OpenShift Virtualization

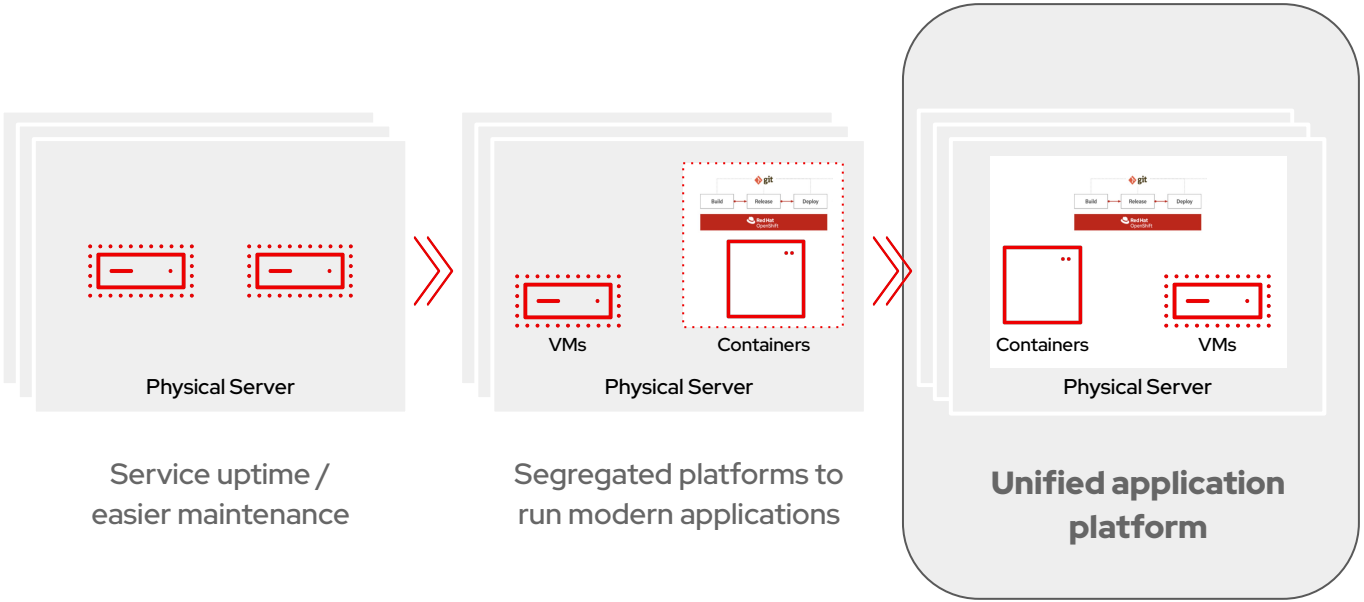
Prepackaged answer to your business's prayers

OpenShift Virtualization is Red Hat's solution for companies trending toward modernization by adopting a containerized architecture for their applications, but find virtualization remains a necessary part of their data center deployment strategy.

