Virtuozzo

Virtuozzo Infrastructure 7.3

Storage User Guide

3/31/2026

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Supported storage types

Your service provider can configure Virtuozzo Infrastructure to keep your data in three storage types:

- S3 object storage: Designed for storing virtually unlimited numbers of objects (files).
- iSCSI block storage: Suitable for virtualization, databases, and applications requiring raw block devices.
- NFS shares. Provides distributed file-level access over the Network File System protocol.
- SMB shares. Provides file-level access over the Server Message Block (SMB) protocol for Windows and compatible clients.

The following sections describe the ways to access data in Virtuozzo Infrastructure in detail.

Accessing S3 buckets

To access S3 buckets, get the following information (credentials) from your system administrator:

- User panel IP address
- DNS name of the S3 endpoint
- Access key ID
- Secret access key

Virtuozzo Infrastructure allows you to access your S3 data in several ways:

- Via the Virtuozzo Infrastructure user panel
- Using the AWS command-line interface (AWS CLI)
- Via a third-party S3 application like Cyberduck, Mountain Duck, etc.

Managing buckets via the Virtuozzo Infrastructure user panel

This section describes how to manage buckets and their contents from the Virtuozzo Infrastructure user panel.

Logging in to the user panel

To log in to the Virtuozzo Infrastructure user panel, do the following:

1. On any computer with access to the web interface, in a web browser visit http://<user_panel_IP_address>:8888/s3/.

   Note
   If you use a self-signed certificate, add it to the browser's exceptions.

   Log in

   ENDPOINT

   s3.example.com

   ☑ Use secure transfer (SSL)

   ACCESS KEY ID

   d9fde6a530879f59HB8U

   SECRET ACCESS KEY

   ●●

   LOG IN

2. On the login screen, enter your credentials, and then click **Log in**.

If logging in to the user panel fails, this can be caused by one of the following reasons:

- Error: "Network failure. Check your S3 endpoint or access protocol (HTTP/HTTPS)."
    - The client is trying to access a bucket over HTTP. This does not work in most browsers, as parts of the web interface are served over HTTPS and mixed HTTP/HTTPS connections are forbidden. To solve the problem, access the service over HTTPS.
    - The client cannot resolve the DNS name associated with the service. In this case, add the mapping in your DNS. Alternatively, you can solve the problem by adding static mappings to the `hosts` file (`/etc/hosts` on Linux or `%windir%\System32\drivers\etc\hosts` on Windows); note that this needs to be done on all clients.
    - The service is using a self-signed or invalid SSL certificate. In this case, use a valid SSL certificate recognized by a certificate authority. Alternatively, you can temporarily solve the problem by pointing the browser to the service URL (for example, https://s3.example.com) and manually accepting the certificate; note that this only works on the client where the certificate has been manually accepted.
- Error: "Bad signature. Check your key and signing method."
    - The client or server time or timezone are incorrect.
    - The user credentials are incorrect.
   - The S3 user is disabled.

Once you log in to the web interface, you will see the **Buckets** screen with the list of your buckets. From here, you can manage buckets, as well as folders and files stored inside the buckets.

To log out, click the user icon in the upper right corner of any screen, and then click **Log out**.

Adding, deleting, and listing S3 buckets

On the **Buckets** screen:

- To add a new bucket, click **Add bucket**, specify a name, and click **Add**.
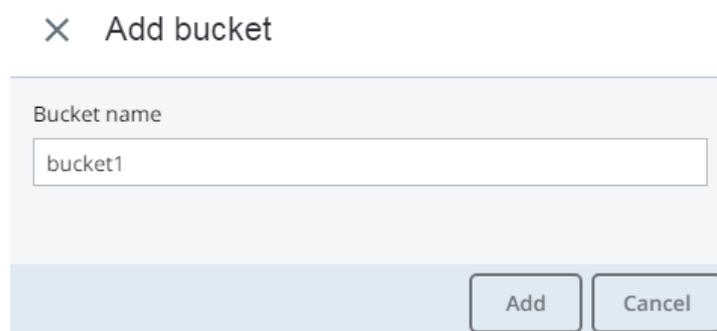
  Use bucket names that comply with DNS naming conventions. For more information on bucket naming, refer to "S3 bucket and key naming policies" (p. 12).
- To delete a bucket, select it, and then click **Delete**.
- To list the bucket contents, click the bucket name on the list.

Listing S3 bucket contents in a browser

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, **s3.example.com/mybucket**.
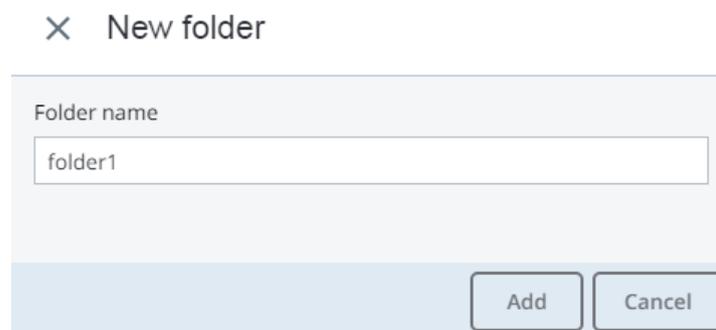
Note
You can also copy the link to bucket contents by right-clicking it in CyberDuck, and then selecting **Copy URL**.

Creating, deleting, and listing folders

On the bucket contents screen:

- To create a folder, click **New folder**, specify the folder name in the **New folder** window, and then click **Add**.
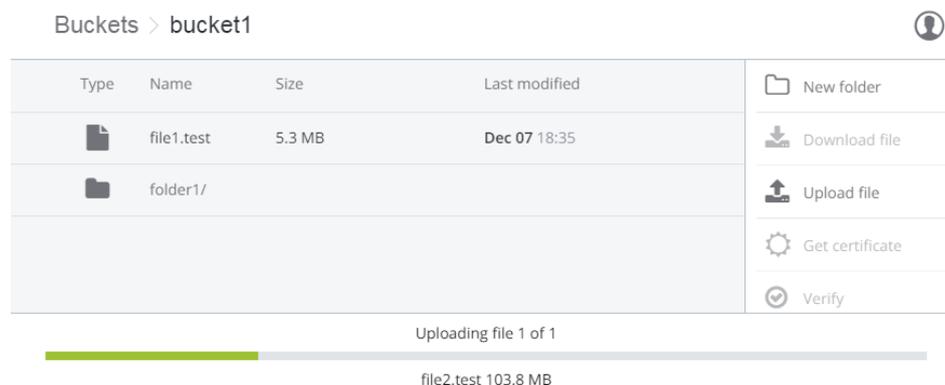

- To delete a folder, select it, and then click **Delete**.
- To list the folder contents, click the folder name.

Uploading and downloading files

On the bucket or folder contents screen:

- To upload files to S3, click **Upload**, and then choose files to upload.

- To download files, select them, and then click **Download**.

Accessing S3 storage via AWS command-line interface

You can access Virtuozzo Infrastructure S3 storage using the AWS command-line interface (AWS CLI). The AWS CLI provides command-line tools to manage S3 buckets and objects, which is particularly useful for automation, scripting, and integration with third-party tools.

Before using the AWS CLI, do the following:

1. Install and set up the AWS CLI as described in the official AWS documentation: Install/Update and Setup.

2. Configure the AWS CLI by running:

```
# aws configure
```

3. Provide your credentials when prompted. For example:

```
AWS Access Key ID [****************TI1S]: bd5187d8b8bec395TI1S
AWS Secret Access Key [****************TO69]:
abpZelzRf8MTPiR0690sNALtji2jHxlUv0ImTO69
Default region name [None]: ostor
Default output format [None]: json
```

Note
The region parameter specified in S3 client configuration is not taken into account when sending requests to Virtuozzo Infrastructure S3 storage. Because region-based routing is not used, the region value can be set to an arbitrary value.

