QSAN Official Document

# BeeGFS Setup Guide

## Application Notes

January 2024

# ANNOUNCEMENT

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# PREFACE

## Executive Summary

This document demonstrates how to install BeeGFS, a high-performance distributed file system for demanding workloads. Building a flexible file storage system that helps to simplify the storage deployments.

## Audience

This document is going to introduce how to setup a BeeGFS environment on QSAN XCubeFAS / XCubeSAN through iSCSI LUN and create a BeeGFS management server, metadata server, and object storage server. It assumes the reader is familiar with QSAN products and has general IT experience, including knowledge as a system or network administrator. If there is any question, please refer to the user manuals of products, or contact QSAN support for further assistance.

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# Information, Tip, and Caution

This document uses the following symbols to draw attention to important safety and operational information.

## INFORMATION

INFORMATION provides useful knowledge, definition, or terminology for reference.

## TIP

TIP provides helpful suggestions for performing tasks more effectively.

## CAUTION

CAUTION indicates that failure to take a specified action could result in damage to the system.

# 1. BeeGFS Introduction

## 1.1. What is BeeGFS

BeeGFS parallel file system is generally called “BeeGFS”. It is a high-performance distributed file system designed for demanding workloads that is scalable storage and accesses data cross-compute nodes.

BeeGFS allows for easy testing in small-scale POC (Proof of Concept) environments to demonstrate performance and value. Many organizations start with small-scale pilots and POCs until the value is proven. POC deployments can be easily scaled as needed for larger-scale testing or transition to production environments. BeeGFS's production deployment enables your data to grow without limitations in every condition.

BeeGFS is a Linux-based file system. The architecture of BeeGFS is consisted of four components. They are MS (Management Server), MDS (MetaData Server), OSS (Object Storage Server), and File System Clients.

### 1.1.1. Management Server in BeeGFS

There must be one MS (Management Server) in the system, and all nodes of BeeGFS must point to the same MS. MS maintains a list of all file system components, including clients, metadata servers, metadata targets, storage servers, and storage targets.

### 1.1.2. Metadata Server in BeeGFS

MDS (MetaData Server) is the primary service for managing metadata. Metadata is the data describes the data including access permissions, file sizes, and locations. Each MDS may have one or multiple metadata targets, which typically consist of SSDs and are recommended for protection using RAID 1 or RAID 10 for data redundancy.

### 1.1.3. Object Storage Server in BeeGFS

OSS (Object Storage Server) is responsible for storing the content of files. Each OSS may have one or multiple OSTs (Object Storage Targets). OSTs can be a local file system (such as XFS, ext4, or ZFS) or a LUN. It is recommended to have 6 to 12 disks per OST and use RAID 6 for data protection.

One of the main features of BeeGFS is striping, which enhances the performance and capacity of a single file. Striping allows files to be distributed across multiple OSTs, enabling parallel data access and improving overall system performance.

### 1.1.4. Client in BeeGFS

The BeeGFS client service provides a standard mount point that allows your application to directly access the BeeGFS storage system.

# 2. CONFIGURATION SETTINGS

In this chapter, we will demonstrate how to setup a BeeGFS environment using two Linux servers. One server is called the master and is configured as the management server, metadata server, object storage server, and client. The other server, called the slave server, will serve as a client. Optimal performance can be achieved by installing different BeeGFS components on different Linux servers.

BeeGFS supports RHEL, Scientific Linux, CentOS, SuSE Linux Enterprise Server, SuSE Linux Enterprise Desktop, OpenSuSE, Debian, and Ubuntu. You can install any of them.

The following example demonstrates the installation process on CentOS.

## 2.1. Environment and Topology

**Demonstration Environment**

- Server
  - Model: 2 x ASUS Server
    OS: CentOS
    Server 1 IP: 192.168.222.105
    Server 1 Data Port IP: 11.11.11.1
    Server 2 IP: 192.168.222.108
    Server 2 Data Port IP: 11.11.11.21
- Storage
  - Model: XS3324D
    Memory: 16 GB per controller
    Firmware: XEVO 2.3.0
    Data Port IP: 11.11.11.11