Red Hat

Bring cloud-native functionality to virtual machines with Red Hat innovation

The benefits of k8s without containerizing



Service uptime / easier maintenance

Segregated platforms to run modern applications

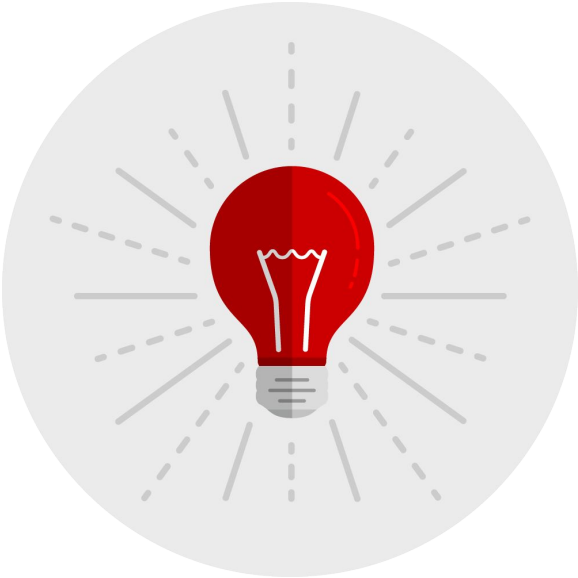
Unified application platform

OpenShift Virtualization

INTRODUCTION

AGENDA

- Built on Kubernetes
- What is OpenShift Virtualization
- Advantages
- Storage
- Metrics and Logging
- Network
- Migration
- OpenShift Virtualization Glossary
- Automation Options



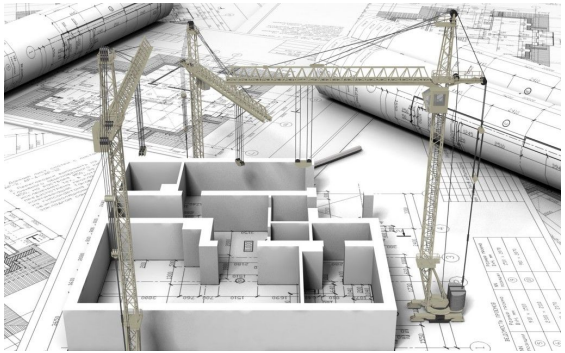
Built on Kubernetes

Red Hat

What is Kubernetes

Kubernetes

Kubernetes is an orchestration service that simplifies the deployment, management, and scaling of containerized applications.



OpenShift

Why is Red Hat using Kubernetes?

- Service discovery
- Load balancing
- Horizontal scaling
- Self-healing
- Automated rollouts and rollbacks
- Storage Orchestration
- Secrets management

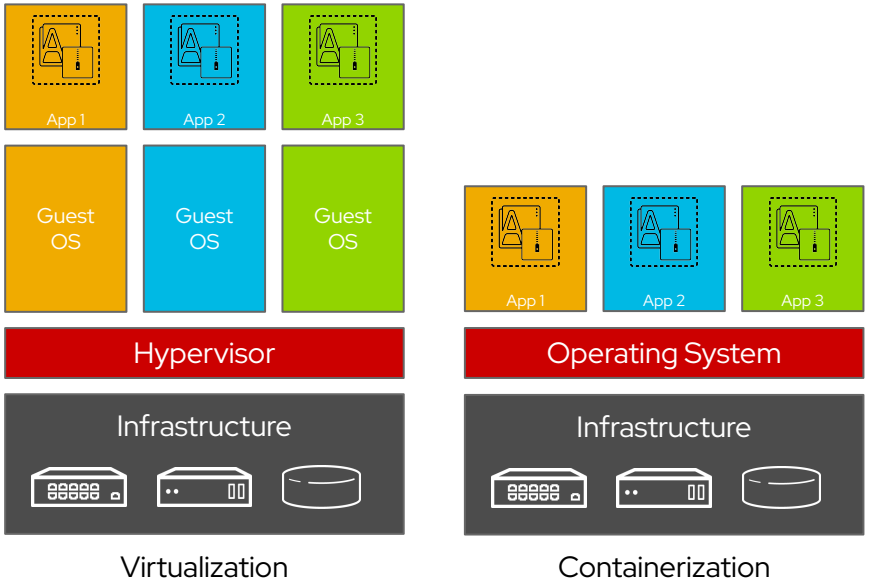
OpenShift

Kubernetes Terminology

- **Operator**
  - A cluster component that simplifies the management of another application or function
- **Control Plane**
  - The cluster layer, responsible for container lifecycle management through its provided API
- **Worker Nodes**
  - Where the applications are running.
- **Pod**
  - A pod encapsulates one or more applications. Container.
- **Container**
  - A container image is a ready-to-run software package, containing everything needed to run an application: the code and any runtime it requires, application and system libraries, and default values for any essential settings.

