open the **DOMAIN USERS** tab:

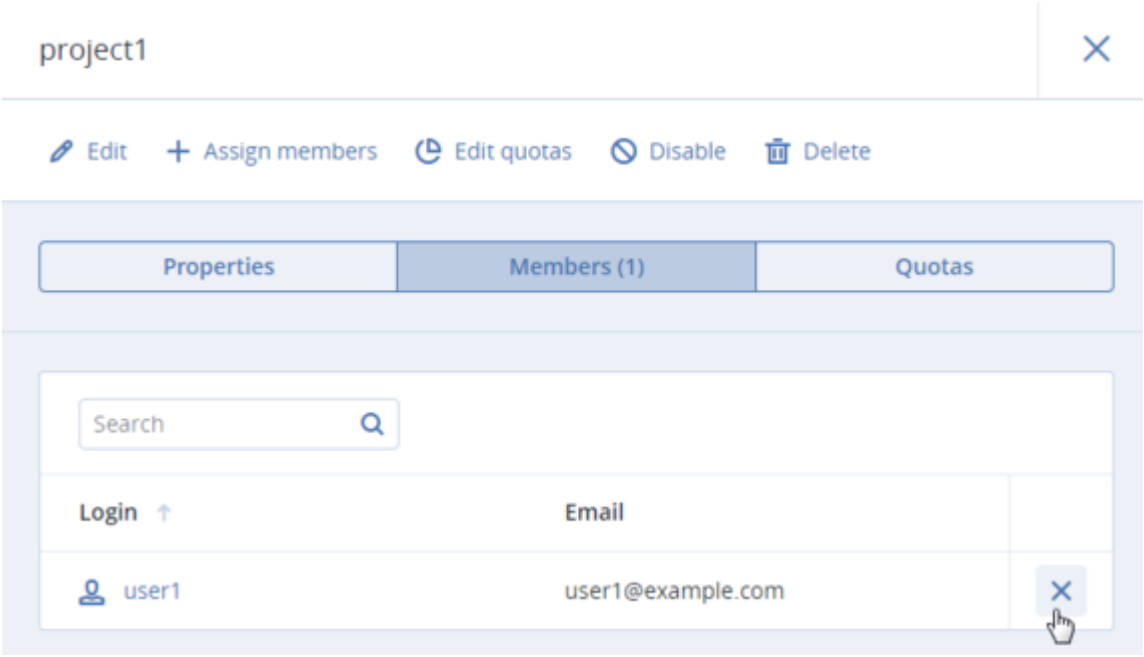
  1. Click the user account with the **Project member** role whom you want to assign to the project.
  2. On the user panel, click **Assign to project**.
  3. On the **Assign user to projects** window, select one or multiple projects and click **Assign**.



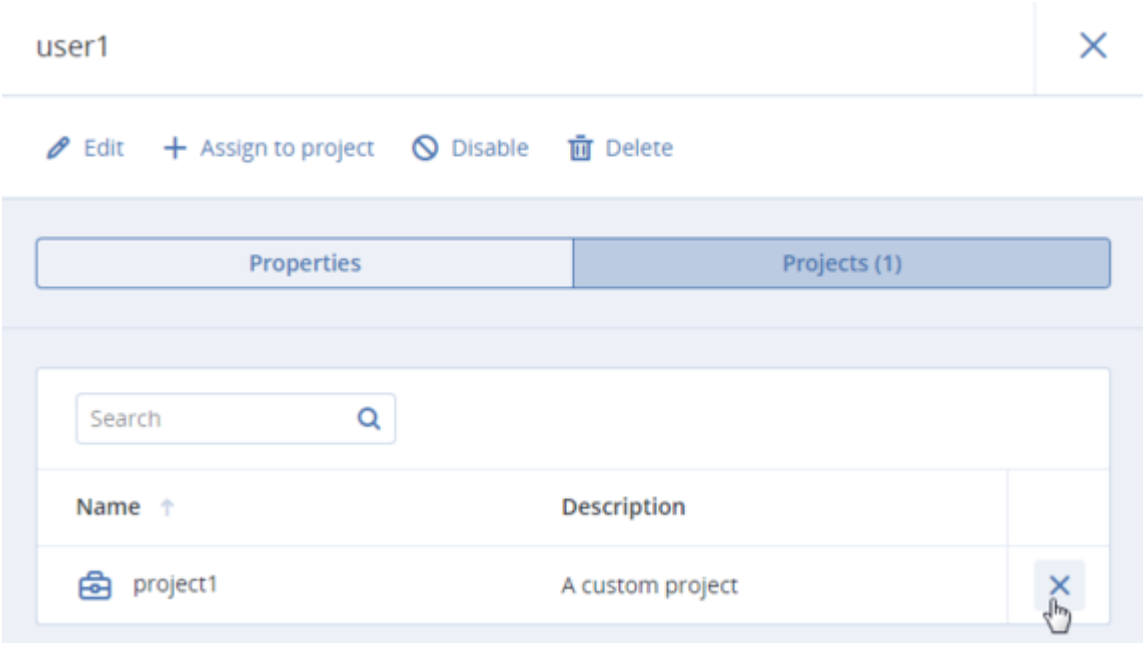
You can monitor user assignment to projects either on the **Members** tab of the project panel or on the **Projects** tab on the user panel.

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

- Within the domain, open the **PROJECTS** tab:
  1. Click the project from which you want to unassign users.
  2. On the project panel, open the **Members** tab.
  3. Click the cross icon next to a user you want to unassign.



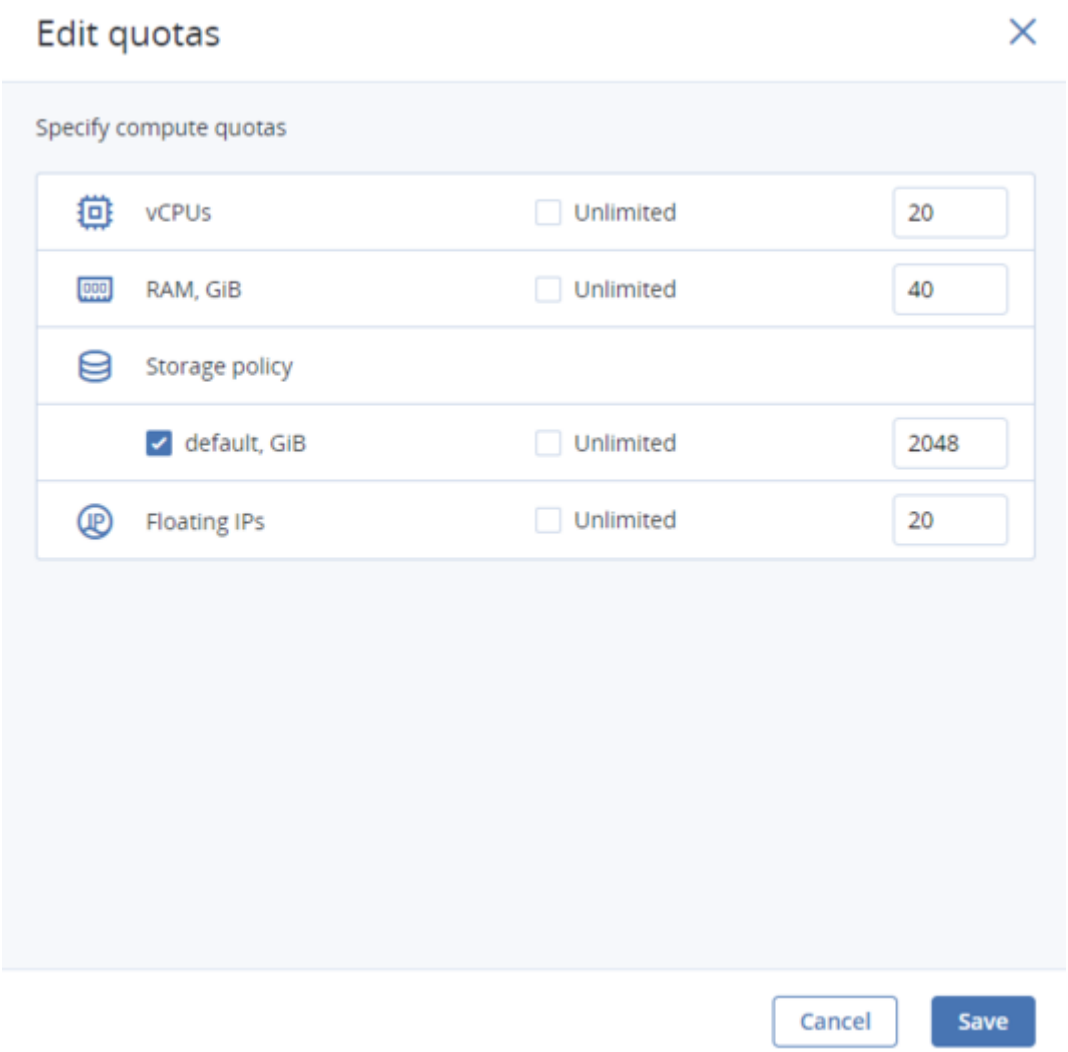
- Within the domain, open the **DOMAIN USERS** tab:
  1. Click the user whom you want to unassign from the project.
  2. On the user panel, open the **Projects** tab.
  3. Click the cross icon next to the project from which you want to unassign the user.



