IBM Storage Driver for OpenStack
Version 1.8.0

User Guide

SC27-4233-13

Note
Before using this document and the product it supports, read the information in "Notices" on page 25.

Edition notice

Publication number: SC27-4233-13. This publication applies to version 1.8.0 of the IBM Storage Driver for OpenStack and to all subsequent releases and modifications until otherwise indicated in a newer publication.

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About this guide

This guide describes how to install and configure the IBM® Storage Driver for OpenStack.

Who should use this guide

This guide is intended for system administrators who are familiar with the OpenStack cloud environment and the supported IBM storage systems that are used.

Conventions used in this guide

These notices are used in this guide to highlight key information.

Note: These notices provide important tips, guidance, or advice.

Important: These notices provide information or advice that might help you avoid inconvenient or difficult situations.

Attention: These notices indicate possible damage to programs, devices, or data. An attention notice appears before the instruction or situation in which damage can occur.

Related information and publications

You can find additional information and publications related to the IBM Storage Driver for OpenStack on the following information sources.

- IBM Knowledge Center
- IBM DS8870 on IBM Knowledge Center(ibm.com/support/knowledgecenter/ST8NCA)
- IBM DS8880 on IBM Knowledge Center(ibm.com/support/knowledgecenter/ST5GLJ)
- IBM XIV® Storage System on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJTAG)
- IBM Spectrum Accelerate on IBM Knowledge Center(ibm.com/support/knowledgecenter/STZSWD)
- IBM FlashSystem® A9000 on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJKMM)
- IBM FlashSystem A9000R on IBM Knowledge Center (ibm.com/support/knowledgecenter/STJKN5)
- OpenStack Block Storage (Cinder) reference page (wiki.openstack.org/Cinder)
- OpenStack Storage reference page (www.openstack.org/software/openstack-storage)
- OpenStack Documentation (docs.openstack.org)

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Procedure

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Chapter 1. Introduction

The IBM Storage Driver for OpenStack is a software component that integrates with the OpenStack cloud environment and enables utilization of storage resources provided by supported IBM storage systems.

After the driver is installed on the OpenStack Cinder (OpenStack Block Storage) nodes, storage volumes can be allocated by the Cinder nodes to the Nova-compute nodes. Virtual machines on the Nova-compute nodes can then utilize these storage resources.

Important:

- Unless stated otherwise, all references to XIV storage system in this guide relate all members of the Spectrum Accelerate Family (XIV, Spectrum Accelerate and FlashSystem A9000/A9000R).

Concept diagram

The following figure illustrates how an IBM storage system is connected to the OpenStack cloud environment and provides storage resources when the IBM Storage Driver for OpenStack is installed on the OpenStack Cinder nodes.

The OpenStack cloud is connected to the IBM storage system over Fibre Channel or iSCSI (DS8000 systems support only Fibre Channel connections).

Remote cloud users can issue requests for storage resources from the OpenStack cloud. These requests are transparently handled by the IBM Storage Driver, which communicates with the IBM storage system and controls the storage volumes on it. The IBM storage resources are then provided to the Nova-compute nodes in the OpenStack cloud.