4. Configure the S3 endpoint. Because Virtuozzo Infrastructure uses a custom S3 endpoint, you must specify it in each command. To simplify usage, create a command alias:

```
# alias aws-vi="aws --endpoint-url https://<endpoint>"
```

Replace `<endpoint>` with the DNS name of your S3 endpoint.

Now, you can use `aws-vi` instead of `aws` when working with Virtuozzo Infrastructure S3.

To verify connectivity, list existing buckets:

```
# aws-vi s3 ls
2026-03-06 17:10:00 bucket
```

Managing S3 buckets and objects

The `aws s3` command provides basic functionality to access and manipulate S3 buckets and objects.

- To create a bucket:

```
# aws-vi s3 mb s3://my-bucket
make_bucket: my-bucket
```

Use bucket names that comply with DNS naming conventions. For more information on bucket naming, refer to "S3 bucket and key naming policies" (p. 12).

- To list all buckets:

```
# aws-vi s3 ls
2026-03-06 17:14:53 bucket
2026-03-06 17:20:08 my-bucket
```

- To upload a local file to a bucket:

```
# ls
file1
# aws-vi s3 cp file s3://my-bucket
upload: ./file1 to s3://my-bucket/file1
```

- To list objects in a bucket, run:

```
# aws-vi s3 ls s3://my-bucket
2026-03-06 17:21:37        5120 file1
```

- To download an object from a bucket:

```
# aws-vi s3 cp s3://my-bucket/file1 file2
download: s3://my-bucket/file1 to ./file2
# ls
file1  file2
```

- To delete a file:

```
# aws-vi s3 rm s3://my-bucket/file1
delete: s3://my-bucket/file1
```

- To delete a bucket:

Note

The bucket must be empty before it can be deleted.

```
# aws-vi s3 rb s3://my-bucket
remove_bucket: my-bucket
```

# Accessing S3 storage with CyberDuck

To access Virtuozzo Infrastructure with CyberDuck, do the following:

1. In CyberDuck, click **Open Connection**.
2. Specify your credentials:
   - The DNS name of the S3 endpoint.
   - The **Access Key ID** and the **Password**, the secret access key of an object storage user.
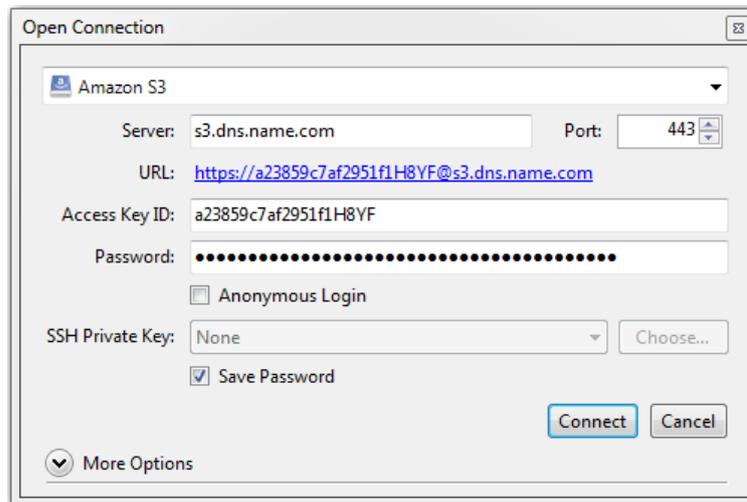


   By default, the connection is established over HTTPS. To use CyberDuck over HTTP, you must install a special S3 profile.

3. Once the connection is established, click **File** > **New Folder** to create a bucket.
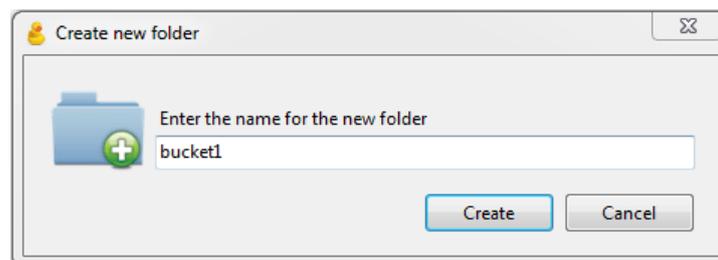


4. Specify a name for the new bucket, and then click **Create**. Use bucket names that comply with DNS naming conventions. For more information on bucket naming, refer to "S3 bucket and key naming policies" (p. 12).

The new bucket will appear in CyberDuck. You can manage it and its contents.

## Managing S3 bucket versions

Versioning is a way of keeping multiple variants of an object in the same bucket. You can use versioning to preserve, retrieve, and restore every version of every object stored in your S3 bucket. With versioning, you can easily recover from both unintended user actions and application failures. For more information about bucket versioning, refer to the Amazon documentation.

Bucket versioning is turned off by default. In CyberDuck, you can enable it in bucket properties. For example:
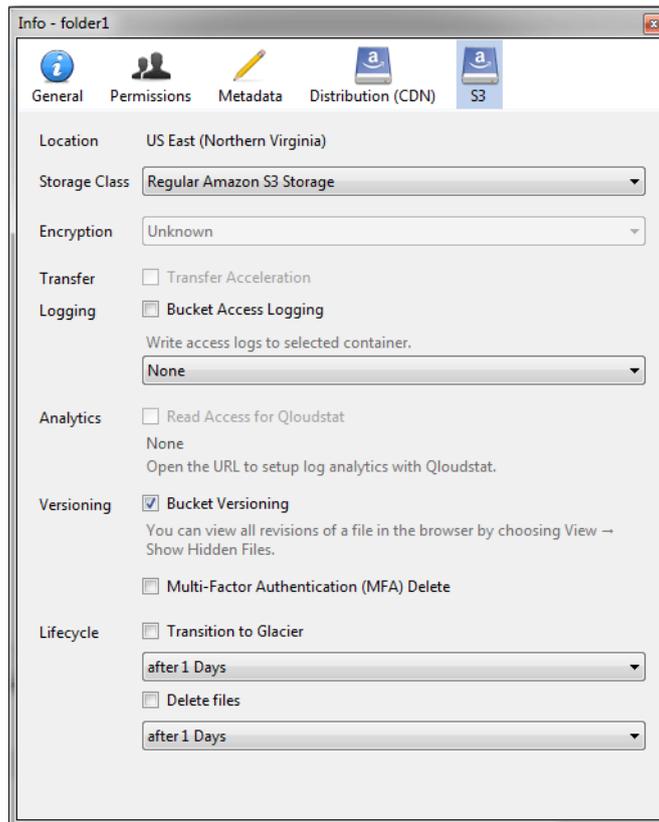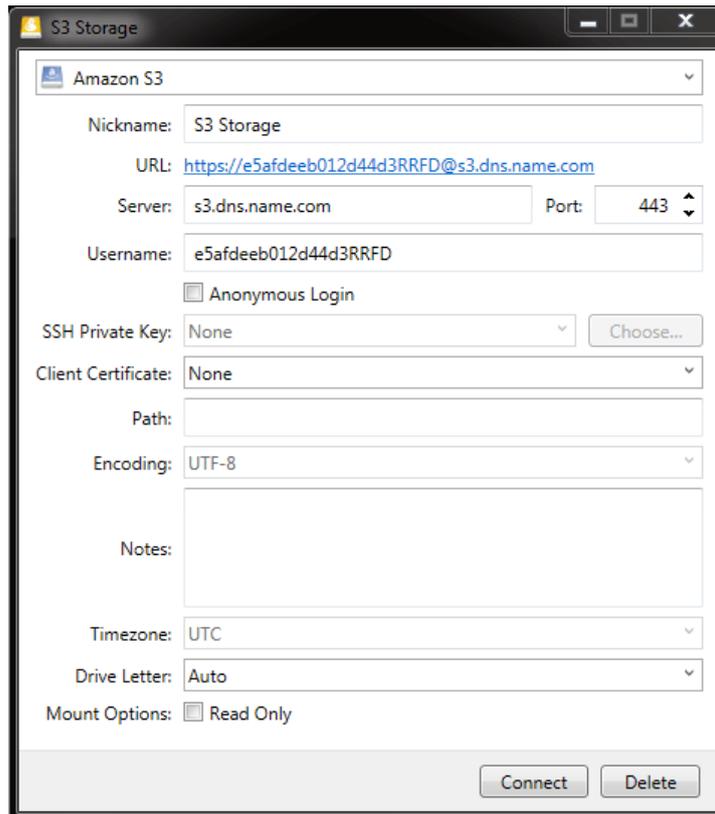
# Mounting S3 storage with Mountain Duck