Containers are not virtual machines

- Containers are process isolation
- Kernel namespaces provide isolation and cgroups provide resource controls
- No hypervisor needed for containers
- Contain only binaries, libraries, and tools which are needed by the application
- Ephemeral

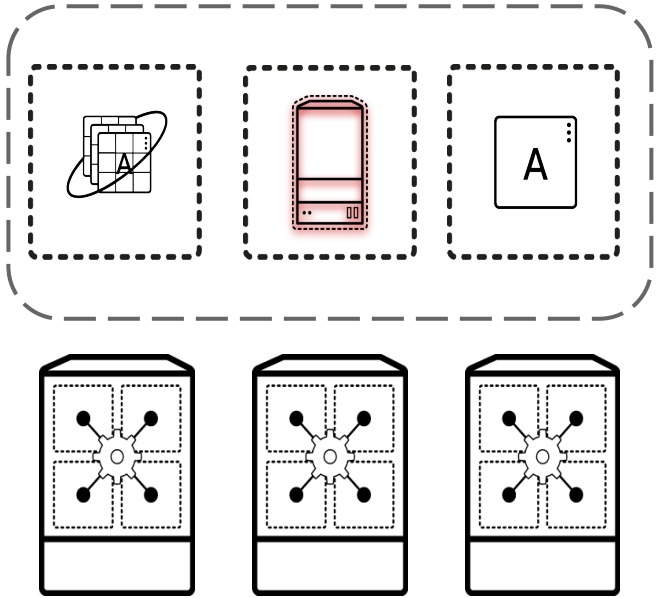


Red Hat

Virtual machines can be put into containers

- A KVM virtual machine is a process
- Containers encapsulate processes
- Both have the same underlying resource needs:
  - Compute
  - Network
  - (sometimes) Storage

KubeVirt



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Kubernetes-Open Shift Architecture