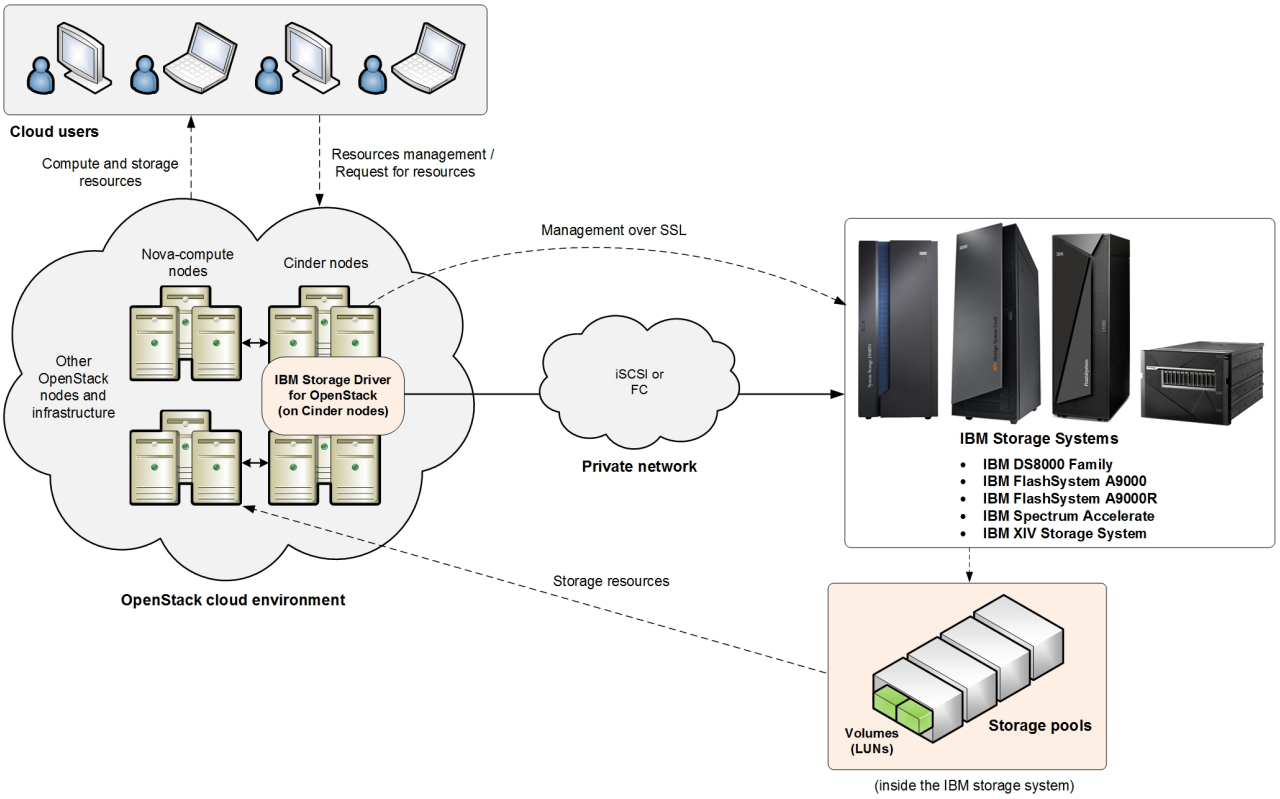

Figure 1. IBM storage systems integrated with an OpenStack cloud

Attention: XIV, Spectrum Accelerate, FlashSystem A9000 or FlashSystem A9000R systems cannot be used together with DS8000 systems by the same IBM Storage Driver installation. Accordingly, determine in advance which system type best suits your OpenStack cloud environment, and use the IBM Storage Driver only with Spectrum Accelerate Family products (XIV, Spectrum Accelerate, FlashSystem A9000 and FlashSystem A9000R) or only with DS8000 systems.

Compatibility and requirements

For the complete and up-to-date information about the compatibility and requirements of the IBM Storage Driver for OpenStack, refer to the latest release notes.

You can find the latest release notes on the IBM Knowledge Center (ibm.com/support/knowledgecenter/) or on the IBM Fix Central (www.ibm.com/support/fixcentral).

Note: Refer to the relevant OpenStack documentation for information about how to deploy the compatible release of the OpenStack platform on your cloud nodes.

Chapter 2. Installation

The IBM Storage Driver for OpenStack should be installed on each OpenStack Cinder node.

For storage systems that use iSCSI connectivity, an option for increased security with CHAP authentication is available.

Important: Use only one connection type (Fibre Channel or iSCSI) per storage system configuration. A configuration in which one storage system is configured twice with different connection types is not supported.

Connecting and attaching OpenStack nodes to the IBM storage system

To ensure proper connection and attachment, refer to the following information sources, depending on the IBM storage system that is used:

- If you are using an IBM storage system and a Red Hat Enterprise Linux (RHEL) node, refer to the IBM Storage Host Attachment Kit documentation on IBM Knowledge Center. Focus on the documentation about setting the Fibre Channel (FC) or iSCSI connectivity parameters with `xiv_fc_admin` or `xiv_iscsi_admin` (according to your connectivity type). Run the appropriate utility with the `-C` flag to attain the required configuration for the relevant connection.
- If you are using FC connectivity and an IBM storage system, ensure that proper zoning is configured between the relevant OpenStack nodes and the storage system. For more information about FC zoning, refer to the 'Overview of Fibre Channel zoning' section in the IBM Storage Host Attachment Kit documentation IBM Knowledge Center.
- If you are using a DS8000® storage system, refer to the 'Attaching and configuring hosts' section on the DS8000 Knowledge Center.

Running the installation wizard on the Cinder node

Run the installation wizard on each individual Cinder node as explained in the following procedure.

Before you begin

Important: You must have root user privileges on the Cinder node.

You can run the installation script in two ways:

- Regular mode – in this mode you are prompted to provide connection parameters and other information in separate interactive steps.
- Unattended mode – in this mode you can avoid prompts in separate steps.

Procedure

Complete the following steps to run the installation in regular mode:

1. Extract the driver installation package onto the Cinder node. For example:

```
# tar xzvf IBM_Storage_Driver_for_OpenStack_1.8.0-[build].tgz
```

2. From the extracted folder, run the following script. See note below.
   `install.sh`

   The following prompt is displayed:

```
Welcome to the IBM Storage Driver for OpenStack (v1.8.0) installation.
Press [ENTER] to proceed.
```

3. Press **Enter**. The following prompt is displayed:

```
Installing IBM Storage Driver for OpenStack Python eggs...
Configuring OpenStack with IBM XIV, Spectrum Accelerate, FlashSystem A9000,
FlashSystem A9000R and DS8000 storage system information...

Installation of the IBM Storage Driver for OpenStack (v1.8.0) is complete.
Press [ENTER] to exit.
```

4. Press **Enter**. The IBM Storage Driver for OpenStack is now installed.

Installing in unattended (silent) mode

Installation of the IBM Storage Driver in unattended mode (referred to as 'silent' in the CLI) allows you to avoid prompts in separate steps during the installation.