Mountain Duck enables you to mount and access Virtuozzo Infrastructure S3 storage as a regular disk drive. Do the following:

1. If your service provider has provided you with an SSL certificate, install it.
2. In Mountain Duck, click **New Bookmark**.
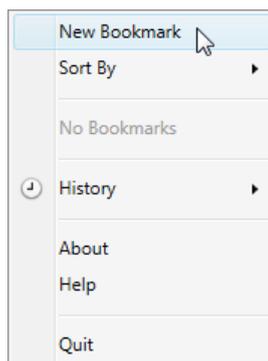


3. In the properties window, select **Amazon S3** profile from the first drop-down list and specify the following parameters:
   - Disk drive name in the **Nickname** field
   - Endpoint DNS name in the **Server** field
   - Access key ID in the **Username** field

   Click **Connect**.

4. In the login window, specify **Secret Access Key** and click **Login**.
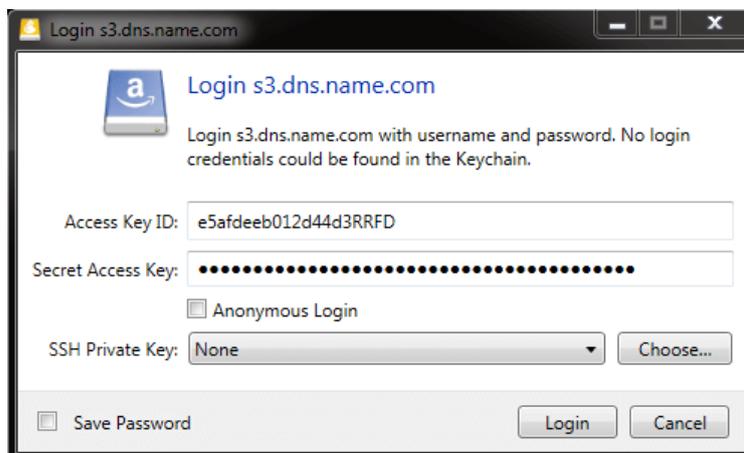


Mountain Duck will mount the S3 storage as a disk drive. On the disk, you can manage buckets and store files in them.

# Creating S3 buckets on mounted S3 storage

Windows and macOS, operating systems supported by Mountain Duck, treat buckets as folders in case the S3 storage is mounted as a disk drive. In both operating systems, the default folder name contains spaces. This violates bucket naming conventions (refer to "S3 bucket and key naming policies" (p. 12)), therefore you cannot create a new bucket directly on the mounted S3 storage. To create a bucket on a mounted S3 storage, create a folder with a name complying with DNS naming conventions elsewhere and copy it to the root of the mounted S3 storage.

# S3 bucket and key naming policies

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

- Must be from 3 to 63 characters long
- Can contain only lowercase letters, numbers, hyphens (-), and periods (.)
- Must start and end with a letter or number
- Can be a series of valid name parts separated by periods

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

# Accessing iSCSI targets

This section describes ways to attach iSCSI targets to operating systems and third-party virtualization solutions that support the explicit ALUA mode.

## Accessing iSCSI targets from VMware ESXi

Before using Virtuozzo Infrastructure volumes with VMware ESXi, you need to configure it to properly work with ALUA Active/Passive storage arrays. It is recommended to switch to the `VMW_PSP_RR` path selection policy (PSP) to avoid any issues. For example, on VMware ESXi 6.5:

- To set the default PSP for all devices, run:

  ```
  # esxcli storage nmp satp rule add --satp VMW_SATP_ALUA --vendor VSTORAGE \
  --model VSTOR-DISK --psp VMW_PSP_RR -c tpgs_on
  ```

- To set the PSP for a specific device, run:

  ```
  # esxcli storage core claimrule load
  ```

Now you can proceed to create datastores from Virtuozzo Infrastructure volumes exported via iSCSI. Log in to the VMware ESXi web panel and do the following:

1. In the Navigator, go to the **Storage** > **Adapters** tab and click **Configure iSCSI**.
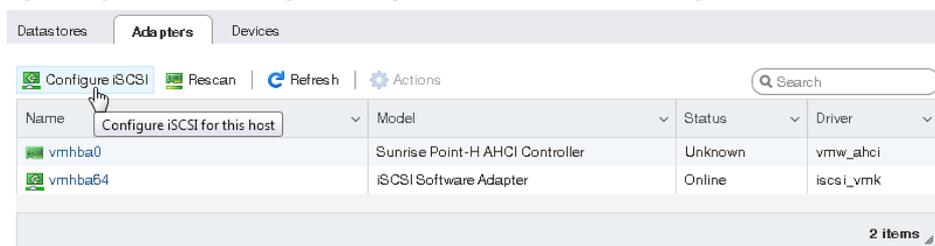
2. In the **Configure iSCSI** window, click **Add static target** in the **Static targets** section, fill out target IQNs, IP addresses, and ports. Click **Save configuration**.
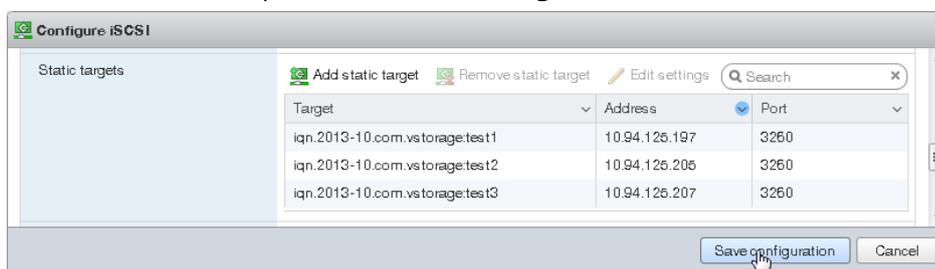
3. Proceed to the **Devices** tab and click **Refresh**. The newly added disk will appear in the list of devices.

4. Select the disk and click **New datastore**. In the wizard that appears, enter a name for the datastore and select partitioning options. Click **Finish** to actually partition the disk.

> **Warning!**
> Partitioning the disk will erase all data from it.

The ready-to-use disk will appear in the list of datastores. You can now view its contents it with the datastore browser and provision it to VMs.

> **Note**
> If your ESXi host loses connectivity to VMFS3 or VMFS5 datastores, follow the instructions in KB article #2113956.

Accessing iSCSI targets from Linux

> **Important**
> To mount an iSCSI device to a storage node from another Virtuozzo Infrastructure cluster, use the `vinfra node iscsi target add/delete` commands, as described in the Administrator Guide.

To connect a Linux-based iSCSI initiator to iSCSI targets of Virtuozzo Infrastructure working in the ALUA mode, do the following:

1. Make sure the required packages are installed.
   - On RPM-based systems (CentOS and other), run:

     ```
     # yum install iscsi-initiator-utils device-mapper-multipath
     ```

   - On DEB-based systems (Debian and Ubuntu), run:

     ```
     # apt-get install open-iscsi multipath-tools
     ```

2. Create and edit the configuration file `/etc/multipath.conf` as follows:

```
...
devices {
  device {
    vendor "VSTORAGE"
      product "VSTOR-DISK"
    features "2 pg_init_retries 50"
    hardware_handler "1 alua"
    path_grouping_policy group_by_node_name
    path_selector "round-robin 0"
      no_path_retry queue
    user_friendly_names no
    flush_on_last_del yes
    failback followover
    path_checker tur
      detect_prio no
    prio alua
  }
}
...
```

3. Load the kernel module and launch the multipathing service.

```
# modprobe dm-multipath
# systemctl start multipathd; systemctl enable multipathd
```

4. If necessary, enable CHAP parameters `node.session.auth.*` and `discovery.sendtargets.auth.*` in `/etc/iscsi/iscsid.conf`.