6.2.3.2 Editing Quotas for Projects

To change resource quotas for a project, do the following:

1. Click the project for which you want to edit quotas.
2. On the project panel, click **Edit quotas**.
3. In the **Edit quotas** window, specify new values for the desired virtual resources.
4. Click **Save** to apply changes.



6.3 Managing Updates

Take note of the following before you start updating nodes:

- To check for and download updates, the cluster must be healthy and each node in the infrastructure must be able to open outgoing Internet connections. This means, in particular, that cluster DNS must be configured and point to a DNS able to resolve external host names. For more details, see *Adding External DNS Servers* (page 214).
- Unassigned nodes cannot be updated.
- Updates are applied to one storage cluster node at a time.

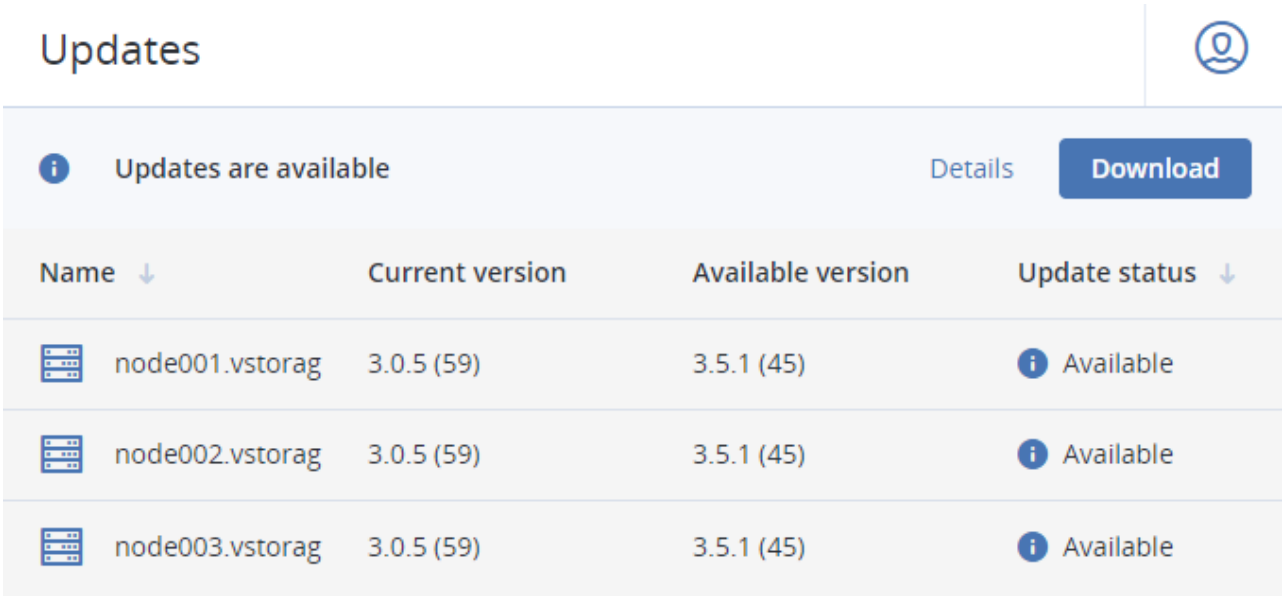
- If a reboot is required:
  - Highly available storage services will continue working.
  - Virtual machines in the compute cluster will be suspended.
  - If the management node HA cluster is configured, the admin panel will remain accessible, although you may expect a lag when it moves to an online node from the one being rebooted.
- Disable any third-party repositories before updating.

Note: For details on upgrading to this version, see the Administrator's Guide for version 2.5.

To update the storage cluster from the admin panel, do the following:

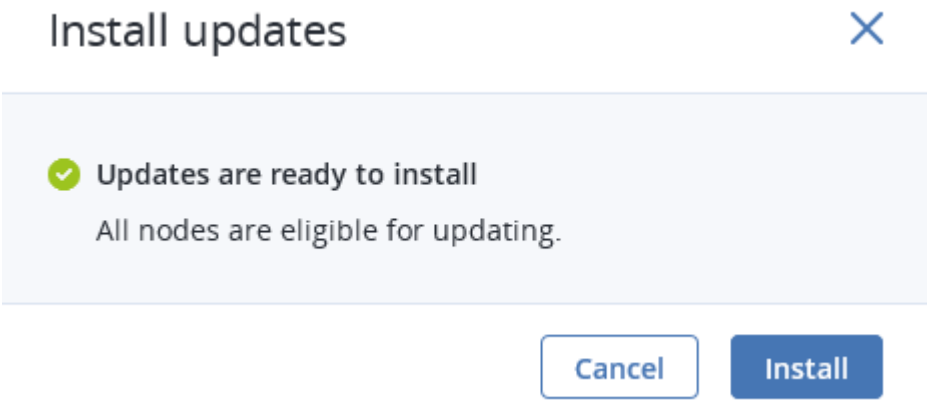
1. Open the **SETTINGS** > **Updates** screen. The date of the last check is displayed in the upper right corner. Click the round arrow to check for new updates. If updates are available for a node, that node's update status changes to **Available**.

   Note: To be able to upgrade to version 3.5, all of the nodes must be online.



2. Click **Download** in the upper right corner to get the updates. When the updates are downloaded to a node, its update status changes to **Ready to install**. After the updates have been downloaded for all of the nodes, the button will change to **Install**. Click it to continue.

3. Click **Install**.



While the updates are being installed, you can pause or cancel the process.

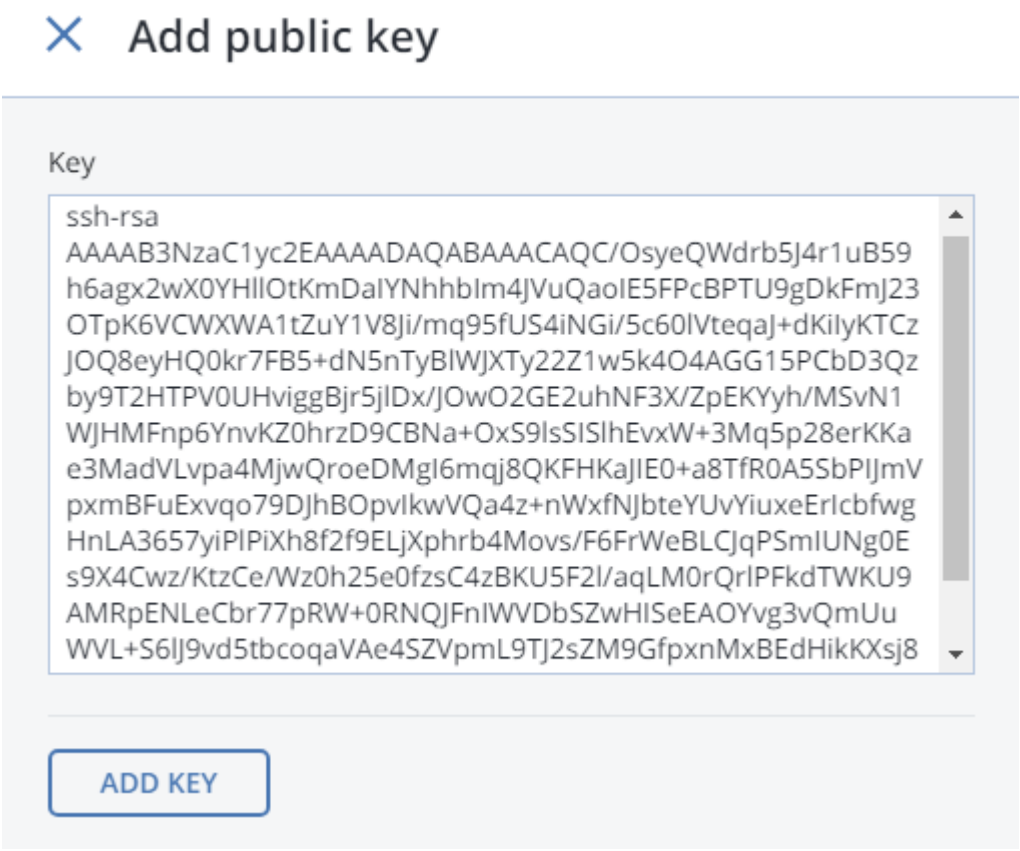
To update the kernel with ReadyKernel, consult the *Administrator's Command Line Guide*.