Before you begin

As in the regular installation, you must first extract the driver installation package onto the Cinder node:

```
# tar xzvf IBM_Storage_Driver_for_OpenStack_1.8.0-[build].tgz
```

Procedure

To install in unattended mode, enter the needed parameters on the command line in the following format. See note below.

```
#./install.sh -s
Installing IBM Storage Driver for OpenStack Python eggs...
Patching open source driver...
Configuring OpenStack with IBM XIV, Spectrum Accelerate,
FlashSystem A9000, FlashSystem A9000R and DS8000 storage system information...
Installation of the IBM Storage Driver for OpenStack (v1.8.0) is complete.
```

Installation flags and exit codes

The optional installation flags are available for you to use in your installation scripts.

Installation flags

-h, --help
: Displays help and usage information

-s, --silent
: Works in silent mode and supplies more information

-v, --version
Displays the current IBM Storage Driver version

-b, --build
Displays the current IBM Storage Driver build

-r, --reinstall
Can only be used with **-s** to silently reinstall the IBM Storage Driver

-u, --upgrade
Can only be used with **-s** to silently upgrade the IBM Storage Driver

Exit code information

Table 1. Exit codes in install.sh

Exit code	Description	Installation mode
1	Cinder is not installed	Interactive/unattended
2	An old version of driver is installed	Interactive/unattended
3	A newer version of driver is installed	Interactive/unattended
4	User aborted installation in interactive mode	Interactive
5	Incorrect flag usage	Interactive
6	User attempted reinstallation while the driver is not installed	Unattended
7	User attempted an upgrade while the driver is not installed	Unattended
8	User attempted to install/upgrade while the version is already installed	Unattended
9	User attempted to install/reinstall while a previous version was installed	Unattended

Uninstalling the IBM Storage Driver

You can uninstall the IBM Storage Driver from each individual Cinder node at any time, as described in the following procedure.

Before you begin

Ensure that you have root user privileges on the Cinder node and the IBM storage resources are not currently in use.

Attention: Removal of the IBM Storage Driver disables the ability to control IBM storage volumes that may currently be in use by the OpenStack cloud environment. However, attached volumes remain fully functional even without the IBM Storage Driver. To restore control over such volumes after the uninstallation, reinstall the IBM Storage Driver and specify the same storage array details.

Procedure

Complete the following steps to uninstall the IBM Storage Driver:

1. Run the following script:

   ```
   uninstall.sh
   ```

   The following prompt is displayed:

```
IBM Storage Driver for OpenStack (v1.8.0) - Uninstallation

Are you sure you want to uninstall the IBM Storage Driver for OpenStack (v1.7.0.1)?
[Default: No]
```

2. Enter `yes` to confirm the removal of the IBM Storage Driver. If there are storage volumes that are still in use by the OpenStack cloud, a confirmation message specifies the amount and location of these volumes:

```
30 volumes on storage pool 'pool_1' have remained attached to the host
'hostdev31.xiv.ibm.com' for OpenStack use.
Are you sure you want to continue? [Default: No]:
```

3. Enter `yes` to confirm that you want to continue. The following prompt is displayed:

```
Stopping OpenStack Volume service...
Removing IBM Storage information from OpenStack...
Do you want to remove all backend-related configuration
from the cinder.conf file? [Default: No ]:
```

4. Enter `yes`. The following prompt is displayed:

```
Removing IBM Storage Driver for OpenStack Python eggs...
Starting OpenStack Volume service...
The IBM Storage Driver for OpenStack (v1.8.0) has been removed successfully.
Press [ENTER] to exit.
```

5. Press **Enter**. The IBM Storage Driver is now uninstalled.

Note: If you encounter any error during the uninstallation, see Chapter 5, "Troubleshooting," on page 21.

Alternatively, you can issue the **`uninstall.sh -s`** command to uninstall the IBM Storage Driver:

```
uninstall.sh -s
```

For example:

```
#./uninstall.sh -s
1 volumes on storage pool 'pool_1' have remained attached to
the host 'hostdev31e.xiv.ibm.com' for OpenStack use.
Stopping OpenStack Volume service...
Removing IBM Storage information from OpenStack...
Removing IBM Storage Driver for OpenStack Python eggs...
Starting OpenStack Volume service...
The IBM Storage Driver for OpenStack (v1.8.0) has been removed successfully.
```

Chapter 3. Configuration

After you install the driver, you can configure it by issuing the **configure.sh** command.

Before you begin, verify that:

- You have root user privileges on the Cinder node.
- OpenStack nodes are physically connected and logically attached to the IBM storage system.
- A predefined storage pool is ready on the IBM storage system. For information about how to define a storage pool, refer to the IBM storage system documentation or contact your storage administrator.

Note: When using domains with the XIV system running microcode 11.5 or later, Spectrum Accelerate, or FlashSystem A9000/A9000R, refer to "Working with multi-tenancy" on page 23.

