OpenShift introduction

wji@ 2022/09

Red Hat

Info

OpenShift content hub (internal)
https://redhat.highspot.com/spots/5fda4a94a4dfa0396bab090e?list=5b646a6e1279585581196a55&overview=false

- What's New in OpenShift 4.11
- OpenShift New Feature Enablement Presentation - Logging 5.5 - Features
- OpenShift New Feature Enablement - Logging 5.5 - Common Labels
- OpenShift New Feature Enablement - Logging 5.5 - Separate Indices
- OpenShift New Feature Enablement Presentation - Logging 5.5 - Vector changes
- OpenShift New Feature Enablement Presentation - Logging 5.5 - Loki Integration
- OpenShift 4.11 Logging Release notes

CNV 简单 demo 演示文档
Openshift 和 Docker 的命令汇总
Openshift 命令与 yaml 文件的匹配表
Red Hat OpenShift Container Platform Cheat Sheet

Resources

Of course there is much more information outside the above mentioned highlights.

Here are a few resources to visit for your next steps with Red Hat OpenShift Data Foundation 4.11:

- Red Hat OpenShift Data Foundation 4.11 landing page on The Source
- Disaster recovery for Red Hat OpenShift workloads deck and video.
- What's New with Red Hat OpenShift Data Foundation 4.11 deck and video.
- Red Hat OpenShift Data Foundation product information.
- Red Hat OpenShift Data Foundation official documentation.

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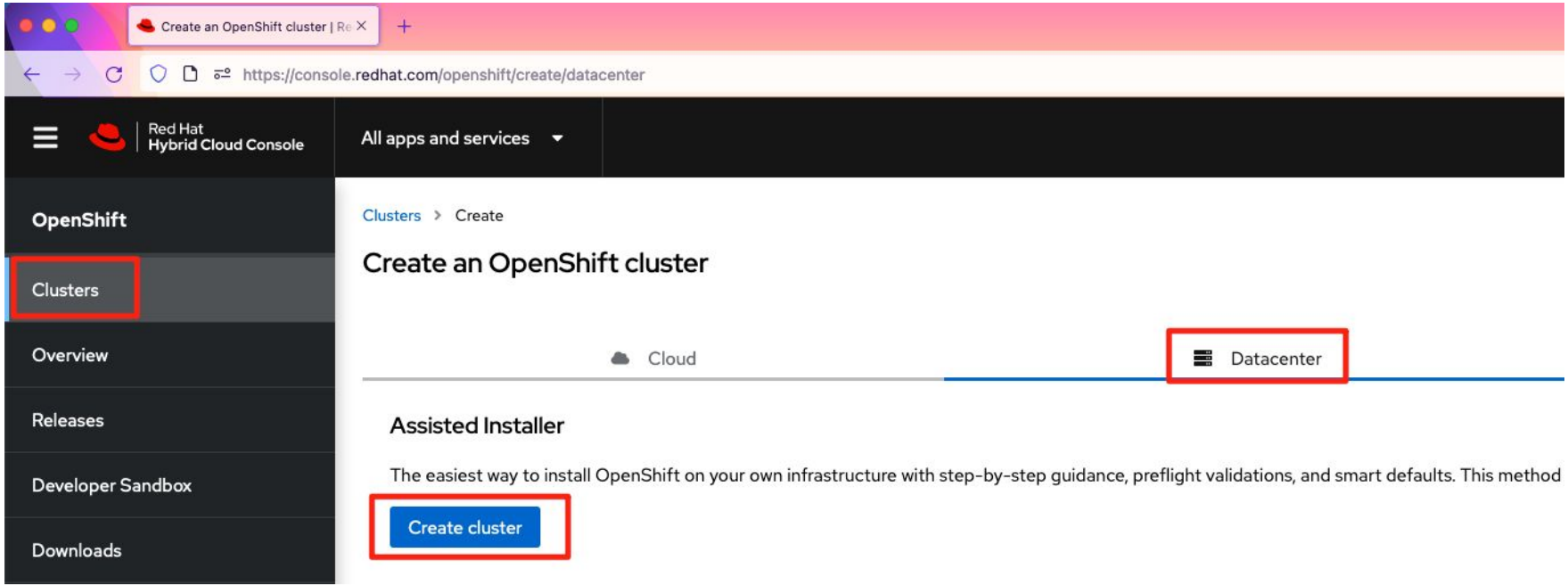
console.redhat.com

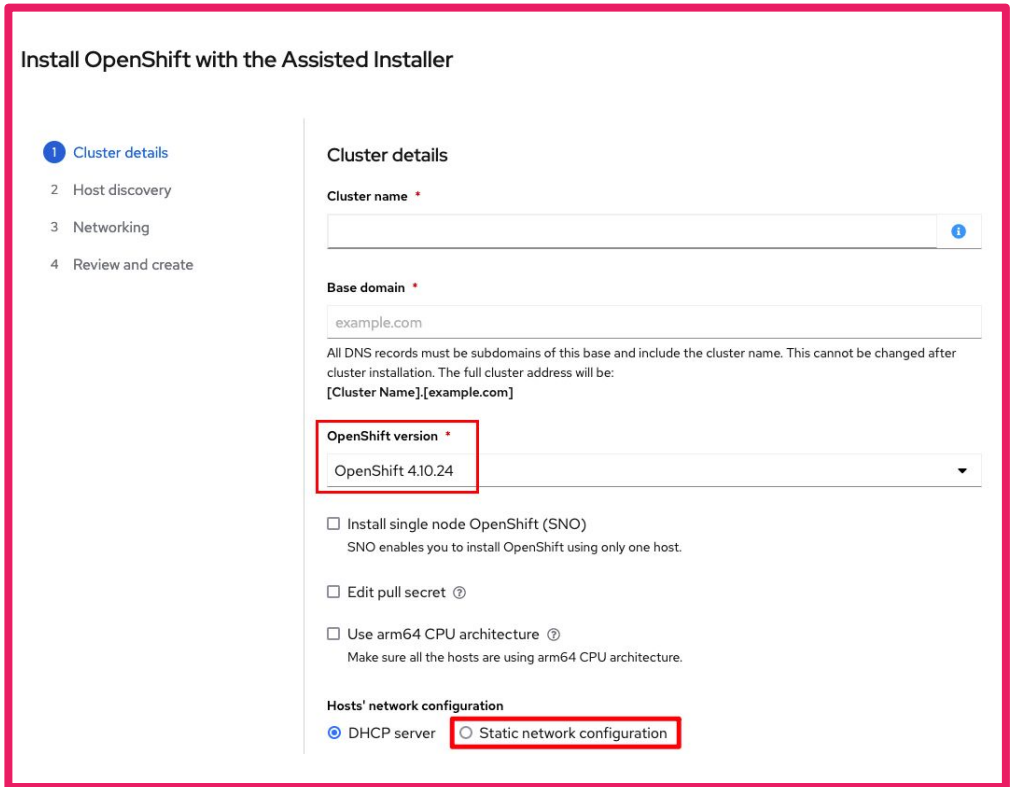


Thanks my manager lijin@ and mentor ngu@ for huge help.

console.redhat.com

Minimum hardware requirements

- Control plane nodes: At least 4 CPU cores, 16.00 GiB RAM, and 100 GB disk size.
- Workers: At least 2 CPU cores, 8.00 GiB RAM, and 100 GB disk size.



Additional Requirements

- Enabled CPU virtualization support in BIOS (Intel-VT / AMD-V) on all nodes
- Each worker node requires an additional 360 MiB of memory and 2 CPUs
- Each control plane node requires an additional 150 MiB of memory and 4 CPUs
- OpenShift Data Foundation (recommended for full functionality) or another persistent storage service

Using the ocp-configure project to deploy

ocp-configure

This project can install OCP(openshift) in beaker.

How to use

```
➜  ocp-configure git:(main) ./getocp.py
usage: getocp.py [-h] [-n {1,3,6} | -r DESTROY DESTROY]

THE OCP INSTALLITION TOOLS

optional arguments:
  -h, --help            show this help message and exit
  -n {1,3,6}, --install {1,3,6}
                        Install the number of ceph hosts
  -r DESTROY DESTROY, --destroy DESTROY DESTROY
                        Destroy the number of ceph hosts

Any questions, you can mail me <wji@redhat.com>
Install: ./getocp.py -n 3
Destroy: ./getocp.py -r yes-i-realy-realy-want-to-destroy-cluster <number>
```

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AGENDA

What is OpenShift?

- Containers
- Container Native Virtualization / Virtual Machines
- How to install cluster with the ocp-configure tool?

OpenShift Storage!

- How to start VM with hostpath / nfs / ceph storage?

OpenShift Network!

- What differents between SofwareDefineNetwork and OpenVirtualNetwork?

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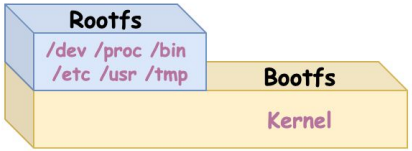
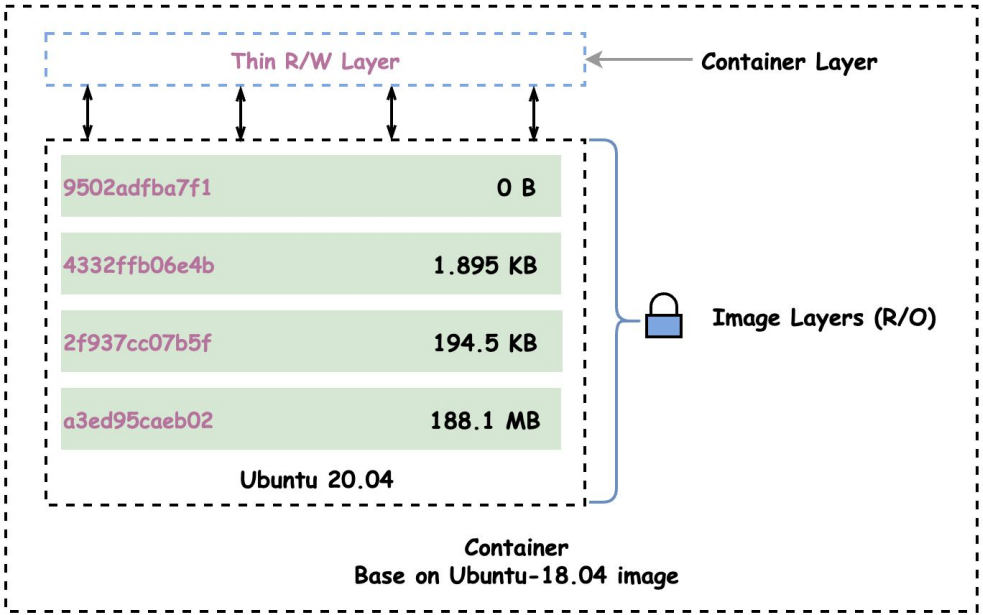
What is OpenShift?

What is Containers?





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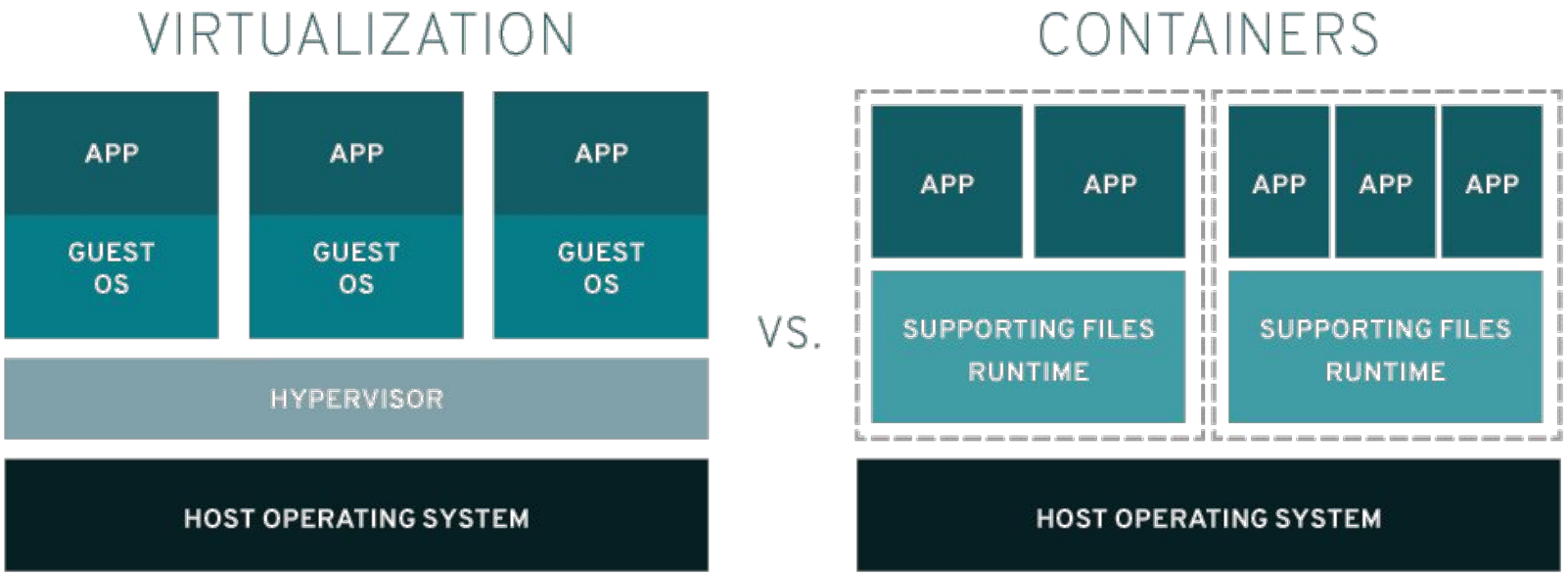
Containers vs VMs



https://www.redhat.com/en/topics/containers/containers-vs-vms

What is OpenShift?

Red Hat® OpenShift® is a Kubernetes distribution—a commercialized software product derived from an open source project. Red Hat OpenShift and Kubernetes are both container orchestration software, but Red Hat OpenShift is packaged as a downstream enterprise open source platform—meaning it's undergone additional testing and contains additional features not available from the Kubernetes open source project.

红帽 OpenShift 和 Kubernetes 都负责管理一组容器（称为集群）。每个集群都分为 2 个部分：控制平面和工作节点。容器在工作节点中运行，而每个工作节点都有自己的 Linux 操作系统。控制平面负责维护集群的整体状态（例如运行什么应用以及使用哪些容器镜像），而工作节点则负责实际的计算工作。

尽管 Kubernetes 无所不能，但用户仍然需要整合其他组件，例如网络、入口和负载平衡、存储、监控、日志记录等。在以 Kubernetes 为核心的前提下，红帽 OpenShift 之所以还要提供这些组件，因为就在于单靠 Kubernetes 是不够的。

作为一个万能的容器平台，红帽 OpenShift 绝不仅仅是一种软件产品。它是实施 DevOps 文化的关键所在 - 在应用的整个生命周期中，实现日常运维任务的自动化和环境的标准化。

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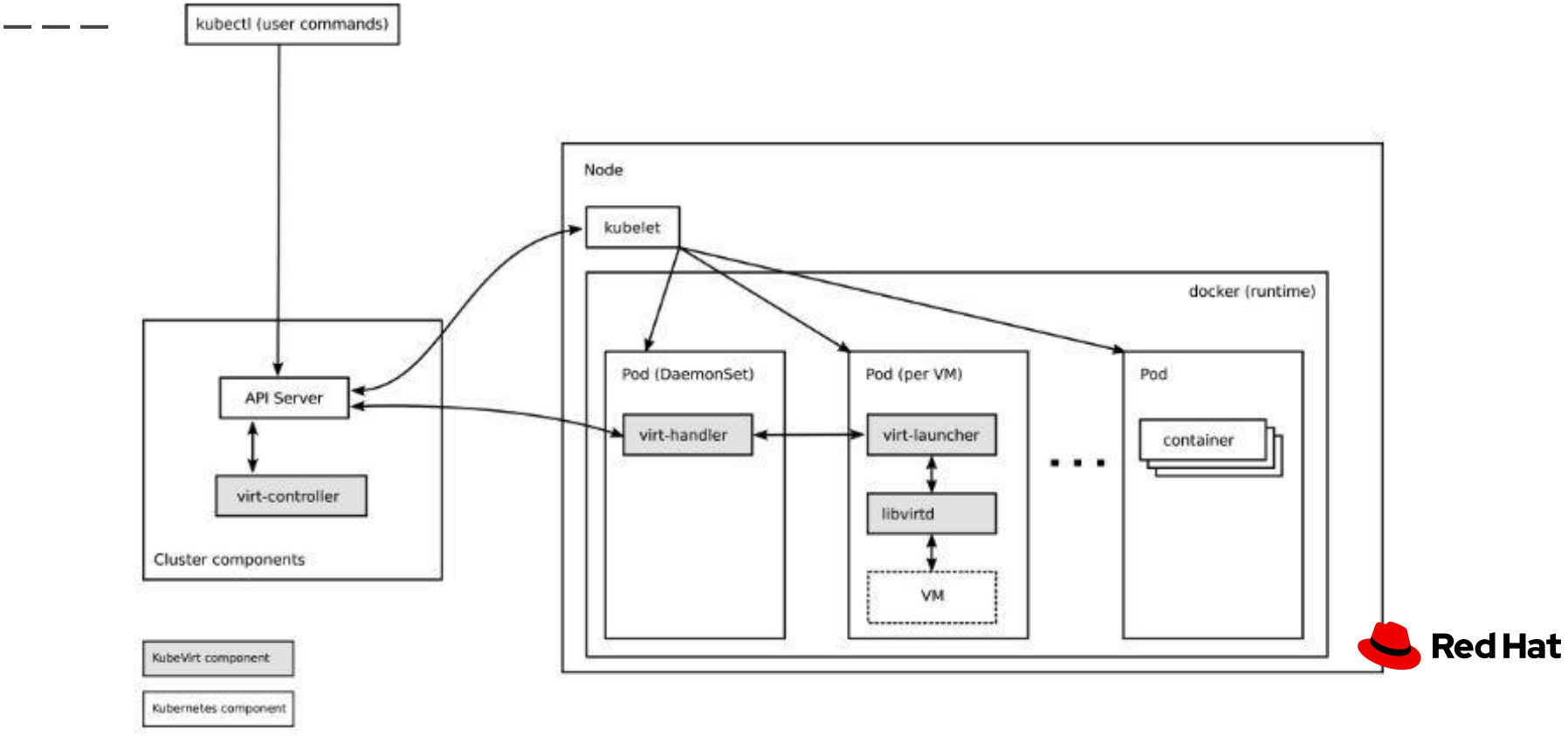
Ref 一文看懂红帽 OpenShift K8s 区别是什么？

OpenShift Component!



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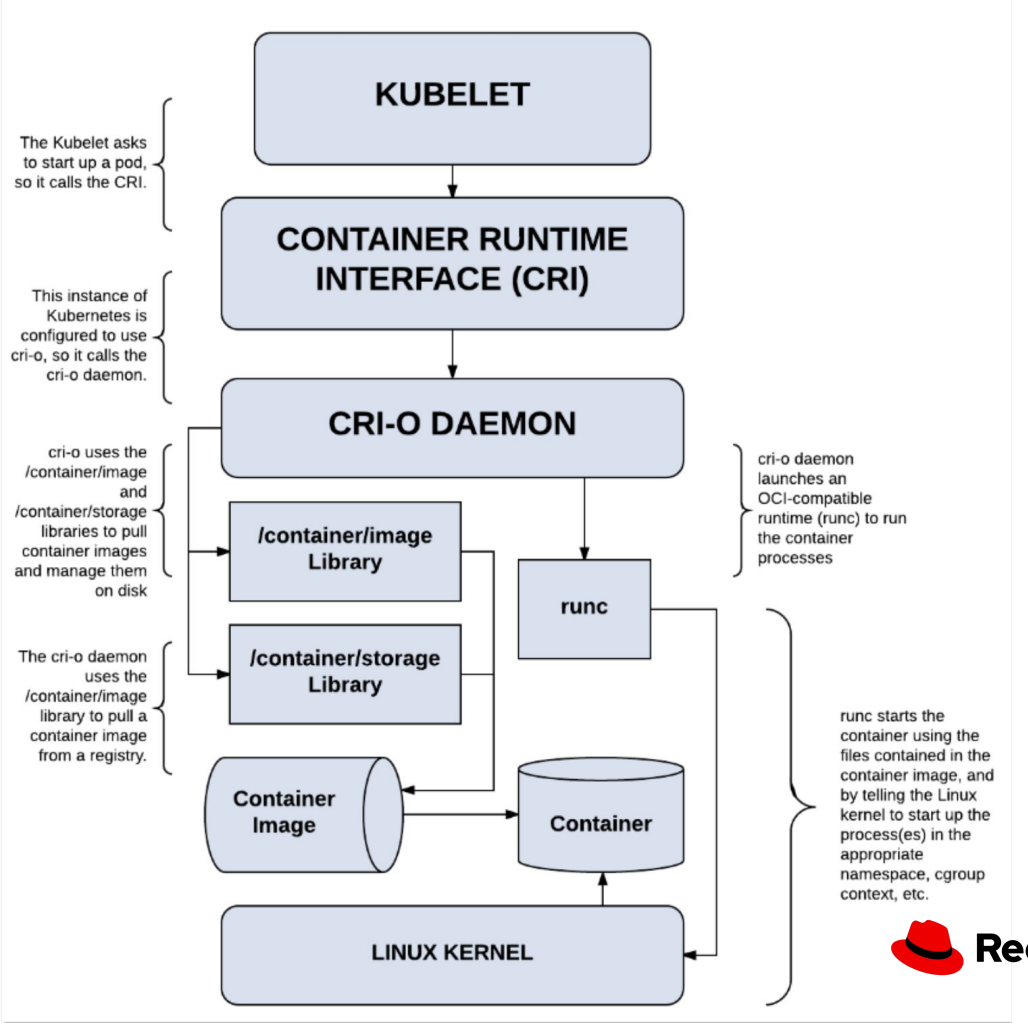
OpenShift Component!

CRI-O 是一个开源的、社区驱动的容器引擎。其主要目标是取代 Docker 服务作为 Kubernetes 实施的容器引擎，例如 OpenShift Container Platform。

Open Container Initiative OCI 于 2015 年 6 月 22 日由 Docker、CoreOS 和其他容器行业的领导者发起。OCI 目前包含两个规范：运行时规范（runtime-spec）和图像规范（image-spec）。

runc是一个 CLI 工具，用于根据 OCI 规范在 Linux 上生成和运行容器。



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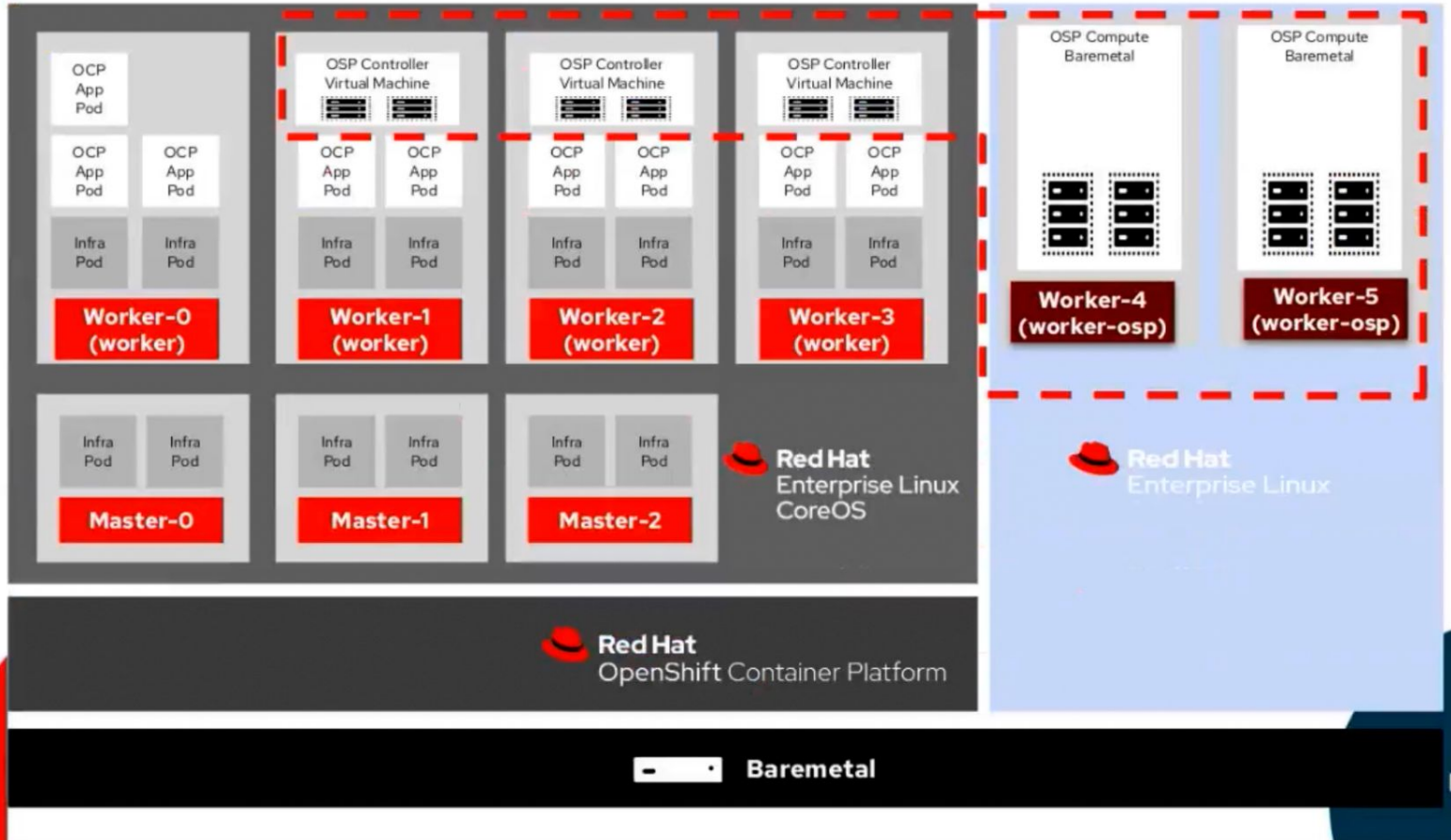
Virtualized control plane on OpenShift Virtualization

Tech Preview in RHOSP 16.2



What is OpenShift? - CNV part

- Upstream: Kubevirt
  - https://kubevirt.io/
- Brief Introduction KubeVirt 2 minutes Intro
  - “We just built the qemu/libvirt daemen or relevant into a container to support running the VM on OpenShift env.” from ycui@
  - "我们只是将 qemu / libvirt daemen 或相关内容构建到容器中，以支持在 OpenShift env 上运行 VM 。" from ycui@