6.4 Allowing root Access to Cluster Nodes Over SSH

Important: If you enable any third-party repositories like EPEL, make sure that packages from the official repository, `hci.repo`, are never overwritten by packages from the third-party repositories. Do not run `yum update` with such repositories enabled and disable them when you do not need them anymore. Otherwise product stability may be at risk.

In certain situations, you or the technical support team may need root access to cluster nodes via SSH. To allow root access to all nodes in the cluster, do the following:

1. Obtain an SSH public key from the technical support team.
2. Open the **SETTINGS** > **Security** > **SSH** screen and click **ADD**.
3. On the **Add public key** panel, paste the key and click **ADD KEY**.



To delete the key after root access is no longer required, select the key and click **Delete**.

6.5 Enabling High Availability

High availability keeps Acronis Cyber Infrastructure services operational even if the node they are located on fails. In such cases, services from a failed node are relocated to healthy nodes according to the Raft consensus algorithm. High availability is ensured by:

- Metadata redundancy. For a storage cluster to function, not all but just the majority of MDS servers must be up. By setting up multiple MDS servers in the cluster you will make sure that if an MDS server fails, other MDS servers will continue controlling the cluster.
- Data redundancy. Copies of each piece of data are stored across different storage nodes to ensure that the data is available even if some of the storage nodes are inaccessible.
- Monitoring of node health.

To achieve the complete high availability of the storage cluster and its services, we recommend that you do

the following:

1. deploy three or more metadata servers,
2. enable management node HA, and
3. enable HA for the specific service.

Note: The required number of metadata servers is deployed automatically on recommended hardware configurations; Management node HA must be enabled manually as described in the next subsection; High availability for services is enabled by adding the minimum required number of nodes to that service's cluster.

On top of highly available metadata services and enabled management node HA, Acronis Cyber Infrastructure provides additional high availability for the following services:

- Admin panel. If the management node fails or becomes unreachable over the network, an admin panel instance on another node takes over the panel's service so it remains accessible at the same dedicated IP address. The relocation of the service can take several minutes. Admin panel HA is enabled manually along with management node HA (see *Enabling Management Node High Availability* (page 204)).
- Virtual machines. If a compute node fails or becomes unreachable over the network, virtual machines hosted on it are evacuated to other healthy compute nodes based on their free resources. The compute cluster can survive the failure of only one node. By default, high availability for virtual machines is enabled automatically after creating the compute cluster and can be disabled manually, if required (see the *Configuring Virtual Machine High Availability* (page 90)).
- iSCSI service. If the active path to volumes exported via iSCSI fails (e.g., a storage node with active iSCSI targets fails or becomes unreachable over the network), the active path is rerouted via targets located on healthy nodes. Volumes exported via iSCSI remain accessible as long as there is at least one path to them.
- S3 service. If an S3 node fails or becomes unreachable over the network, name server and object server components hosted on it are automatically balanced and migrated between other S3 nodes. S3 gateways are not automatically migrated; their high availability is based on DNS records. You need to maintain the DNS records manually when adding or removing S3 gateways. High availability for S3 service is enabled automatically after enabling management node HA and creating an S3 cluster from three or more nodes. An S3 cluster of three nodes may lose one node and remain operational.
- Backup gateway service. If a backup gateway node fails or becomes unreachable over the network,

other nodes in the backup gateway cluster continue to provide access to the chosen storage backend. Backup gateways are not automatically migrated; their high availability is based on DNS records. You need to maintain the DNS records manually when adding or removing backup gateways. High availability for backup gateway is enabled automatically after creating a backup gateway cluster from two or more nodes. Access to the storage backend remains until at least one node in the backup gateway cluster is healthy.

- NFS shares. If a storage node fails or becomes unreachable over the network, NFS volumes located on it are migrated between other NFS nodes. High availability for NFS volumes on a storage node is enabled automatically after creating an NFS cluster.

Also take note of the following:

1. Creating the compute cluster prevents (and replaces) the use of the management node backup and restore feature.
2. If nodes to be added to the compute cluster have different CPU models, consult the section “Setting Virtual Machines CPU Model” in the *Administrator’s Command Line Guide*.

6.5.1 Enabling Management Node High Availability

To make your infrastructure more resilient and redundant, you can create a high availability configuration of three nodes.

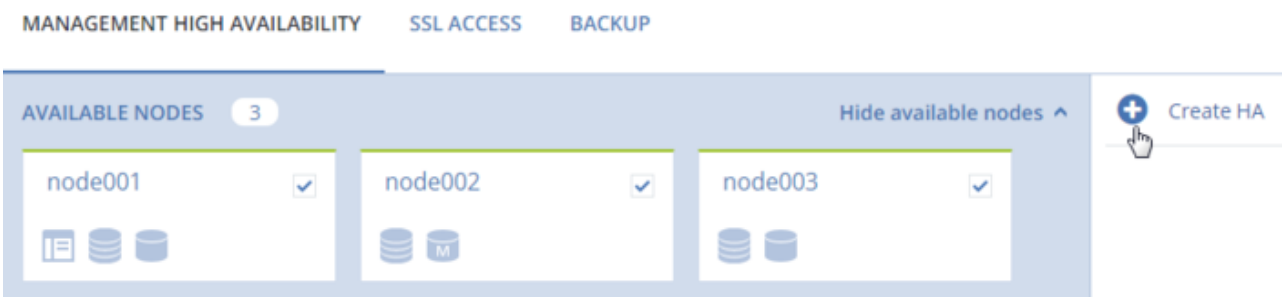
Management node HA and compute cluster are tightly coupled, so changing nodes in one usually affects the other. Take note of the following:

1. Each node in the HA configuration must meet the requirements to the management node listed in the *Installation Guide*. If the compute cluster is to be created, its hardware requirements must be added as well.
2. If the HA configuration has been created before the compute cluster, all nodes in it will be added to the compute cluster.
3. If the compute cluster has been created before HA configuration, only nodes in the compute cluster can be added to the HA configuration. For this reason, to add a node to HA configuration, add it to the compute cluster first.
4. If both the HA configuration and compute cluster include the same three nodes, single nodes cannot be removed from the compute cluster. In such a case, the compute cluster can be destroyed completely,

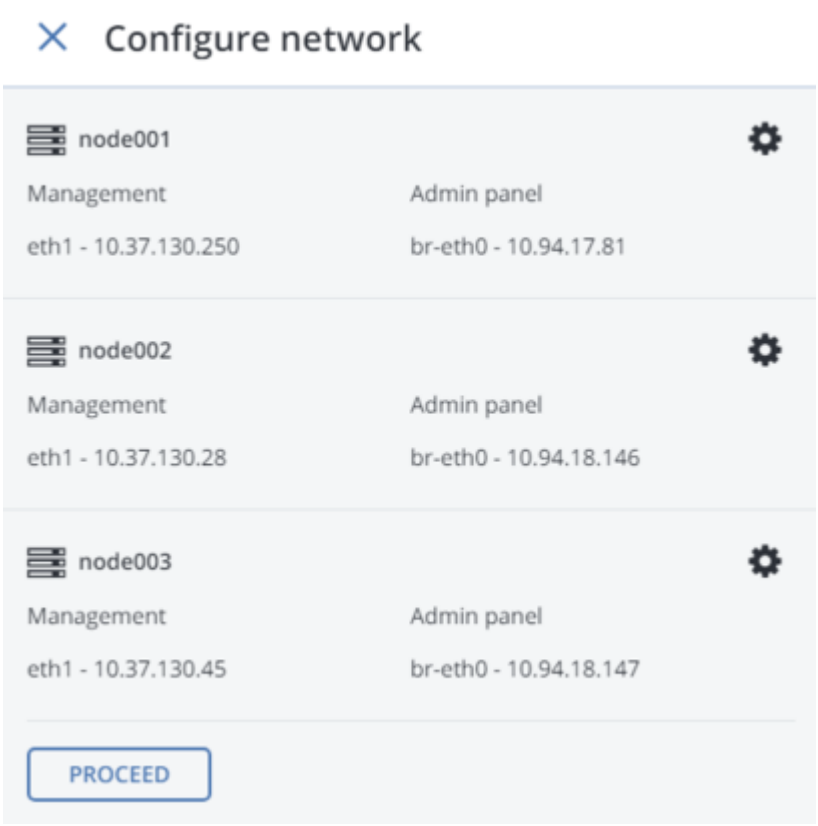
but the HA configuration will remain. This is also true vice versa, the HA configuration can be deleted, but the compute cluster will continue working.