During configuration you can connect the Cinder node to one or more IBM storage systems using different connectivity types and user credentials. Each individual connection between the Cinder node and a storage system is referred to as a volume backend.

You can run the configuration script in two ways:

- Interactive mode – in this mode you are prompted to provide connection parameters and other information in separate interactive steps (see "Configuring in interactive mode" on page 10).
- Unattended mode – in this mode you can avoid prompts in separate steps (see "Configuring in unattended (silent) mode" on page 16).

Configuring Cinder nodes for trusted communication with DS8000

The IBM Storage Driver for OpenStack communicates with DS8000 over HTTPS, using self-signed certificate or certificate signed by a certificate authority (CA).

Configure a trusted communication link to ensure a successful attachment of a Cinder node to a DS8000 storage system, as detailed in the following sections.

- "Configuring trusted communication link, using configuration script"
- "Configuring trusted communication link manually" on page 8
- "Adding a public certificate to trusted CA certificate store" on page 9
- "Verifying trusted communication link" on page 9

Configuring trusted communication link, using configuration script

If you configure the IBM Storage Driver for OpenStack in interactive mode, obtain a self-signed certificate from DS8000 or use a certificate signed by a certificate authority (CA).

Procedure

The configuration script obtains the certificate from the DS8000 and checks if a CA public certificate is stored in the trusted CA certificates store.

1. Locate the directory where the installation packages were saved and run the **configure.sh** command. If the certificate is self-signed, the following information is displayed:

```
 ds8000.ibm.com uses a self-signed certificate, which authenticity
cannot be verified. You can add an exception, making the driver vulnerable to MitM
attacks.
Do you want to continue? [Default: no ]: yes
```

2. Add the exception and continue configuration.
3. If the CA public certificate is not located in the trusted CA certificates store, the following information is displayed:

```
 Please add the CA certificate into requests CA bundle file
/etc/pki/tls/certs/ca-bundle.crt, and you can use command
[openssl verify -CAfile /etc/pki/tls/certs/ca-bundle.crt
 /opt/ibm/ds8k_certs/ds8000.ibm.com.pem] to verify it beforehand.
```

   Follow the procedure detailed in "Adding a public certificate to trusted CA certificate store" on page 9 to complete the chain of trust and run configuration script again.
4. Then, verify the link, as explained in "Verifying trusted communication link" on page 9

Configuring trusted communication link manually

You can obtain a self-signed certificate from DS8000 or use a certificate signed by a certificate authority (CA) manually, without running the `configure.sh` command.

Procedure

Before configuring a DS8000 backend, complete the following steps to establish the chain of trust manually.

1. In your operating system shell, run the **openssl x509 -in <(openssl s_client -connect <host fqdn>:8452 -prexit 2>/dev/null) -text -out <host fqdn>.pem** command to obtain the certificate. If the certificate is self-signed, the following information is displayed:

```
---
      Certificate chain
      0 s:/CN=ds8000.ibm.com
      i:/CN=ds8000.ibm.com
      ---
```

2. Create an exception by moving the certificate `<fqdn>.pem` to the `/opt/ibm/ds8k_certs/<host>.pem` file.
3. Verify that the `<host fqdn>` is the same as configured in `san_ip`.
4. If the certificate subject and issuer are different, the certificate is signed by a CA, as illustrated below:

```
---
      Certificate chain
      0 s:/C=US/ST=New York/L=Armonk/O=IBM/OU=EI/CN=www.ibm.com
      i:/C=US/O=GeoTrust Inc./CN=GeoTrust SSL CA - G3
      1 s:/C=US/O=GeoTrust Inc./CN=GeoTrust SSL CA - G3
      i:/C=US/O=GeoTrust Inc./CN=GeoTrust Global CA
      ---
```

5. Follow the procedure detailed in "Adding a public certificate to trusted CA certificate store" to complete the chain of trust.
6. Then, verify the link, as explained in "Verifying trusted communication link"

Adding a public certificate to trusted CA certificate store

If the CA public certificate needs to be imported into the trusted CA certificates store on the Cinder node, use the relevant instructions of your operating system.

Procedure

Add the CA public certificate to the trusted CA certificates store on the Cinder node, according to procedures for the operating system in use.

1. For RHEL 7.x or CentOS 7.x, place the certificate to be trusted (in PEM format) into the `/etc/pki/ca-trust/source/anchors/` directory. Then, run the **`sudo update-ca-trust`** command.
2. For Ubuntu 14.04, place the certificate to be trusted (in PEM format) into the `/usr/local/share/ca-certificates/` directory. Then, run the **`sudo update-ca-certificates`** command.
3. For Python requests library with `certifi`, run the **`cat ca_public_certificate.pem`** command to append the certificate to the location of the `certifi` trust store file. For example:

```
cat ca_public_certificate.pem >> /usr/local/lib/python2.7/dist-packages/certifi/
cacert.pem.
```

Verifying trusted communication link

Before configuring a DS8000 backend, verify that a trusted communication link has been created.

Procedure

Verify the chain of trust has been established successfully.