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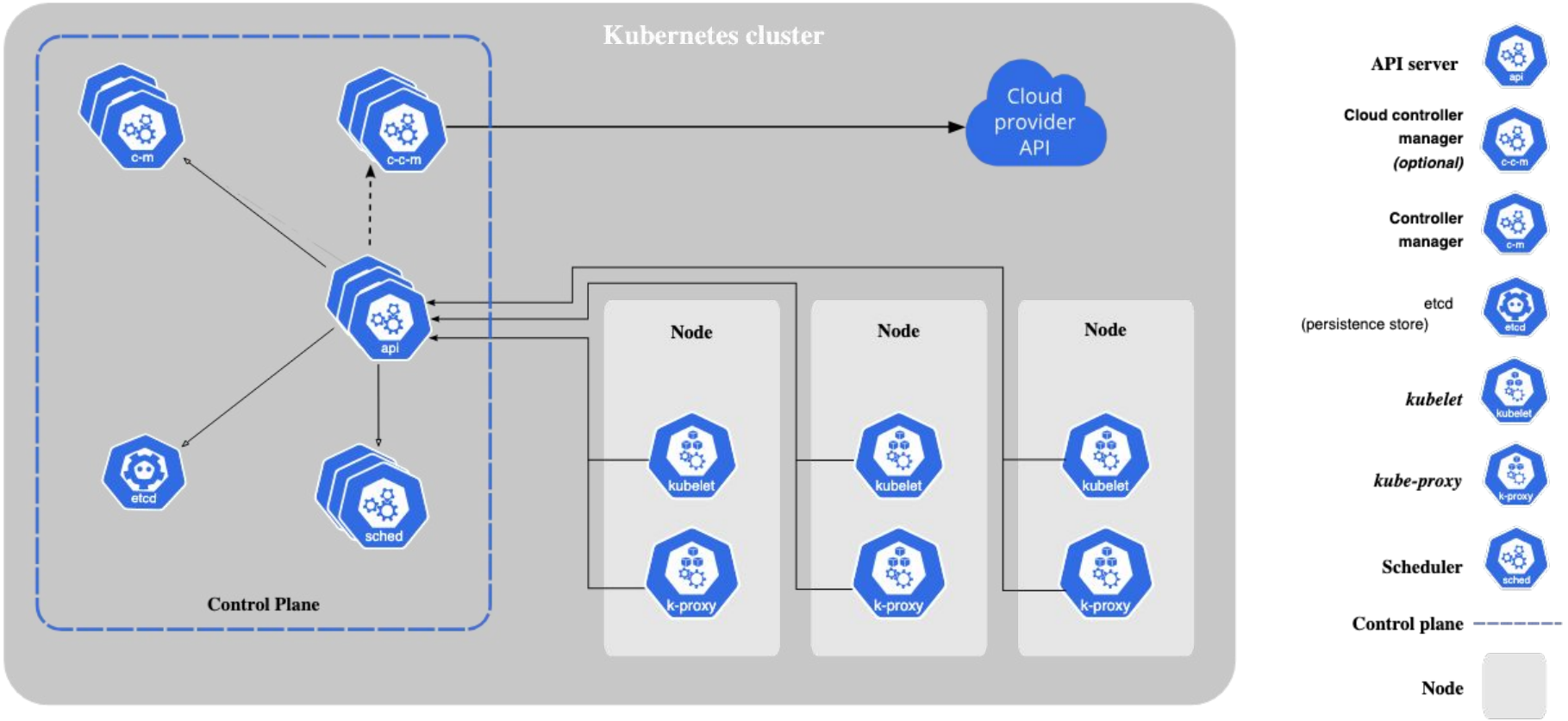
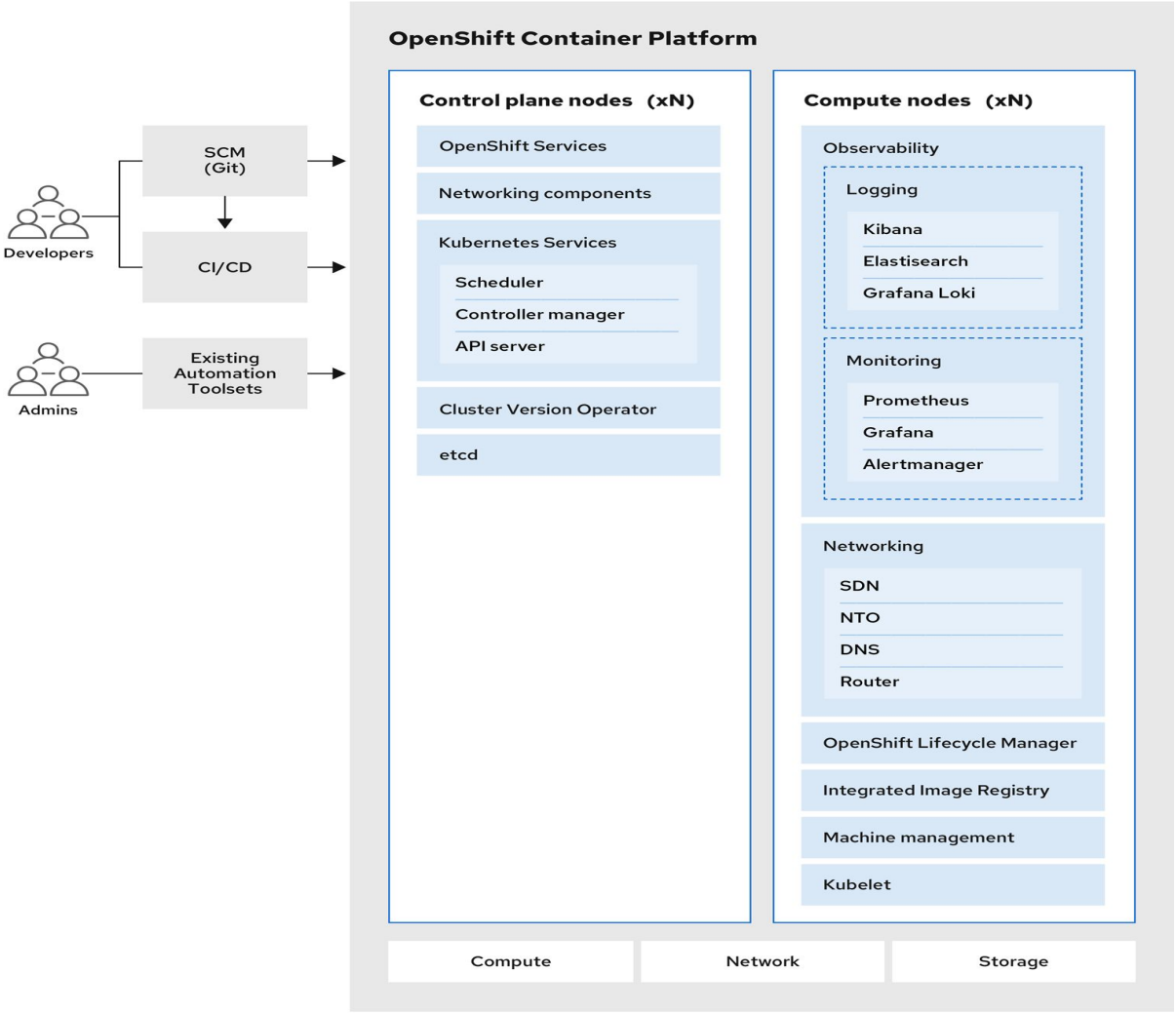
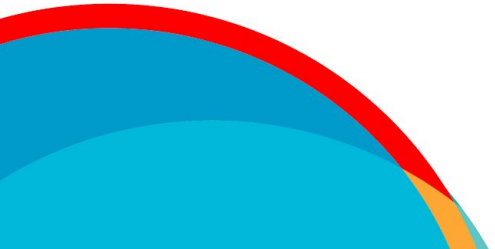