5. Launch the iSCSI services:

```
# systemctl start iscsi iscsid
# systemctl enable iscsi iscsid
```

6. Discover all targets by their IP addresses. For example:

```
# iscsiadm -m discovery -t st -p 10.94.91.49 10.94.91.49 3260,1 \
iqn.2014-06.com.vstorage:target1
# iscsiadm -m discovery -t st -p 10.94.91.54 10.94.91.54:3260,1 \
iqn.2014-06.com.vstorage:target2
# iscsiadm -m discovery -t st -p 10.94.91.55 10.94.91.55:3260,1 \
iqn.2014-06.com.vstorage:target3
```

7. Log in to the discovered targets. For example:

```
# iscsiadm -m node -T iqn.2014-06.com.vstorage:target1 -l
# iscsiadm -m node -T iqn.2014-06.com.vstorage:target2 -l
# iscsiadm -m node -T iqn.2014-06.com.vstorage:target3 -l
```

8. Find out the multipath device ID. For example:

```
# multipath -ll
360000000000000000000b50326ea44e3 dm-10 VSTORAGE,VSTOR-DISK
```

```
size=200G features='2 pg_init_retries 50' hwhandler='1 alua' wp=rw
|-+- policy='round-robin 0' prio=50 status=active
| `- 6:0:0:1 sdf 8:80  active ready running
|-+- policy='round-robin 0' prio=1 status=enabled
| `- 8:0:0:1 sdj 8:144 active ghost running
`-+- policy='round-robin 0' prio=1 status=enabled
  `- 7:0:0:1 sdh 8:112 active ghost running
# fdisk -l | grep 360000000000000000000b50326ea44e3
Disk /dev/mapper/360000000000000000000b50326ea44e3: 10.7 GB, \
10737418240 bytes, 20971520 sectors
```

You can also find out the multipath device ID by adding `3600000000000000000` to the last six bytes of the volume ID. In the example above, `360000000000000000000b50326ea44e3` is the multipath device ID mapped from the volume ID `61c9d567-4666-4c16-8030-b50326ea44e3`.

Now you can create partitions on the iSCSI device (`/dev/mapper/360000000000000000000b50326ea44e3` in this example), as well as format and mount it to your initiator node using standard Linux tools.

When you no longer need the external iSCSI device, you can remove it from the initiator node. Do the following:

1. Make sure the iSCSI device is not in use.

2. Disable multipathing to the device. For example:

   ```
   # multipath -f /dev/mapper/360000000000000000000b50326ea44e3
   ```

3. Log out of the iSCSI targets. For example:

   ```
   # iscsiadm -m node -T iqn.2014-06.com.vstorage:target1 -p 10.94.91.49:3260 -u
   # iscsiadm -m node -T iqn.2014-06.com.vstorage:target2 -p 10.94.91.54:3260 -u
   # iscsiadm -m node -T iqn.2014-06.com.vstorage:target3 -p 10.94.91.55:3260 -u
   ```

4. Delete the iSCSI targets. For example:

   ```
   # iscsiadm -m node -o delete -T iqn.2014-06.com.vstorage:target1 \
   -p 10.94.91.49:3260
   # iscsiadm -m node -o delete -T iqn.2014-06.com.vstorage:target2 \
   -p 10.94.91.54:3260
   # iscsiadm -m node -o delete -T iqn.2014-06.com.vstorage:target3 \
   -p 10.94.91.55:3260
   ```

Accessing iSCSI targets from Microsoft Hyper-V

Before connecting an iSCSI initiator of Microsoft Hyper-V to iSCSI targets working in the ALUA mode, you need to install and configure Multipath I/O (MPIO). This feature can be used starting from Windows Server 2008 R2. To connect the initiator, for example, on Microsoft Hyper-V Server 2016, do the following:
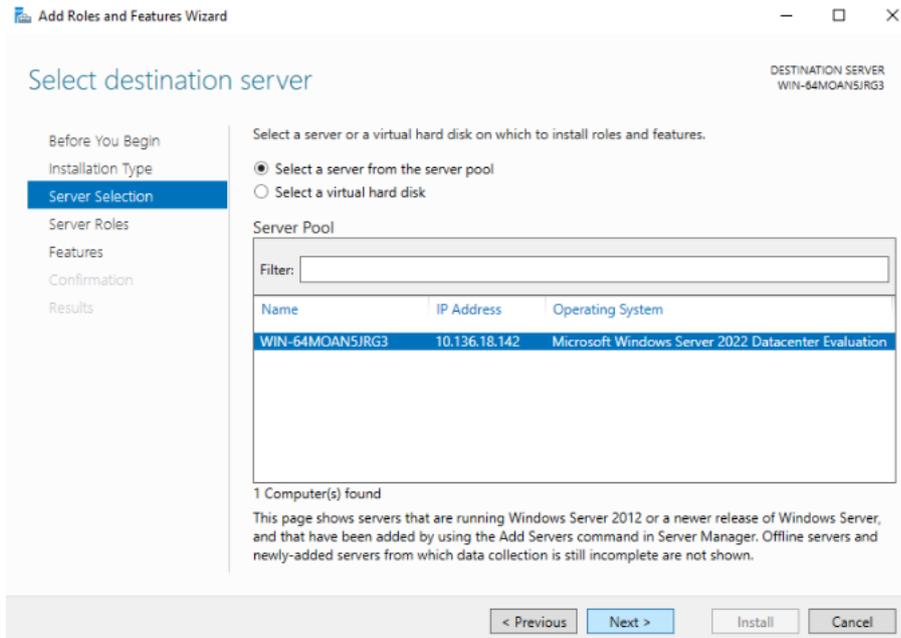
1. Add the MPIO feature:

   a. Open Server Manager, click **Manage**, and select **Add Roles and Features**.
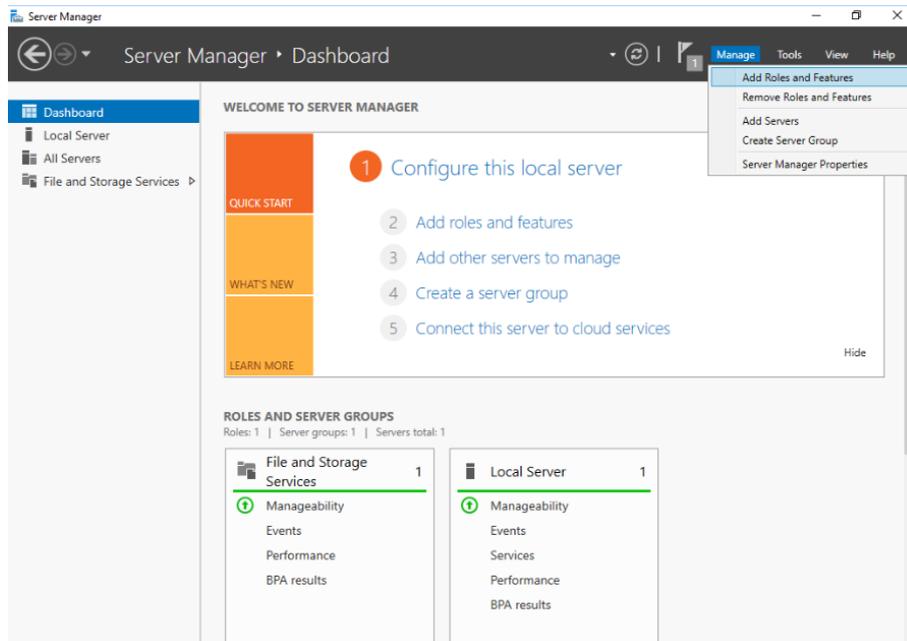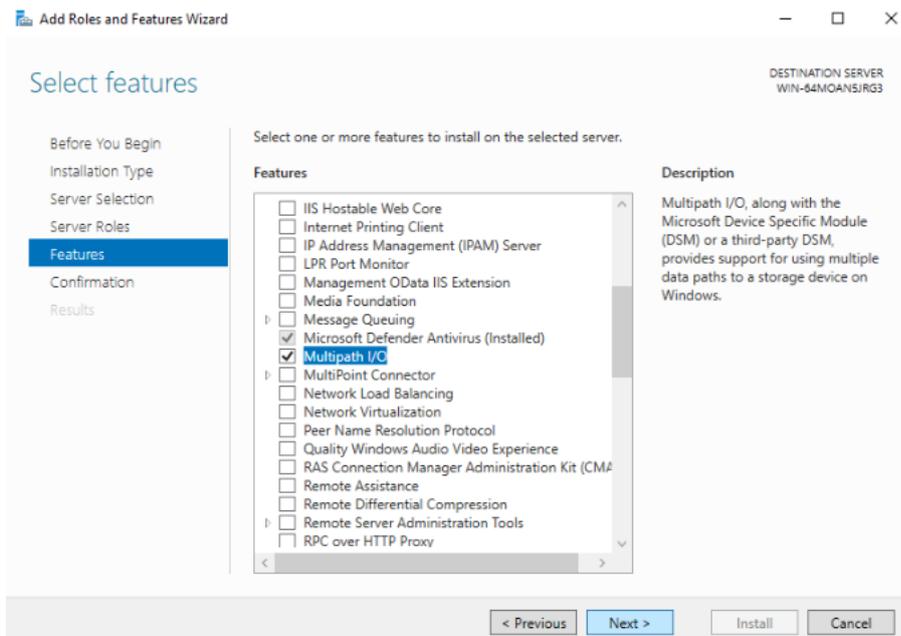