1. Obtain the location of the Python library requests trust store, according to the installation type.
2. RHEL 7.x or CentOS 7.x:

```
# python
      Python 2.7.5 (default, Oct 11 2015, 17:47:16)
      [GCC 4.8.3 20140911 (Red Hat 4.8.3-9)] on linux2
      Type "help", "copyright", "credits" or "license" for more information.
      >>> import requests
      >>> print requests.certs.where()
      /etc/pki/tls/certs/ca-bundle.crt
```

3. Ubuntu 14.04:

```
# python
       Python 2.7.6 (default, Jun 22 2015, 17:58:13)
       [GCC 4.8.2] on linux2
       Type "help", "copyright", "credits" or "license" for more information.
       >>> import requests
       >>> print requests.certs.where()
       /etc/ssl/certs/ca-certificates.crt
```

4. Python requests library with `certifi`:

```
# python
      Python 2.7.6 (default, Jun 22 2015, 17:58:13)
      [GCC 4.8.2] on linux2
      Type "help", "copyright", "credits" or "license"for more information.
      >>> import requests
      >>> print requests.certs.where() /usr/local/lib/python2.7/dist-packages/certifi/
cacert.pem
```

5. Run the **`openssl s_client -CAfile <location> -connect <host fqdn>:8452 < /dev/null`** command. The following return codes indicate a successful or failed attempt in establishing a trusted communication link.
   - `Verify return code: 0 (ok)`: success.
   - `Verify return code: 21 (unable to verify the first certificate)`, or any other non-zero value: failure.

Configuring in interactive mode

When you configure the IBM Storage Driver for OpenStack in interactive mode, you are prompted to provide connection parameters and other information in separate interactive steps.

About this task

The configuration script adds details for backends to the `cinder.conf` file and restarts the cinder-volume service. You can also list or remove the configured backends, or update the storage system password in the `cinder.conf` file.

Procedure

Complete the following steps to configure the IBM Storage Driver for OpenStack in interactive mode:

1. Locate the directory where the installation packages were saved and run the following command.

   ```
   configure.sh
   ```

   Press **Enter** after the welcome screen appears:

   ```
   Welcome to the IBM Storage Driver for OpenStack (v1.8.0) configuration.
   Press [ENTER] to proceed.
   ```

2. After pressing **Enter**, the following message is displayed:

   ```
   No backends were configured yet. Would you like to configure
   a new backend? [Default: Yes ]:
   ```

3. Type `Y` to configure a new backend. The following message is displayed:

```
Enter the storage system type [x]iv family or [d]s8000 family: [Default: x ]:
```

4. Enter the storage system type. The following prompt is displayed:

```
Enter the storage system IP address or hostname:
```

5. Enter the storage system IP address or host name. The following prompt is displayed:

```
Enter the username: [Default: admin ]:
Enter the password:
```

6. Enter the user name and password. The following prompt is displayed for Spectrum Accelerate Family storage systems:

```
Specify the connectivity type, [f]ibre channel or [i]SCSI: [Default: i ]:
```

7. For XIV storage systems, specify the type of connection that you have. The following prompt is displayed:

```
Enter the name of the storage pool to be used:
```

8. Enter the name of an XIV storage pool that is predefined for your OpenStack environment or a storage pool ID for DS8000 systems in the *P#* format. The DS8000 storage pools are identified as a single entry (*P0*) or comma-separated double entry (*P0,P1*).

Note: The use of double entry, or pool pair is recommended, as explained in Configuring a system for an open systems host of the DS8000 series user guide.

The following line is displayed:

```
Would you like to configure replication? [Default: no ]: yes
```

9. Select y (yes) to enable volume replication. The following prompt is displayed for Spectrum Accelerate Family storage systems. The rest of the replication configuration steps are relevant for all supported storage system types.

```
Enter the target name:
```

10. Enter the name of the target Spectrum Accelerate Family storage system. The following prompt is displayed:

```
Enter replication storage system IP address or hostname:
```

11. Enter an IP address or host name of the target storage system. The following prompt is displayed:

```
Enter the username: [Default: admin ]:
Enter the password:
```

12. Enter the user name and password to be used during replication procedure. The following prompt is displayed:

```
Enter the name of replication storage pool to be used:
```

13. Enter the name of a storage pool to be used in replication. The following message is displayed:

```
A new backend, IBM-XIV_hostdev31e.xiv.ibm.com_pool_1_iscsi,
was successfully configured.

Choose an action: [a]dd backend, [r]emove backend, [l]ist, [c]hange password, [e]xit:
```

Note: For details on volume replication configuration for different storage system type, see:

- "Configuring volume replication for Spectrum Accelerate Family storage systems" on page 14
- "Configuring volume replication for DS8000 storage systems" on page 15

14. After all backends were configured and if you use iSCSI as your connection type, you are prompted with the following directive:

```
Would you like to use CHAP authentication (relevant only to iSCSI connections)
for all iSCSI backends? [Default: N ]:
```

Select y (yes) or n (no) to choose whether to use iSCSI CHAP authentication.