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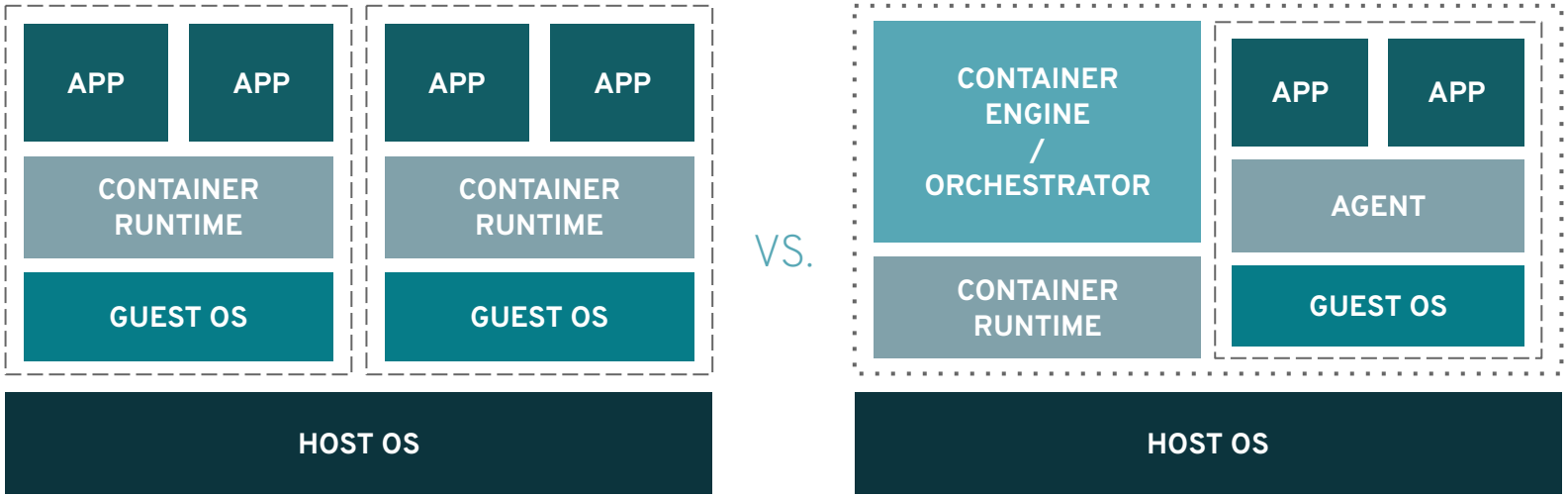
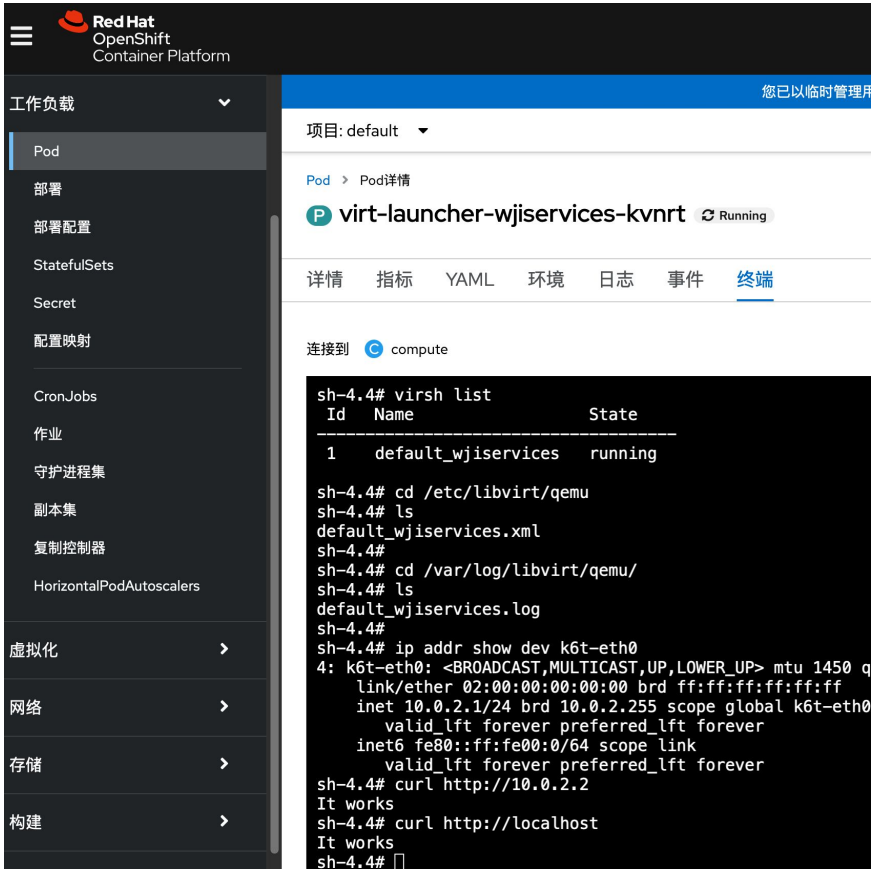
Containers + VMs vs VM-based Containers



What is OpenShift? - CNV part

OCP and CNV have something in common, they are both containers. And the difference is CNV, which creates a virtual machine inside a container. **The screenshot on the right shows the details.**

Since they are all containers, they can be managed by scheduling.The next page will show the process.



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```
/usr/bin/qemu-system-x86_64 \
      -machine accel=kvm \
      -name sandbox-6c2056050a9fa63d726711e01002f0497c2f9ad839fb424eb6e63f0b0c7e39fc \
      -uuid c28e839a-26e3-425c-8c90-b86caece4d65 \
      -machine q35,accel=kvm,kernel_irqchip \
      -cpu host \
      -qmp unix:/run/vc/vm/6c2056050a9fa63d726711e01002f0497c2f9ad839fb424eb6e63f0b0c7e39fc/qmp.sock,server,nowait \
      -m 2048M,slots=10,maxmem=8630M \
      -device pci-bridge,bus=pcie.0,id=pci-bridge-0,chassis_nr=1,shpc=on,addr=2,romfile= \
      -device virtio-serial-pci,disable-modern=false,id=serial0,romfile= \
      -device virtconsole,chardev=charconsole0,id=console0 \
      -chardev
socket,id=charconsole0,path=/run/vc/vm/6c2056050a9fa63d726711e01002f0497c2f9ad839fb424eb6e63f0b0c7e39fc/console.sock,server,nowa
it \
      -device virtio-scsi-pci,id=scsi0,disable-modern=false,romfile= \
      -object rng-random,id=rng0,filename=/dev/urandom \
      -device virtio-rng-pci,rng=rng0,romfile= \
      -device vhost-vsock-pci,disable-modern=false,vhostfd=3,id=vsock-2862916059,guest-cid=2862916059,romfile= \
      -chardev
socket,id=char-a9ef5c8cd2d0989c,path=/run/vc/vm/6c2056050a9fa63d726711e01002f0497c2f9ad839fb424eb6e63f0b0c7e39fc/vhost-fs.sock \
      -device vhost-user-fs-pci,chardev=char-a9ef5c8cd2d0989c,tag=kataShared,romfile= \
      -netdev tap,id=network-0,vhost=on,vhostfds=4,fds=5 \
      -device driver=virtio-net-pci,netdev=network-0,mac=2e:7a:6b:f2:f6:74,disable-modern=false,mq=on,vectors=4,romfile= \
      -global kvm-pit.lost_tick_policy=discard \
      -vga none \
      -no-user-config \
      -nodefaults \
      -nographic \
      -daemonize \
      -object memory-backend-file,id=dimm1,size=2048M,mem-path=/dev/shm,share=on \
      -numa node,memdev=dimm1 \
      -kernel /usr/lib/modules/5.7.11-200.fc32.x86_64/vmlinuz \
      -initrd /var/cache/kata-containers/osbuilder-images/5.7.11-200.fc32.x86_64/fedora-kata-5.7.11-200.fc32.x86_64.initrd \
      -append tsc=reliable no_timer_check rcupdate.rcu_expedited=1 i8042.direct=1 i8042.dumbkbd=1 i8042.nopnp=1 i8042.noaux=1
noreplace-smp reboot=k console=hvc0 console=hvc1 iommu=off cryptomgr.notests net.ifnames=0 pci=lastbus=0 quiet panic=1 nr_cpus=4
agent.use_vsock=true scsi_mod.scan=none \
      -pidfile /run/vc/vm/6c2056050a9fa63d726711e01002f0497c2f9ad839fb424eb6e63f0b0c7e39fc/pid \
      -smp 1,cores=1,threads=1,sockets=4,maxcpus=4
```

Monitor Port

Console Port

Agent Port

Pod Image

Pod Network

Guest OS

What is OpenShift? - CNV part

OCP and CNV have something in common, they are both containers. And the difference is CNV, which creates a virtual machine inside a container. The screenshot on the right shows the details.

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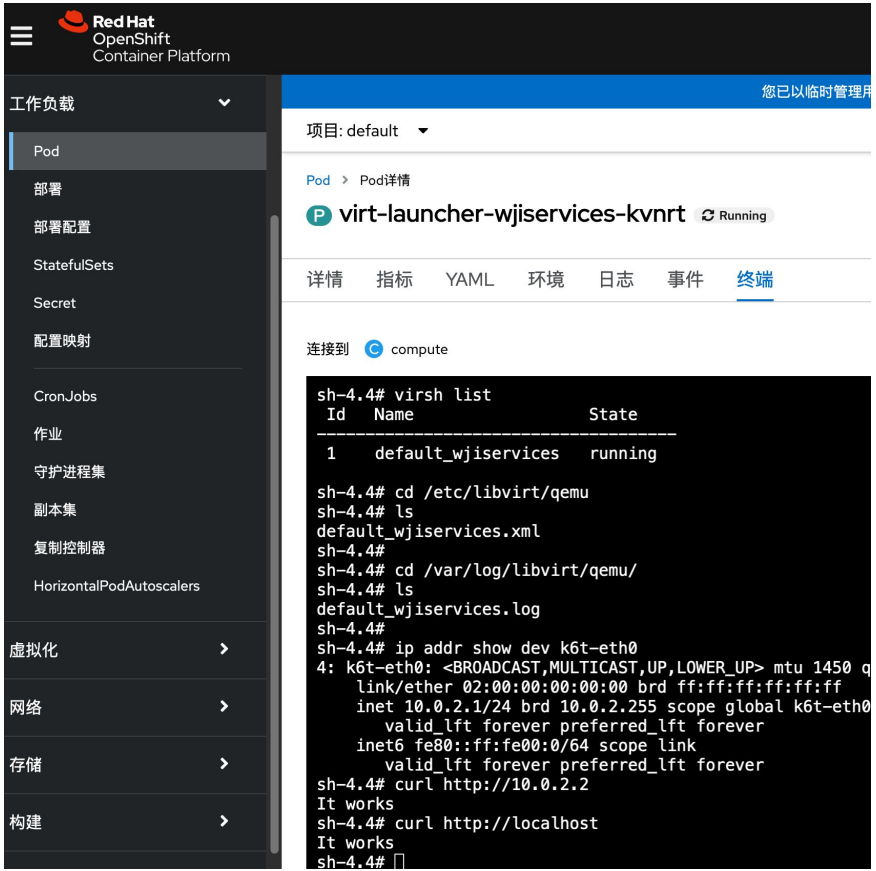

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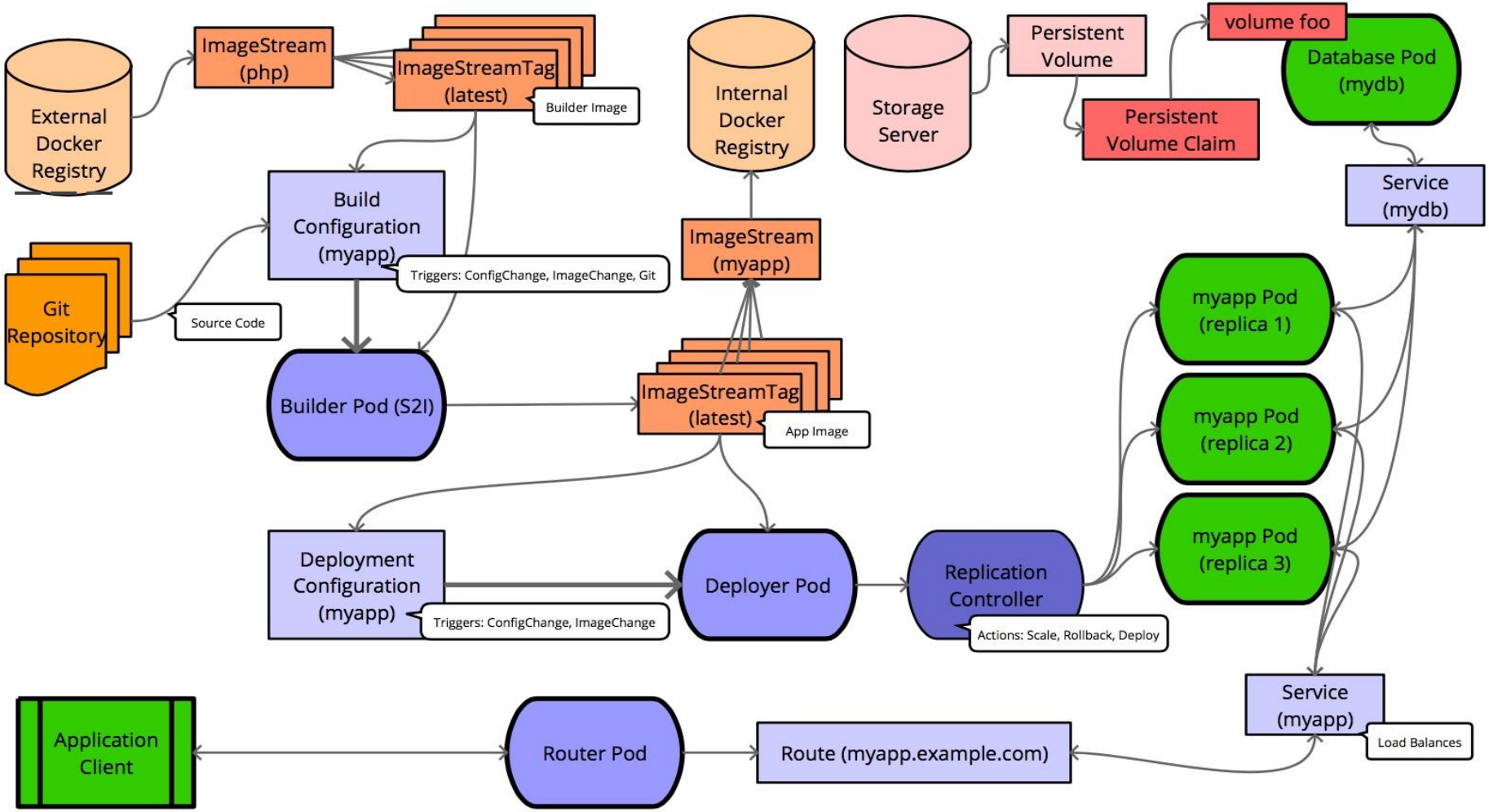
External Docker Registry
ImageStream (php)
ImageStreamTag (latest)
Builder Image
Internal Docker Registry
Storage Server
Persistent Volume
volume foo
Database Pod (mydb)
Persistent Volume Claim
Service (mydb)
Build Configuration (myapp)
Triggers: ConfigChange, ImageChange, Git
ImageStream (myapp)
Git Repository
Source Code
Builder Pod (S2I)
ImageStreamTag (latest)
App Image
myapp Pod (replica 1)
myapp Pod (replica 2)
myapp Pod (replica 3)
Deployment Configuration (myapp)
Triggers: ConfigChange, ImageChange
Deployer Pod
Replication Controller
Actions: Scale, Rollback, Deploy
Service (myapp)
Load Balances
Application Client
Router Pod
Route (myapp.example.com)

CNV demo presentation

I. Cluster Deployment

II. Cluster Login

III. Storage configuration

IV. Virtual Machine Management

V. Virtual machine more operations

Practical part: service provisioning

https://gitlab.cee.redhat.com/wji/learningmd/-/blob/master/CNV/README.md

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OpenShift Storage!

OpenShift Storage! - pv storage

这里会展示三类存储：

- 手动创建的 PV：

  nfs / iscsi / local disk / local folder

- 使用 Local Storage Operator 自动创建的 PV

  local disk

- 使用 StorageClass 自动创建的 PV

  nfs / iscsi / local / ceph / aws / azure / swift ……

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OpenShift Storage! - pv storage - nfs

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: example
spec:
  capacity:
        storage: 5Gi
  accessModes:
        - ReadWriteOnce
  persistentVolumeReclaimPolicy: Retain
  storageClassName: slow
  nfs:
        path: /tmp
        server: 172.17.0.2
```

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OpenShift Storage! - pv storage - iscsi

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: iscsi-pv
spec:
  capacity:
        storage: 1Gi
  accessModes:
        - ReadWriteOnce
  iscsi:
        targetPortal: 10.16.154.81:3260
        iqn: iqn.2014-12.example.server:storage.target00
        lun: 0
        fsType: 'ext4'
```

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OpenShift Storage! - pv storage - local without LSO - howto

```
apiVersion: v1
kind: PersistentVolume
metadata:
  name: example-pv-filesystem
spec:
  capacity:
        storage: 100Gi
  volumeMode: Filesystem
  accessModes:
  - ReadWriteOnce
  persistentVolumeReclaimPolicy: Delete
  storageClassName: local-storage
  local:
        path: /dev/xvdf
  nodeAffinity:
        required:
        nodeSelectorTerms:
        - matchExpressions:
        - key: kubernetes.io/hostname
        operator: In
        values:
        - example-node
```

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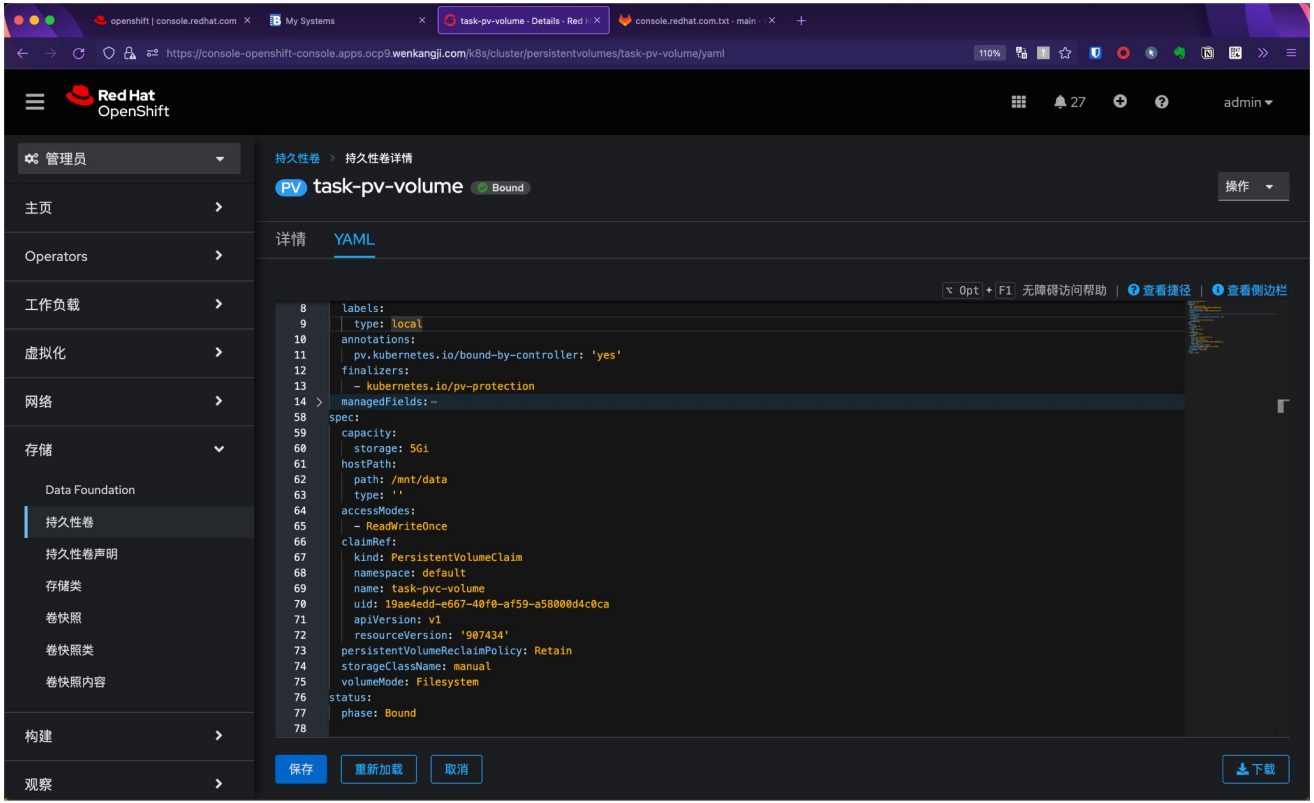
OpenShift Storage! - pv storage - local without LSO - effect



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OpenShift Storage! - Local Volume with LSO - GUI

Red Hat

OpenShift Storage! - Local Volume with LSO - CLI

```
apiVersion: local.storage.openshift.io/v1
kind: LocalVolume
metadata:
  name: local-block
  namespace: openshift-local-storage
spec:
  nodeSelector:
        nodeSelectorTerms:
        - matchExpressions:
        - key: cluster.ocs.openshift.io/openshift-storage
        operator: In
        values:
        - ""
  storageClassDevices:
        - storageClassName: localblock
        volumeMode: Block
        devicePaths:
        - /dev/disk/by-path/pci-0000:07:00.0
        - /dev/disk/by-path/pci-0000:07:00.0
        - /dev/disk/by-path/pci-0000:07:00.0
```

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OpenShift Storage! - hostpath storageclass

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HPP hostpath-provisioner

操作

详情 YAML

⌥ Opt + F1 无障碍访问帮助 | 查看捷径 | 查看侧边栏

```yaml
apiVersion: hostpathprovisioner.kubevirt.io/v1beta1
kind: HostPathProvisioner
metadata:
  annotations:
    kubectl.kubernetes.io/last-applied-configuration: >
      {"apiVersion":"hostpathprovisioner.kubevirt.io/v1beta1","kind":"HostPathProvisioner","metadata":{"annotations":{},"name":"hostpath-provisioner"},"spec":{"imagePullPolicy":"IfNotPresent",
  creationTimestamp: '2022-08-15T06:06:49Z'
  finalizers:
    - finalizer.delete.hostpath-provisioner
  generation: 1835
  managedFields: …
  name: hostpath-provisioner
  resourceVersion: '8865658'
  uid: 43c7e97f-b8e7-45f4-80ba-2b7c86df9e95
spec:
  imagePullPolicy: IfNotPresent
  storagePools:
    - name: sno
      path: /var/hpvolumes
      pvcTemplate:
        accessModes:
          - ReadWriteOnce
        resources:
          requests:
            storage: 50Gi
        storageClassName: localblock-sc
        volumeMode: Block
  workload:
    nodeSelector:
      kubernetes.io/os: linux
status:
  conditions:
    - lastHeartbeatTime: '2022-08-19T05:44:00Z'
```

保存 重新加载 取消

下载

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OpenShift Storage! - nfs storageclass

helm repo add nfs-subdir-external-provisioner https://kubernetes-sigs.github.io/nfs-subdir-external-provisioner/

helm install nfs-subdir-external-provisioner nfs-subdir-external-provisioner/nfs-subdir-external-provisioner \
--set nfs.server=<THE NFS SERVER> \
--set nfs.path=<THE NFS EXPORTFS>

oc patch storageclasses nfs-client -p '{"metadata": {"annotations":{"storageclass.kubernetes.io/is-default-class":"true"}}}'

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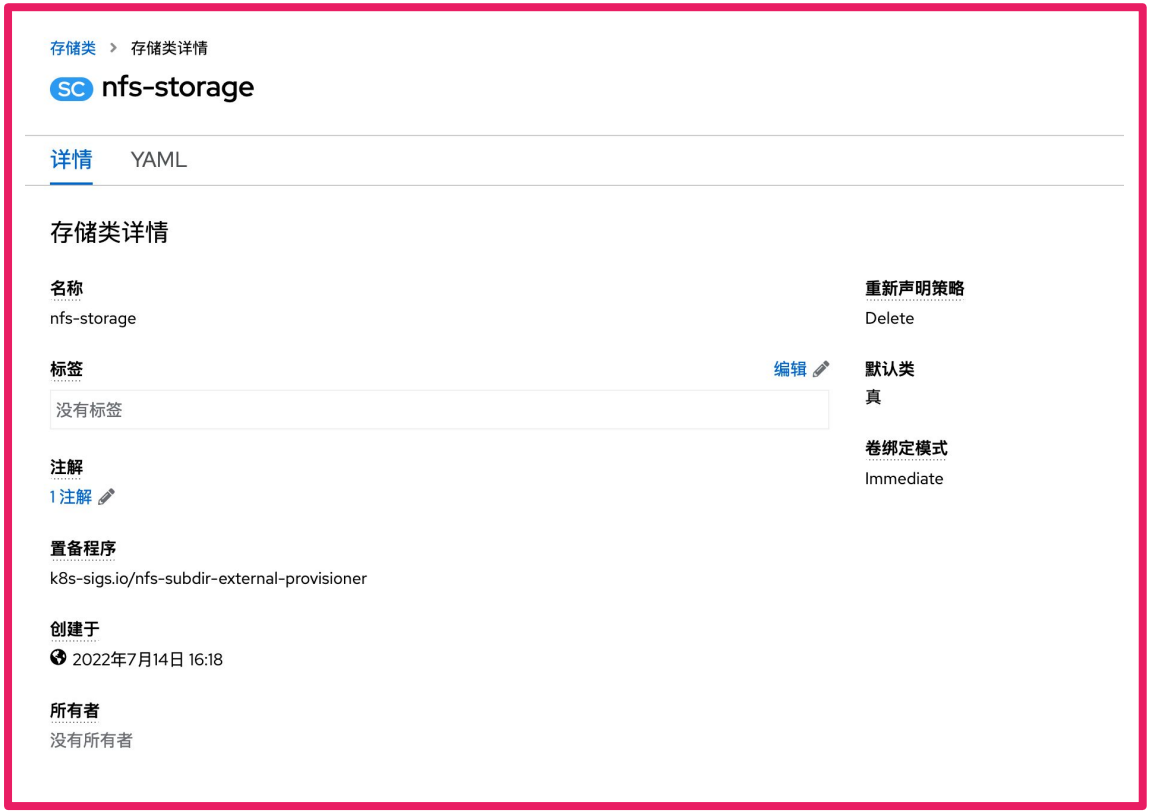
OpenShift Storage! - nfs storageclass



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OpenShift Storage! - ceph storageclass

What is ceph?

- A reliable,autonomous,distributed object store comprised of self-healing,self-managing, intelligent storage nodes

How to install ceph?

- Ceph can be installed both manually and automatically, and the automatic way is achieved through service specifications.

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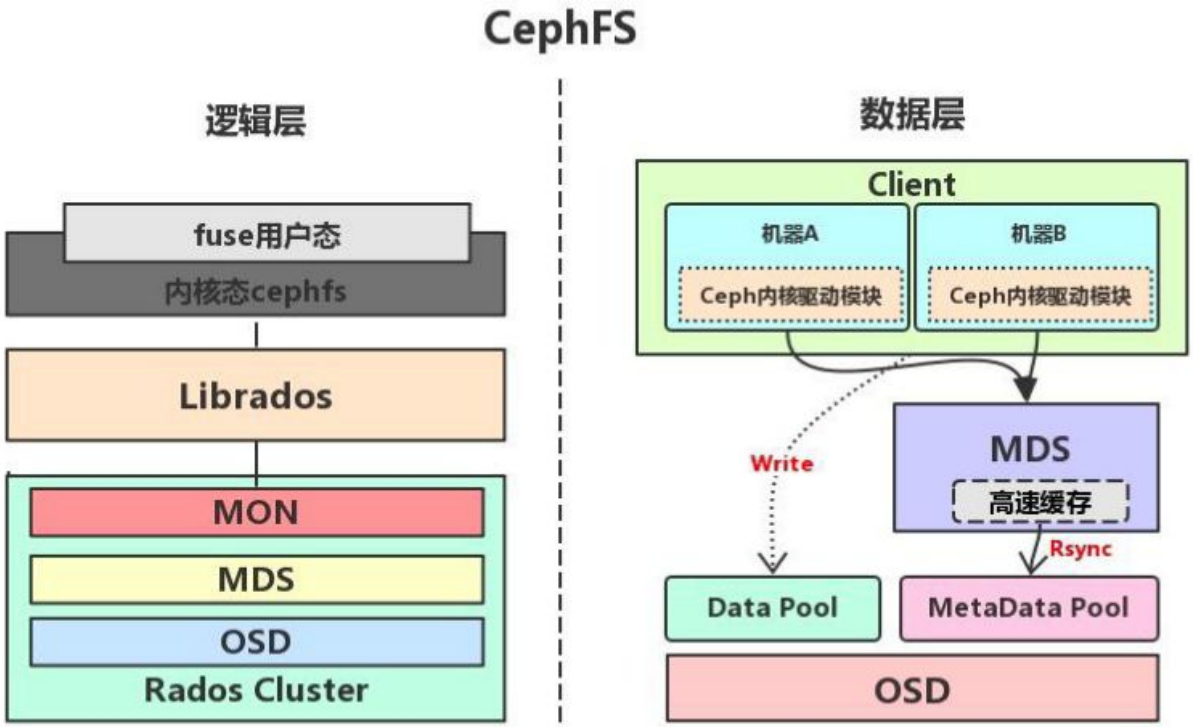
OpenShift Storage! - ceph storageclass



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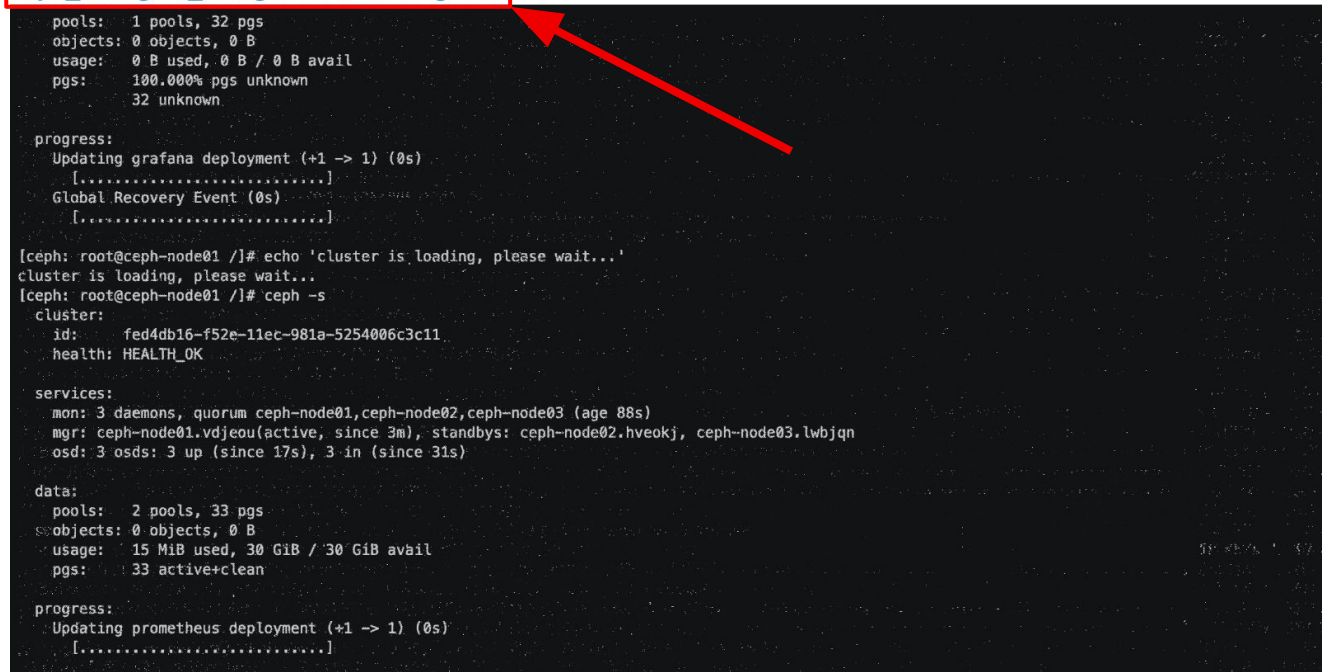
Using the ceph_configure_autogen project to deploy

ceph_configure_autogen

The rhel87 is more recommended, rhel9 works but uses the rhel8 package. Only x86 platform is supported.

ceph_configure_autogen installation guide



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ceph_configure_autogen installation guide

文件 编辑 查看 插入 格式 工具 扩展程序 帮助 上次修改是在 7 天前进行的

100% 1 级标题 Arial 20

摘要

ceph storage installation guide

大纲

Step0: Check environment likes RAM & Disk