**Demonstration Topology**

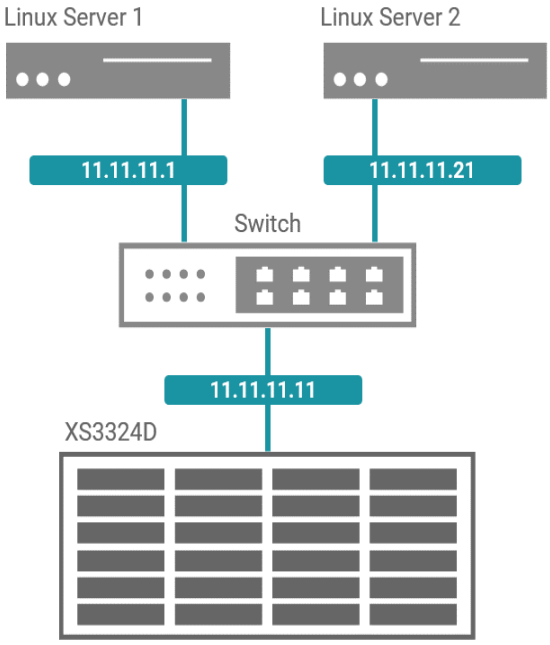


*Figure 2-1 Demonstration Topology*

## 2.2. Configuration Steps

### 2.2.1. Configuration Storage

1. In XS3324D, create a pool and three volumes, then add them into a host group.

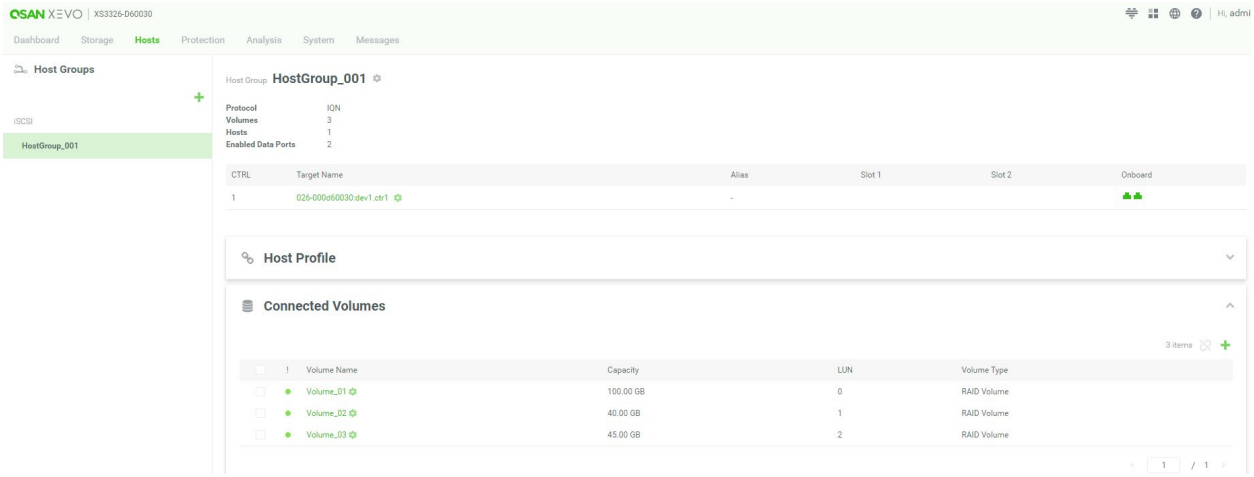


*Figure 2-2 Create a Pool and a Host Group*

## 2.2.2. Configuration Linux Server 1

1. Use the terminal software program (such as PuTTY) to login to Linux server 1.

```
Login as: root
[root@master ~]#
```

*Figure 2-3 Login to Linux server 1*

2. Enter the command **vi /etc/hosts** and then enter the IP addresses and hostnames of the two CentOS servers for testing.

```
127.0.0.1   localhost
192.168.222.105 master
192.168.222.108 slave
```

*Figure 2-4 Edit the Hosts in Linux Server 1*

3. Enter the following command to disable the firewall.

```
# systemctl disable firewalld
# systemctl stop firewalld
```

4. Enter the following commands to update the system and modify the hostname.

```
# yum -y update
# sed -i 's/SELINUX=enforcing/SELINUX=disabled/g' /etc/sysconfig/selinux
# hostnamectl set-hostname master
# reboot
```