If you enter `y` (yes), CHAP names and secrets are generated automatically for each host that uses the storage system, and are not shown. If hosts were manually predefined on the XIV-type storage system before the IBM Storage Driver installation, iSCSI connectivity for these hosts is affected depending on your choice of CHAP authentication mode:

- If you choose `y` to enable CHAP authentication, iSCSI connectivity does not work with any host that was manually predefined on the storage system side.
- If you choose `n` to disable CHAP authentication, iSCSI connectivity does not work with hosts for which CHAP parameters were specified on the storage system side. iSCSI connectivity works only with hosts for which CHAP parameters were not specified on the storage system side.

To avoid this problem, check for and remove any previous host definition that was made on an XIV-type storage system before the IBM Storage Driver installation.

Important: For XIV microcode 11.5 or later, Spectrum Accelerate, or FlashSystem A9000/A9000R, the storage pool can be part of a domain. For more information about how to configure the driver with multi-tenancy, see "Working with multi-tenancy" on page 23.

Removing backends

After configuration you can choose to remove a single backend or all backends.

Procedure

Complete the following steps to remove a backend:

1. Issue the `configure.sh` command.

```
Choose an action: [a]dd backend, [r]emove backend, [l]ist, [c]hange password, [e]xit:
```

2. Type `remove` to remove one or all backends. A list of all of the backends is created.

```
Index   Storage System   Address                  Pool          Connectivity
1       XIV              hostdev31e.xiv.ibm.com   pool_1        iscsi
2       XIV              hostdev31e.xiv.ibm.com   pool_2        iscsi
```

3. Specify the index number of the backend that you want to remove or `all` to remove all backends. If you enter an index number, that specific backend is removed. If you select `all`, the following message is displayed:

```
Are you sure you want to remove all configured backends? [Default: No ]:
```

4. Type `yes` or `no`. If you type `yes`, the following message is displayed:

```
All configured backends were removed.

No backends were configured yet. Would you like to configure a new backend?
[Default: Yes ]:
```

5. Type `yes` to configure a new backend or `no` to exit.

Listing backends

After configuration you can produce a list of all backends.

Procedure

Complete the following steps to list the backends:

1. Issue the `configure.sh` command.

```
Choose an action: [a]dd backend, [r]emove backend, [l]ist,
[c]hange password, [e]xit:
```

2. Type `list` to list all backends. See the following example list:

```
Index   Storage System   Address                  Pool          Connectivity
1       XIV              hostdev31e.xiv.ibm.com   pool_1        iscsi
2       XIV              hostdev31e.xiv.ibm.com   pool_2        iscsi
Choose an action: [a]dd backend, [r]emove backend, [l]ist, [c]hange password, [e]xit:
```

3. Type your selection.

Changing the password

After configuration you can change the password for the backend.

Procedure

Complete the following steps to change the backend password:

1. Issue the `configure.sh` command.

```
Choose an action: [a]dd backend, [r]emove backend, [l]ist, [c]hange password, [e]xit:
```

2. Type `change` to edit the password. A list of backends is displayed. See the following example list:

```
Index   Storage System   Address                 Pool          Connectivity
1       XIV              hostdev31e.xiv.ibm.com  pool_1        iscsi
2       XIV              hostdev31e.xiv.ibm.com  pool_2        iscsi
Please select the index of a backend to change its password [Default: Back]:
```

3. Select the backend whose password you want to change by typing the index number and pressing **Enter**.
4. Enter the password. After you change the password, the results are displayed. See the following example result screen:

```
Password for backend IBM-XIV_hostdev31e.xiv.ibm.com_pool_1_fibre_channel
was changed successfully.

Choose an action: [a]dd backend, [r]emove backend, [l]ist, [c]hange password, [e]xit:
```

Configuring volume replication for Spectrum Accelerate Family storage systems

Volume replication is required for disaster recovery and high-availability applications running on top of OpenStack-based clouds. The IBM Storage Driver for OpenStack supports synchronous and asynchronous volume replication for XIV, Spectrum Accelerate and FlashSystem A9000/A9000R storage systems.

Before you begin

Prior to enabling volume replication, verify that the following requirements have been met:

- Primary and secondary storage pools exist on a storage system.
- Reliable communication link is established between the primary and secondary sites, including physical connection and PPRC path.
- Synchronous or asynchronous replication is enabled on a storage system.

Procedure

During configuration you can choose to enable replication for a storage system:

1. Issue the `configure.sh` command.

```
Would you like to configure replication? [Default: n ]: y:
```

2. Type `y` to enable volume replication. The following prompt is displayed:

```
Enter the target name:
```

3. Enter the name of the target storage system. The following prompt is displayed:

```
Enter replication storage system IP address or hostname:
```

4. Enter the IP address or host name of the storage system for the secondary backend. The following prompt is displayed:

```
Enter the username: [Default: admin ]:
Enter the password:
```

5. Enter the user name and password to be used during replication procedure. The following prompt is displayed:

```
Enter the name of replication storage pool to be used:
```

6. Enter the name of the storage pool to be used in replication procedure. A storage backend is created. The SAN IP address and the replication SAN IP address of one backend serve as the replication SAN IP and SAN IP of the other backend.