```
[root@hpe-ml350gen9-01 ~]# hostname
hpe-ml350gen9-01.hpe2.lab.eng.bos.redhat.com
[root@hpe-ml350gen9-01 ~]# free -mh
              total        used        free      shared  buff/cache   available
Mem:           46Gi       726Mi        42Gi        12Mi       3.3Gi        45Gi
Swap:          23Gi          0B        23Gi
[root@hpe-ml350gen9-01 ~]#
[root@hpe-ml350gen9-01 ~]#
[root@hpe-ml350gen9-01 ~]# df -hT
Filesystem                      Type   Size  Used Avail Use% Mounted on
devtmpfs                        devtmpfs  24G     0   24G   0% /dev
tmpfs                           tmpfs   24G     0   24G   0% /dev/shm
tmpfs                           tmpfs   24G  9.7M   24G   1% /run
tmpfs                           tmpfs   24G     0   24G   0% /sys/fs/cgroup
/dev/mapper/rhel_hpe--ml350gen9--01-root xfs       70G  4.9G   66G   7% /
/dev/sda1                       xfs     1004M  217M  788M  22% /boot
/dev/mapper/rhel_hpe--ml350gen9--01-home xfs      464G  3.8G  461G   1% /home
tmpfs                           tmpfs   4.7G     0  4.7G   0% /run/user/0
[root@hpe-ml350gen9-01 ~]#
[root@hpe-ml350gen9-01 ~]#
```

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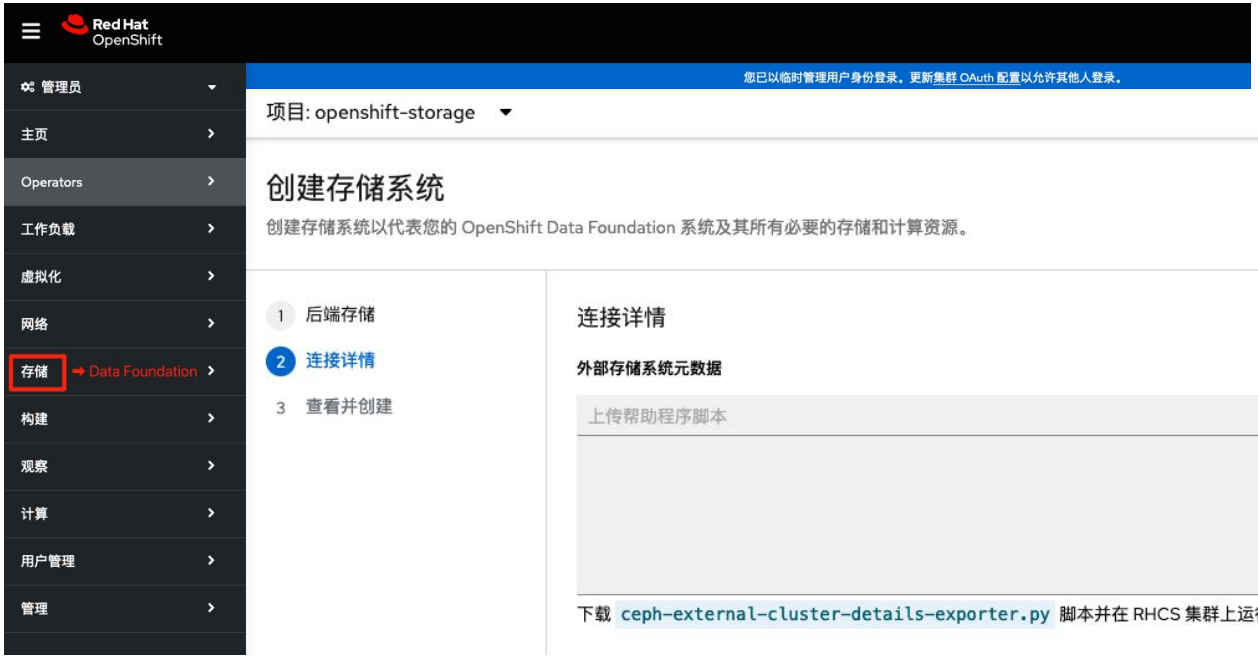
OpenShift Storage! - ceph storageclass



Red Hat

OpenShift Storage! - ceph storageclass

ocp 与 ceph 的联动，后续需要配置的有：

1、下载 ceph-external-cluster-details-exporter.py 文件

2、创建存储池

```
[root@ceph-node01 ~]# ceph osd pool create myPool 32
pool 'myPool' created
[root@ceph-node01 ~]# rbd pool init myPool
[root@ceph-node01 ~]# ceph osd pool application enable myPool rbd
```

3、生成配置文件

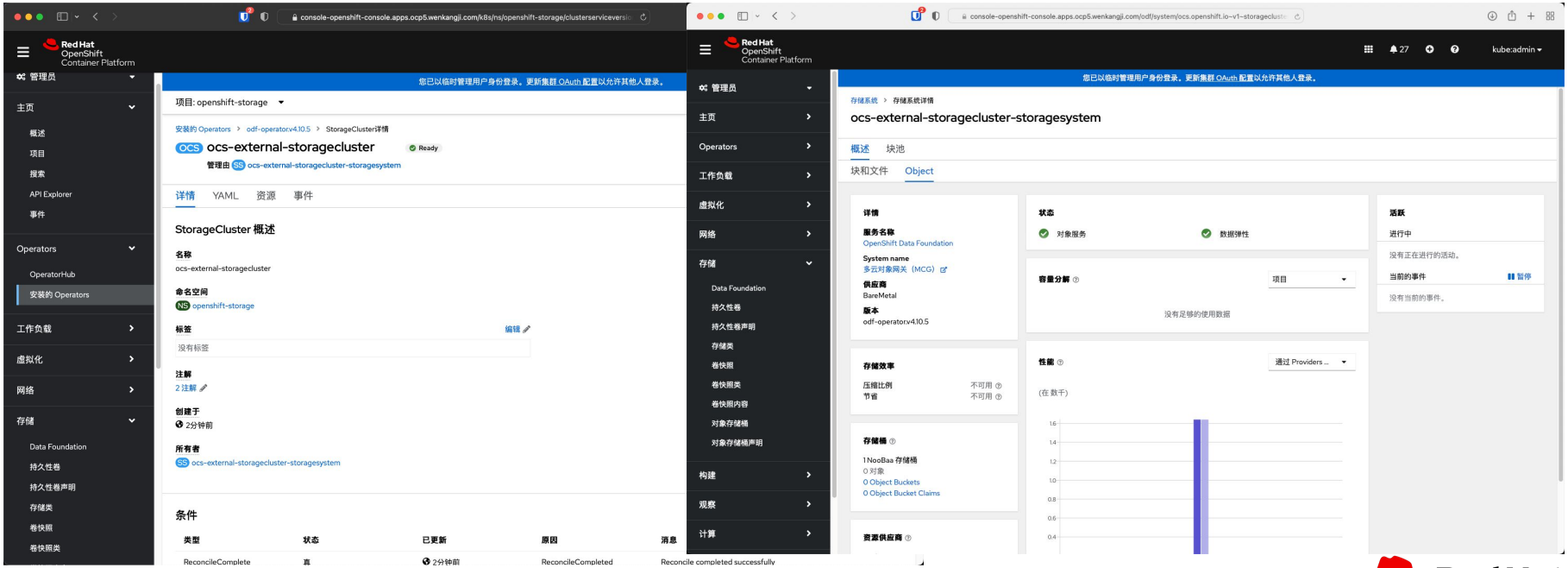
```
[root@ceph-node01 ~]# python3 ceph-external-cluster-details-exporter.py --upgrade
[root@ceph-node01 ~]# python3 ceph-external-cluster-details-exporter.py --rbd-data-pool-name myPool
[{"name": "rook-ceph-mon-endpoints", "kind": "ConfigMap", "data": {"data": "ceph-node01=10.16.217.232:6789"...}}]
```

4、上传到 ocp 上进行调用

略

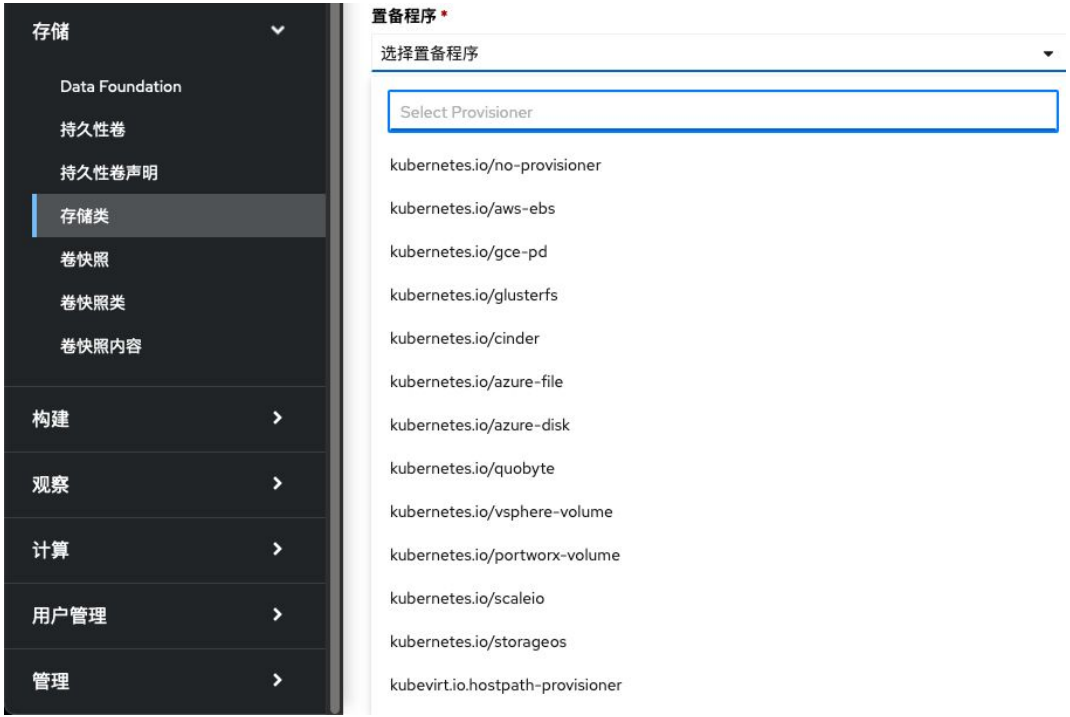
Red Hat

OpenShift Storage! - ceph storageclass



Red Hat

OpenShift Storage! - more storageclass



Red Hat

OpenShift Network!

Technology Highlights Comparison

OpenShift SDN	OVN Kubernetes
veth pairs	veth pairs
OVS bridge	OVS bridge
Central controller / host-ipam	Central controller / host-ipam
VXLAN tunnels	Geneve tunnels
OVS flows for NetworkPolicy	OVS flows for NetworkPolicy
IPTables for services	OVN LBs for services
IPTables for NAT	OVS for NAT

Red Hat

OpenShift Network!

What different between sdn, ovn and ovs?

ovs 是 open vswitch 的缩写，可以通过备注里的方法编译一个 ovs 出来。
sdn 是单纯用 ovs 搭建起来的网络，需要配合其他组件比如 dhcp 等配合使用。
ovn 是使用的 ovn 来搭建的网络，ovn 下层用的是 ovs 但是它包含了很多功能，比如 dhcp 这样就不需要其他组件了。

What is controller and how ovs works?

sdn 使用控制器比如 openstack 的 opendaylight 来控制 ovs 网络。
ovn 里边的控制器比如 openshift-network-operate 给 ovs 创建网络。

What connection between OVN and Geneve tunnel?

geneve本身跟功能关系不大，它的作用是用来 传输，连接不同 ovn 节点。而隧道使用 Geneve的网络性能会高于VxLAN。
不同 ovn 节点上的数据要通信的 话就得通过 geneve，同一个 ovn 节点上的数据不需要走 geneve

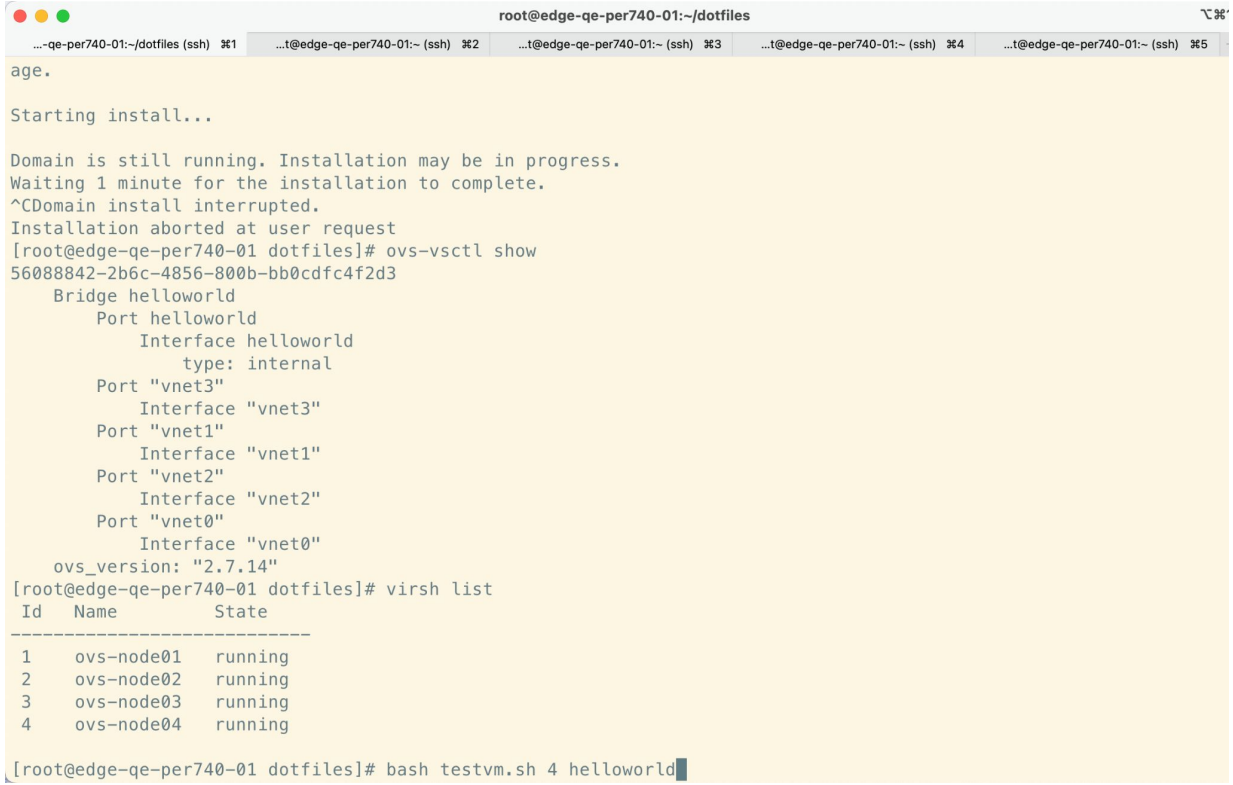
What is flow table betwwen OVN and SDN?

这个 flow table 是 OVS 的核心，并且比 传统的交换机具有更强大的功能。

thank you.
shuali@ and jishi@

Red Hat

OpenShift Network! - Try it!



Red Hat

OpenShift Network! SDN part

默认情况下，Docker 网络使用仅使用主机虚机网 桥 bridge，主机内的所有容器都 连接至该网桥。

连接到此桥的所有容器都可以彼此通信，但不能与不同主机上的容器通信。

为了支持跨集群的容器之 间的通信，OpenShift 容器平台使用了 软件定义的网络(SDN)方法。

软件定义的网络是一种网 络模型，它通 过**几个网络层的抽象来管理网 络服务**。

SDN 将**处理流量的软件**(称为控制平面)和**路由流量的底 层机制**(称为数据平面)解耦。SDN 支持**控制平面** 和**数据平面** 之间的通信。

cluster network 由 OpenShift SDN 建立和维护，它使用 Open vSwitch 创建 overlay 网络，master 节点不能通 过集群网络访问容器，除非 master 同时也为 node 节点。

Red Hat

OpenShift Network! SDN part - plugin

在 OpenShift 中，可以为 pod 网络配置三个 SDN 插件：

- ovs-subnet：默认插件，子网提供了一个 flat pod 网络，其中每个 pod 可以与其他 pod 和 service 通信。
- ovs-multitenant：该为 pod 和服务提供了额外的隔离层。当使用此插件时，每个 project 接收一个惟一的虚拟网络 ID (VLANID)，该 ID 标识来自属于该 project 的 pod 的流量。通过使用 VLANID，来自不同 project 的 pod 不能与其他 project 的 pod 和 service 通信。
- ovs-network policy：此插件允许管理员使用 NetworkPolicy 对象定义自己的隔离策略。

Red Hat

OpenShift Network! SDN part - plugin - ovs-subnet

在 OpenShift 中，可以为 pod 网络配置三个 SDN 插件：

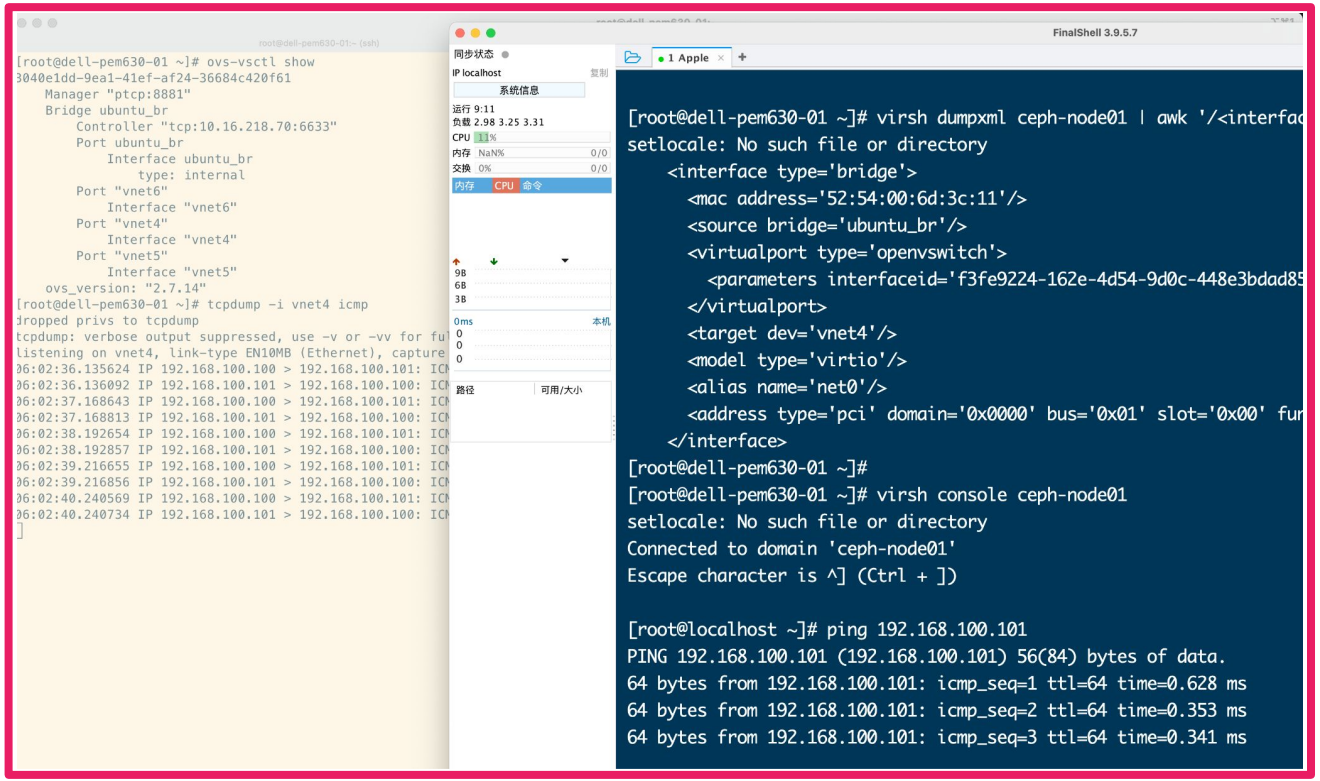
- ovs-subnet：默认插件，子网提供了一个 flat pod 网络，其中每个 pod 可以与其他 pod 和 service 通信。

```
[root@dell-pem630-01 ~]# ovs-vsctl add-br  br
[root@dell-pem630-01 ~]# virsh edit <VMnode>
<interface type='bridge'>
          <source bridge='br'/>
          <virtualport type='openvswitch'>
             <parameters
interfaceid='f3fe9224-162e-4d54-9d0c-448e3bdad851'/>
          </virtualport>
</interface>
```