To enable high availability for the management node and admin panel, do the following:

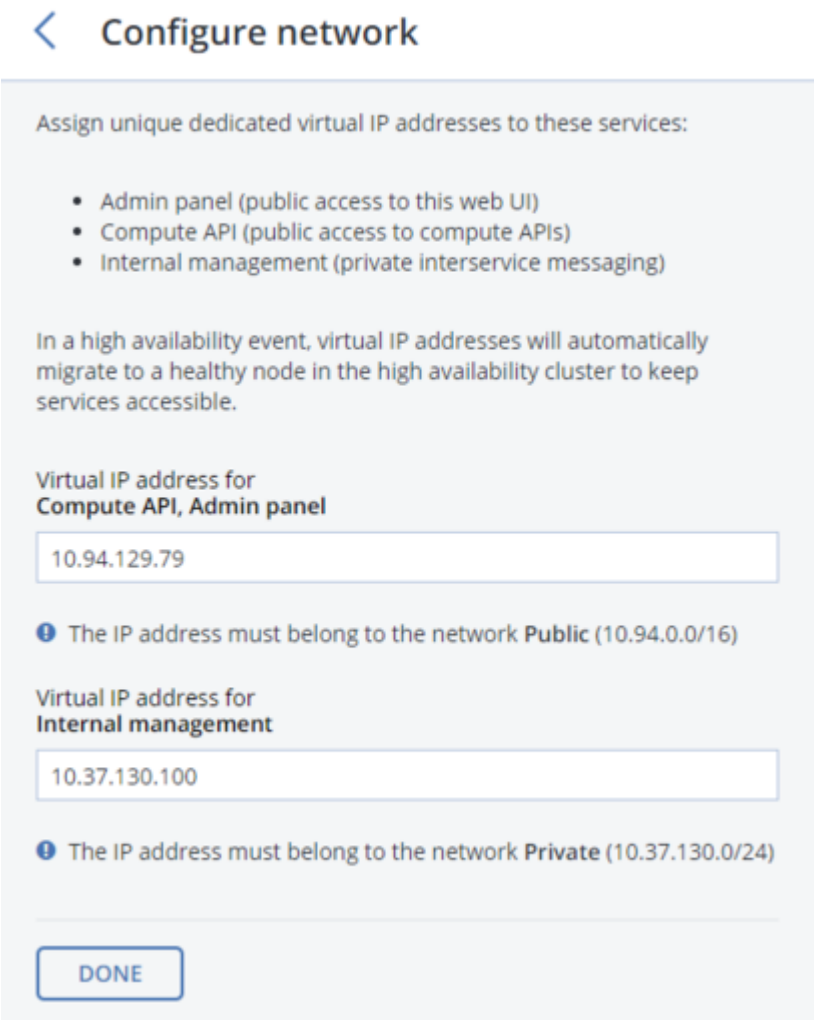
1. Make sure that each node is connected to a network with the **Admin panel** and **Internal management** traffic types.
2. On the **SETTINGS** > **Management node** screen, open the **MANAGEMENT HIGH AVAILABILITY** tab.



3. Select three nodes and click **Create HA**. The management node is automatically selected.
4. On **Configure network**, check that correct network interfaces are selected on each node. Otherwise, click the cogwheel icon for a node and assign networks with the **Internal management** and **Admin panel** traffic types to its network interfaces. Click **PROCEED**.



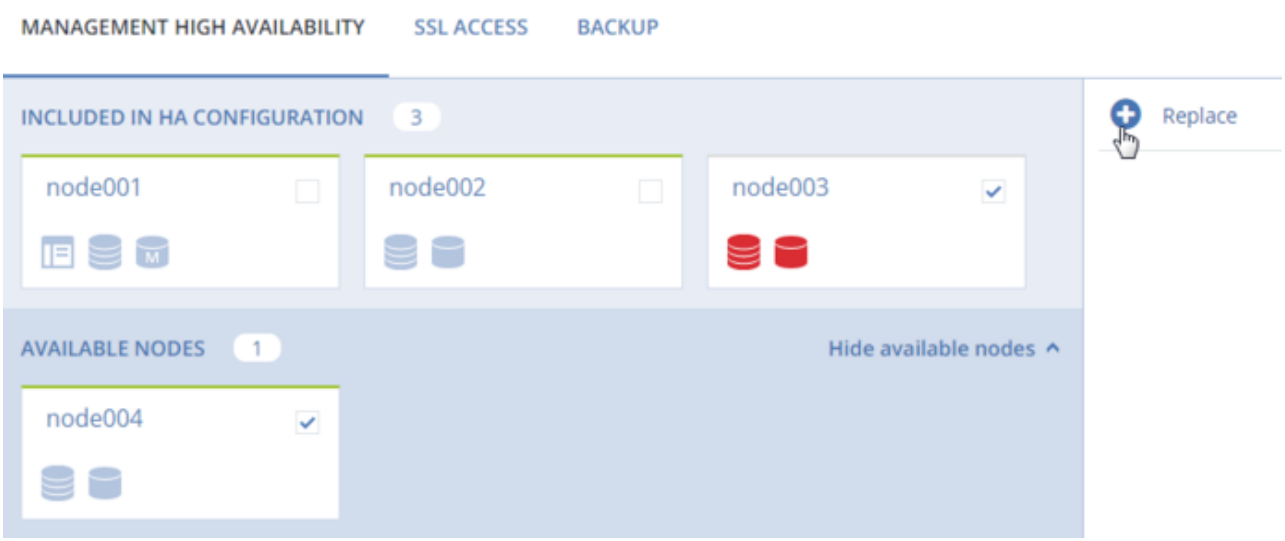
5. Next, on **Configure network**, provide one or more unique static IP addresses for the highly available admin panel, compute API endpoint, and interservice messaging. Click **DONE**.



Once the high availability of the management node is enabled, you can log in to the admin panel at the specified static IP address (on the same port 8888).

As management node HA must include exactly three nodes at all times, removing a node from the HA configuration is not possible without adding another one at the same time. For example, to remove a failed node from the HA configuration, you can replace it with a healthy one as follows:

1. On the **SETTINGS** > **Management node** > **MANAGEMENT HIGH AVAILABILITY** tab, select one or two nodes that you wish to remove from the HA configuration and one or two available nodes that will be added into the HA configuration instead and click **Replace**.



2. On **Configure network**, check that correct network interfaces are selected on each node to be added. Otherwise, click the cogwheel icon for a node and assign networks with the **Internal management** and **Admin panel** traffic types to its network interfaces. Click **PROCEED**.

To remove nodes from the HA setup, click **Destroy HA**.

6.6 Accessing the Admin Panel via SSL

When configuring various Acronis Cyber Infrastructure features, you may need to enter sensitive information like credentials for user and e-mail accounts, S3 services, and such. The system uses a pre-generated self-signed certificate by default, and you may want to upload one issued by a trusted CA instead.

Note the following before you proceed:

1. If you want to upload an SSL certificate before creating the HA cluster, you will need one issued for admin panel's current IP address. If you later create the HA cluster, the admin panel will move to the chosen virtual IP address, and you will need another SSL certificate issued for that address.
2. When you create or destroy the HA cluster, the current certificate is overwritten by a self-signed one generated by the system. You will need to re-upload your certificate and key from a trusted CA after completing either operation.
3. If you acquired an SSL certificate from an intermediate certificate authority (CA), you should have an end-user certificate along with a CA bundle that contains the root and intermediate certificates. To be able to use these certificates, you need to merge them into a chain first. A certificate chain includes the

end-user certificate, the certificates of intermediate CAs, and the certificate of a trusted root CA. In this case, an SSL certificate can only be trusted if every certificate in the chain is properly issued and valid.