Important: When you configure volume replication in the OpenStack environment, make sure to select correct replication type: synchronous or asynchronous. These two examples illustrate how to define the sync and async replication types. For asynchronous replication, the following RPO interval values are supported: 30, 60, 300, 600, 3600, 7200, 14400 and 43200 seconds.

```
> cinder type-create sync_replication_type
> cinder type-key sync_replication_type set replication_type='<is> sync'
replication_enabled='<is> True'
volume_backend_name='IBM-nova--newton-rhel72_iscsi'
```

```
> cinder type-create async_replication_type600
> cinder type-key async_replication_type600 set replication_type='<is> async'
replication_enabled='<is> True'
volume_backend_name='IBM-nova--newton-rhel72_iscsi' rpo='<is> 600'
```

Configuring volume replication for DS8000 storage systems

Volume replication is required for disaster recovery and high-availability applications that run on top of OpenStack-based clouds. The IBM Storage Driver for OpenStack supports synchronous (Metro Mirror) volume replication for DS8000 storage systems.

Before you begin

Before you enable volume replication, verify that the following requirements are met:

- Primary and secondary storage pools exist on DS8000 systems.
- Reliable communication link is established between the primary and secondary sites, including physical connection and PPRC path.
- Metro Mirror replication is enabled on DS8000 storage systems.

Procedure

During configuration, you can choose to enable replication for DS8000 systems.

1. Issue the `configure.sh` command.

```
Would you like to configure replication? [Default: n ]: y:
```

2. Type `y` to enable replication. The following prompt is displayed:

```
Enter replication storage system IP address or hostname:
```

3. Enter the IP address or host name of the storage system for the secondary backend. The following prompt is displayed:

```
Enter the username: [Default: admin ]:
Enter the password:
```

4. Enter the user name and password to be used during replication procedure. The following prompt is displayed:

```
Enter the ID of the storage pool to be used:
```

5. Enter the name of the storage pool to be used in replication procedure. The following prompt is displayed:

```
Would you like to dedicate the HA port for replication? [Default: yes ]:
```

6. Dedicate the HA (host adapter) port for replication. The following prompt is displayed:

```
Enter one or two ID pairs of IO port(such as I0001:I0002, I0003:I0004):
```

Note: If the HA port is not dedicated for the replication, all available DS8000 ports are used for this purpose.

7. Enter the ID pairs of IO ports, participating in replication. A storage backend is created. The SAN IP address and the replication SAN IP address of one backend serve as the replication SAN IP and SAN IP of the other backend.

```
replication_device = xiv_ds8k_address: xy074.sms.ibm.com;
xiv_ds8k_user: dsadmin; xiv_ds8k_password: dsadmin;
xiv_ds8k_vol_pool: P16,P17; xiv_ds8k_ioport_pairs: I0031:I0137, I0111:I0230
```

Configuring in unattended (silent) mode

The configuration script adds details for backends to the `cinder.conf` file and restarts the cinder-volume service. Also, you can incorporate a `.ini` file that contains the required connection parameters. To view a sample `.ini` file, see the `EXAMPLE.ini` file in the installation directory.

Before you begin

Important:

- The configuration file must be a text file that contains the parameters for each backend. Retain the file in a secure folder and do not distribute the file over non-secure media. Use any required precaution to avoid unauthorized remote access to your IBM storage systems.
- When you use a `.ini` file to configure the IBM Storage Driver for OpenStack, the existing configuration is overwritten.

Procedure

Type the command in the following format, where `[file name]` represents the directory location and name of the file:

```
configure.sh -s -i [file name]
```

For example:

```
# configure.sh -s -i path/config_filename.ini
```

- For an XIV-type (XIV, Spectrum Accelerate, FlashSystem A9000/A9000R) backend, the file must contain the following information:

```
[backend1]
xiv_ds8k_address = xiv1.domain.com or IP address
xiv_ds8k_user = storage_admin_user
xiv_ds8k_password = password
xiv_ds8k_vol_pool = poolname
xiv_ds8k_connection_type = iscsi or fibre_channel
xiv_chap = disabled or enabled
```

  The file can contain more sections with connection parameters for extra storage systems (extra backends). The details of each additional backend are specified in a separate section with a different name.

  For example, `[backend2]` is the section name for the additional XIV-type system:

```
[backend2]
xiv_ds8k_address = xiv2.domain.com or IP address
xiv_ds8k_user = storage_admin_user
xiv_ds8k_password = password
xiv_ds8k_vol_pool = poolname
xiv_ds8k_connection_type = fibre_channel
```

- For a DS8000 backend, the file must contain the following:

```
[backend1]
xiv_ds8k_address = XIV_DS8K_IP_OR_HOSTNAME
xiv_ds8k_user = XIV_DS8K_USER
xiv_ds8k_password = XIV_DS8K_PASSWORD
xiv_ds8k_vol_pool = XIV_DS8K_VOLUME_POOL
xiv_ds8k_storage_array_type = ds8k
```

  More sections can be used in the file for connecting additional XIV-type and DS8000 systems.