```
[root@dell-pem630-01 ~]# ovs-vsctl show
3040e1dd-9ea1-41ef-af24-36684c420f61
          Bridge br
          Port br
          Interface br
                    type: internal
          Port "vnet6"
          Interface "vnet6"
          Port "vnet4"
          Interface "vnet4"
          Port "vnet5"
          Interface "vnet5"
          ovs_version: "2.7.14"
```

Red Hat

OpenShift Network! SDN part - plugin - ovs-subnet



Red Hat

OpenShift Network! SDN part - plugin - ovs-multitenant

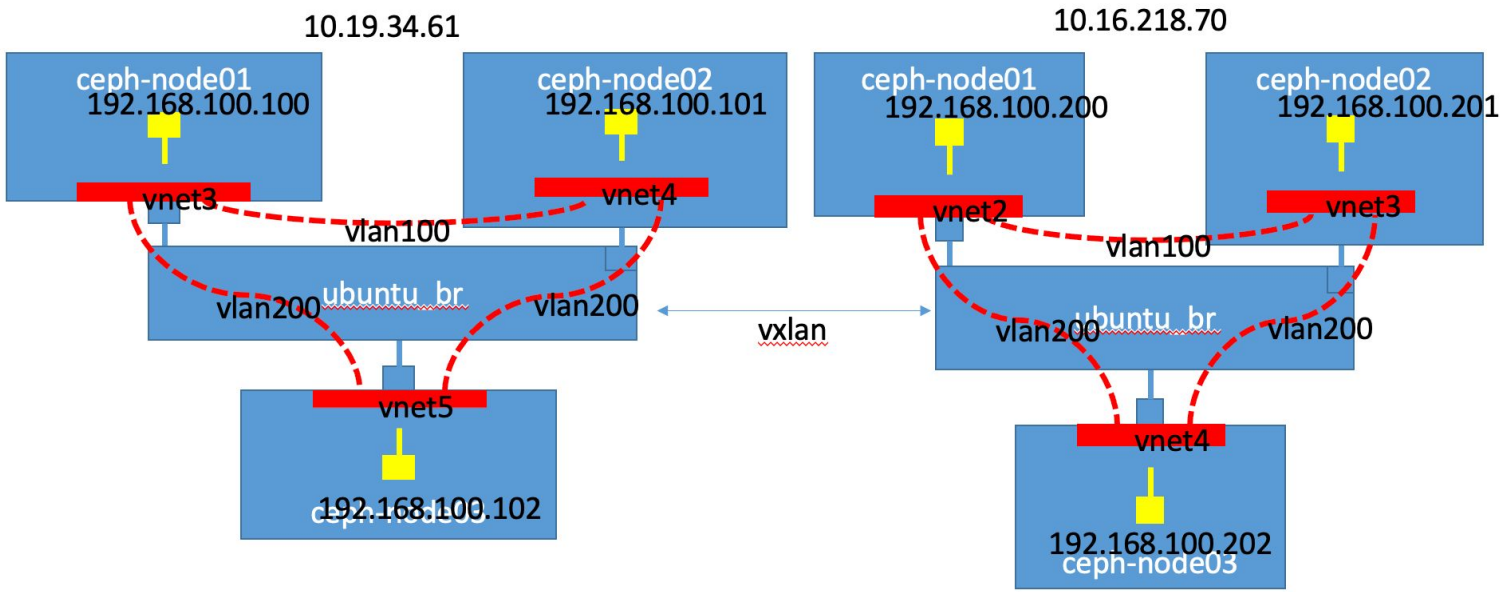
在 OpenShift 中，可以为 pod 网络配置三个 SDN 插件：

- ovs-multitenant：该为 pod 和服务提供了额外的隔离层。当使用此插件时，每个 project 接收一个惟一的虚拟网络 ID (VLANID)，该 ID 标识来自属于该 project 的 pod 的流量。通过使用 VLANID，来自不同 project 的 pod 不能与其他 project 的 pod 和 service 通信。

```
/usr/share/openvswitch/scripts/ovs-ctl start
ovs-vsctl add-br ubuntu_br
ovs-vsctl set Port vnet2 tag=100
ovs-vsctl set Port vnet3 tag=100
ovs-vsctl set Port vnet4 tag=200

ovs-vsctl add-port ubuntu_br \
    vxlan -- set interface vxlan type=vxlan options:remote_ip=10.19.34.61  option:key=1
ovs-vsctl set Port vxlan trunks=100,200
```

Red Hat

OpenShift Network! SDN part - plugin - ovs-multitenant



OpenShift Network! SDN part - plugin - ovs-multitenant

```
[root@dell-pem630-01 ~]# ovs-vsctl show
64b60993-3196-4278-aeae-07e6c3479377
    Bridge ubuntu_br
        Port "vnet4"
            tag: 200
            Interface "vnet4"
        Port ubuntu_br
            Interface ubuntu_br
                type: internal
        Port "vnet3"
            tag: 100
            Interface "vnet3"
        Port vxlan
            trunks: [100, 200]
            Interface vxlan
                type: vxlan
                options: {key="1", remote_ip="10.19.34.61"}
        Port "vnet2"
            tag: 100
            Interface "vnet2"
    ovs_version: "2.7.14"
[root@dell-pem630-01 ~]# ovs-ofctl dump-flows ubuntu_br
```

```
[root@cloud-qe-20 ~]# ovs-vsctl show
0795f011-6ff9-49c4-876a-d79808e44a03
    Bridge ubuntu_br
        Port vxlan
            Interface vxlan
                type: vxlan
                options: {key="1", remote_ip="10.16.218.70"}
        Port "vnet3"
            tag: 100
            Interface "vnet3"
        Port "vnet5"
            tag: 200
            Interface "vnet5"
        Port "vnet4"
            tag: 100
            Interface "vnet4"
        Port ubuntu_br
            Interface ubuntu_br
                type: internal
    ovs_version: "2.7.14"
[root@cloud-qe-20 ~]# ovs-ofctl dump-flows ubuntu
```

Red Hat

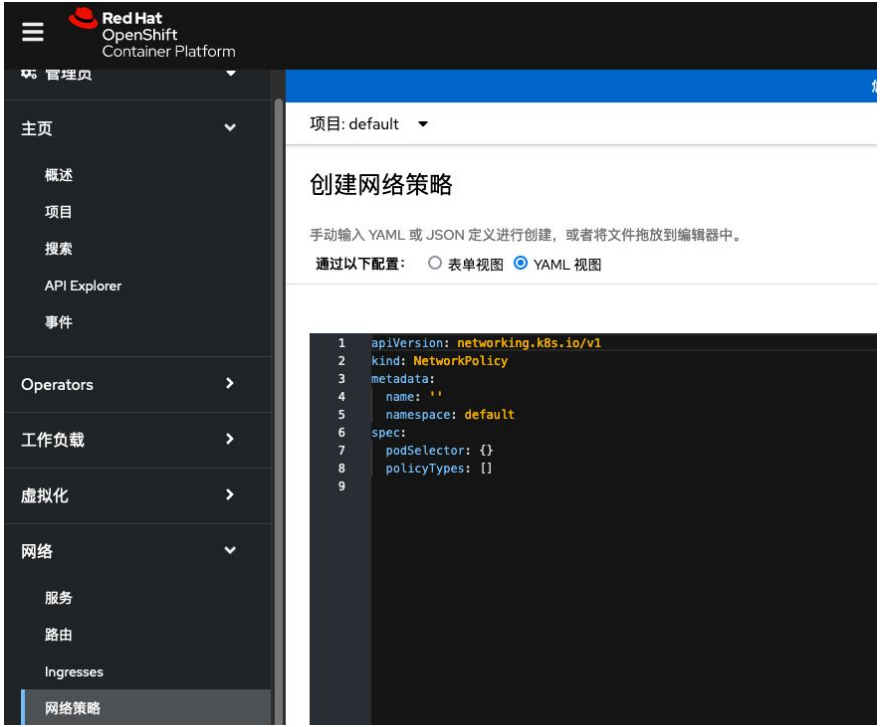
OpenShift Network! SDN part - plugin - ovs-network policy

在 OpenShift 中，可以为 pod 网络配置三个 SDN 插件：

- ovs-network policy：此插件允许管理员使用 NetworkPolicy 对象定义自己的隔离策略。

Red Hat

OpenShift Network! SDN part - plugin - ovs-network policy

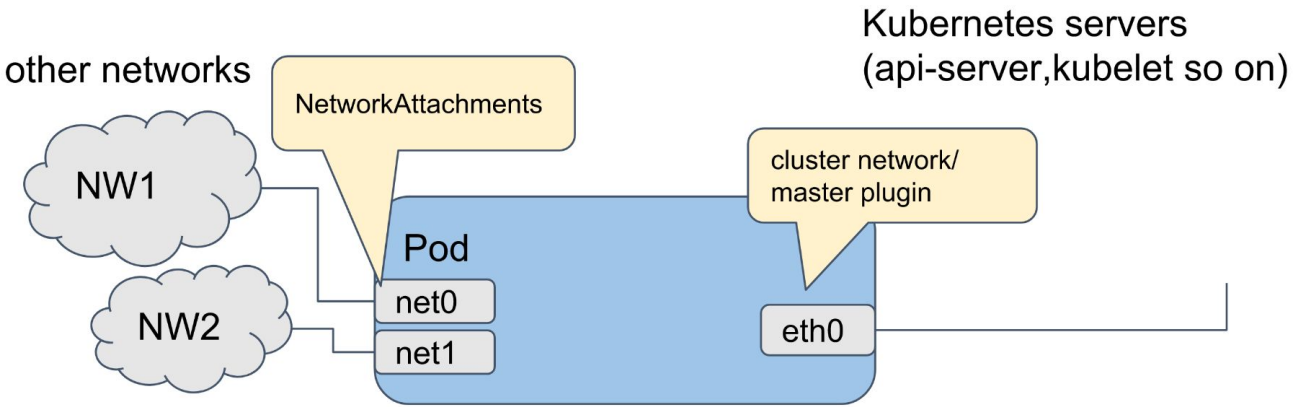


Red Hat

OpenShift Network! Multus CNI plugin

在 Kubernetes 中，容器联网由实现了 Container Network Interface (CNI) 的网络插件负责。

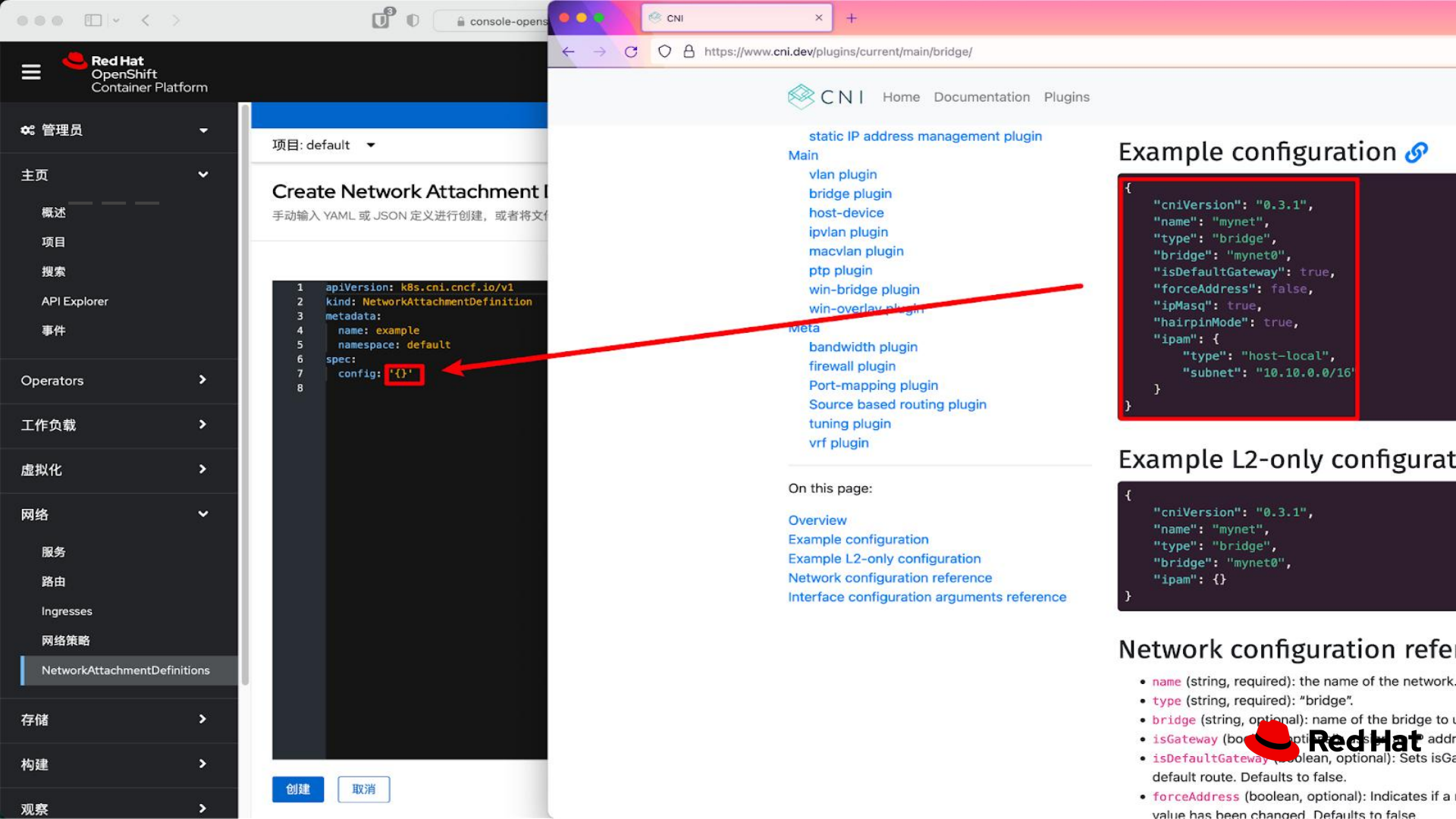
OpenShift Container Platform 使用 Multus CNI 插件来实现对 CNI 插件的链接。在集群安装过程中，您要配置 default pod 网络。默认网络处理集群中的所有一般网络流量。您可以基于可用的 CNI 插件定义额外网络，并将一个或多个这种网络附加到 pod。您可以根据需要为集群定义多个额外网络。这可让您灵活地配置提供交换或路由等网络功能的 pod。

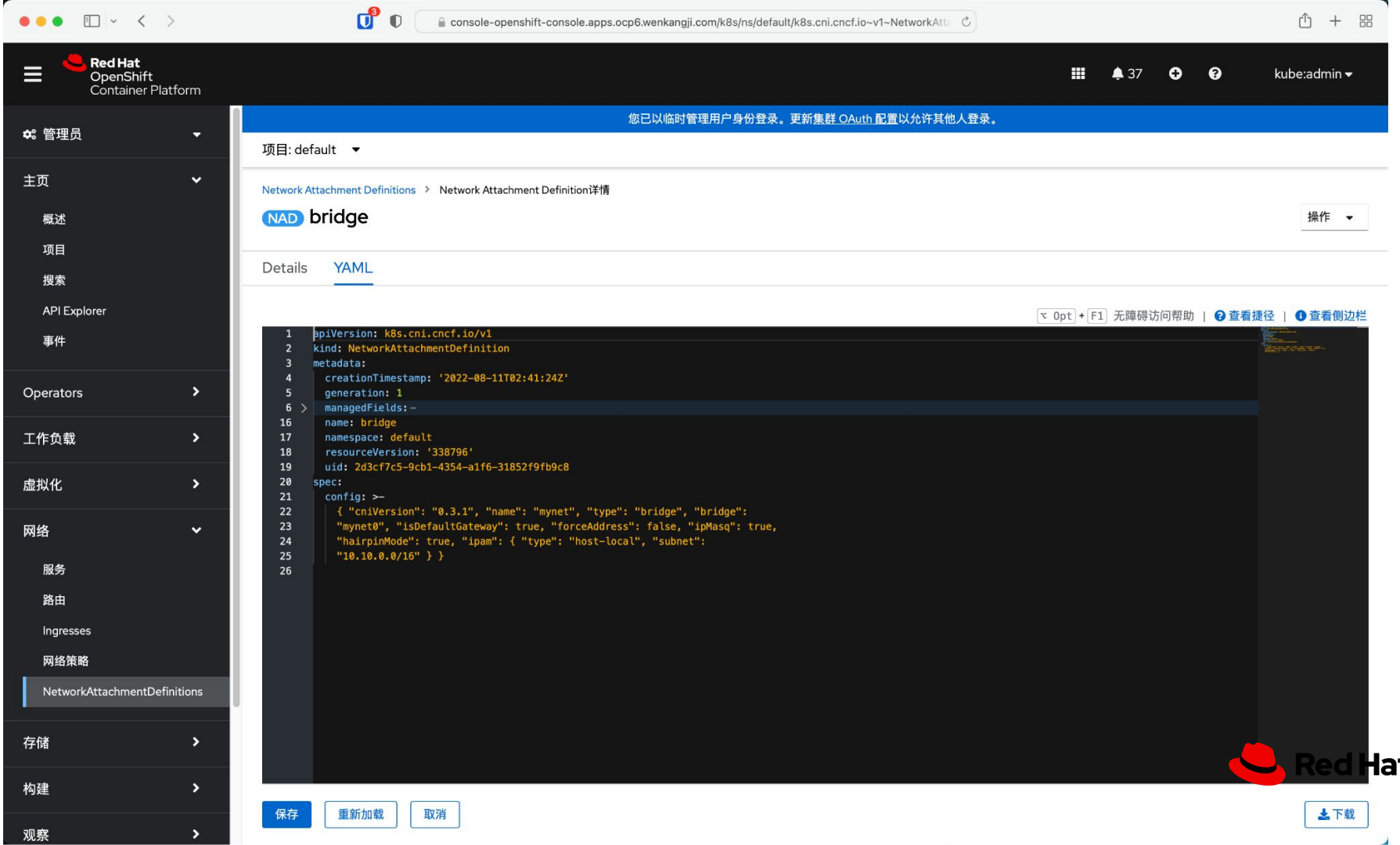


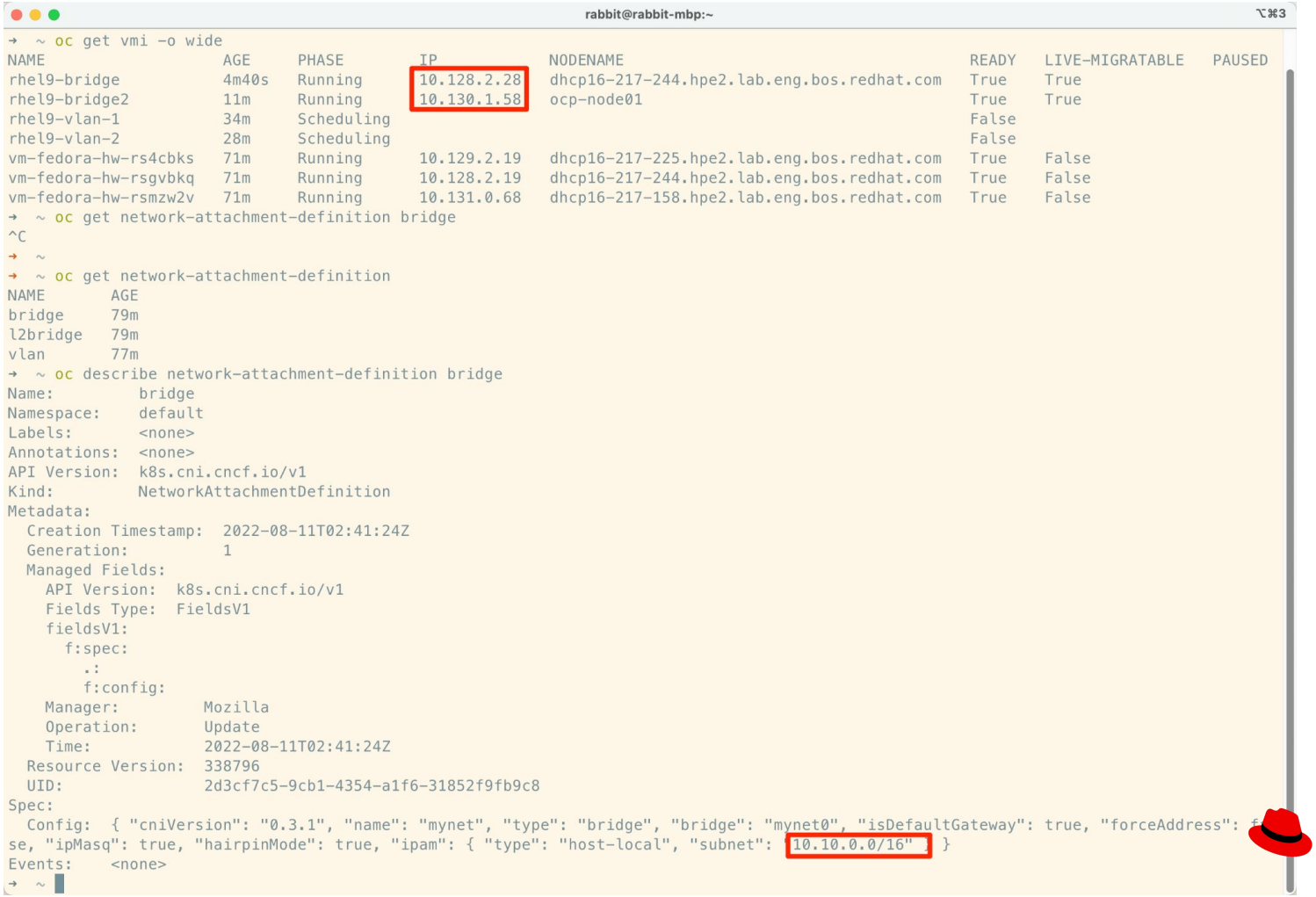
- Specific User Traffic

- (Liveness and Readiness) Probes
- Communication between API and Pod

Red Hat


Red Hat OpenShift Container Platform
管理员
主页
概述
项目
搜索
API Explorer
事件
Operators
工作负载
虚拟化
网络
服务
路由
Ingresses
网络策略
NetworkAttachmentDefinitions
存储
构建
观察
项目: default
Create Network Attachment
手动输入 YAML 或 JSON 定义进行创建，或者将文
apiVersion: k8s.cni.cncf.io/v1
kind: NetworkAttachmentDefinition
metadata:
name: example
namespace: default
spec:
config: '{}'
创建
取消
CNI
https://www.cni.dev/plugins/current/main/bridge/
CNI
Home
Documentation
Plugins
static IP address management plugin
Main
vlan plugin
bridge plugin
host-device
ipvlan plugin
macvlan plugin
ptp plugin
win-bridge plugin
win-overlay plugin
Meta
bandwidth plugin
firewall plugin
Port-mapping plugin
Source based routing plugin
tuning plugin
vrf plugin
On this page:
Overview
Example configuration
Example L2-only configuration
Network configuration reference
Interface configuration arguments reference
Example configuration
{
"cniVersion": "0.3.1",
"name": "mynet",
"type": "bridge",
"bridge": "mynet0",
"isDefaultGateway": true,
"forceAddress": false,
"ipMasq": true,
"hairpinMode": true,
"ipam": {
"type": "host-local",
"subnet": "10.10.0.0/16"
}
}
Example L2-only configurat
{
"cniVersion": "0.3.1",
"name": "mynet",
"type": "bridge",
"bridge": "mynet0",
"ipam": {}
}
Network configuration refe
name (string, required): the name of the network.
type (string, required): "bridge".
bridge (string, optional): name of the bridge to
isGateway (bo
isDefaultGateway (
default route. Defaults to false.
forceAddress (boolean, optional): Indicates if a
value has been changed. Defaults to false
RedHat


console-openshift-console.apps.ocp6.wenkangji.com/k8s/ns/default/k8s.cni.cncf.io~v1~NetworkAtt
Red Hat
OpenShift
Container Platform
37
kube:admin
管理员
主页
概述
项目
搜索
API Explorer
事件
Operators
工作负载
虚拟化
网络
服务
路由
Ingresses
网络策略
NetworkAttachmentDefinitions
存储
构建
观察
您已以临时管理用户身份登录。更新集群 OAuth 配置以允许其他人登录。
项目: default
Network Attachment Definitions
Network Attachment Definition详情
NAD bridge
操作
Details
YAML
Opt + F1 无障碍访问帮助
查看捷径
查看侧边栏
1 apiVersion: k8s.cni.cncf.io/v1
2 kind: NetworkAttachmentDefinition
3 metadata:
4 creationTimestamp: '2022-08-11T02:41:24Z'
5 generation: 1
6 managedFields:
16 name: bridge
17 namespace: default
18 resourceVersion: '338796'
19 uid: 2d3cf7c5-9cb1-4354-a1f6-31852f9fb9c8
20 spec:
21 config: >-
22 { "cniVersion": "0.3.1", "name": "mynet", "type": "bridge", "bridge":
23 "mynet0", "isDefaultGateway": true, "forceAddress": false, "ipMasq": true,
24 "hairpinMode": true, "ipam": { "type": "host-local", "subnet":
25 "10.10.0.0/16" } }
26
保存
重新加载
取消
下载
Red Hat


rabbit@rabbit-mbp:~
⌥⌘3
→ ~ oc get vmi -o wide
NAME AGE PHASE IP NODENAME READY LIVE-MIGRATABLE PAUSED
rhel9-bridge 4m40s Running 10.128.2.28 dhcp16-217-244.hpe2.lab.eng.bos.redhat.com True True
rhel9-bridge2 11m Running 10.130.1.58 ocp-node01 True True
rhel9-vlan-1 34m Scheduling False
rhel9-vlan-2 28m Scheduling False
vm-fedora-hw-rs4cbks 71m Running 10.129.2.19 dhcp16-217-225.hpe2.lab.eng.bos.redhat.com True False
vm-fedora-hw-rsgvbkq 71m Running 10.128.2.19 dhcp16-217-244.hpe2.lab.eng.bos.redhat.com True False
vm-fedora-hw-rsmzw2v 71m Running 10.131.0.68 dhcp16-217-158.hpe2.lab.eng.bos.redhat.com True False
→ ~ oc get network-attachment-definition bridge
^C
→ ~
→ ~ oc get network-attachment-definition
NAME AGE
bridge 79m
l2bridge 79m
vlan 77m
→ ~ oc describe network-attachment-definition bridge
Name: bridge
Namespace: default
Labels: <none>
Annotations: <none>
API Version: k8s.cni.cncf.io/v1
Kind: NetworkAttachmentDefinition
Metadata:
Creation Timestamp: 2022-08-11T02:41:24Z
Generation: 1
Managed Fields:
API Version: k8s.cni.cncf.io/v1
Fields Type: FieldsV1
fieldsV1:
f:spec:
.:
f:config:
Manager: Mozilla
Operation: Update
Time: 2022-08-11T02:41:24Z
Resource Version: 338796
UID: 2d3cf7c5-9cb1-4354-a1f6-31852f9fb9c8
Spec:
Config: { "cniVersion": "0.3.1", "name": "mynet", "type": "bridge", "bridge": "mynet0", "isDefaultGateway": true, "forceAddress": f
se, "ipMasq": true, "hairpinMode": true, "ipam": { "type": "host-local", "subnet": "10.10.0.0/16" } }
Events: <none>
→ ~

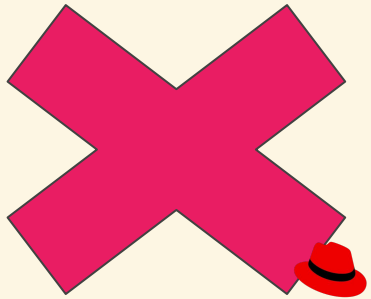
Red Hat

virtctl console rhel9-bridge ⌥⌘1

```
[root@rhel9-bridge ~]# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
 qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc fq_codel state UP group
 default qlen 1000
    link/ether 02:ca:4d:00:00:05 brd ff:ff:ff:ff:ff:ff
    altname enp1s0
    inet 10.0.2.2/24 brd 10.0.2.255 scope global dynamic noprefixroute eth0
       valid_lft 86312276sec preferred_lft 86312276sec
    inet6 fe80::ca:4dff:fe00:5/64 scope link
       valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group
 default qlen 1000
    link/ether 02:ca:4d:00:00:06 brd ff:ff:ff:ff:ff:ff
    altname enp2s0
    inet 10.10.0.2/16 brd 10.10.255.255 scope global dynamic noprefixroute eth1
       valid_lft 86312276sec preferred_lft 86312276sec
    inet6 fe80::c7a4:7eaa:70d4:9de7/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
[root@rhel9-bridge ~]#
```

virtctl console rhel9-bridge3 ⌥⌘3