   b. In **Installation Type**, leave **Role-based or feature-based installation**.
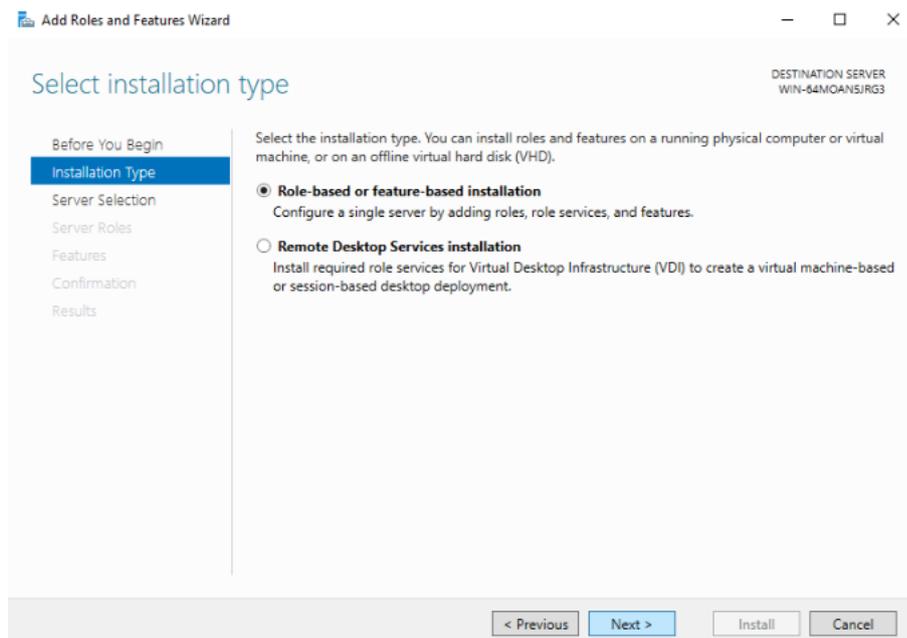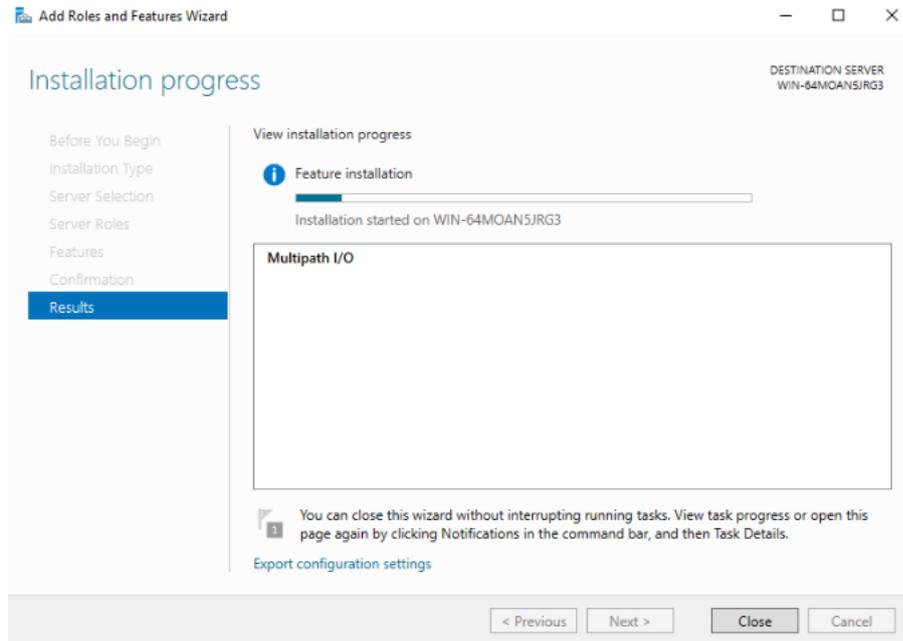

   c. In **Server Selection**, leave **Select a server from the server pool**.

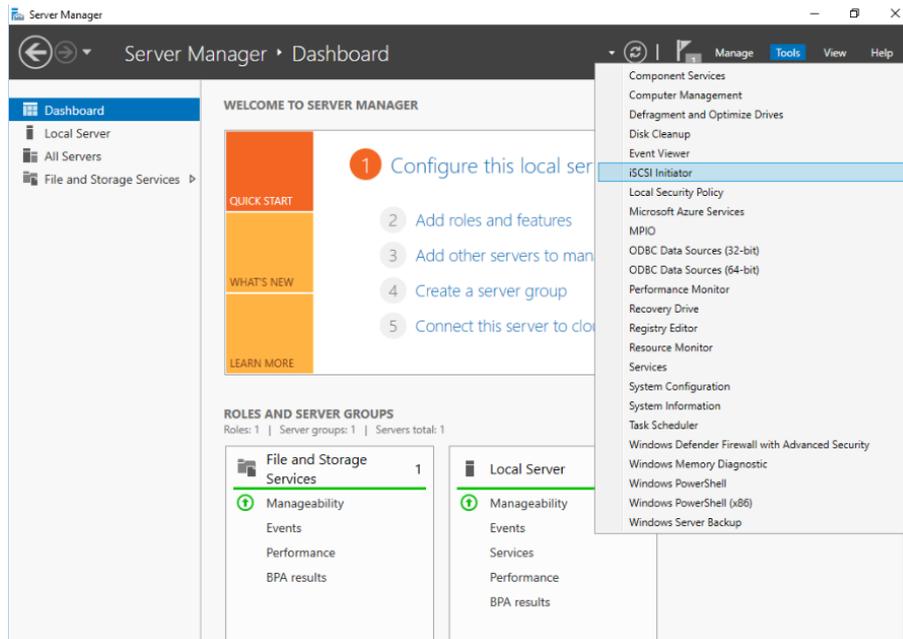d. In **Features**, select the **Multipath I/O** option and click **Next** to install this feature.