For example, if you have an end-user certificate, two intermediate CA certificates, and a root CA certificate, create a new certificate file and add all certificates to it in the following order:

```
# End-user certificate issued by the intermediate CA 1
-----BEGIN CERTIFICATE-----
MIICiDCCAg2gAwIBAgIQNfwmXNmET8k9Jj1X<...>
-----END CERTIFICATE-----
# Intermediate CA 1 certificate issued by the intermediate CA 2
-----BEGIN CERTIFICATE-----
MIIEIDCCAwigAwIBAgIQNE7VVyDV7exJ9ON9<...>
-----END CERTIFICATE-----
# Intermediate CA 2 certificate issued by the root CA
-----BEGIN CERTIFICATE-----
MIIC8jCCAdqgAwIBAgICZngwDQYJKoZIhvcN<...>
-----END CERTIFICATE-----
# Root CA certificate
-----BEGIN CERTIFICATE-----
MIIDODCCAiCgAwIBAgIGIAYFFnACMA0GCSqG<...>
-----END CERTIFICATE-----
```

To upload an SSL certificate, do the following:

1. On the **SETTINGS** > **Management node** > **SSL ACCESS** tab, click **Upload**.
2. Upload an SSL certificate issued for admin panel's current IP address.
3. Upload the private key. This option shows after uploading a valid certificate.
4. Click **SAVE**.

The uploaded certificate will be added to the configuration of the web server that hosts the admin panel and you will be able to access it over HTTPS.

You can also generate a new self-signed certificate instead of the one used by default. However, it will not be trusted and you will have to manually accept it in your browser.

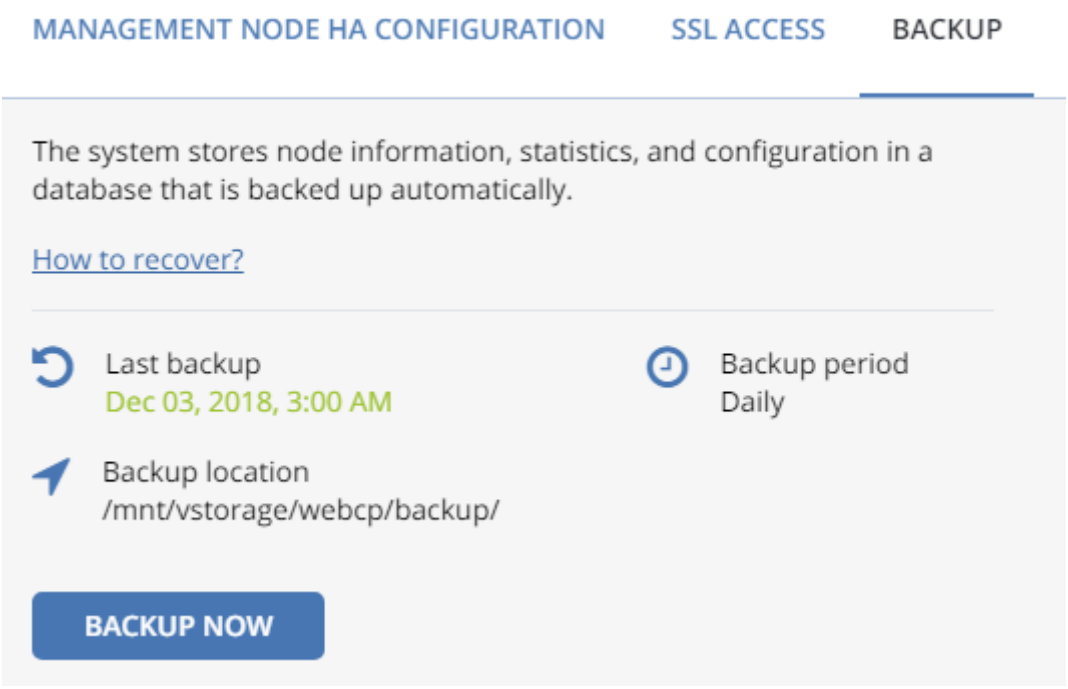
6.7 Backing Up and Restoring Management Database

Node information, statistics, and configurations are stored in a database on the management node (the one with the admin panel). Backups of this database are created automatically every day. If the management

node is not highly available, restoring such a backup recovers the node in case of failure or database corruption.

Important: Database backups cannot be restored if management node high availability is enabled and/or if the compute cluster is deployed. For this reason, it is highly recommended to set up management node HA before deploying the compute cluster.

To back up the database manually, open the **SETTINGS** > **Management node** > **Backup** screen and click **BACKUP NOW**.



Once backup is completed, the **Last backup** date will be refreshed.

Warning: Do not rename the backup file! Otherwise you will not be able to restore the management database from it.

6.7.1 Restoring Management Database from Backup

You can restore a management node database from backup on the same management node or any node assigned to the cluster.

Warning: The `vstorage-ui-backend` service must be up and running only on one node in a cluster. Thus, when restoring a management node database on another storage node, make sure the service is stopped on the current management node or the node itself is offline.

Run the following script on the node where the MN database will be restored:

```
# /usr/libexec/vstorage-ui-backend/bin/restore-management-node.sh \
-x <public_net_iface> -i <private_net_iface> \
-f /mnt/vstorage/webcp/backup/<backup_file>
```

where `<public_net_iface>` and `<private_net_iface>` are interfaces assigned the **Public** and **Private** networks, respectively. If required, you can specify the same network interface in both parameters. If the `-f` option is omitted, the management node database will be restored from the latest backup.

To access the admin panel, use the public IP address of the node with the restored MN database.

6.8 Managing Licenses

Acronis Cyber Infrastructure comes with a trial license that allows you to evaluate its features. The trial license has no expiration date but limits storage capacity to 1TB.

Acronis Cyber Infrastructure supports the following licensing models for production environments:

- License key. Implementing the provisioning model, keys are time-limited (subscription) or perpetual and grant a certain storage capacity. If a commercial license is already installed, a key augments its expiration date or storage limit.
- Services provider license agreement (SPLA). SPLA implements the pay-as-you-go model: it grants unlimited storage capacity and customers are charged for the actual usage of these resources. With SPLA, Acronis Cyber Infrastructure automatically sends reports to Acronis Cyber Cloud once every four hours. If no reports have been received for two weeks, the license expires. For reports to reach destination, the cluster must be able to access the Acronis datacenter that has been used to enable SPLA. Make sure that TCP port 443 is open.

Note: SPLA license is valid for Cloud Partners. If SPLA is enabled, you can connect Backup Gateway only to Acronis Backup Cloud and not to Acronis Backup 12.5 or Acronis Backup Advanced 12.5. To connect ABGW to these products, you will need to use license keys. Furthermore, Acronis Backup Gateway usage is not counted in SPLA in Acronis Cyber Infrastructure. SPLA only counts universal usage that is not related to backup. Backup usage is shown in the Acronis Backup Cloud section of Acronis Cyber Cloud.

You can switch the licensing model at any time:

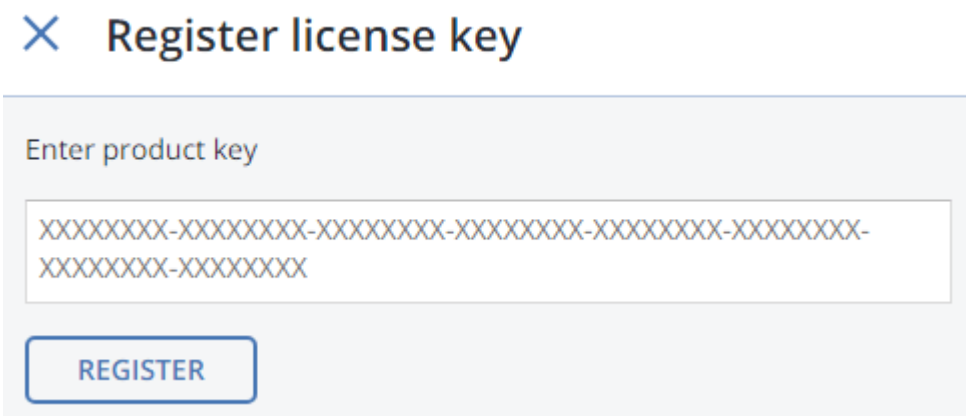
- Switching from a license key to SPLA terminates the key even if it has not yet expired. Terminated keys cannot be used anymore.
- Switching from SPLA to a license key changes the licensing model to subscription or perpetual. After doing so, ask your service provider to terminate your SPLA by either disabling the Storage application for your account or deleting the account.

