

## Block Storage

Block storage is implemented in OpenStack by the **Block Storage** service (Cinder). The **Block Storage** service provides persistent volumes that remain in storage and are stable when not attached to any instance. It is common to configure the **Block Storage** service with multiple back ends. The default storage back end is the Logical Volume Manager (LVM), which is configured to use a volume group called `cinder-volumes`. **TripleO** can create the volume group during an installation, or use an existing `cinder-volumes` volume group.

When Ceph storage is integrated into RHOSP, **TripleO** configures the **Block Storage** service to use **RADOS Block Devices (RBD)** as the back end. **Block Storage** volumes are stored in a Ceph pool called `volumes`. Volume backups are stored in a Ceph pool called `backups`. Ceph block device images attach to an OpenStack instance by using `libvirt`, which configures the QEMU interface to the `librbd` Ceph module. Ceph stripes block volumes across multiple OSDs within the cluster, providing increased performance for large volumes when compared to local drives.

OpenStack volumes, snapshots, and clones are implemented as block devices. OpenStack uses volumes to boot VMs, or to attach to running VMs as further application storage.

## File Storage

File storage is implemented in OpenStack by the **Shared File Systems** service (Manila). The **Shared File Systems** service supports multiple back ends and can provision shares from one or more back ends. Share servers export file shares by using various file system protocols such as NFS, CIFS, GlusterFS, or HDFS.

The **Shared File Systems** service is persistent storage and can be mounted to any number of client machines. You can detach file shares from one instance and attach them to another instance without data loss. The **Shared File Systems** service manages share attributes, access rules, quotas, and rate limits. Because unprivileged users are not allowed to use the `mount` command, the **Shared File Systems** service acts as a broker to mount and unmount shares that the storage operator configured.

When Ceph storage is integrated into RHOSP, **TripleO** configures the **Shared File Systems** service to use CephFS as the back end. CephFS uses the NFS protocol with the **Shared File Systems** service. **TripleO** can use the `ControllerStorageNFS` server role to configure an NFS Ganesha cluster as the scalable interface to the `libcephfs` back end.

## Compute Storage

Ephemeral storage is implemented in OpenStack by the **Compute** service (Nova). The **Compute** service uses the KVM hypervisor with `libvirt` to launch compute workloads as VMs. The **Compute** service requires two types of storage for `libvirt` operations:

- **Base image:** A cached and formatted copy of the image from the Image service.
- **Instance overlay:** A layered volume to be overlaid on the base image to become the VM's instance disk.

When Ceph storage is integrated into RHOSP, **TripleO** configures the **Compute** service to use **RADOS Block Devices (RBD)** as the back end. With RBD, instance operating system disks can be managed either as ephemeral, to be deleted when the instance is shut down, or as a persistent volume. An ephemeral disk behaves like a normal disk, to be listed, formatted, mounted, and used as a block device. However, the disk and its data cannot be preserved or accessed beyond the instance that it is attached to.