```
[root@rhel9-bridge3 ~]# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
 qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1450 qdisc fq_codel state UP group
 default qlen 1000
    link/ether 02:ca:4d:00:00:0d brd ff:ff:ff:ff:ff:ff
    altname enp1s0
    inet 10.0.2.2/24 brd 10.0.2.255 scope global dynamic noprefixroute eth0
       valid_lft 86312705sec preferred_lft 86312705sec
    inet6 fe80::ca:4dff:fe00:d/64 scope link
       valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group
 default qlen 1000
    link/ether 02:ca:4d:00:00:0e brd ff:ff:ff:ff:ff:ff
    altname enp2s0
    inet 10.10.0.3/16 brd 10.10.255.255 scope global dynamic noprefixroute eth1
       valid_lft 86312705sec preferred_lft 86312705sec
    inet6 fe80::bdcd:916d:1993:3df5/64 scope link noprefixroute
       valid_lft forever preferred_lft forever
[root@rhel9-bridge3 ~]#
```



Red Hat

OpenShift Network! Multus CNI plugin - Problem Solved

Run a vm on specific host and volumes?

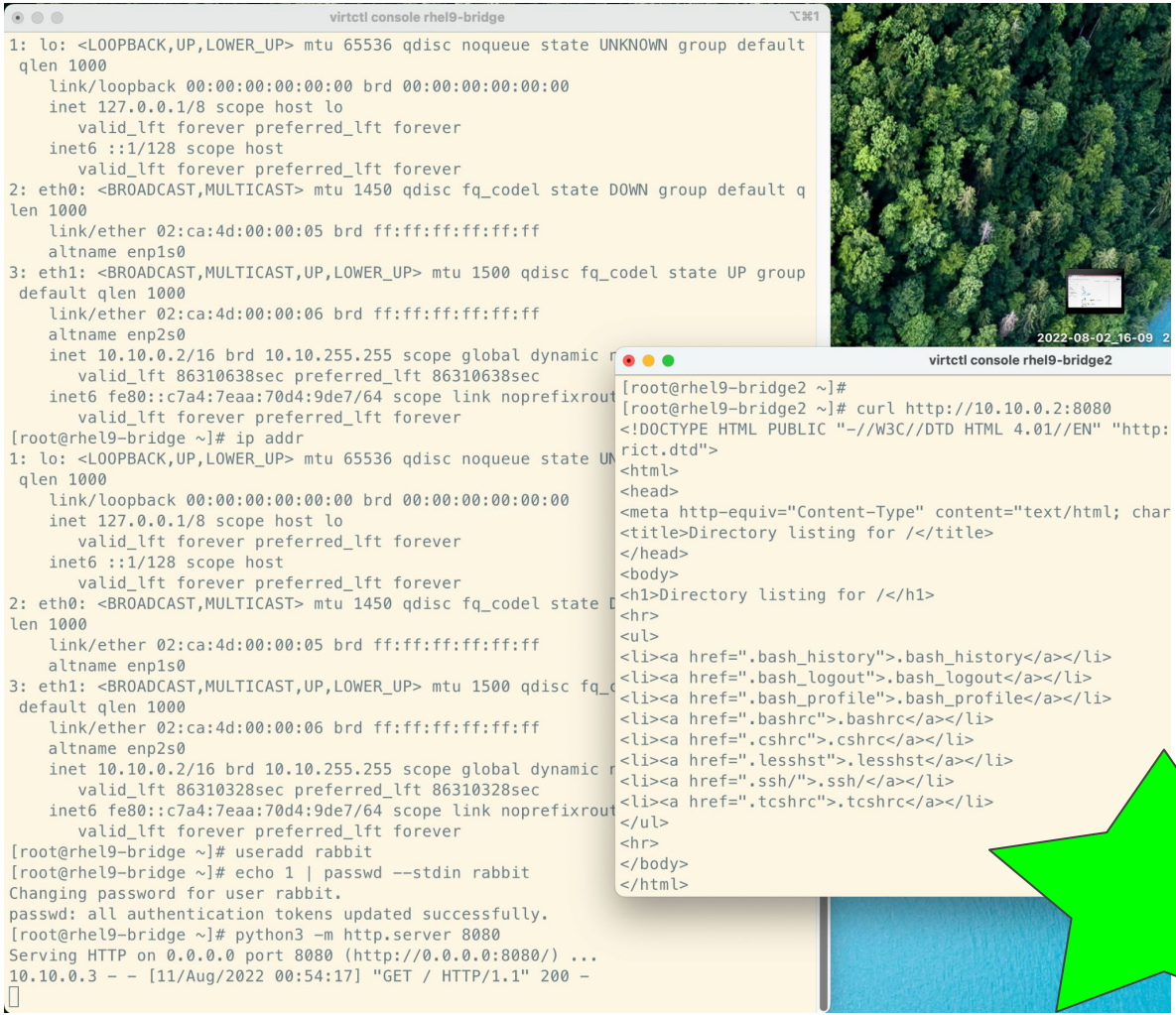
nodeSelector:

    kubernetes.io/hostname: hp-dl380g10-06.lab.eng.pek2.redhat.com

annotations:

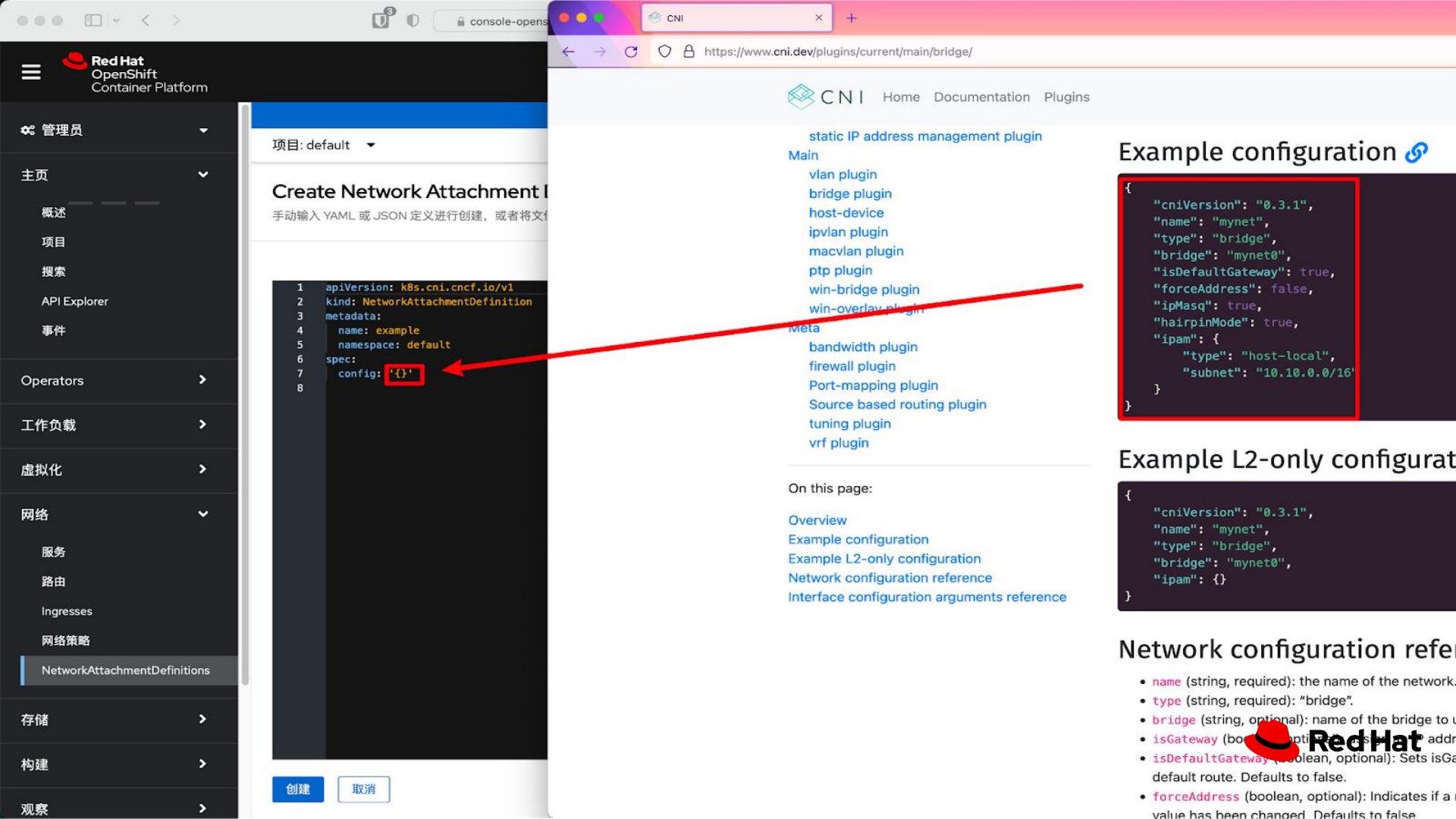
    kubevirt.io/provisionOnNode: hp-dl380g10-06.lab.eng.pek2.redhat.com

Red Hat


virtctl console rhel9-bridge
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST> mtu 1450 qdisc fq_codel state DOWN group default qlen 1000
link/ether 02:ca:4d:00:00:05 brd ff:ff:ff:ff:ff:ff
altname enp1s0
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000
link/ether 02:ca:4d:00:00:06 brd ff:ff:ff:ff:ff:ff
altname enp2s0
inet 10.10.0.2/16 brd 10.10.255.255 scope global dynamic
valid_lft 86310638sec preferred_lft 86310638sec
inet6 fe80::c7a4:7eaa:70d4:9de7/64 scope link noprefixrout
valid_lft forever preferred_lft forever
[root@rhel9-bridge ~]# ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UN
qlen 1000
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST> mtu 1450 qdisc fq_codel state D
len 1000
link/ether 02:ca:4d:00:00:05 brd ff:ff:ff:ff:ff:ff
altname enp1s0
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_c
default qlen 1000
link/ether 02:ca:4d:00:00:06 brd ff:ff:ff:ff:ff:ff
altname enp2s0
inet 10.10.0.2/16 brd 10.10.255.255 scope global dynamic
valid_lft 86310328sec preferred_lft 86310328sec
inet6 fe80::c7a4:7eaa:70d4:9de7/64 scope link noprefixrout
valid_lft forever preferred_lft forever
[root@rhel9-bridge ~]# useradd rabbit
[root@rhel9-bridge ~]# echo 1 | passwd --stdin rabbit
Changing password for user rabbit.
passwd: all authentication tokens updated successfully.
[root@rhel9-bridge ~]# python3 -m http.server 8080
Serving HTTP on 0.0.0.0 port 8080 (http://0.0.0.0:8080/) ...
10.10.0.3 - - [11/Aug/2022 00:54:17] "GET / HTTP/1.1" 200 -
2022-08-02_16-09
virtctl console rhel9-bridge2
[root@rhel9-bridge2 ~]#
[root@rhel9-bridge2 ~]# curl http://10.10.0.2:8080
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN" "http:
rict.dtd">
<html>
<head>
<meta http-equiv="Content-Type" content="text/html; char
<title>Directory listing for /</title>
</head>
<body>
<h1>Directory listing for /</h1>
<hr>

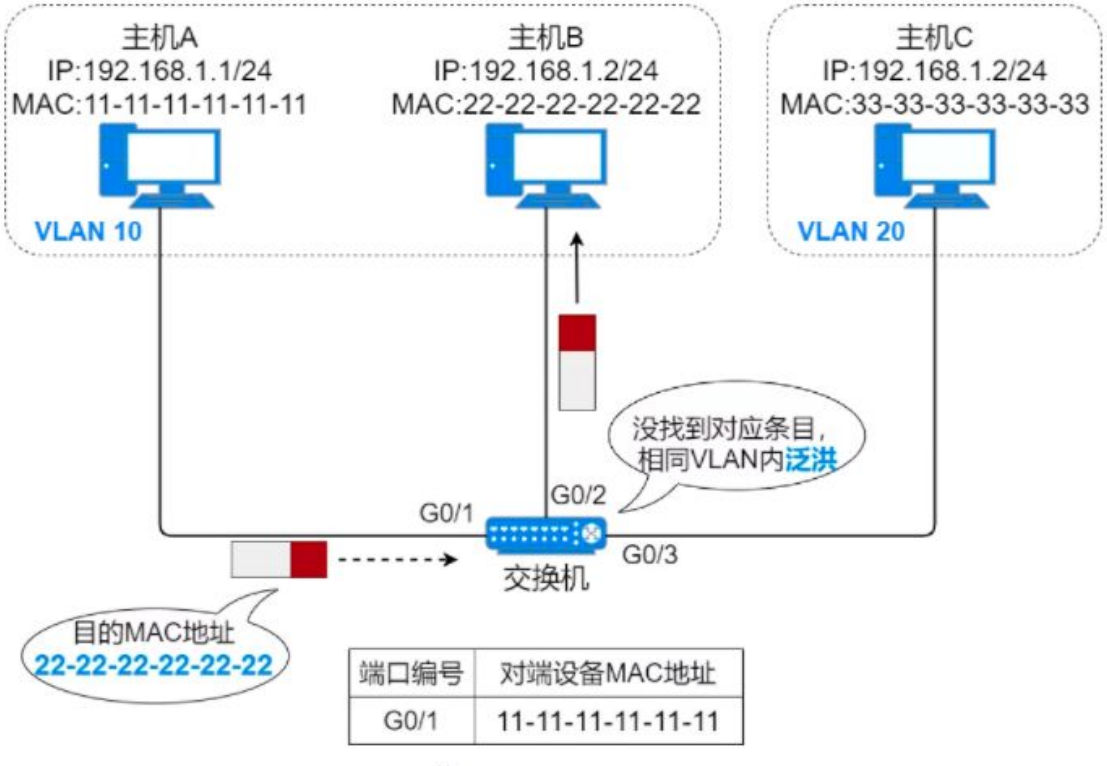
.bash_history
.bash_logout
.bash_profile
.bashrc
.cshrc
.lesshst
.ssh/
.tcshrc

<hr>
</body>
</html>
Red Hat


Red Hat OpenShift Container Platform
管理员
主页
概述
项目
搜索
API Explorer
事件
Operators
工作负载
虚拟化
网络
服务
路由
Ingresses
网络策略
NetworkAttachmentDefinitions
存储
构建
观察
项目: default
Create Network Attachment
手动输入 YAML 或 JSON 定义进行创建，或者将文
apiVersion: k8s.cni.cncf.io/v1
kind: NetworkAttachmentDefinition
metadata:
name: example
namespace: default
spec:
config: '{}'
创建
取消
CNI
https://www.cni.dev/plugins/current/main/bridge/
CNI
Home
Documentation
Plugins
static IP address management plugin
Main
vlan plugin
bridge plugin
host-device
ipvlan plugin
macvlan plugin
ptp plugin
win-bridge plugin
win-overlay plugin
Meta
bandwidth plugin
firewall plugin
Port-mapping plugin
Source based routing plugin
tuning plugin
vrf plugin
On this page:
Overview
Example configuration
Example L2-only configuration
Network configuration reference
Interface configuration arguments reference
Example configuration
{
"cniVersion": "0.3.1",
"name": "mynet",
"type": "bridge",
"bridge": "mynet0",
"isDefaultGateway": true,
"forceAddress": false,
"ipMasq": true,
"hairpinMode": true,
"ipam": {
"type": "host-local",
"subnet": "10.10.0.0/16"
}
}
Example L2-only configurat
{
"cniVersion": "0.3.1",
"name": "mynet",
"type": "bridge",
"bridge": "mynet0",
"ipam": {}
}
Network configuration refe
name (string, required): the name of the network.
type (string, required): "bridge".
bridge (string, optional): name of the bridge to
isGateway (bo
isDefaultGateway (
default route. Defaults to false.
forceAddress (boolean, optional): Indicates if a
value has been changed. Defaults to false
RedHat

Maybe Deeper...
(flow table)

Openvswitch: Traditional Switch



Openvswitch: Flow Table

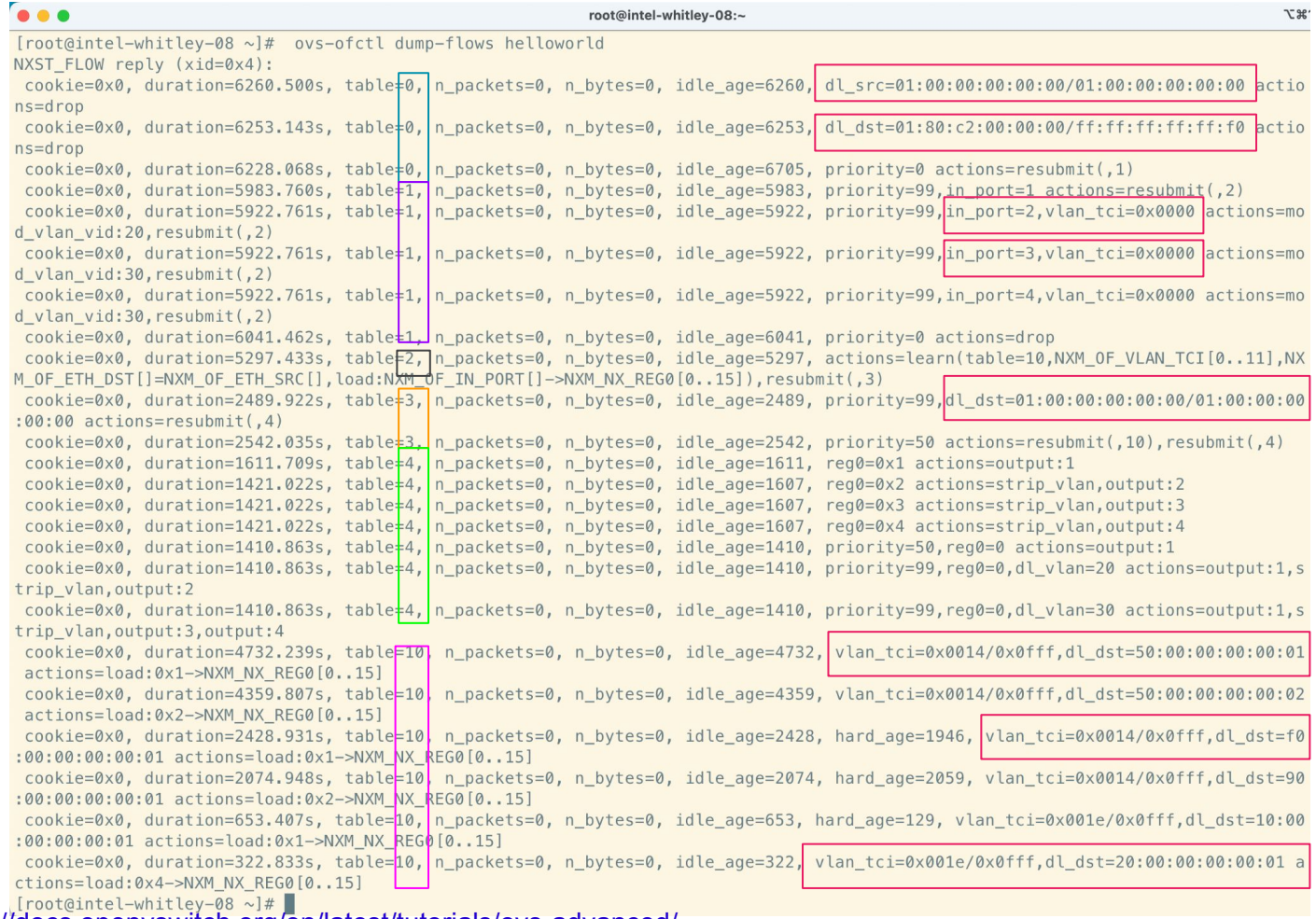
```
R2#show ip route

S    192.168.1.0/24 [1/0] via 192.168.5.2
C    192.168.2.0/24 is directly connected, FastEthernet1/0
C    192.168.5.0/24 is directly connected, Serial2/0
```

```
Switch>show mac address
        Mac Address Table
-------------------------------------------

Vlan    Mac Address         Type          Ports
----      -----------       --------      -----

1      0050.0f40.e0a6     DYNAMIC      Fa0/1
1      0090.0c02.cb01     DYNAMIC      Fa0/2
```