Chapter 4. Security

The following information provides an overview of security for the IBM Storage Driver for OpenStack.

Avoiding Man-in-the-Middle attacks

You can protect the IBM Storage Driver from Man-in-the-Middle (MITM) attacks by following some rules.

- Upgrade to IBM XIV storage system version 11.3 or later.
- If working in a secure mode, you cannot work insecurely against another storage system in the same environment.
- Validate the storage certificate. If you are using an XIV-provided certificate, use the CA file that was provided by your storage system as part of the IBM Storage Driver for OpenStack (file location: `IBM_Storage_Driver_for_OpenStack_1.8.0-[build]/certs/XIV-CA.pem`). The certificate files should be copied to one of the following directories:

  ```
  /etc/ssl/certs
  /etc/ssl/certs/xiv
  /etc/pki
  /etc/pki/xiv
  ```

  If you are using your own certificates, copy them to the same directories with the prefix "XIV" and in the `.pem` format. For example: `XIV-my_cert.pem`.
- In order to prevent the CVE-2014-3566 MITM attack, follow the OpenStack community directions (http://osdir.com/ml/openstack-dev/2014-10/msg01349.html).

Chapter 5. Troubleshooting

Refer to this information to troubleshoot technical problems that you might encounter when using the IBM Storage Driver for OpenStack.

- "Checking the OpenStack node log files"
- "Displaying on-screen help" on page 22

Note:

- For up-to-date information about known issues and possible workarounds, refer to the latest release notes.
- When contacting IBM Support, specify the type of the storage system in use and indicate that the support request pertains to IBM Storage Driver for OpenStack.

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Checking the OpenStack node log files

The Nova-compute and Cinder log files record operation information that might be useful for troubleshooting.

Before you begin

To achieve optimal and clear logging of events, activate the verbose logging level in the **cinder.conf** file, located in the `/etc/cinder` folder. Add the following line in the file, save the file, and then restart the cinder-volume service:

```
verbose = True
debug = True
```

To turn off the verbose logging level, change `True` to `False`, save the file, and then restart the cinder-volume service.

About this task

You can check the log files on a periodic basis to ensure that the IBM Storage Driver is functioning properly. If you encounter issues with the driver functionality, you can send the contents of the files to IBM Support if needed.

Procedure

- To check the log file on a Cinder node:
  - Go to the `/var/log/cinder` folder and open the activity log file named `cinder-volume.log` or `volume.log`. The IBM Storage Driver writes to this log file using the `[IBM DS8K STORAGE]` or `[IBM XIV STORAGE]` prefix (depending on the relevant storage system) for each event that it records in the file.
  - Go to the `/var/log/cinder/xivds8k_logger` folder and open the installation log file named `install.log`. The IBM Storage Driver installer writes to this log file.
- To check the log file on a Nova-compute node:
  - Go to the `/var/log/nova` folder and then open the log file named `nova-compute.log` or `compute.log`.

Displaying on-screen help

When needed, you can display on-screen help information that summarizes usage format, syntax, and other options that are available for the installation and uninstallation commands.

About this task

You can type the **--help** or **-h** argument after each of following commands:

- **install.sh** (installation; see "Running the installation wizard on the Cinder node" on page 3)
- **uninstall.sh** (uninstallation; see "Uninstalling the IBM Storage Driver" on page 5)
- **configure.sh** (configuration; see Chapter 3, "Configuration," on page 7)

Chapter 6. Best practices

Refer to the general guidance and best practices that are described in the following sections.

- "Working with multi-tenancy"
- "Working with IBM Real-time Compression"

Working with multi-tenancy

The XIV storage systems running microcode version 11.5 or later and other XIV-type systems (Spectrum Accelerate and FlashSystem A9000/A9000R) can employ multi-tenancy.

Complete the following requirements to support multi-tenancy with the IBM Storage Driver for OpenStack:

- For each storage system, verify that all predefined storage pools are in the same domain or, that all are not in a domain.
- Use the storage admin or domain admin user's credentials, as long as the user has a full access to the relevant pool.
- If the user is a domain admin, the storage system domain access policy can be Closed (domain_policy: `access=CLOSED`). Otherwise, verify that the storage system domain access policy is Open (domain_policy: `access=OPEN`).
- If the user is not a domain admin, the storage system domain host management policy can be Basic (domain_policy: `host_management=BASIC`). Otherwise, verify that the storage system domain host management policy is Extended (domain_policy: `host_management=EXTENDED`).

Working with IBM Real-time Compression

The XIV storage systems running microcode version 11.6 or later, Spectrum Accelerate and FlashSystem A9000/A9000R can employ IBM Real-time Compression™ .

Follow these guidelines, when working with compressed storage resources, using the IBM Storage Driver for OpenStack:

- Compression mode cannot be changed for storage volumes, using the IBM Storage Driver for OpenStack. The volumes are created according to the default pool mode. For example, any volume, defined on a compressed pool, will be compressed as well.
- The minimum size for a compressed storage volume is 87 GB.

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