Kubernetes cluster
c-m
c-c-m
Cloud provider API
api
etcd
sched
Control Plane
Node
kubelet
k-proxy
Node
kubelet
k-proxy
Node
kubelet
k-proxy
API server
Cloud controller manager (optional)
Controller manager
etcd (persistence store)
kubelet
kube-proxy
Scheduler
Control plane
Node


OpenShift Container Platform
Control plane nodes (xN)
OpenShift Services
Networking components
Kubernetes Services
Scheduler
Controller manager
API server
Cluster Version Operator
etcd
Compute nodes (xN)
Observability
Logging
Kibana
Elastisearch
Grafana Loki
Monitoring
Prometheus
Grafana
Alertmanager
Networking
SDN
NTO
DNS
Router
OpenShift Lifecycle Manager
Integrated Image Registry
Machine management
Kubelet
Compute
Network
Storage
SCM (Git)
CI/CD
Existing Automation Toolsets
Developers
Admins

OPENSHIFT

Kubernetes-OpenShift Architecture



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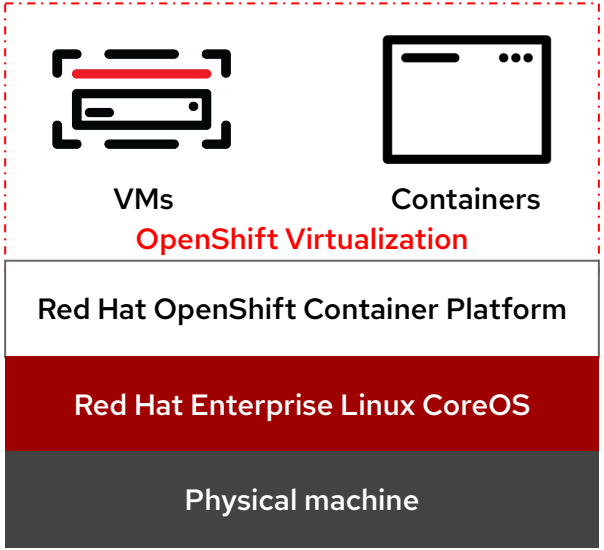
What is OpenShift Virtualization?