```
root@controller:~# ovs-ofctl dump-flows br-int

NXST_FLOW reply (xid=0x4):
 cookie=0xbfcbcc1f0281737c, table=0, n_packets=885,
n_bytes=873, idle_age=0, hard_age=65534, priority=2,in_port=1
actions=drop
```

ovs-ofctl 命令是对流表的操作，包括对流表的增，删，改，查等命令。

简单来说流表类似于交换机的MAC地址表，路由器的路由表，是ovs交换机指挥流量转发的表。



https://docs.openvswitch.org/en/latest/tutorials/ovs-advanced/

Our switch design will consist of five main flow tables, each of which implements one stage in the switch pipeline:

Table 0
Admission control

Table 1
VLAN input processing

Table 2
Learn source MAC and VLAN for ingress port

Table 3
Look up learned port for destination MAC and VLAN

Table 4
Output processing

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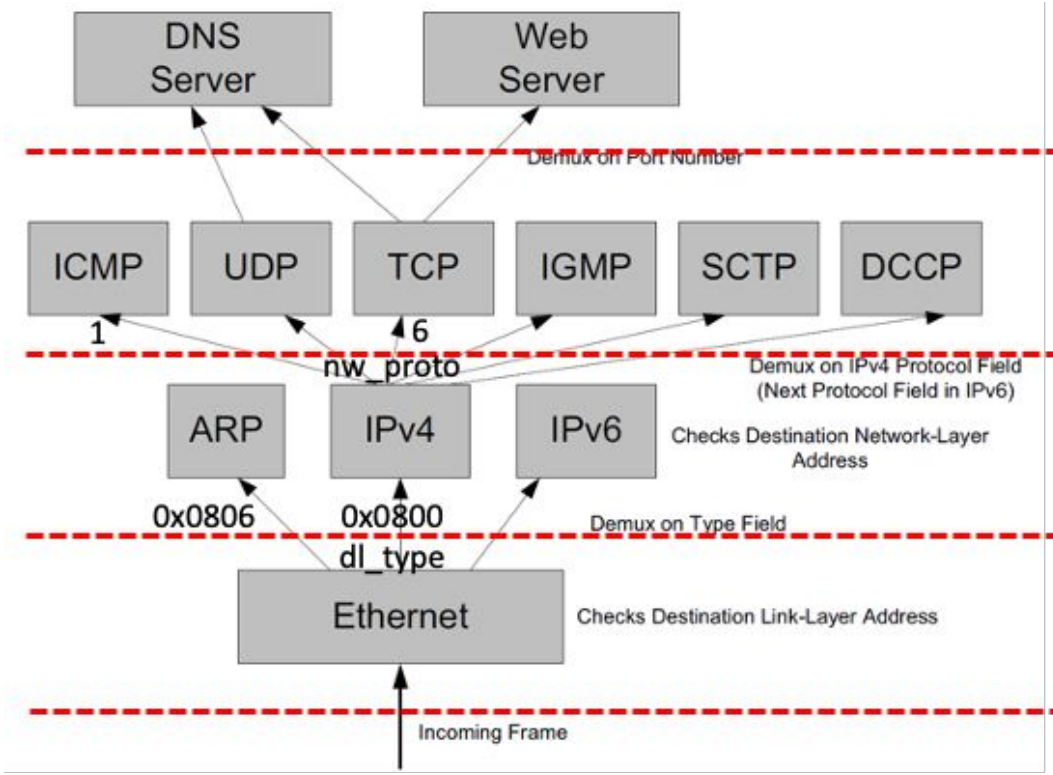
Openvswitch: Flow Table - Match Field



icmp_type=type tp_src=port
icmp_code=code tp_dst=port

arp_sha=xx:xx:xx:xx:xx:xx nw_src=ip[/netmask]
arp_tha=xx:xx:xx:xx:xx:xx nw_dst=ip[/netmask]

dl_src=xx:xx:xx:xx:xx:xx/xx:xx:xx:xx:xx:xx
dl_dst=xx:xx:xx:xx:xx:xx/xx:xx:xx:xx:xx:xx
dl_vlan=vlan

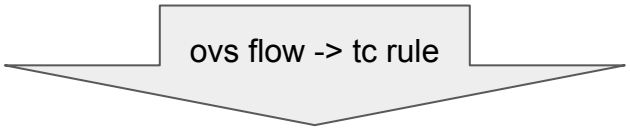
in_port=port

Red Hat

OvS-TC offload

A sample of TC offload:

recirc_id(0),in_port(3),eth(src=24:8a:07:a5:28:02,dst=24:8a:07:a5:28:01),eth_type(0x0800) actions:2



tc filter add dev ens1f0_1 ingress protocol ip chain 0 prio 3 flower dst_mac 24:8a:07:a5:28:01 src_mac 24:8a:07:a5:28:02 action mirred egress redirect dev ens1f0_0

SmartNIC读取tc rules,并根据这些规则，在NIC内部的e-switch中进行转发处理，完成后，将统计信息反馈给TC subsystem

Red Hat

Openvswitch: Flow Table - Actions

对于Flow Table的管理，由ovs-ofctl来控制

add-flow *switch flow*

mod-flows *switch flow*

del-flows *switch* [*flow*]

Match Fields	Priority	Counters	Instructions	Timeouts	Cookie

Table 1: Main components of a flow entry in a flow table.

Match Field

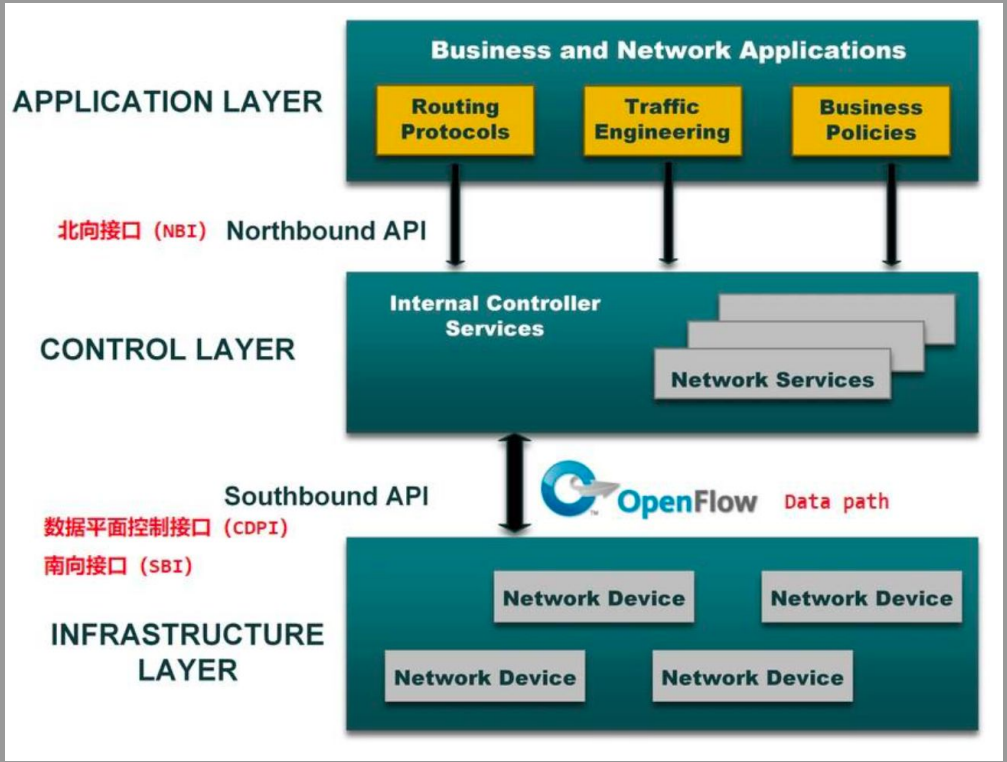
Actions

Actions:

output:port 和 output:NXM_NX_REG0[16..31]
enqueue:port:queue
mod_vlan_vid:vlan_vid
strip_vlan
mod_dl_src:mac 和 mod_dl_dst:mac
mod_nw_src:ip 和 mod_nw_dst:ip
mod_tp_src:port 和 mod_tp_dst:port
set_tunnel:id
resubmit([port],[table])
move:src[start..end]->dst[start..end]
load:value->dst[start..end]
learn(argument[,argument]...)

Red Hat

CONTROL LAYER



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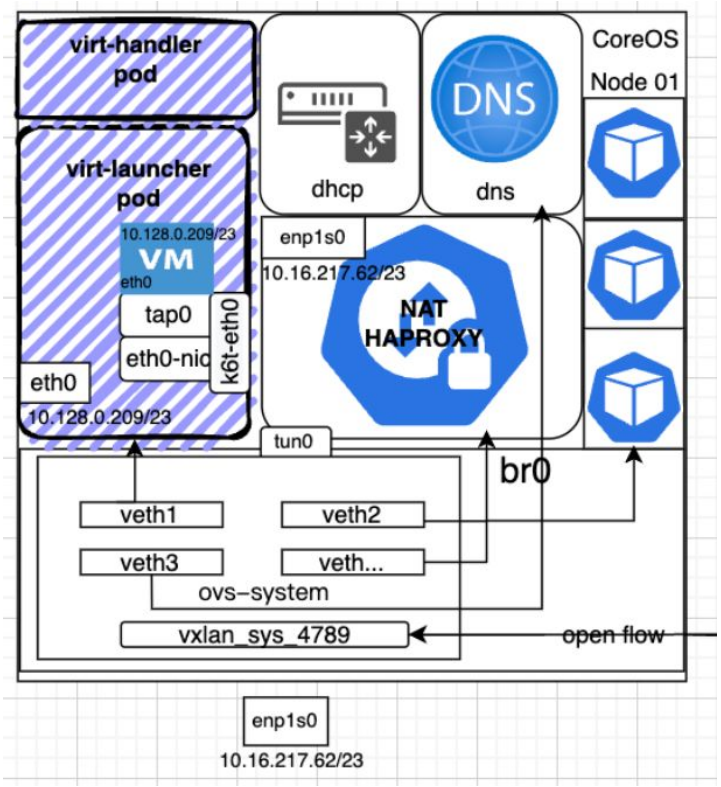
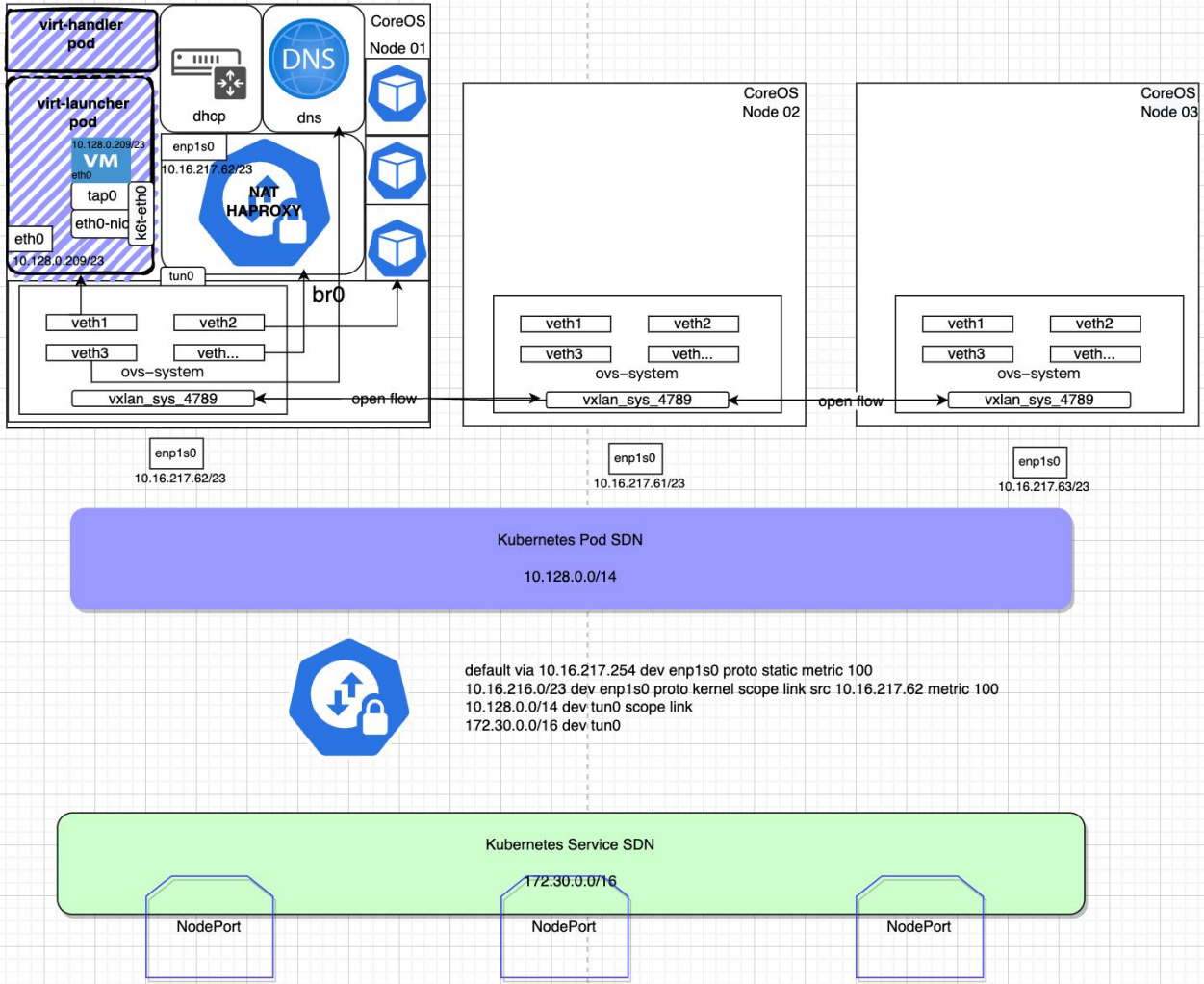
OpenShift Network! SDN part



Red Hat


virt-handler pod
virt-launcher pod
10.128.0.209/23
VM
eth0
tap0
eth0-nic
k6t-eth0
eth0
10.128.0.209/23
dhcp
DNS
dns
CoreOS Node 01
enp1s0
10.16.217.62/23
NAT HAPROXY
tun0
br0
veth1
veth2
veth3
veth...
ovs-system
vxlan_sys_4789
open flow
enp1s0
10.16.217.62/23
CoreOS Node 02
veth1
veth2
veth3
veth...
ovs-system
vxlan_sys_4789
enp1s0
10.16.217.61/23
open flow
CoreOS Node 03
veth1
veth2
veth3
veth...
ovs-system
vxlan_sys_4789
enp1s0
10.16.217.63/23
Kubernetes Pod SDN
10.128.0.0/14
default via 10.16.217.254 dev enp1s0 proto static metric 100
10.16.216.0/23 dev enp1s0 proto kernel scope link src 10.16.217.62 metric 100
10.128.0.0/14 dev tun0 scope link
172.30.0.0/16 dev tun0
Kubernetes Service SDN
172.30.0.0/16
NodePort
NodePort
NodePort

Red Hat

不安全 — dell-pem630-01.dell2.lab.eng.bos.redhat.com

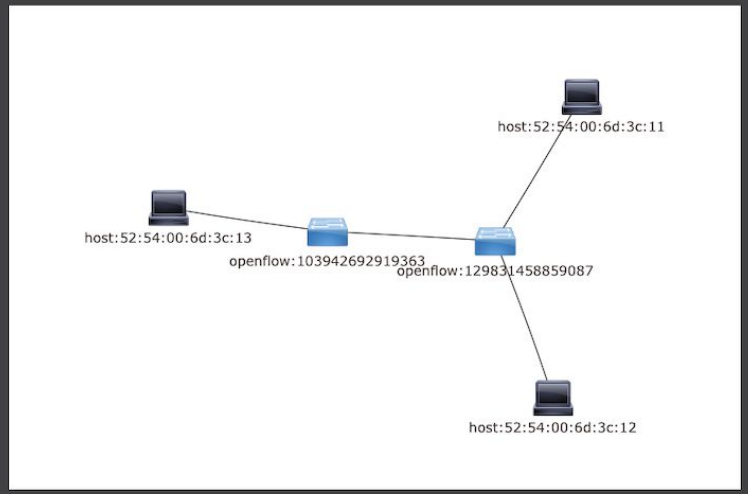
此网页正使用大量能耗。将其关闭可能提高 Mac 的响应速度。

OPEN DAYLIGHT | Topology | Logout (admin)

- Topology
- Nodes
- Yang UI
- Yang Visualizer
- Yangman

Controls

Reload




```
[root@dell-pem630-01 ~]# ovs-vsctl show
a42dac02-fe91-4dc1-b4d5-3c6ad2f65305
    Bridge "vlan1_br"
        Controller "tcp:127.0.0.1:6633"
            is_connected: true
        Port "vnet12"
            Interface "vnet12"
        Port patch-eth
            Interface patch-eth
                type: patch
                options: {peer=patch-tap}
        Port "vlan1_br"
            Interface "vlan1_br"
                type: internal
    Bridge ubuntu_br
        Controller "tcp:127.0.0.1:6633"
            is_connected: true
        Port "vnet10"
            Interface "vnet10"
        Port patch-tap
            Interface patch-tap
```

Red Hat

OpenShift Network! OVN part

OVN（Open Virtual Network）是一系列的守护程序，它将虚拟网络配置翻译成 OpenFlow，并将其安装到 Open vSwitch 中。

OVN 比 Open vSwitch 提供了更高层次的抽象，它与**模拟路由器和模拟交换机**一起工作而不仅仅是 flows。

OVN旨在被**云计算管理软件（CMS）**所使用。OVN提供的一些高级功能包括：

- Distributed virtual routers
- Distributed logical switches
- Access Control Lists
- DHCP
- DNS server

与 Open vSwitch 一样，OVN是用独立于平台的C编写的。**OVN完全在用户空间中运行，因此不需要安装内核模块。**

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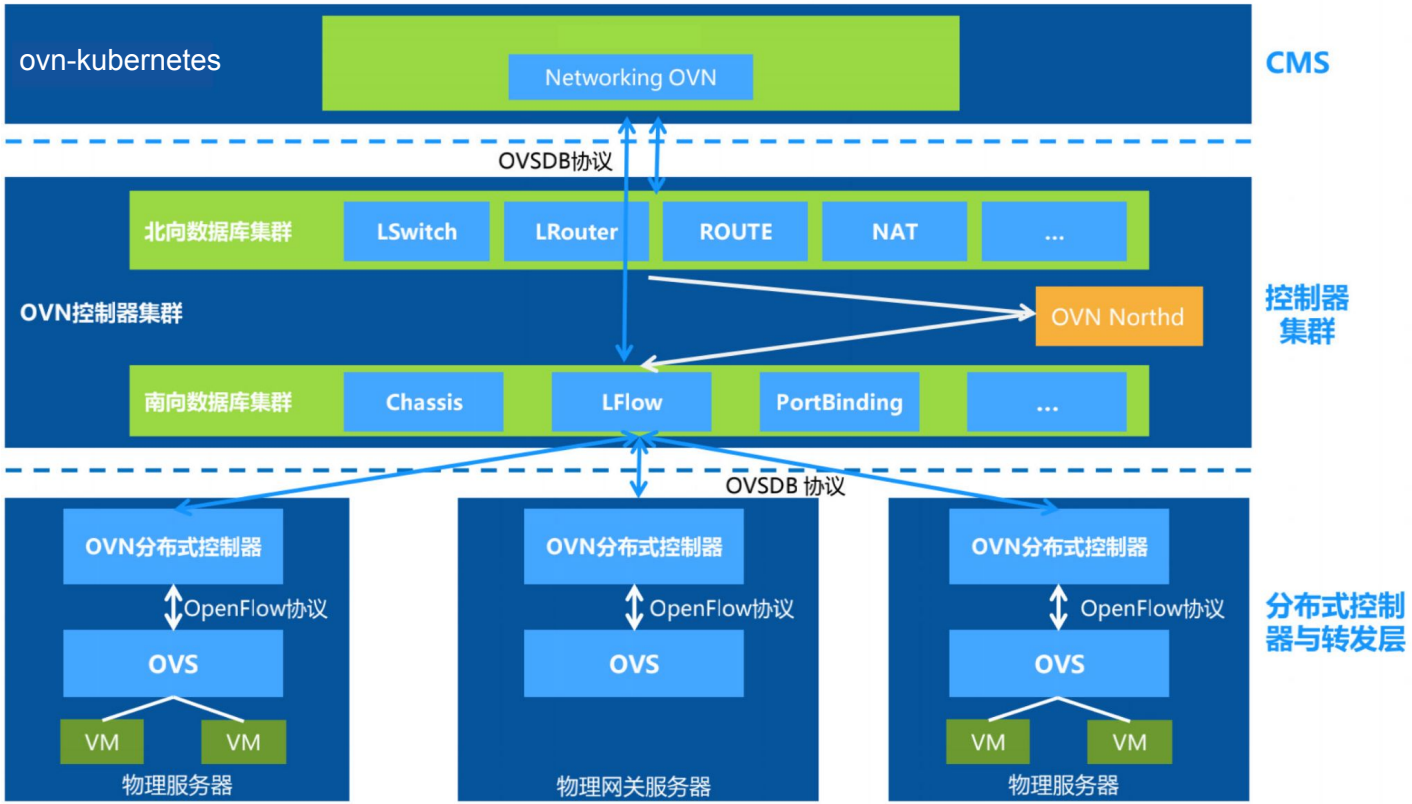
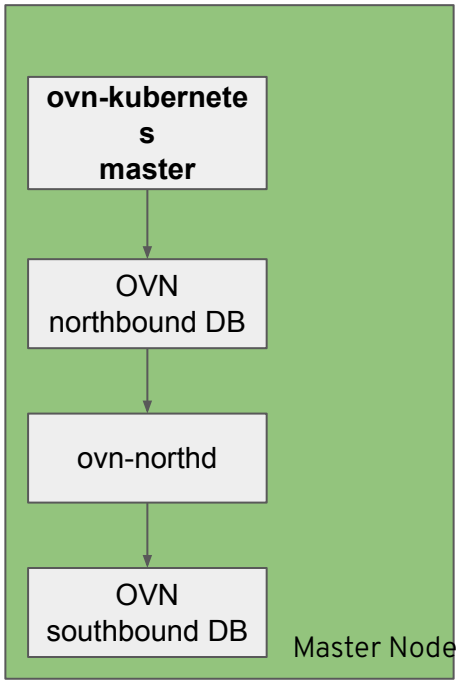
OpenShift Network! OVN part - Architecture



OVN-Kubernetes

- CNI 网络插件从 ocp (GA from 4.6)/kubernetes
  - https://github.com/ovn-org/ovn-kubernetes
  - Started by the OVN/OVS communities
  - 使用 OVN on OVS 作为抽象来管理节点上的网络流量
  - 使用 Geneve（通用网络虚拟化封装）协议，而不是 VXLAN（由OpenShift SDN使用）来创建节点之间的覆盖 overlay 网络 。
  - Creates logical network topologies
    - Logical switches, routers, ports, acls (network policies), load balancers etc..
  - 不像 SDN 那样需要 kube-proxy（作为 pod 和 ocp 之间的连接渠道）
  - 允许将网络管理抽象到多节点

OVN-Kubernetes Architecture: Master



- **OVN-Kubernetes Master**
  - OVN Kubernetes **component**
  - **Central process** that **watches** for cluster events (Pods, Namespaces, Services, Endpoints, NetworkPolicy)
  - **Translates** cluster events into OVN logical network elements **stored** in nbdb
  - **Tracks** Kube-API state
  - **Manages** pod **subnet allocation** to nodes
- **OVN-northd**
  - **Native** OVN component
  - Process that **converts** northbound DB network representation to the lower-level logical flows that are stored in southbound DB

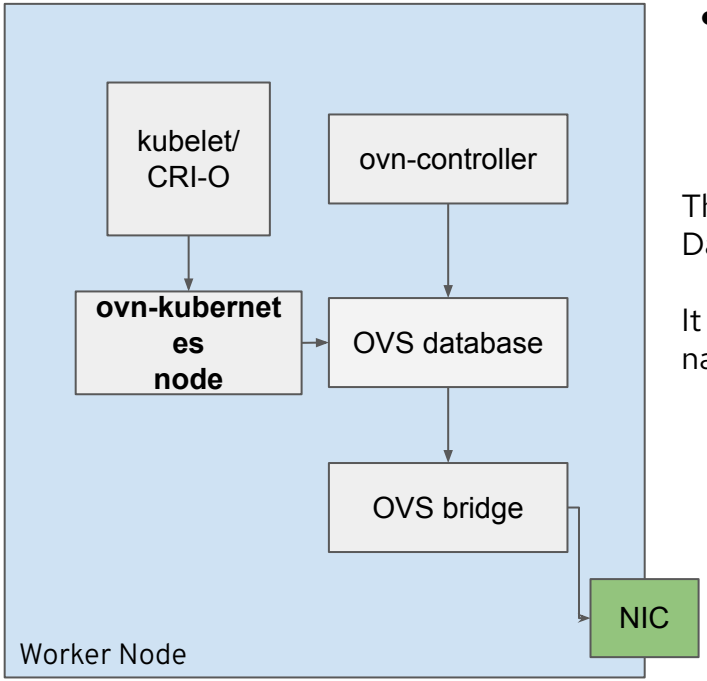
These processes are **started** by the CNO via a **Daemonset** -> `ovnkube-master`

They can be seen running on an OCP cluster in the `openshift-ovn-kubernetes` namespace within the `ovnkube-master` pod as the following containers

- `[northd, nbdb, sbdb, ovnkube-master]`

https://docs.google.com/presentation/d/1iktpCdAsdaJPJe7Yk36T-BtYwuB04oc3lHdMHH2qBcw/edit#slide=id.g6fa84b026f_2_109

OVN-Kubernetes Architecture: Node



- **Open vSwitch**
  - **Pushes** the new "edge of network" to the hypervisor
  - Multilayer software switch used to **implement** openflow rules
  - Datapath used by containers

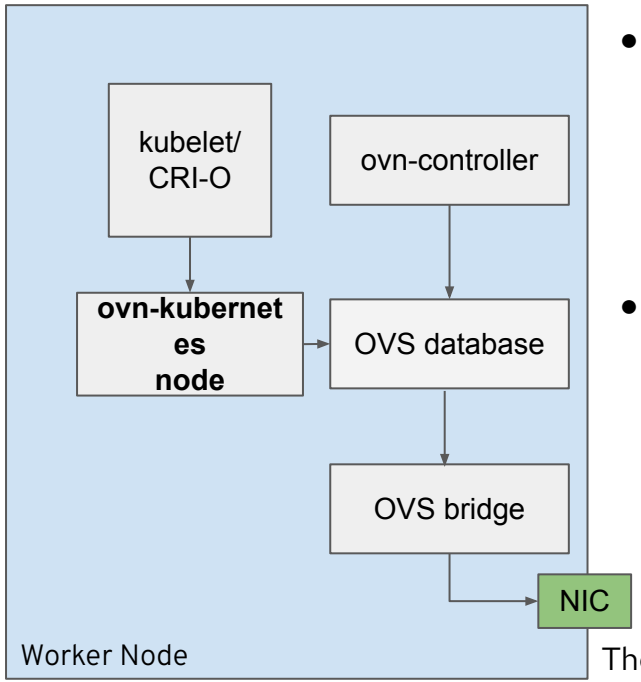
The OVS process is run via systemd on the host but is managed by the CNO via a Daemonset for log tailing and other monitoring reasons-> `ovs-node`

It can be seen running on an OCP cluster in the `openshift-ovn-kubernetes` namespace within the `ovs-node` pods as the following containers

- `[ovs-daemons]`

https://docs.google.com/presentation/d/1iktpCdAsdaJPJe7Yk36T-BtYwuB04oc3lHdMHH2qBcw/edit#slide=id.g6fa84b026f_2_109

OVN-Kubernetes Architecture: Node



- **OVN-Controller**
  - OVN **component**
  - **Watches** sbdb
  - **Matches** OVS “physical” ports to OVN logical ports
  - **Reads** logical flows from sbdb, **translates** them into OpenFlow flows and **sends** them to the worker node’s OVS daemon

- **OVN-Kubernetes node**
  - Called as CNI plugin (just an executable) from kublet/CRI-O
  - **Digests** IPAM annotation written by ovn-kubernetes master
  - **Sets up** firewall rules and routes for HostPort and Service access from node
  - **Creates** OVS port on bridge, **moves** it into pod network namespace, **sets** IP details/QoS
  - **Deletes** entities when pods die

These process are also **started** by the CNO via a **Daemonset**-> `ovnkube-node`
They can be seen running on an OCP cluster in the `openshift-ovn-kubernetes` namespace within the `ovnkube-node` pod as the following containers

- `[ovn-controller, ovnkube-node]`

https://docs.google.com/presentation/d/1iktpCdAsdaJPJe7Yk36T-BtYwuB04oc3lHdMHH2qBcw/edit#slide=id.g6fa84b026f_2_109

OpenShift Network! OVN part

```
➜  ~ oc get pods -A | grep -i operator | grep -i dns
openshift-dns-operator                          dns-operator-69db46cc47-9bwdp                                  2/2     Running       0
       27h
➜  ~ oc get pods -A | grep -i operator | grep -i dhcp
➜  ~ oc get all -n openshift-ovn-kubernetes
NAME                       READY   STATUS    RESTARTS   AGE
pod/ovnkube-master-hw7gw   6/6     Running   0          26h
pod/ovnkube-master-nnhsr   6/6     Running   0          27h
pod/ovnkube-master-xdjxp   6/6     Running   0          27h
pod/ovnkube-node-4cmwt     5/5     Running   0          26h
pod/ovnkube-node-58dk8     5/5     Running   0          26h
pod/ovnkube-node-m7ngq     5/5     Running   0          27h
pod/ovnkube-node-nnmxx     5/5     Running   0          27h
pod/ovnkube-node-rpvw9     5/5     Running   0          26h
pod/ovnkube-node-tjqnq     5/5     Running   0          27h

NAME                            TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)             AGE
service/ovn-kubernetes-master   ClusterIP   None         <none>        9102/TCP            27h
service/ovn-kubernetes-node     ClusterIP   None         <none>        9103/TCP,9105/TCP   27h
service/ovnkube-db              ClusterIP   None         <none>        9641/TCP,9642/TCP   27h

