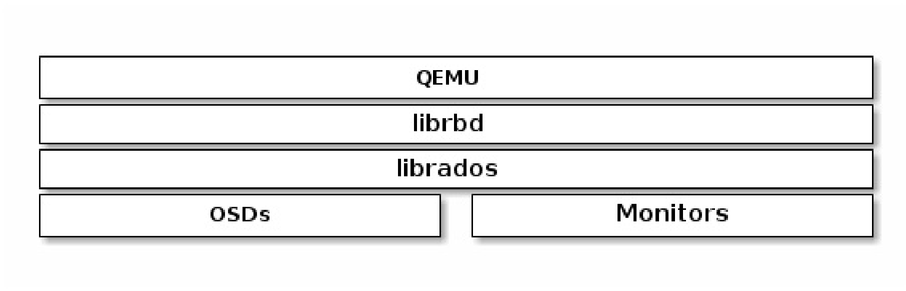
QEMU AND BLOCK DEVICES

The most frequent Ceph Block Device use case involves providing block device images to virtual machines. For example, a user may create a “golden” image with an OS and any relevant software in an ideal configuration. Then, the user takes a snapshot of the image. Finally, the user clones the snapshot (usually many times). See Snapshots for details. The ability to make copy-on-write clones of a snapshot means that Ceph can provision block device images to virtual machines quickly, because the client doesn’t have to download an entire image each time it spins up a new virtual machine.



Ceph Block Devices can integrate with the QEMU virtual machine. For details on QEMU, see QEMU Open Source Processor Emulator. For QEMU documentation, see QEMU Manual. For installation details, see Installation.

Important: To use Ceph Block Devices with QEMU, you must have access to a running Ceph cluster.

USAGE

The QEMU command line expects you to specify the pool name and image name. You may also specify a snapshot name.

QEMU will assume that the Ceph configuration file resides in the default location (e.g., `/etc/ceph/$cluster.conf`) and that you are executing commands as the default `client.admin` user unless you expressly specify another Ceph configuration file path or another user. When specifying a user, QEMU uses the `ID` rather than the full `TYPE:ID`. See User Management - User for details. Do not prepend the client type (i.e., `client.`) to the beginning of the user `ID`, or you will receive an authentication error. You should have the key for the `admin` user or the key of another user you specify with the `:id={user}` option in a keyring file stored in default path (i.e., `/etc/ceph` or the local directory with appropriate file ownership and permissions. Usage takes the following form:

```
qemu-img {command} [options] rbd:{pool-name}/{image-name}[@snapshot-name][:option1=value1][:o
```

For example, specifying the `id` and `conf` options might look like the following:

```
qemu-img {command} [options] rbd:glance-pool/maipo:id=glance:conf=/etc/ceph/ceph.conf
```

Tip: Configuration values containing `:`, `@`, or `=` can be escaped with a leading `\` character.

CREATING IMAGES WITH QEMU

You can create a block device image from QEMU. You must specify `rbd`, the pool name, and the name of the image you wish to create. You must also specify the size of the image.

```
qemu-img create -f raw rbd:{pool-name}/{image-name} {size}
```

For example:

```
qemu-img create -f raw rbd:data/foo 10G
```

Important: The `raw` data format is really the only sensible `format` option to use with RBD. Technically, you could use other

QEMU-supported formats (such as qcow2 or vmdk), but doing so would add additional overhead, and would also render the volume unsafe for virtual machine live migration when caching (see below) is enabled.

RESIZING IMAGES WITH QEMU

You can resize a block device image from QEMU. You must specify rbd, the pool name, and the name of the image you wish to resize. You must also specify the size of the image.

```
qemu-img resize rbd:{pool-name}/{image-name} {size}
```

For example:

```
qemu-img resize rbd:data/foo 10G
```

RETRIEVING IMAGE INFO WITH QEMU

You can retrieve block device image information from QEMU. You must specify rbd, the pool name, and the name of the image.

```
qemu-img info rbd:{pool-name}/{image-name}
```

For example:

```
qemu-img info rbd:data/foo
```

RUNNING QEMU WITH RBD

QEMU can pass a block device from the host on to a guest, but since QEMU 0.15, there’s no need to map an image as a block device on the host. Instead, QEMU can access an image as a virtual block device directly via `librbd`. This performs better because it avoids an additional context switch, and can take advantage of RBD caching.

You can use `qemu-img` to convert existing virtual machine images to Ceph block device images. For example, if you have a qcow2 image, you could run:

```
qemu-img convert -f qcow2 -O raw debian_squeeze.qcow2 rbd:data/squeeze
```

To run a virtual machine booting from that image, you could run:

```
qemu -m 1024 -drive format=raw,file=rbd:data/squeeze
```

RBD caching can significantly improve performance. Since QEMU 1.2, QEMU’s cache options control `librbd` caching:

```
qemu -m 1024 -drive format=rbd,file=rbd:data/squeeze,cache=writeback
```

If you have an older version of QEMU, you can set the `librbd` cache configuration (like any Ceph configuration option) as part of the ‘file’ parameter:

```
qemu -m 1024 -drive format=raw,file=rbd:data/squeeze:rbd_cache=true,cache=writeback
```

Important: If you set rbd_cache=true, you must set cache=writeback or risk data loss. Without cache=writeback, QEMU will not send flush requests to librbd. If QEMU exits uncleanly in this configuration, filesystems on top of rbd can be corrupted.

ENABLING DISCARD/TRIM

Since Ceph version 0.46 and QEMU version 1.1, Ceph Block Devices support the discard operation. This means that a guest can send TRIM requests to let a Ceph block device reclaim unused space. This can be enabled in the guest by mounting `ext4` or XFS with the `discard` option.

For this to be available to the guest, it must be explicitly enabled for the block device. To do this, you must specify a `discard_granularity` associated with the drive:

```
qemu -m 1024 -drive format=raw,file=rbd:data/squeeze,id=drive1,if=none \
     -device driver=ide-hd,drive=drive1,discard_granularity=512
```

Note that this uses the IDE driver. The virtio driver does not support discard.

If using libvirt, edit your libvirt domain’s configuration file using `virsh edit` to include the `xmlns:qemu` value. Then, add a `qemu:commandline` block as a child of that domain. The following example shows how to set two devices with `qemu id=` to different `discard_granularity` values.

```
<domain type='kvm' xmlns:qemu='http://libvirt.org/schemas/domain/qemu/1.0'>
        <qemu:commandline>
                <qemu:arg value='-set'/>
                <qemu:arg value='block.scsi0-0-0.discard_granularity=4096'/>
                <qemu:arg value='-set'/>
                <qemu:arg value='block.scsi0-0-1.discard_granularity=65536'/>
        </qemu:commandline>
</domain>
```

QEMU CACHE OPTIONS

QEMU’s cache options correspond to the following Ceph RBD Cache settings.

Writeback:

```
rbd_cache = true
```

Writethrough:

```
rbd_cache = true
rbd_cache_max_dirty = 0
```

None:

```
rbd_cache = false
```

QEMU’s cache settings override Ceph’s cache settings (including settings that are explicitly set in the Ceph configuration file).

Note: Prior to QEMU v2.4.0, if you explicitly set RBD Cache settings in the Ceph configuration file, your Ceph settings override the QEMU cache settings.