e. Wait until the installation process is complete, and then close the window.
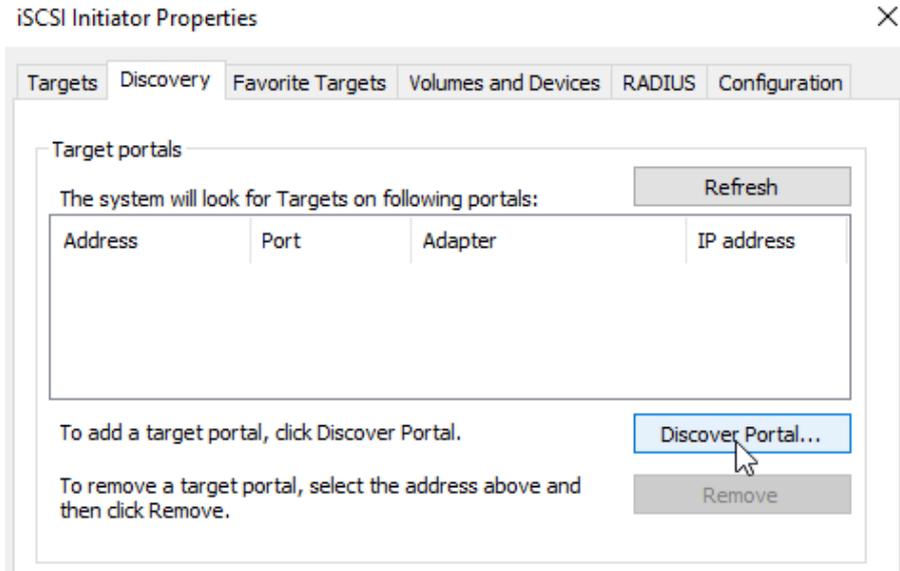
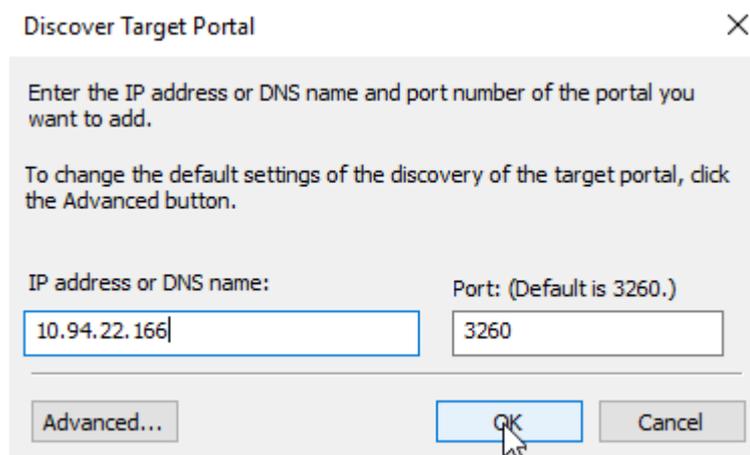2. Connect your iSCSI targets to the iSCSI initiator as follows:

    a. In Server Manager, click **Tools**, and select **iSCSI Initiator** to launch it.
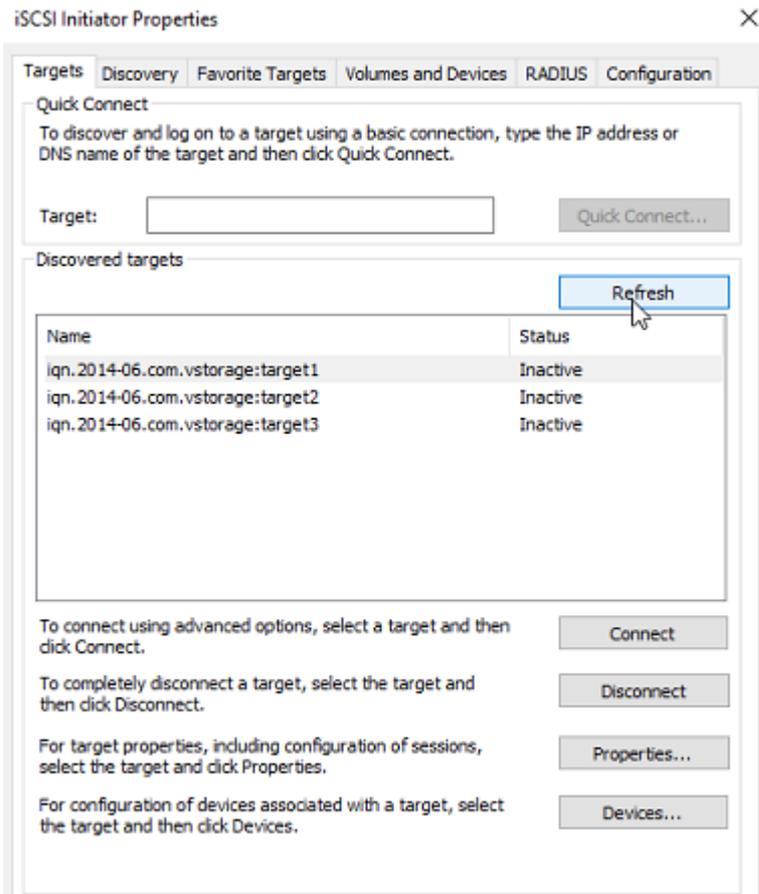

    b. In the **iSCSI Initiator Properties** window, open the **Discovery** tab and click **Discover Portal**.
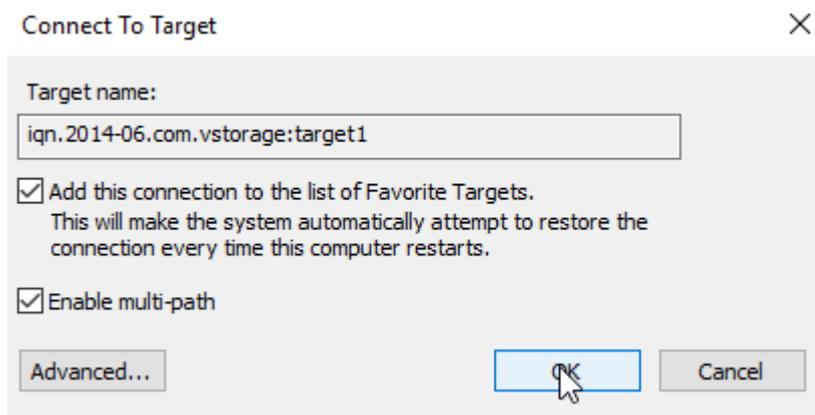
c. In the **Discover Target Portal** window, enter the target IP address and click **OK**. Repeat this step for each target from the target group.

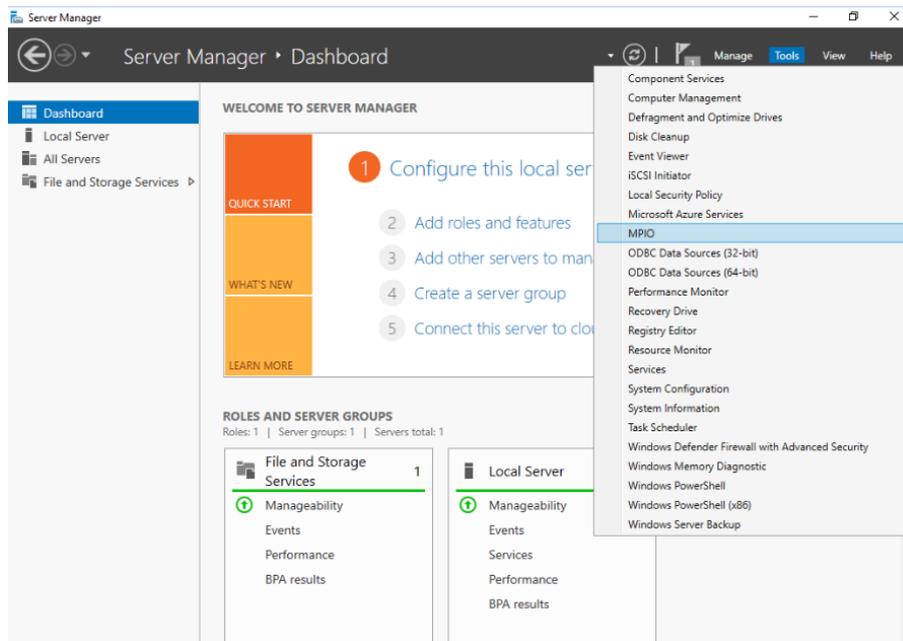d. On the **Targets** tab, click **Refresh** to discover the added targets.