NAME                                 DESIRED   CURRENT   READY   UP-TO-DATE   AVAILABLE   NODE SELECTOR                                                AGE
daemonset.apps/ovnkube-master   3         3         3       3            3           beta.kubernetes.io/os=linux,node-role.kubernetes.io/master=   27h
daemonset.apps/ovnkube-node     6         6         6       6            6           beta.kubernetes.io/os=linux                                  27h
➜  ~
```

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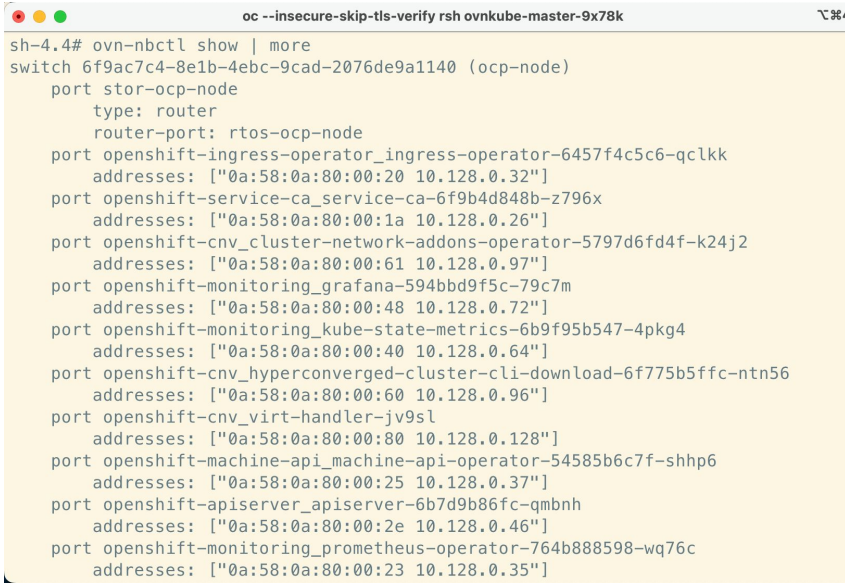
OpenShift Network! OVN part - ovn-controller

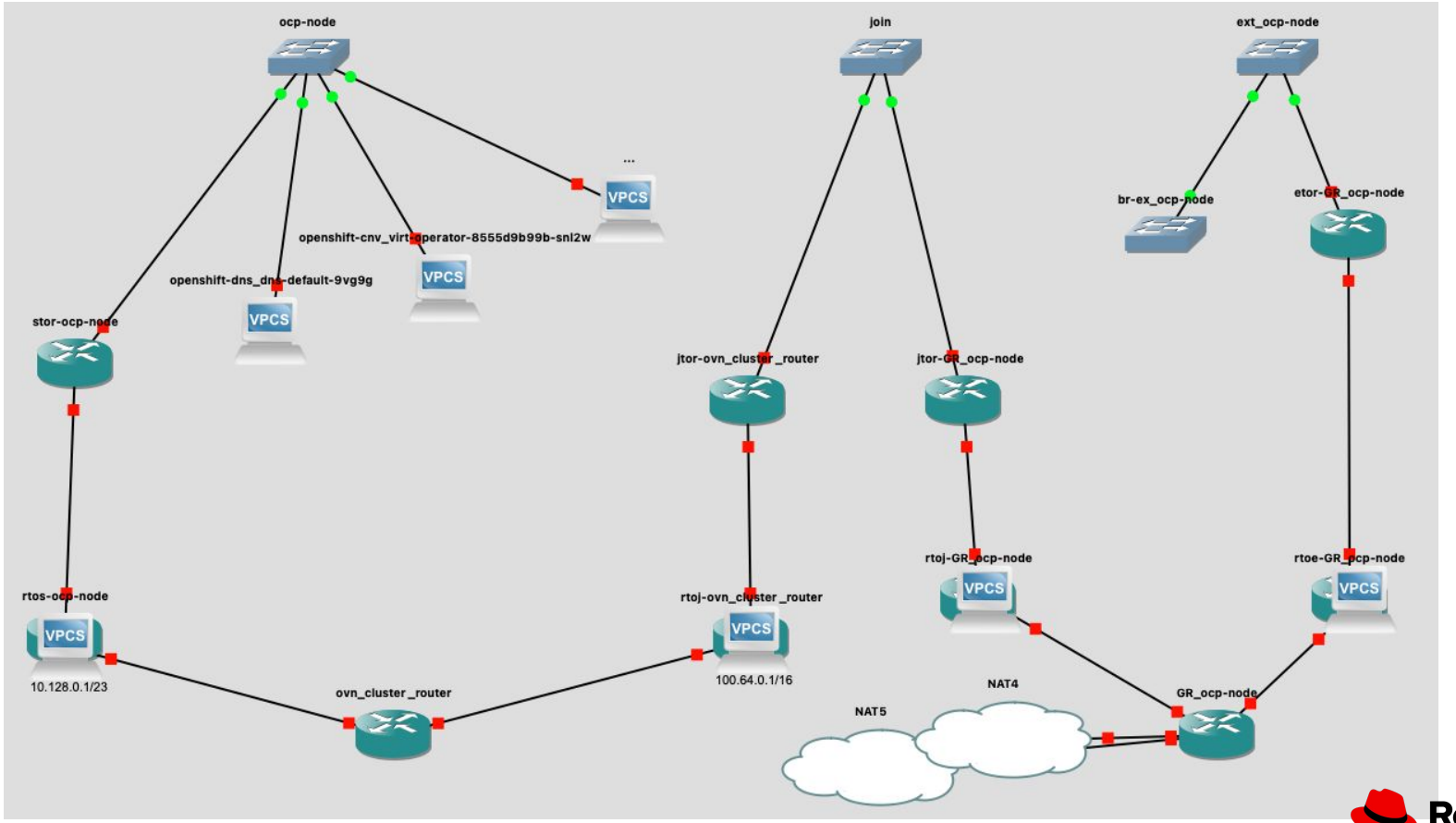
Red Hat

OpenShift Network! OVN part



北 向网络定义逻辑流（人读）

南 向网络表达 OpenFlow（机器）

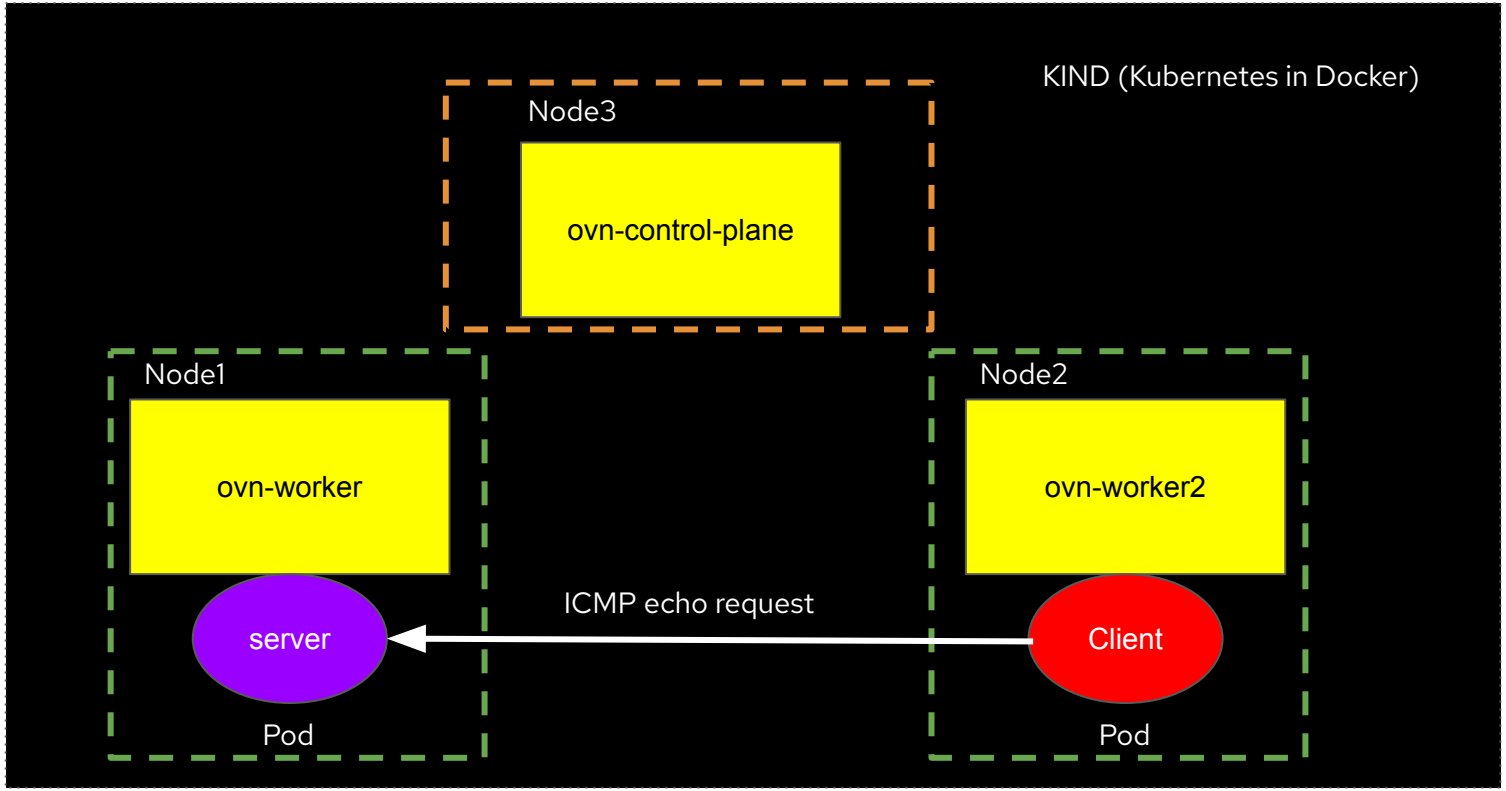

ocp-node
join
ext_ocp-node
...
VPCS
openshift-cnv_virt-operator-8555d9b99b-snl2w
br-ex_ocp-node
etor-GR_ocp-node
openshift-dns_dns-default-9vg9g
VPCS
VPCS
stor-ocp-node
jtor-ovn_cluster_router
jtor-GR_ocp-node
rtos-ocp-node
rtoj-ovn_cluster_router
rtoj-GR_ocp-node
rtoe-GR_ocp-node
VPCS
VPCS
VPCS
VPCS
10.128.0.1/23
100.64.0.1/16
ovn_cluster_router
NAT4
NAT5
GR_ocp-node

Red Hat

```
[root@hpe-sl2x160zg6-02 ~]# kubectl get nodes
NAME                STATUS   ROLES           AGE   VERSION
ovn-control-plane   Ready    control-plane   16h   v1.24.0
ovn-worker          Ready    <none>          16h   v1.24.0
ovn-worker2         Ready    <none>          16h   v1.24.0
[root@hpe-sl2x160zg6-02 ~]# kubectl get pods --all-namespaces
NAMESPACE            NAME                                         READY   STATUS    RESTARTS      AGE
default              client                                       1/1     Running   0             33m
default              server                                       1/1     Running   0             34m
kube-system          coredns-6d4b75cb6d-7bnpc                     1/1     Running   0             16h
kube-system          coredns-6d4b75cb6d-dhgsf                     1/1     Running   0             16h
kube-system          etcd-ovn-control-plane                       1/1     Running   0             16h
kube-system          kube-apiserver-ovn-control-plane             1/1     Running   0             16h
kube-system          kube-controller-manager-ovn-control-plane    1/1     Running   2 (15h ago)   16h
kube-system          kube-scheduler-ovn-control-plane             1/1     Running   2 (15h ago)   16h
local-path-storage   local-path-provisioner-9cd9bd544-gn56b       1/1     Running   0             16h
ovn-kubernetes       ovnkube-db-5c6757846-s64b6                   2/2     Running   0             15h
ovn-kubernetes       ovnkube-master-7f9fc84984-bftdx              2/2     Running   0             15h
ovn-kubernetes       ovnkube-node-d4nng                           3/3     Running   0             15h
ovn-kubernetes       ovnkube-node-dgzjx                           3/3     Running   0             15h
ovn-kubernetes       ovnkube-node-ksk6r                           3/3     Running   0             15h
ovn-kubernetes       ovs-node-jnj6b                               1/1     Running   0             15h
ovn-kubernetes       ovs-node-kbccf                               1/1     Running   0             15h
ovn-kubernetes       ovs-node-ml2tj                               1/1     Running   0             15h
[root@hpe-sl2x160zg6-02 ~]# kubectl get pods -n default
NAME     READY   STATUS    RESTARTS   AGE
client   1/1     Running   0          33m
server   1/1     Running   0          34m
[root@hpe-sl2x160zg6-02 ~]# kubectl get pods -n default -o wide
NAME     READY   STATUS    RESTARTS   AGE   IP           NODE          NOMINATED NODE   READINESS GATES
client   1/1     Running   0          33m   10.244.1.3   ovn-worker2   <none>           <none>
server   1/1     Running   0          34m   10.244.0.11  ovn-worker    <none>           <none>
[root@hpe-sl2x160zg6-02 ~]#
```

https://github.com/ovn-org/ovn-kubernetes/blob/master/docs/kind.md

Goal – trace the packet flow



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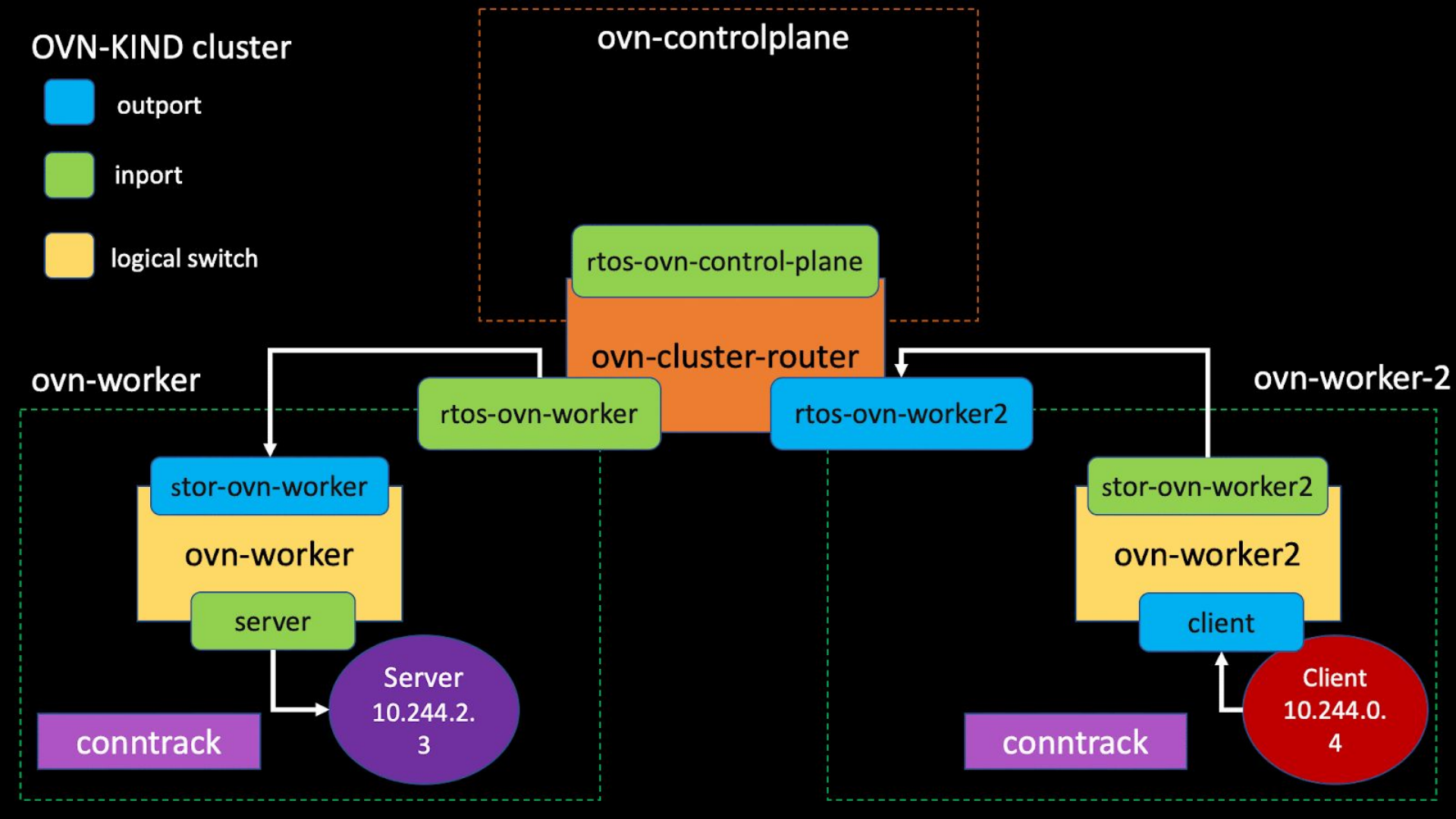
OVN logical entities

The logical components are stored in ovn-nbdb (showing only necessary components):

```
[root@ovn-control-plane ~]# ovn-nbctl show
switch 459ebbb9-2cb5-488f-8b1e-f35cda235957 (ovn-control-plane)
        port kube-system_coredns-6d4b75cb6d-7bnpc
                addresses: ["0a:58:0a:f4:02:04 10.244.2.4"]
        port stor-ovn-control-plane
                type: router
                router-port: rtos-ovn-control-plane
        port local-path-storage_local-path-provisioner-9cd9bd544-gn56b
                addresses: ["0a:58:0a:f4:02:05 10.244.2.5"]
        port kube-system_coredns-6d4b75cb6d-dhgsf
                addresses: ["0a:58:0a:f4:02:03 10.244.2.3"]
        port k8s-ovn-control-plane
                addresses: ["da:af:4d:0c:48:a5 10.244.2.2"]

switch 08adf0fb-4fee-474f-a010-0b7eef718806 (ovn-worker)
        port stor-ovn-worker
                type: router
                router-port: rtos-ovn-worker
        port k8s-ovn-worker
                addresses: ["36:1e:87:09:fe:90 10.244.0.2"]
        port default_server
                addresses: ["0a:58:0a:f4:00:0b 10.244.0.11"]
switch d000f3a1-7e84-4055-a326-2c3b989e52ba (ovn-worker2)
        port stor-ovn-worker2
                type: router
                router-port: rtos-ovn-worker2
        port default_client
                addresses: ["0a:58:0a:f4:01:03 10.244.1.3"]
        port k8s-ovn-worker2
                addresses: ["7e:18:c5:1f:9f:ba 10.244.1.2"]
router 9dd99282-8d69-4bf0-a06e-5abc95fd4191 (ovn_cluster_router)
        port rtos-ovn-control-plane
                mac: "0a:58:0a:f4:02:01"
                networks: ["10.244.2.1/24"]
                gateway chassis: [fb39d137-8727-418b-b3ce-2dd461ad50f
        port rtoj-ovn_cluster_router
                mac: "0a:58:64:40:00:01"
                networks: ["100.64.0.1/16"]
        port rtos-ovn-worker
                mac: "0a:58:0a:f4:00:01"
                networks: ["10.244.0.1/24"]
                gateway chassis: [50758e69-6f60-4bad-91b3-9edc585b8f9
        port rtos-ovn-worker2
                mac: "0a:58:0a:f4:01:01"
                networks: ["10.244.1.1/24"]
                gateway chassis: [d3d2ba94-a8a9-4832-a895-a611dc5992e
```


OVN-KIND cluster
outport
inport
logical switch
ovn-controlplane
rtos-ovn-control-plane
ovn-cluster-router
ovn-worker
rtos-ovn-worker
rtos-ovn-worker2
ovn-worker-2
stor-ovn-worker
ovn-worker
server
Server
10.244.2.
3
conntrack
stor-ovn-worker2
ovn-worker2
client
Client
10.244.0.
4
conntrack

OVN Packet Processing

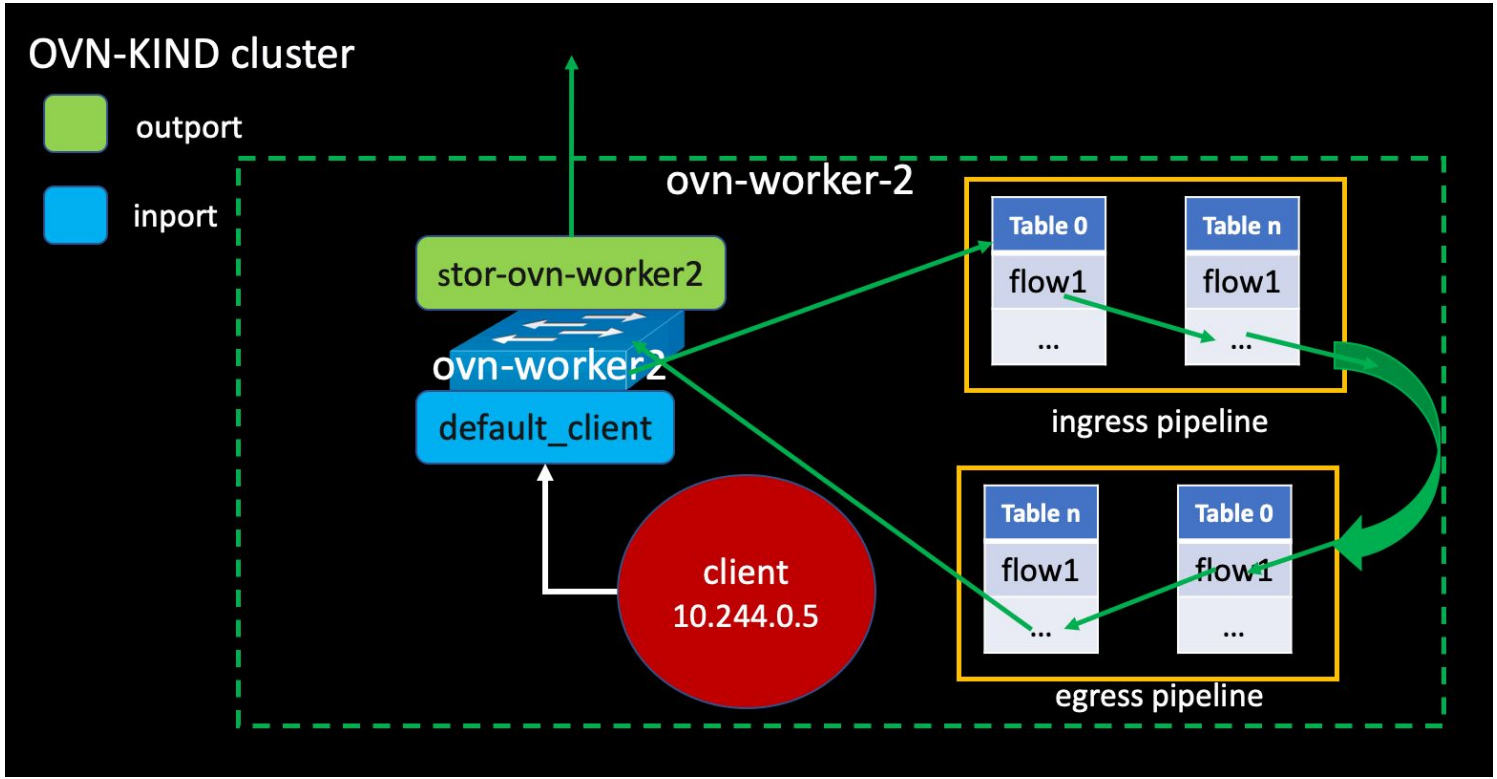
```
/* The two purposes for which ovn-northd uses OVN logical datapaths. */
enum ovn_datapath_type {
    DP_SWITCH,                  /* OVN logical switch. */
    DP_ROUTER                   /* OVN logical router. */
};
```

```
/* The two pipelines in an OVN logical flow table. */
enum ovn_pipeline {
    P_IN,                       /* Ingress pipeline. */
    P_OUT                       /* Egress pipeline. */
};
```

- OVN 有一套复杂的方法来处理数据包
- 它有两条 pipeline，数据包通过这些管道进行 progress
  - Ingress
  - Egress
- OVN中的数据包首先进入 Ingress pipeline，然后再进入 Egress pipeline。
  - 它将与 logical flow rules defined in ovn-sbdb `Logical_Flows` 进行比较，用于该数据通路 datapath 的 ingress/egress pipeline。
  - 然后找到匹配的流 flow 并执行该动作。

```
[root@ovn-control-plane ~]# ovn-sbctl lflow-list
Datapath: "ovn-worker2" (684a68ba-7d4c-4bac-9360-de8b47e52dd7)  Pipeline: ingress
table=0 (ls_in_port_sec_l2), priority=50, match=(inport == "default_client" && eth.src ==
{0a:58:0a:f4:00:05}), action=(next;)
table=1 (ls_in_port_sec_ip), priority=90   , match=(inport == "default_client" && eth.src ==
0a:58:0a:f4:00:05 && ip4.src == {10.244.0.5}), action=(next;)
table=19(ls_in_l2_lkup), priority=50   , match=(eth.dst == 0a:58:0a:f4:00:01), action=(outport
= "stor-ovn-worker2"; output;)
```

OVN Packet Processing



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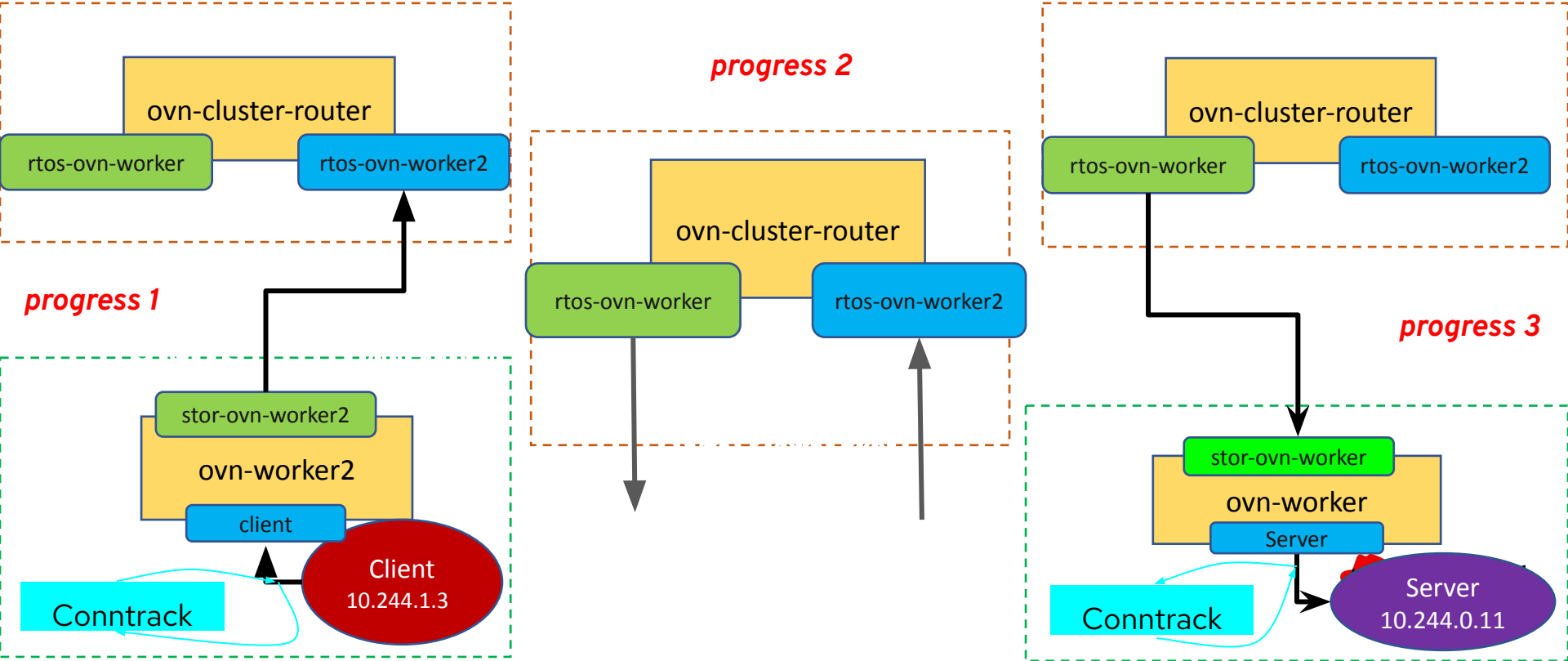
Ovn-Trace

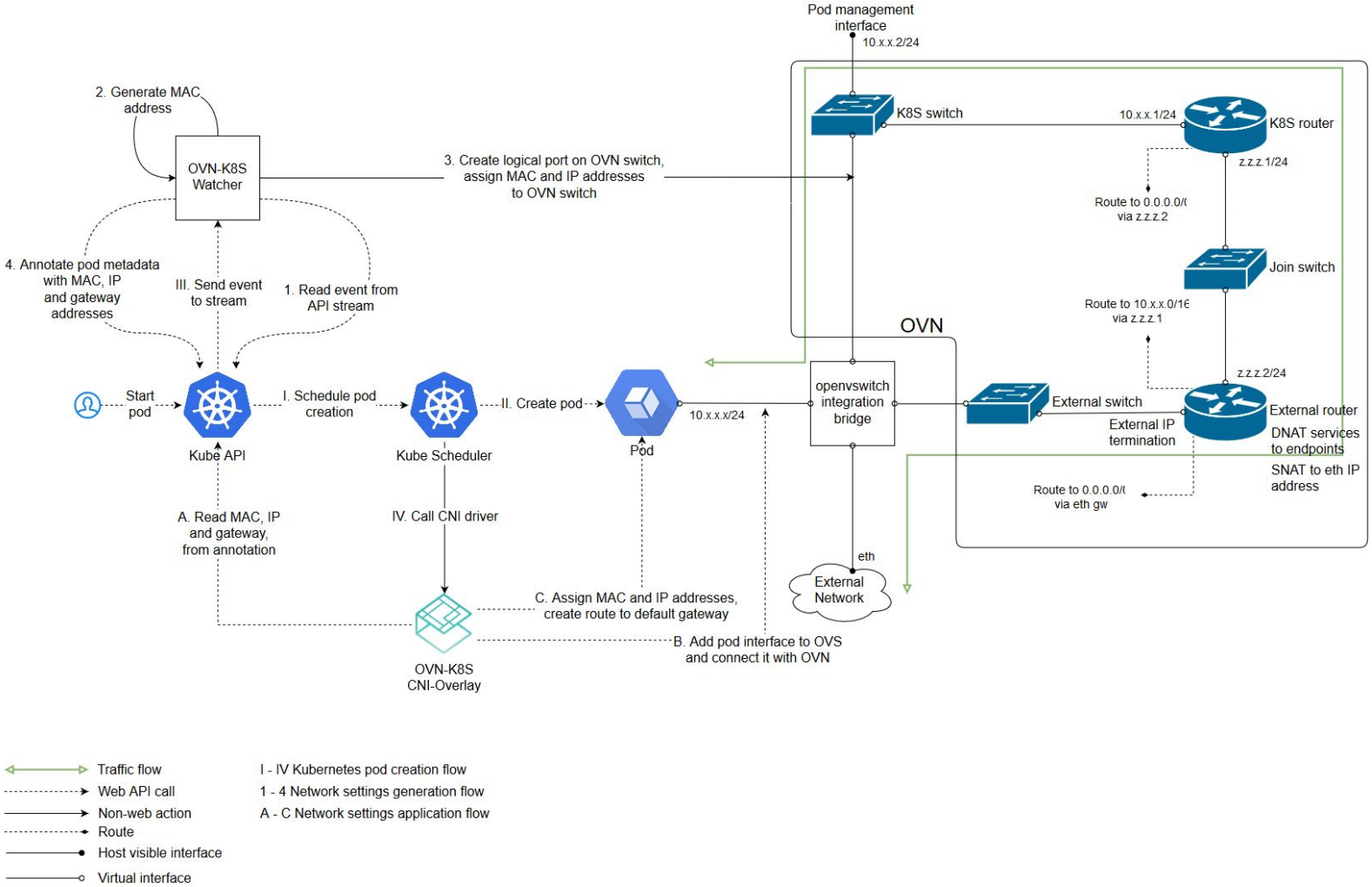
- 要想通过 OVN 追踪一个数据包，需要一个名 为 ovn-trace 的工具。
  - 它模拟了 OVN 逻辑拓扑中的数据包 转发场景
- A typical ovn-trace command:

```
[root@ovn-control-plane ~]# ovn-trace --ct new --ovs ovn-worker2
'inport=="default_client" && eth.dst==0a:58:0a:f4:01:01 && eth.src==0a:58:0a:f4:01:03&&
ip4.src==10.244.1.3 && ip4.dst==10.244.0.11 && ip.ttl==64 && tcp && tcp.src==80'
```

- **--ovs**
  - 使得 ovn-trace 试图获得并显示对应于每个 OVN 逻辑流的 Openflow flows，i.e connects to ovn-sbdb
- **inport**
  - 要开始追踪数据包的端口
- **eth.dst and eth.src**
  - The destination of the next layer two hop
  - Here the MAC's relate to: `default_client` -> `rtos-ovn-worker2`
- **ip4.src and ip4.dst**
  - 客户端和服务器 pods 的 IP地址 分别为

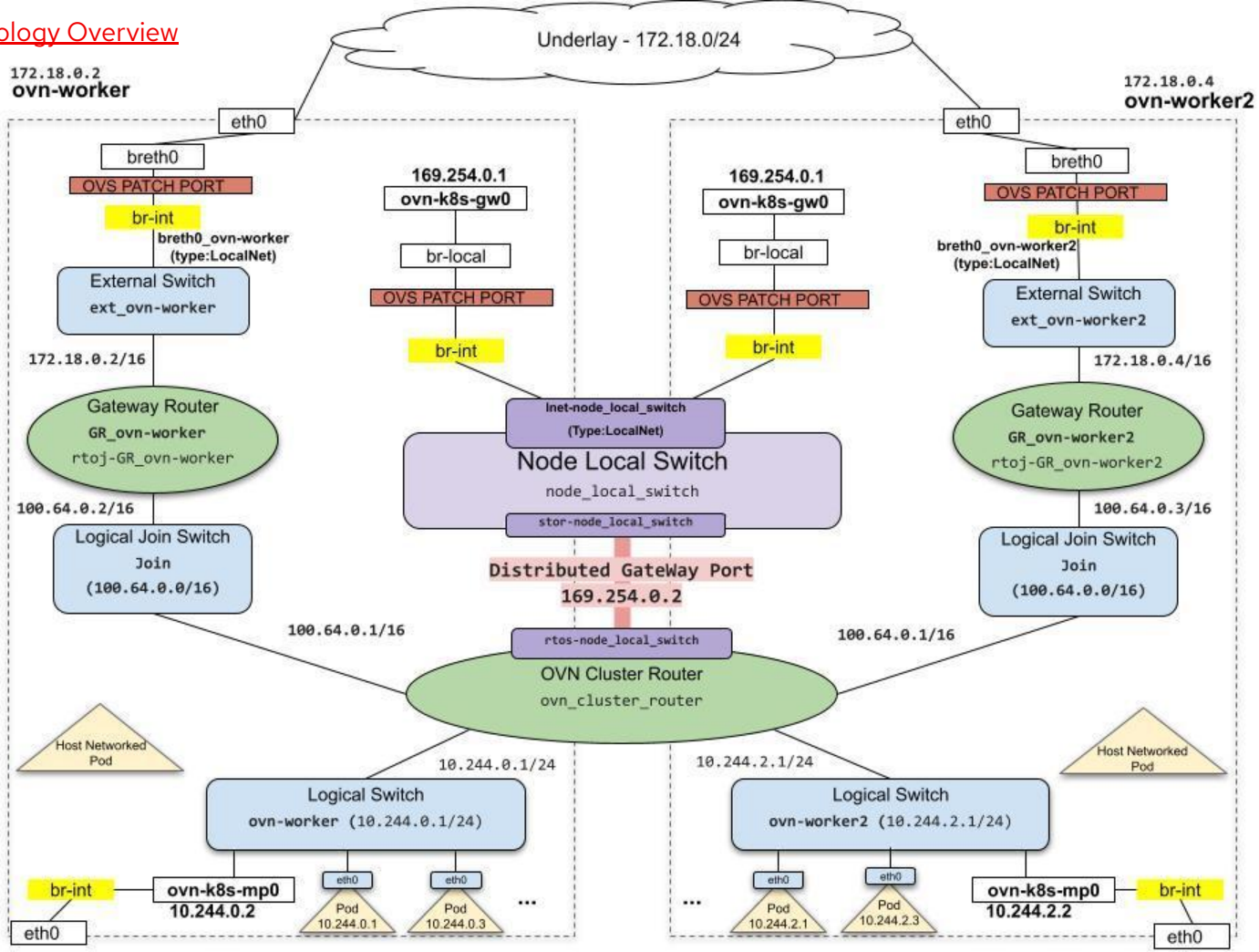
```
[root@ovn-control-plane ~]# ovn-trace --ct new --ovs ovn-worker2 'inport=="default_client" && eth.dst==0a:58:0a:f4:01:01 && eth.src==0a:58:0a:f4:01:03
&& ip4.src==10.244.1.3 && ip4.dst==10.244.0.11 && ip.ttl==64 && tcp && tcp.src==8080 ' | grep -e ingress -e egress
ingress(dp="ovn-worker2", inport="default_client")
egress(dp="ovn-worker2", inport="default_client", outport="stor-ovn-worker2")
ingress(dp="ovn_cluster_router", inport="rtos-ovn-worker2")
egress(dp="ovn_cluster_router", inport="rtos-ovn-worker2", outport="rtos-ovn-worker")
ingress(dp="ovn-worker", inport="stor-ovn-worker")
egress(dp="ovn-worker", inport="stor-ovn-worker", outport="default_server")
[root@ovn-control-plane ~]#
```




Pod management interface
10.x.x.2/24
K8S switch
10.x.x.1/24
K8S router
z.z.z.1/24
Route to 0.0.0.0/(
via z.z.z.2
Join switch
Route to 10.x.x.0/16
via z.z.z.1
z.z.z.2/24
OVN
2. Generate MAC address
OVN-K8S Watcher
3. Create logical port on OVN switch, assign MAC and IP addresses to OVN switch
4. Annotate pod metadata with MAC, IP and gateway addresses
III. Send event to stream
1. Read event from API stream
Start pod
I. Schedule pod creation
II. Create pod
Kube API
Kube Scheduler
Pod
10.x.x.x/24
openvswitch integration bridge
External switch
External router
External IP termination
DNAT services to endpoints
SNAT to eth IP address
Route to 0.0.0.0/(
via eth gw
A. Read MAC, IP and gateway, from annotation
IV. Call CNI driver
eth
External Network
C. Assign MAC and IP addresses, create route to default gateway
B. Add pod interface to OVS and connect it with OVN
OVN-K8S CNI-Overlay
Traffic flow
Web API call
Non-web action
Route
Host visible interface
Virtual interface
I - IV Kubernetes pod creation flow
1 - 4 Network settings generation flow
A - C Network settings application flow

Local GW Topology Overview

Updated:
06/25/2021



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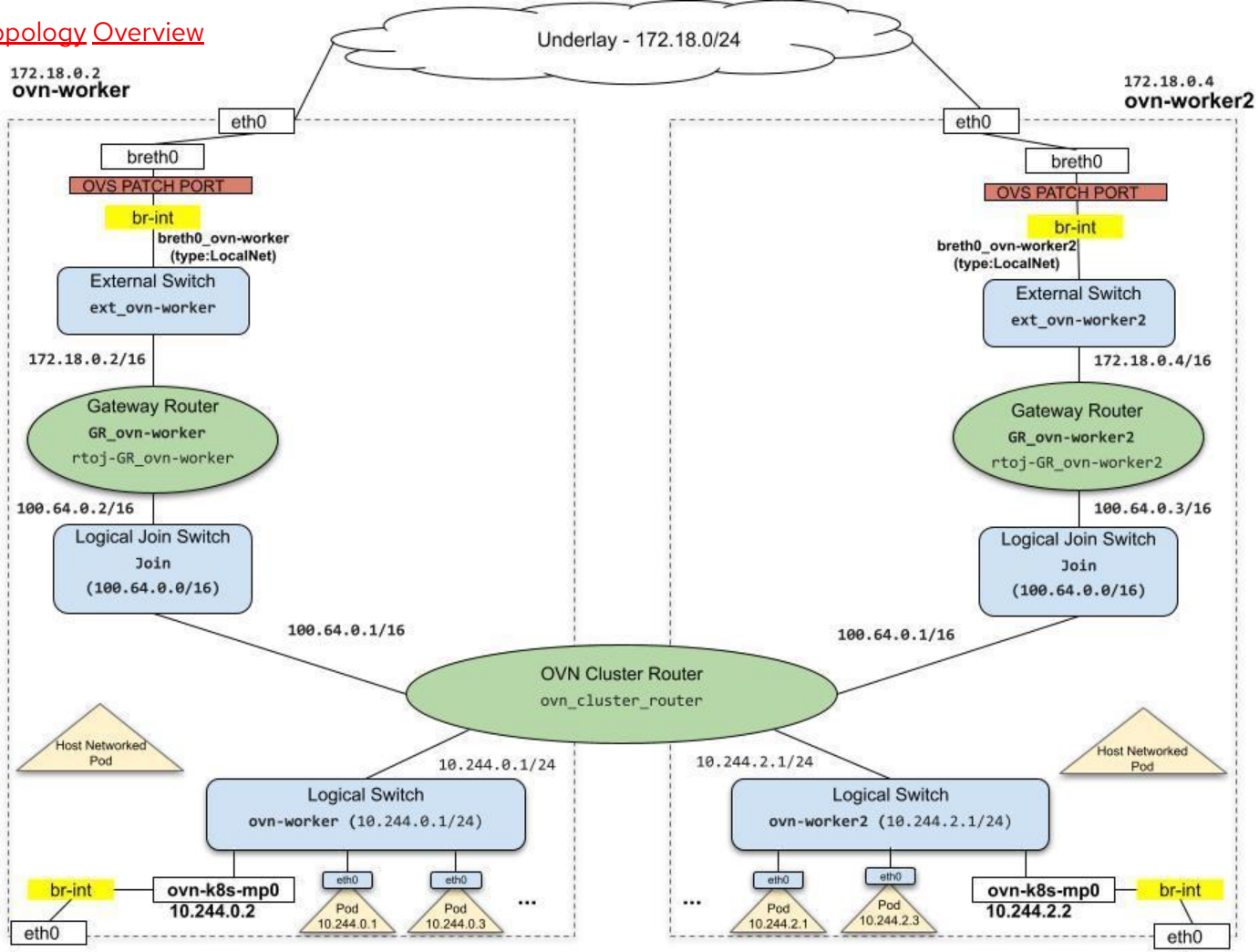
Shared GW Topology Overview

Updated:
06/25/2021



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Q & A

Reference

KubeVirt User-Guide

OpenShift Container Platform 4.11 Documentation

OVN

How to use Open Virtual Networking with Kubernetes

OVN-Kubernetes-presentation-OCTO-October6th2020

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Reference - Learning day

CNV Demo

Openshift/Container Training and Info

Openshift sandboxed container

https://docs.google.com/presentation/d/1U-KSJBPaMPp65v4RqDyFwqSMg9yegiG5/edit#slide=id.p6

https://docs.google.com/presentation/d/1Xsyboav89hv-Xg3f6IuF9W-f5eR8_MYxZwyWK4Ra8RY/edit#slide=id.g91c10be5e6_0_87

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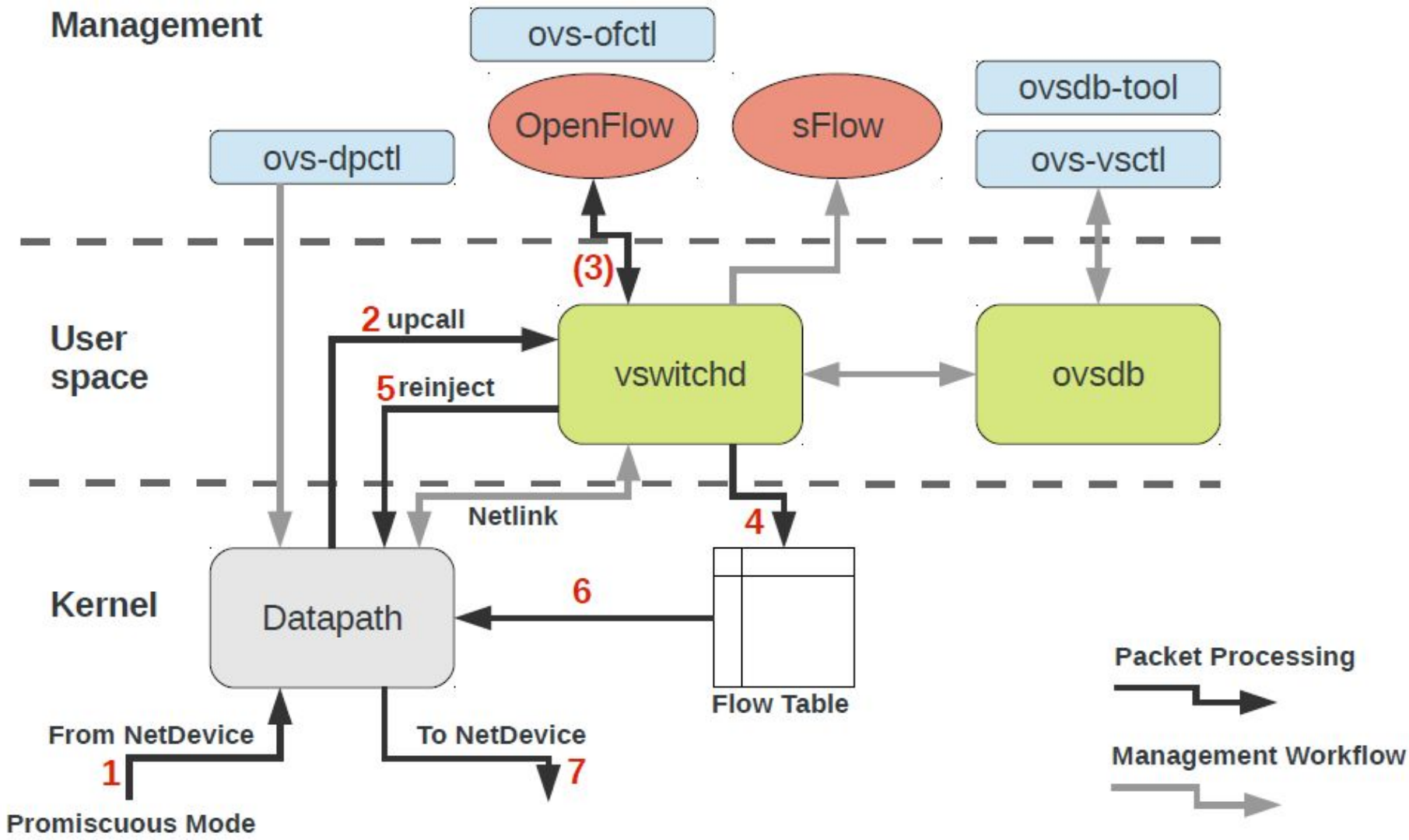
OVS

OVS

Open vSwitch supports the following features:

- Visibility into inter-VM communication via NetFlow, sFlow(R), IPFIX, SPAN, RSPAN, and GRE-tunneled mirrors
- LACP (IEEE 802.1AX-2008)
- Standard 802.1Q VLAN model with trunking
- Multicast snooping
- IETF Auto-Attach SPBM and rudimentary required LLDP support
- BFD and 802.1ag link monitoring
- STP (IEEE 802.1D-1998) and RSTP (IEEE 802.1D-2004)
- Fine-grained QoS control
- Support for HFSC qdisc
- Per VM interface traffic policing
- NIC bonding with source-MAC load balancing, active backup, and L4 hashing
- OpenFlow protocol support (including many extensions for virtualization)
- IPv6 support
- Multiple tunneling protocols (GRE, VXLAN, STT, and Geneve, with IPsec support)
- Remote configuration protocol with C and Python bindings
- Kernel and user-space forwarding engine options
- Multi-table forwarding pipeline with flow-caching engine
- Forwarding layer abstraction to ease porting to new software and hardware platforms


Management
ovs-ofctl
OpenFlow
sFlow
ovsdb-tool
ovs-dpctl
ovs-vsctl
(3)
User space
2 upcall
vswitchd
ovsdb
5 reinject
Netlink
4
Kernel
Datapath
6
Flow Table
From NetDevice
1
Promiscuous Mode
To NetDevice
7
Packet Processing
Management Workflow

OVS db

ovs - db schema

```
[root@edge-qe-per740-01 ~]# ovsdb-client list-dbs
Open_vSwitch
[root@edge-qe-per740-01 ~]# ovsdb-client list-tables Open_vSwitch
Table
--------------------------
Controller
Bridge
Queue
IPFIX
NetFlow
Open_vSwitch
QoS
Port
sFlow
SSL
Flow_Sample_Collector_Set
Mirror
Flow_Table
Interface
AutoAttach
Manager
```

```
[root@edge-qe-per740-01 ~]#  ovsdb-client list-columns Open_vSwitch Port
Column            Type
----------------- ------------------------------------------------------------------------------------------------------
bond_downdelay    "integer"
name              "string"
statistics        {"key":"string","max":"unlimited","min":0,"value":"integer"}
protected         "boolean"
fake_bridge       "boolean"
mac               {"key":"string","min":0}
trunks            {"key":{"maxInteger":4095,"minInt
_uuid             "uuid"
tag               {"key":{"maxInteger":4095,"minInt
rstp_status       {"key":"string","max":"unlimited"
_version          "uuid"
bond_updelay      "integer"
bond_active_slave {"key":"string","min":0}
external_ids      {"key":"string","max":"unlimited"
other_config      {"key":"string","max":"unlimited"
status            {"key":"string","max":"unlimited"
qos               {"key":{"refTable":"QoS","type":"
bond_mode         {"key":{"enum":["set",["active-ba
bond_fake_iface   "boolean"
interfaces        {"key":{"refTable":"Interface","t
vlan_mode         {"key":{"enum":["set",["access","
rstp_statistics   {"key":"string","max":"unlimited"
lacp              {"key":{"enum":["set",["active","
[root@edge-qe-per740-01 ~]#
```

```
sh-4.4# ovsdb-client list-columns Open_vSwitch Controller
Column                  Type
----------------------- ------------------------------------------------------------------------------------------
enable_async_messages   {"key":"boolean","min":0}
local_gateway           {"key":"string","min":0}
local_netmask           {"key":"string","min":0}
type                    {"key":{"enum":["set",["primary","service"]],"type":"string"},"min":0}
controller_rate_limit   {"key":{"minInteger":100,"type":"integer"},"min":0}
_uuid                   "uuid"
role                    {"key":{"enum":["set",["master","other","slave"]],"type":"string"},"min":0}
inactivity_probe        {"key":"integer","min":0}
max_backoff             {"key":{"minInteger":1000,"type":"integer"},"min":0}
_version                "uuid"
connection_mode         {"key":{"enum":["set",["in-band","out-of-band"]],"type":"string"},"min":0}
is_connected            "boolean"
status                  {"key":"string","max":"unlimited","min":0,"value":"string"}
other_config            {"key":"string","max":"unlimited","min":0,"value":"string"}
external_ids            {"key":"string","max":"unlimited","min":0,"value":"string"}
controller_burst_limit  {"key":{"minInteger":25,"type":"integer"},"min":0}
local_ip                {"key":"string","min":0}
controller_queue_size   {"key":{"maxInteger":512,"minInteger":1,"type":"integer"},"min":0}
target                  "string"
sh-4.4#
```

```
[root@edge-qe-per740-01 ~]# cat /etc/openvswitch/conf.db  | sed -n '2p' | jq | more
{
  "cksum": "3374030633 22987",
  "name": "Open_vSwitch",
  "version": "7.14.0",
  "tables": {
    "Controller": {
      "columns": {
        "is_connected": {
          "ephemeral": true,
          "type": "boolean"
        },
        "connection_mode": {
          "type": {
            "min": 0,
            "key": {
              "type": "string",
              "enum": [
                "set",
                [
                  "in-band",
                  "out-of-band"
                ]
              ]
            }
          }
        },
        "local_gateway": {
          "type": {
            "min": 0,
            "key": "string"
          }
        },
        "enable_async_messages": {
          "type": {
            "min": 0,
            "key": "boolean"
          }
        },
        "other_config": {
          "type": {
            "max": "unlimited",
            "min": 0,
            "key": "string",
            "value": "string"
          }
```

```
[root@edge-qe-per740-01 ~]# ovsdb-client get-schema Open_vSwitch | jq | more
{
  "cksum": "3374030633 22987",
  "name": "Open_vSwitch",
  "tables": {
    "AutoAttach": {
      "columns": {
        "mappings": {
          "type": {
            "key": {
              "maxInteger": 16777215,
              "minInteger": 0,
              "type": "integer"
            },
            "max": "unlimited",
            "min": 0,
            "value": {
              "maxInteger": 4095,
              "minInteger": 0,
              "type": "integer"
            }
          }
        },
        "system_description": {
          "type": "string"
        },
        "system_name": {
          "type": "string"
        }
      }
    },
    "Bridge": {
      "columns": {
        "auto_attach": {
          "type": {
            "key": {
              "refTable": "AutoAttach",
              "type": "uuid"
            },
            "min": 0
          }
        },
        "controller": {
          "type": {
            "key": {
              "refTable": "Controller",
```

```
[root@edge-qe-per740-01 ~]# ovsdb-client dump
AutoAttach table
_uuid mappings system_description system_name
----- -------- ------------------ -----------

Bridge table
_uuid                                auto_attach controller datapath_id        datapath_type datapath_version external_ids fail_mode flood_vlans flow_tables ipfix mc
ast_snooping_enable mirrors name  netflow other_config ports
                                                                                 protocols rstp_enable rstp_status sflow status stp_enable
------------------------------------ ----------- ---------- ------------------ ------------- ---------------- ------------ --------- ----------- ----------- ----- --
------------------- ------- ----- ------- ------------ ---------------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------- --------- ----------- ----------- ----- ------ ----------
b61e977d-3251-4e54-a287-d126d6746ae5 []          []         "00007e971eb6544e" ""            "<unknown>"      {}           []        []          {}          []    fa
lse                 []     "br2" []     {}           [36361a0e-e3a8-43ec-a088-b74e78d6e386, 4a2bc419-f9af-4abb-8c6c-8f6d843ab500, b9324926-fb18-4f3b-9084-1cfdf7736
d50, cc0dd740-af32-43b4-b644-1fe742599f3e, f7f390bc-a7eb-43df-807f-97f50fa37e25] []        false       {}          []    {}     false
4ba0cfda-db16-4eaf-a0d5-9fe10addd644 []          []         "0000dacfa04baf4e" ""            "<unknown>"      {}           []        []          {}          []    fa
lse                 []     "br1" []     {}           [5e8a1f44-b8ac-42f0-a926-869888f7299d, 76b7656f-3768-4177-87bf-5c60dc006b98, 8053a6b0-582d-4951-8d38-12684913b
b8f, ce380ea6-3a64-484f-b72c-ba134b01b241, df50366b-9cc1-4dcf-b4e9-ef072a49ef6d] []        false       {}          []    {}     false

Controller table
_uuid connection_mode controller_burst_limit controller_rate_limit enable_async_messages external_ids inactivity_probe is_connected local_gateway local_ip local_netm
ask max_backoff other_config role status target
----- --------------- ---------------------- --------------------- --------------------- ------------ ---------------- ------------ ------------- -------- ----------
--- ----------- ------------ ---- ------ ------

Flow_Sample_Collector_Set table
_uuid bridge external_ids id ipfix
----- ------ ------------ -- -----

Flow_Table table
_uuid external_ids flow_limit groups name overflow_policy prefixes
----- ------------ ---------- ------ ---- --------------- --------

IPFIX table
_uuid cache_active_timeout cache_max_flows external_ids obs_domain_id obs_point_id other_config sampling targets
----- -------------------- --------------- ------------ ------------- ------------ ------------ -------- -------

Interface table
_uuid                                admin_state bfd bfd_status cfm_fault cfm_fault_status cfm_flap_count cfm_health cfm_mpid cfm_remote_mpids cfm_remote_opstate dup
lex error external_ids                                                                                                                                           ifin
dex ingress_policing_burst ingress_policing_rate lacp_current link_resets link_speed link_state lldp mac mac_in_use          mtu  mtu_request name    ofport ofport_r
equest options other_config statistics
                                                status                                                                                       type
------------------------------------ ----------- --- ---------- --------- ---------------- -------------- ---------- -------- ---------------- ------------------ ---
--- ----- ------------------------------------------------------------------------------------------------------------------------------------------------------ ----
--- ---------------------- --------------------- ------------ ---------- ---------- ---------- ---- --- ------------------- ---- ----------- ------- ------ --------
```

ovs - db CRUD

```
ovs-vsctl add-br helloworld
ip link add first_br type veth peer name first_if
ip link set first_br up
ip link set first_if up
ovs-vsctl add-port helloworld first_br
```

list table

    ovs-vsctl list Bridge

list table [record]

    ovs-vsctl list Bridge helloworld

get table record [column[:key]]

    ovs-vsctl get Bridge helloworld ports

set table record column[:key]=value

    ovs-vsctl set Port first_br tag=100

add table record column [key=]value

    ovs-vsctl add Port first_br trunks 110

remove table record column key

    ovs-vsctl remove Port first_br trunks 100

clear table record column

    ovs-vsctl clear Port first_br trunks