Important: If a license expires, all write operations to the storage cluster stop until a valid license is installed.

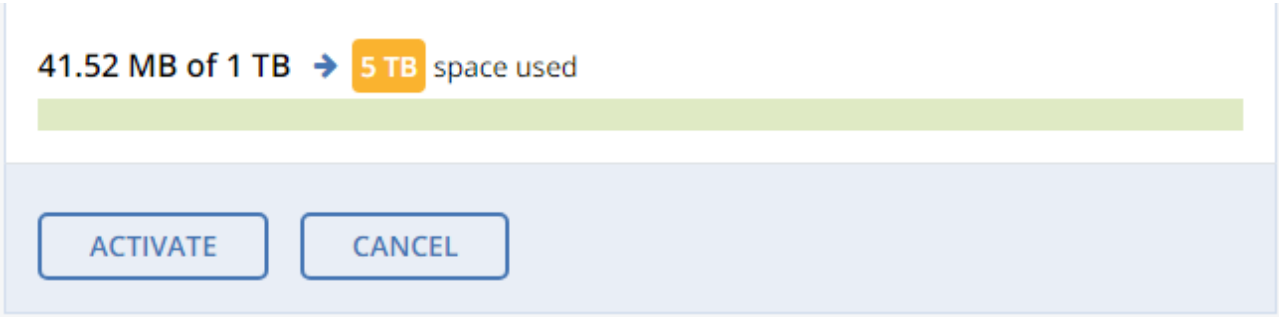
6.8.1 Installing License Keys

To install a license key, do the following:

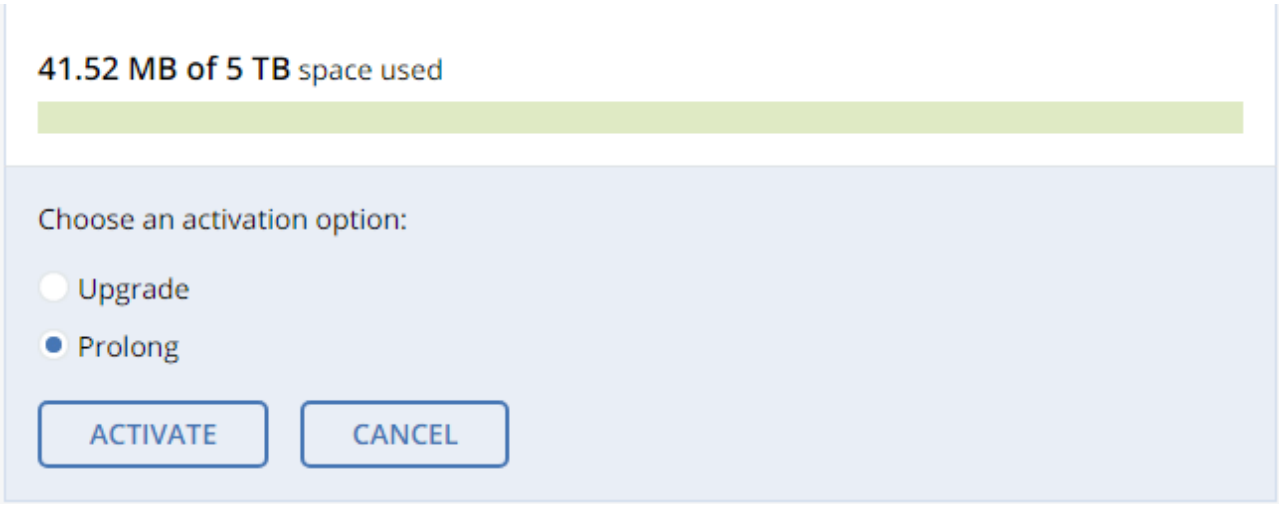
1. If you are switching from SPLA, ask your service provider to terminate the agreement by either disabling the Acronis Cyber Infrastructure application for your account or deleting the account.
2. On the **SETTINGS** > **Licenses** screen, click **Upgrade** and **Register key**.



3. In the **Register license key** window, paste the license key and click **REGISTER**.



4. Back on the **Licenses** screen, click **Activate** if you are activating from a trial or choose one of the following:



   - **Upgrade**, to add storage capacity to the active license.
   - **Prolong**, to prolong the soon-to-be-expired license.

   And click **Activate**.

The expiration date or storage capacity will change according to what the key grants.

6.8.2 Installing SPLA Licenses

To install a SPLA license, do the following:

1. On the **SETTINGS** > **Licenses** screen, click **Upgrade** and **Use SPLA**.
2. In the **Use SPLA** window, select a region from the drop-down list and click **Activate**. You will be redirected to a login page of Acronis Cyber Cloud.

   Note: For more information on datacenters, see https://kb.acronis.com/servicesbydc.

3. Log in to Acronis Cyber Cloud.
4. In the **Register cluster** window, accept the license agreement.
5. In the registration confirmation window, click **Done**.

The registered cluster will show up in Acronis Cyber Cloud. You will be able to monitor its resource usage and download reports.

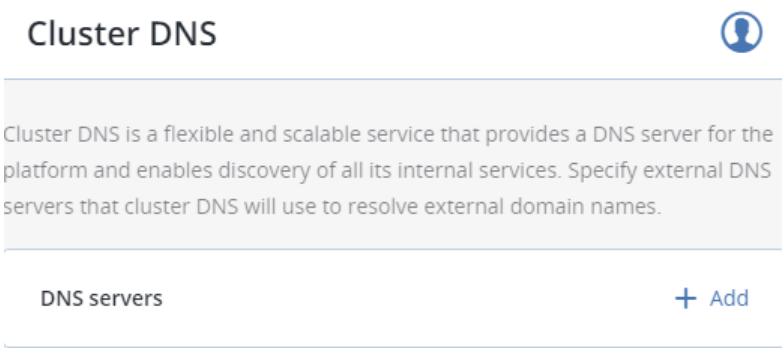
6.9 Adding External DNS Servers

Acronis Cyber Infrastructure features a built-in DNS server that enables discovery of all its internal services. For resolving external domain names, you can add DNS servers that already exist in your network infrastructure.

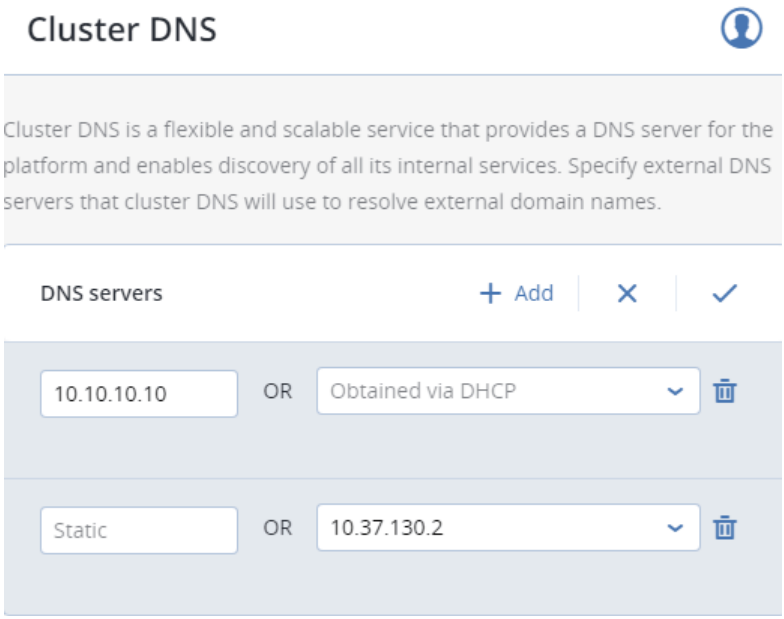
Important: Specify a DNS that belongs to a public network to be able to reach external locations like the updates repository as well as any public networks.

Do the following:

1. On the **SETTINGS** > **Cluster DNS** screen, click **Add**.



2. Either specify a static DNS IP address in the **Static** field or select a DHCP-provided DNS IP address from the list. Click **Add** multiple times to specify multiple external DNS servers.