5. Enter the following command to create directories.

```
# mkdir /mnt/beegfs.conf.d
# mkdir /mnt/beegfs.conf.d/mgmtd
# mkdir /mnt/beegfs.conf.d/meta
# mkdir /mnt/beegfs.conf.d/oss1
# mkdir /mnt/beegfs.conf.d/oss2
```

6. Enter the following commands to map the LUN and to make the Linux Server be the master.

```
# iscsiadm -m discovery -t st -p 11.11.11.1
# iscsiadm -m node -T 026-000d60030:dev1.ctr1 --login
# fdisk -l
```

```
# fdisk -l
Disk /dev/sde : 107.4 GB
Disk /dev/sdf : 42.9 GB
Disk /dev/sdg : 48.3 GB
```

*Figure 2-5 Master Linux Server*

7. Enter the following commands to mount “sde” as a metadata server.

```
# mkfs.ext4 /dev/sde
# mount /dev/sde /mnt/beegfs.conf.d/meta
# df -h
```

8. Enter the following commands to mount “sdf” as an object storage server 1.

```
# mkfs.xfs /dev/sdf
# mount /dev/sdf /mnt/beegfs.conf.d/oss1
```

```
# df -h
```

9. Enter the following commands to mount “sdg” as an object storage server 2.

```
# mkfs.xfs /dev/sdf
# mount /dev/sdf /mnt/beegfs.conf.d/oss2
# df -h
```

10. Download the BeeGFS repository.

```
# wget -O /etc/yum.repos.d/beegfs-rhel7.repo
https://www.beegfs.io/release/latest-stable/dists/beegfs-rhel7.repo
```

**Setup BeeGFS Management Server**

11. Enter the following commands to install and configure the BeeGFS management server.

```
# yum install -y beegfs-mgmtd
# /opt/beegfs/sbin/beegfs-setup-mgmtd -p /mnt/beegfs.conf.d/mgmtd
# systemctl start beegfs-mgmtd
# systemctl status beegfs-mgmtd
```

12. After completing the above steps, please check whether the status is "active", as shown in the figure below.

```
# systemctl status beegfs-mgmtd
beegfs-mgmtd.service - BeeGFS Management Server
Loaded: loaded
Active: active (running)
```

*Figure 2-6 Setup BeeGFS Management Server*

**Setup BeeGFS Metadata Server**

13. Enter the following commands to install and configure the BeeGFS metadata server.

```
# yum install -y beegfs-meta
# /opt/beegfs/sbin/beegfs-setup-meta -p /mnt/beegfs.conf.d/meta -m master
# systemctl start beegfs-meta
# systemctl status beegfs-meta
```

**Setup BeeGFS Object Storage Server**

14. Enter the following commands to install and configure the BeeGFS object storage server.

```
# yum install -y beegfs-storage
# /opt/beegfs/sbin/beegfs-setup-storage -p /mnt/beegfs.conf.d/oss1 -i 1 -m master
# /opt/beegfs/sbin/beegfs-setup-storage -p /mnt/beegfs.conf.d/oss2 -i 2 -m master
# systemctl start beegfs-storage
# systemctl status beegfs-storage
```

**INFORMATION**

**-i** represents the storage target ID, and **-m** represents specifying the hostname of the management server.

15. After completing the above steps, please check whether the status is "active", as shown in the figure below.

```
# systemctl status beegfs-storage
beegfs-storage.service - BeeGFS Storage Server
Loaded: loaded
Active: active (running)
```

*Figure 2-7 Setup BeeGFS Object Storage Server*

**Setup BeeGFS Clients**

16. Enter the following commands to install and configure BeeGFS client.

```
# yum install -y beegfs-client beegfs-helperd beegfs-utils
# /opt/beegfs/sbin/beegfs-setup-client -m master
# systemctl start beegfs-helperd
# systemctl status beegfs-helperd
# systemctl start beegfs-client
# systemctl status beegfs-client
```

17. After completing the above steps, please check whether the status is "active", as shown in the figure below.

```
# systemctl status beegfs-helperd
beegfs-helperd.service - BeeGFS Helperd
Loaded: loaded
Active: active (running)
# systemctl status beegfs-client
beegfs-client.service - start BeeGFS Client
Loaded: loaded
Active: active (running)
```

