

[Linux information](#) > [Virtualization on Linux](#) > [KVM](#) > [Best practices for KVM](#) > [Best practices for networking](#)

Best practice: Use the tap networking option in QEMU

Learn about QEMU networking options and Linux bridge support.

QEMU networking options

QEMU networking support includes the following options:

User

The user option is a networking environment that supports the TCP and UDP protocols. QEMU provides services to the guest operating system such as DHCP, TFTP, SMB, and DNS. QEMU acts as a gateway and a firewall for the guest operating system such that communication from the guest operating system appears to be from the QEMU host.

You cannot initiate a connection to the guest operating system without help from QEMU. For this type of connection, QEMU provides the `redir` parameter. The `redir` parameter redirects TCP or UDP connections from a specific port on the host to a specific port on the guest operating system.

The user option is the default networking option in QEMU.

Socket

The socket option is used to connect together the network stacks of multiple QEMU processes. You create one QEMU process that listens on a specified port. Then, you create other QEMU processes that connect to the specified port.

Tap

The tap option connects the network stack of the guest operating system to a TAP network device on the host. By using a TAP device, QEMU can perform the following actions:

- Receive networking packets from the host network stack and pass the packets to the guest operating system.
- Receive networking packets from the guest operating system and inject the packets into the host network stack.

Use the tap networking option because it provides full networking capability to a guest operating system.

Linux bridge support

Perform the following tasks to add and remove TAP network devices to and from the bridges when you start and stop a guest operating system:

1. Create the bridges before you start the first guest operating system.
2. If you want the guest operating system to access the physical network, add an Ethernet device to the bridge.
3. Specify a script for configuring the tap network device and a script for unconfiguring the tap network device.

Guest operating systems that you add to the same bridge can communicate with each other. If you want multiple subnets available to the guest operating systems, define multiple bridges. In this situation, each bridge is for a unique subnet. Each bridge contains the TAP devices that are associated with the NICs of the guest operating systems that are part of the same subnet.

When using the Linux bridge, consider the form of receive offload supported by the network adapter. Receive offload aggregates multiple packets into a single packet to improve network performance. Many network adapters provide a form of receive offload in the adapter, which is often referred to as large receive offload (LRO). The Linux kernel provides a form of receive offload called generic receive offload (GRO). Linux bridges can forward GRO packets. Linux bridges cannot forward LRO packets unless the driver is compliant with GRO. Therefore, in order for guest operating systems to use receive offload the network adapter must support GRO.

QEMU VLAN

QEMU networking uses a networking technology that is like VLAN. A QEMU VLAN is not an 802.1q VLAN. Rather, a QEMU VLAN is a way for QEMU to forward packets to guest operating systems that are on the same VLAN. When you define the networking options for a guest operating system, you can specify a VLAN to which the network interface is assigned. If you do not specify a VLAN, by default QEMU assigns the interface to VLAN 0. In general, if you create more than one network interface for a guest operating system, assign the network interfaces to different VLANs.

Example

The following example shows the `qemu-kvm` options you can use to set up multiple interfaces:

```
-net nic,model=virtio,vlan=0,macaddr=00:16:3e:00:01:01
-net tap,vlan=0,script=/root/ifup-br0,downscript=/root/ifdown-br0
-net nic,model=virtio,vlan=1,macaddr=00:16:3e:00:01:02
-net tap,vlan=1,script=/root/ifup-br1,downscript=/root/ifdown-br1
```

The example shows two network devices configured for a guest operating system as follows:

- The `-net nic` command defines a network adapter in the guest operating system. Both network devices are para-virtualized devices which is indicated by the `model=virtio` value. Both devices also have unique MAC addresses which is indicated by the `macaddr` values. Each network device is on a different VLAN. The first device is on VLAN 0 and the second network device is on VLAN 1.
- The `-net tap` command defines how QEMU configures the host. Each network device is added to and removed from a different bridge by using scripts. The first device is added to the `br0` bridge by using the `/root/ifup-br0` script and removed from the `br0` bridge by using the `/root/ifdown-br0` script. Similarly, the second network device is added to the `br1` bridge by using the `/root/ifup-br1` script and removed from the `br1` bridge by using the `/root/ifdown-br1` script. Each network device is also on a different VLAN. The first device is on VLAN 0 and the second network device is on VLAN 1.

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