e. Click **Connect** for each target to connect it to the initiator. In the **Connect To Target** window, select **Enable multi-path** and click **OK**.
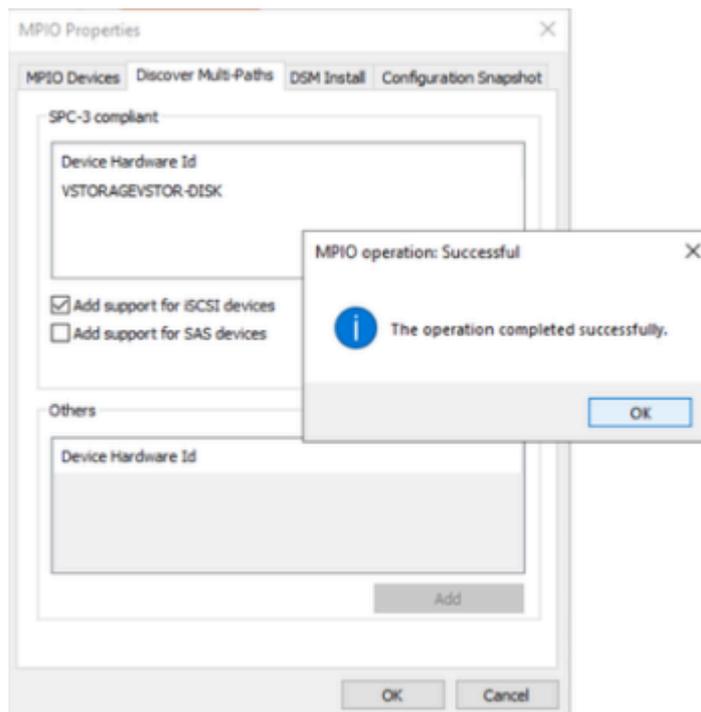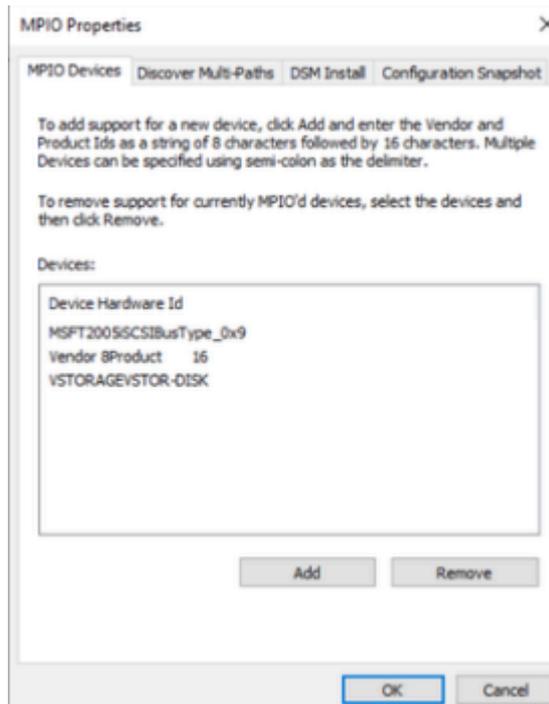

3. Configure MPIO settings:

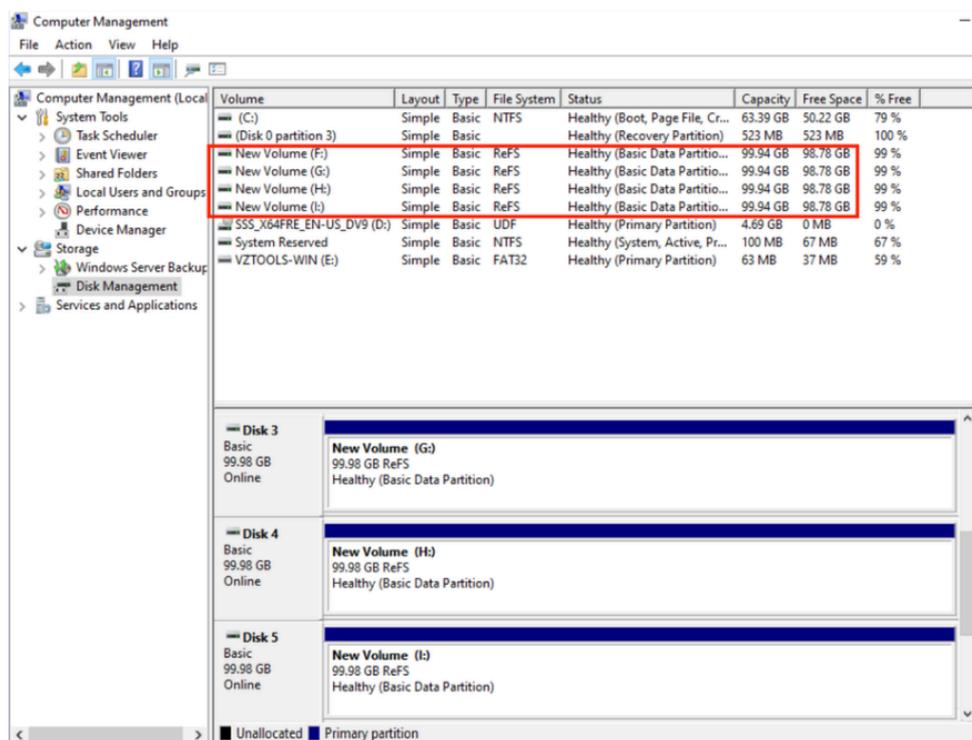a. In Server Manager, click **Tools**, and select **MPIO**.

b. In the **MPIO Properties** window, go to the **Discover Multi-Paths** tab and select **Add support for iSCSI devices**.

c. On the **MPIO Devices** tab, check the displayed devices and click **OK**.

Now, you can check the added devices and their status in **Disk Management**.


To improve the iSCSI initiator performance, configure Microsoft Windows registry keys as follows:

1. Open **Registry Editor**. In the **Start** menu, type **regedit** in the search box and press Enter.
2. Navigate to the following location: `[\HKEY_LOCAL_ MACHINE\SYSTEM\CurrentControlSet\Control\Class\{4d36e97b-e325-11ce-bfc1-08002be10318}\0004 (Microsoft iSCSI Initiator)\Parameters]`.

3. Update the following settings. Right-click on each setting and select **Modify**. Change **Base** to **Decimal**, update the value, and select **OK**.