*Figure 2-8 Setup BeeGFS Client*

18. At this point, the management server, metadata server, object storage servers, and clients have been successfully installed on the master server. Enter the following command to check if the configuration is correct.

```
# beegfs-check-servers
# beegfs-df
```

```
# beegfs-check-servers
Management
==========
Master [ID: 1]: reachable at 192.168.222.105:8008

Metadata
==========
Master [ID: 1]: reachable at 192.168.222.105:8005
```

```
Storage
============
Master [ID: 1]: reachable at 192.168.222.105:8003
```

```
# beegfs-df
METADATA SERVERS:
TargetID        Total           Free    %
========        =====           ====    =
       1      97.9GiB        97.9GiB 100%

STORAGE TARGETS:
TargetID        Total           Free    %
========        =====           ====    =
       5      40.0GiB        38.9GiB  97%
       6      45.0GiB        43.9GiB  98%
```

*Figure 2-9 Check the Configuration*

19. At this point, the master server is well configured. The next section will demonstrate how to install the BeeGFS client on another Linux server and test it using FIO (Flexible IO Tester).

## 2.2.3. Configuration Linux Server 2

1. Use the terminal software program (such as PuTTY) to login to Linux server 2.
2. Enter the command **vi /etc/hosts** and then enter the IP addresses and hostnames of the two CentOS servers for testing.

```
127.0.0.1   localhost
192.168.222.105 master
192.168.222.108 slave
```

*Figure 2-10 Edit the Hosts in Linux Server 2*

3. Enter the following command to disable the firewall.

```
# systemctl disable firewalld
# systemctl stop firewalld
```

4. Enter the following commands to update the system and modify the hostname.

```
# yum -y update
# sed -i 's/SELINUX=enforcing/SELINUX=disabled/g' /etc/sysconfig/selinux
# hostnamectl set-hostname master
# reboot
```

5. Enter the following commands to install and setup BeeGFS client.

```
# yum install -y beegfs-client beegfs-helperd beegfs-utils
# /opt/beegfs/sbin/beegfs-setup-client -m master
# systemctl start beegfs-helperd
# systemctl status beegfs-helperd
# systemctl start beegfs-client
# systemctl status beegfs-client
```

6. After completing the above steps, please check whether the status is "active", as shown in the figure below.

```
# systemctl status beegfs-helperd
beegfs-helperd.service - BeeGFS Helperd
Loaded: loaded
Active: active (running)
# systemctl status beegfs-client
beegfs-client.service - start BeeGFS Client
Loaded: loaded
Active: active (running)
```

*Figure 2-11 Setup BeeGFS Client*

## 2.2.4. Final Test

1. Enter the command **df -h -T** on the master and slave, you can observe that both Linux machines detect the filesystem type BeeGFS called "beegfs_nodev" and have combined storage from both storage targets.

   The default mount path for this filesystem is **/mnt/beegfs**.

```
# df -h -T
Beegfs_nodev    beegfs    85G    /mnt/beegfs
```

*Figure 2-12 Check the Filesystem Type*

2. Then perform an FIO test and write a 1 GB file on the master and slave servers, using the path **/mnt/beegfs**.

   Master:

```
# fio --name=test --group_report --filename=/mnt/beegfs/testfile1 --
ioengine=posixaio --time_based --runtime=180 --startdelay=10 --nrfiles=1 --
size=1G --numjobs=1 --bs=128K --rw=read
```

   Slave:

```
# fio --name=test --group_report --filename=/mnt/beegfs/testfile2 --
ioengine=posixaio --time_based --runtime=180 --startdelay=10 --nrfiles=1 --
size=1G --numjobs=1 --bs=128K --rw=read
```

3. Use the **ls** command to check whether testfile 1 and testfile 2 have been successfully written to the **/mnt/beegfs** directory of the master and slave servers.

```
# cd /mnt/beegfs
# ls
testfile1 testfile2
```

*Figure 2-13 Test Result*

4. If the information shown in the figure above appears, it means that the BeeGFS environment is running.

# 3. CONCLUSION

BeeGFS is an efficient and scalable file system, especially suitable for large-scale data storage and high-performance computing. By implementing QSAN storage through the BeeGFS file system, users can build a stable, reliable, and efficient data storage environment. This solution enables organizations to meet the demands of large-scale data processing while ensuring data reliability and availability. The integration of QSAN storage and BeeGFS is a powerful solution for high-performance data storage needs.

# 4. APPENDIX

## 4.1. Apply To

- XEVO firmware 2.3.0 and later

## 4.2. Reference

Document

- XEVO Software Manual