3. Click the check mark icon to save changes.

6.10 Enabling RDMA

Warning: This feature is experimental and not recommended for production until version 4.0.

Acronis Cyber Infrastructure supports remote direct memory access (RDMA) over Converged Ethernet (RoCE), Internet Wide-area RDMA Protocol (iWARP), or InfiniBand (IB) for the storage backend network. The

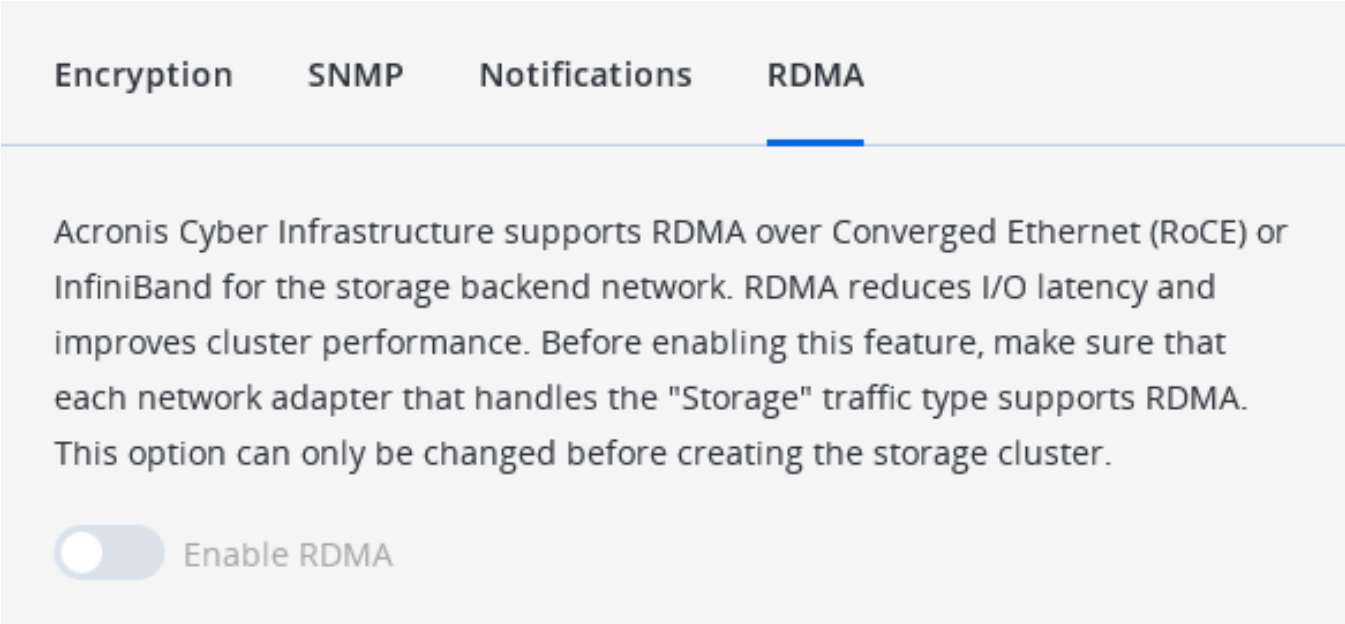
RDMA technology allows servers in this network to exchange data in main memory without involving their processors, cache or operating systems, thus freeing up resources and improving throughput and performance.

Your RDMA network infrastructure must be ready before you install Acronis Cyber Infrastructure.

Important: In the current version of Acronis Cyber Infrastructure, you can only enable (or disable) RDMA before creating the storage cluster.

By default, RDMA is disabled. Before enabling it, make sure that each network adapter connected to a network with the **Storage** traffic type supports RDMA.

To enable or disable RDMA, use the switcher on the **SETTINGS** > **Advanced settings** > **RDMA** tab. Changing this option may temporarily affect cluster availability.

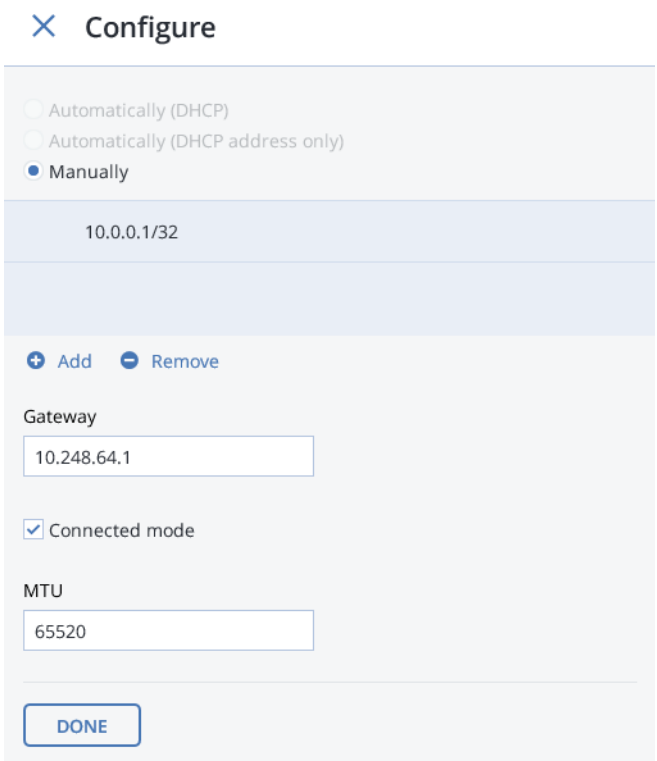


6.10.1 Configuring InfiniBand Devices

Note: As the admin panel only shows IP states and does not show InfiniBand connection states, it may report plugged in but yet unconfigured IB devices as **UNPLUGGED**. The status will change to **OK** once you assign an IP address to such a device.

If you have an InfiniBand infrastructure, do the following before enabling RDMA:

1. Assign the traffic type **Storage** to an empty network (without any other traffic types) on the **INFRASTRUCTURE** > **Networks** screen. Create a new network if needed by clicking **Edit** > **Create network**.
2. Configure each IB device on registered nodes:
    1. Open **INFRASTRUCTURE** > **Nodes** > <node> > **Network**, and select the device.
    2. Click **Configure**. In the pane that opens:
        - Assign an IP address (**Manually** will be selected by default).
        - Specify the gateway.
        - Check the **Connected mode** box.
        - Set MTU to 65520.



    Click **DONE**.
    3. Click **Assign network**. In the pane that opens, select the network with just the **Storage** traffic type and click **DONE**.

6.10.2 Configuring RoCE and iWARP Devices

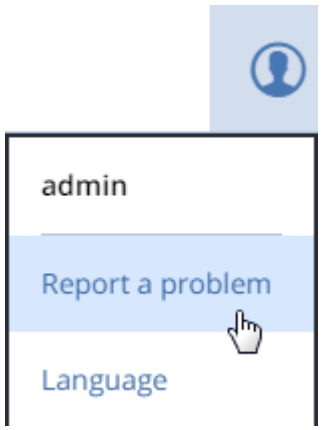
If you have a RoCE or iWARP infrastructure, do the following for each network device in it before enabling RDMA:

1. Open **INFRASTRUCTURE** > **Nodes** > <node> > **Network**, and select the device.
2. Click **Configure**. In the pane that opens, assign an IP address if the device does not have one yet and specify the gateway. Click **DONE**.
3. Click **Assign network**. In the pane that opens, select the network with the **Storage** traffic type (and possibly other traffic types like **Internal management**, **OSTOR private**, and **ABGW private**) and click **DONE**.