Parameter	Value	Description
MaxTransferLength	262144	Sets maximum data the initiator sends in an iSCSI PDU to the target to 256 KB
MaxBurstLength	262144	Sets the maximum SCSI payload that the initiator negotiates with the target to 256 KB
FirstBurstLength	262144	Sets maximum unsolicited data the initiator can send in an iSCSI PDU to a target to 256 KB
MaxRecvDataSegmentLength	262144	Sets maximum data the initiator can receive in an iSCSI PDU from the target to 256 KB
InitialR2T	0	Disables R2T flow control
ImmediateData	1	Enables immediate data
WMIRequestTimeout	30 seconds	Sets the timeout value for WMI requests to 30 seconds
LinkDownTime	30 seconds	Sets timeout value for link down time to 30 seconds
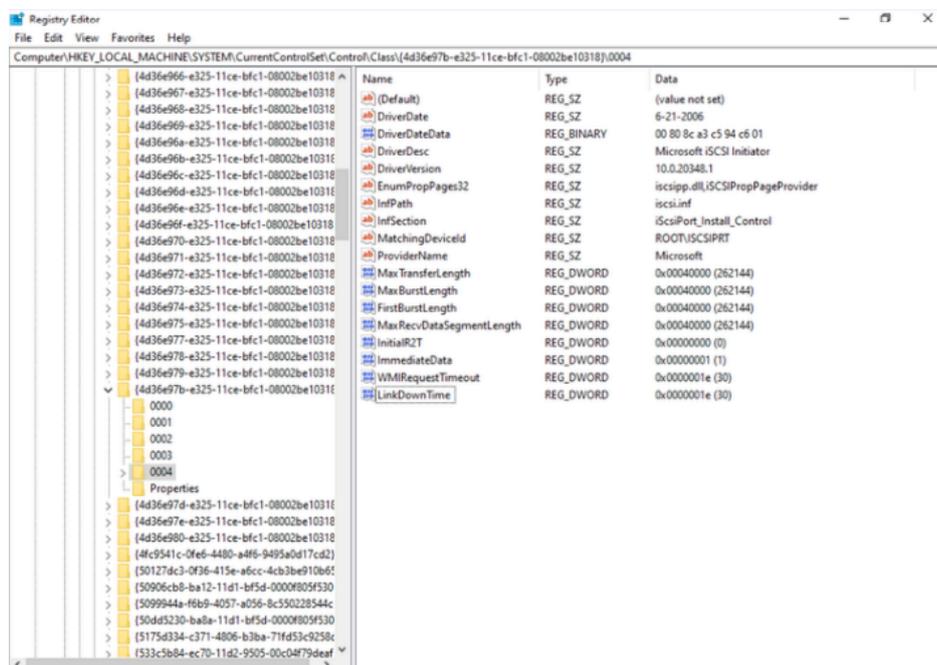
Accessing NFS shares

This section describes ways to mount Virtuozzo Infrastructure NFS shares on Linux and macOS.

Note
Virtuozzo Infrastructure currently does not support the Windows built-in NFS client.

Mounting NFS exports on Linux

You can mount an NFS export created in Virtuozzo Infrastructure like any other directory exported via NFS. You will need the share IP address (or hostname) and the volume identifier.

In console, run the following commands:

```
# mkdir /mnt/nfs
# mount -t nfs -o vers=4.0 <share_IP>:/<share_name>/ /mnt/nfs
```

where:

- `-o vers=4.0` is the NFS version to use.

    Virtuozzo Infrastructure supports NFS versions 4.0 and 4.1.
- `<share_IP>` is the share IP address. You can also use the share hostname.
- `/<share_name>/` is the root export path, like `share1`. For user exports, specify their full path, for example: `/<share_name>/export1`.
- `/mnt/nfs` is an existing local directory to mount the export to.

Mounting NFS exports on macOS

You can mount an NFS export created in Virtuozzo Infrastructure like any other directory exported via NFS. You will need the share IP address (or hostname) and the volume identifier.

You can use the command-line prompt or Finder:

- In console, run the following commands:

    ```
    # mkdir /mnt/nfs
    # mount -t nfs -o vers=4.0 <share_IP>:/<share_name>/ /mnt/nfs
    ```

    where:

    - `-o vers=4.0` is the NFS version to use.

        Virtuozzo Infrastructure supports NFS versions 4.0 and 4.1.
    - `<share_IP>` is the share IP address. You can also use the share hostname.
    - `/<share_name>/` is the root export path, like `share1`. For user exports, specify their full path, for example: `/<share_name>/export1`.
    - `/mnt/nfs` is an existing local directory to mount the export to.
- In Finder, do the following:

1. Set the NFS version to 4.0. To do this, add the `nfs.client.mount.options = vers=4.0` line to the `/etc/nfs.conf` file.

2. In the **Finder** > **Go** > **Connect to server** window, specify `nfs://192.168.0.51:/<share_name>/` where:

   - `192.168.0.51` is the share IP address. You can also use the share hostname.
   - `/<share_name>/` is the root export path. For user exports, specify their full path, for example: `/<share_name>/export1`.

3. Click **Connect**.

The Finder will mount the export to `/Volumes/<share_name>/`.

Accessing SMB shares

This section describes how to connect to Virtuozzo Infrastructure SMB shares on Windows and configure NTFS-level permissions.

Connecting to SMB shares

To connect to an SMB share, you need to mount an SMB export created in Virtuozzo Infrastructure like any other resource shared via SMB. You will need:

- The virtual IP address of the node hosting the share
- The export path
- Active Directory (AD) administrator credentials

Run the following command in the console:

```
# net use Z: \\10.10.10.101\export1 /user:TEST\Administrator
```

where:

- `Z:` is an arbitrary drive letter to assign to the share
- `10.10.10.101` is the virtual IP address of the node hosting the share
- `\export1` is the path to the export inside your share
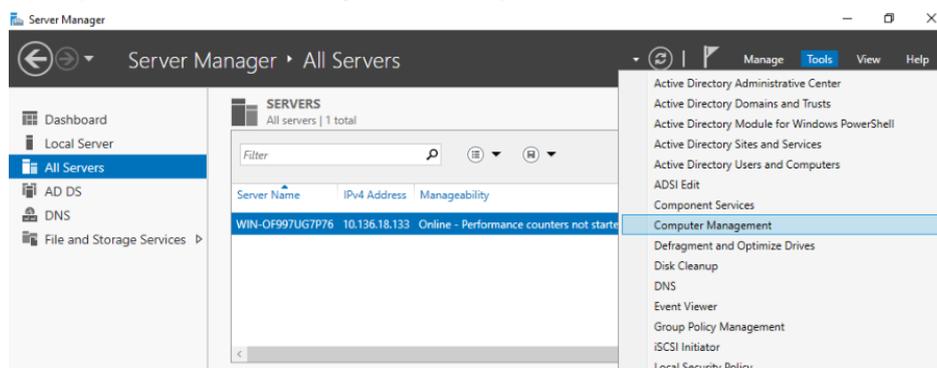- `TEST` is the NetBIOS domain name

Setting NTFS permissions

NTFS (New Technology File System) permissions define how users and groups can interact with individual files and folders within a share.
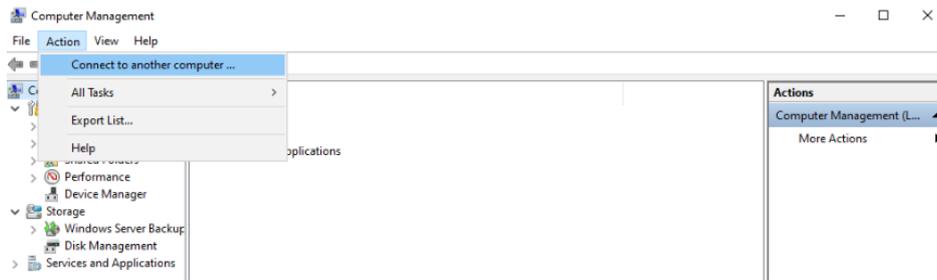
Note that to configure NTFS permissions, you must have administrative privileges.
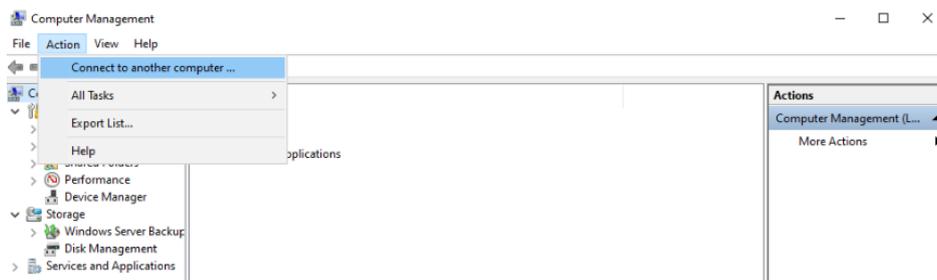
Do the following:

1. In Server Manager, click **Tools** > **Computer Management**.

2. Click **Action** and select **Connect to another computer...**.

3. In **Another computer**, enter the virtual IP address of the node that hosts your share.

4. Navigate to **System Tools** > **Shared Folders** > **Shares** and right-click the desired export.

5. In the **Properties** window, go to the **Security** tab and click **Edit**.

6. Add the required AD users or groups, and configure their permissions for the export.

7. Click **Apply**, then **OK**.