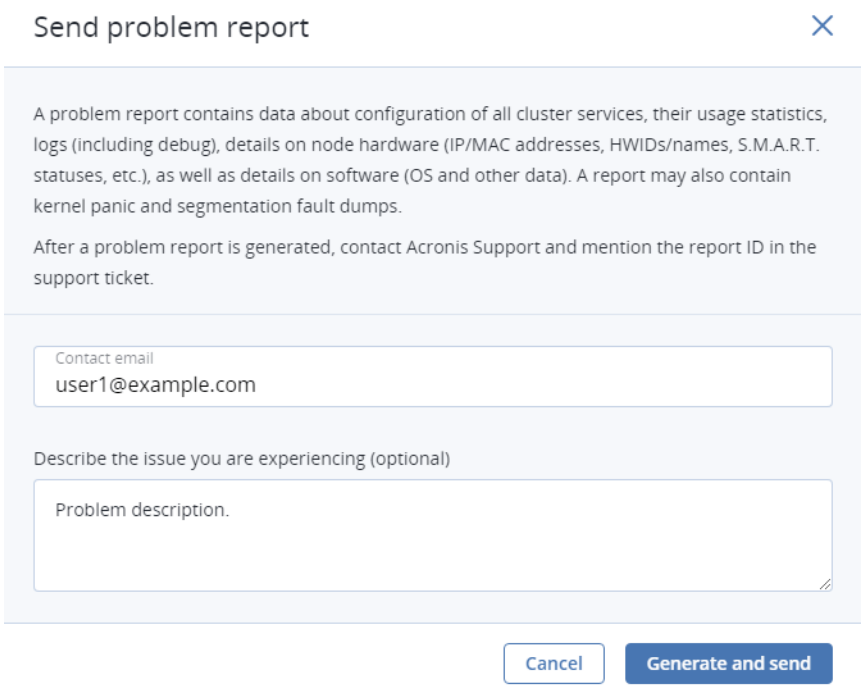
6.11 Sending Problem Reports

To send a problem report to the technical support team, do the following:

1. On any screen, click the user icon in the top right corner and select **Report a problem**.



2. Enter your contact email and a problem description and click **Generate and send**.



The problem report will be generated and assigned an ID. Make sure to mention this ID in the support ticket.

6.12 Configuring the Self-Service Panel

The self-service panel is a web-based control panel that allows end users to manage virtual objects, such as virtual machines, volumes, private networks, and other, in isolated administrative environments.

Note: The default system administrator cannot log in to the self-service portal.

To be able to access the self-service panel and manage virtual objects in it, do the following:

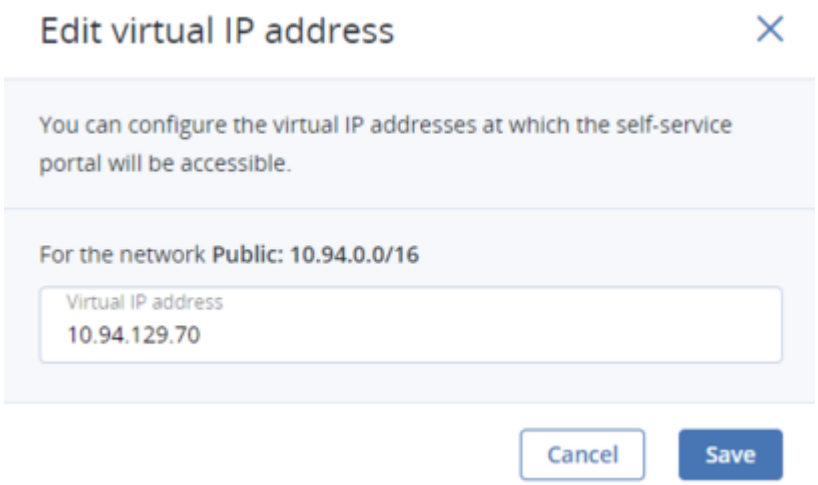
1. Create the compute cluster as described in *Creating the Compute Cluster* (page 52).
2. Create new domains, projects, and user accounts as described in *Managing Domains, Users, and Projects* (page 186).
3. Make sure the compute cluster has images and virtual public networks shared between all projects.
4. Open TCP port 8800 on the management node as follows:
    1. On the **INFRASTRUCTURE** > **Networks** screen, click **Edit**.

2. Add the **Self-service panel** traffic type to your public network by ticking the corresponding checkbox.
3. Click **Save** to apply changes.

You can now access the self-service panel at http://<admin_panel_IP_address>:8800. Use the domain name and user credentials to log in. If high availability for the management node is enabled, log in into the self-service panel using the virtual address for the admin panel: http://<admin_panel_virtual_IP_address>:8800. You can also use the link in the **Self-service panel URL** field on **SETTINGS** > **Self-service** screen.

To change the virtual IP address of the self-service panel, do the following:

1. Make sure high availability for the management node is enabled (see *Enabling Management Node High Availability* (page 204)).
2. On the **SETTINGS** > **Self-service** screen, click the pencil icon next to the **Self-service panel IP address** field.
3. In the **Edit virtual IP address** window, enter the desired IP address and click **Save**.

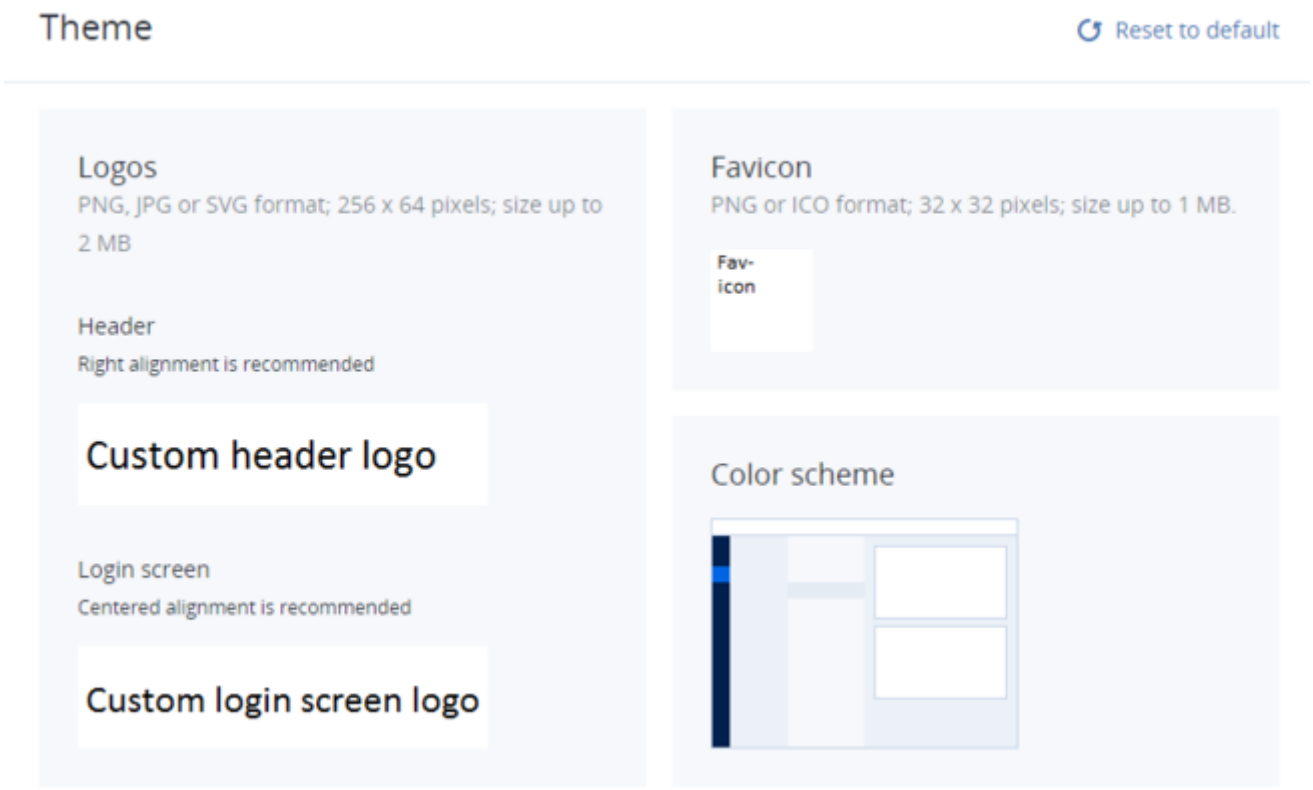


Note: You cannot change the virtual IP address, if the **Self-service panel** traffic type is assigned along with **Compute API** or **Internal management** to the same network. In this case, you need to destroy

the management node HA and re-create it specifying the desired IP address.

On the **SETTINGS** > **Self-service** screen, you can customize the self-service panel appearance as follows:

- In the **Logos** section, click **Upload** to upload logos for the panel header and login screen and select an image file in the PNG, JPG, or SVG format. The image must be 256 x 64 pixels and size up to 2 MB.
- In the **Favicon** section, click the upload icon to upload a favicon for the self-service panel and select an image file in the PNG or ICO format. The image must be 32 x 32 pixels and size up to 1 MB.
- In the **Color scheme** section, click **Change scheme** to choose a color scheme for the self-service panel. In a window that opens, choose the desired color scheme and click **Apply**.



To remove the chosen logos and favicon from the self-service and reset the theme to default, click **Reset to default**.