What is OpenShift Virtualization?

- Included feature of the OpenShift application platform
- Run VMs in OpenShift
- Performance, stability, scalability, and reliability of **KVM**, the Linux kernel-based hypervisor
- **RHEL guest entitlements are included**
- Supports Microsoft Windows guests - Microsoft Server Virtualization Validation Program (SVVP)
- Manageability and ecosystem of OpenShift
- Unified platform for running VMs and Containers



Advantages

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Modernize at your own pace

Legacy Virtualization
Apps in VMs

Slow evolution

Increasing costs

Developer productivity

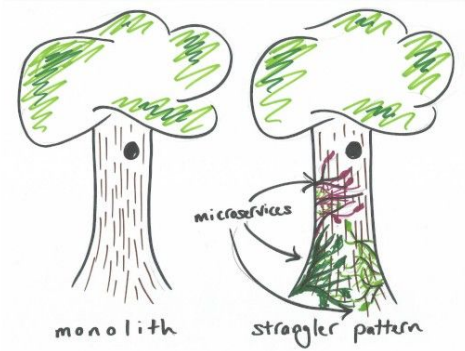
MTV

Infrastructure Modernization
Apps in VMs

Cloud Elasticity + Scalability

Reduce Operating Cost

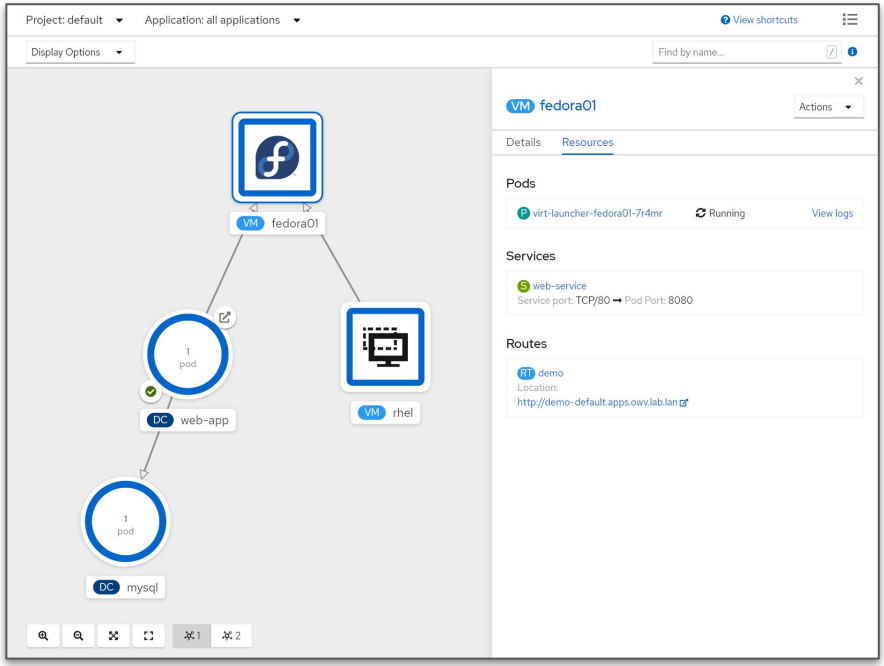
Increase IT efficiency + reliability



Speed of Infrastructure Deployment
Speed of Application Development

Using VMs and containers together

- Virtual machines connected to pod networks are accessible using standard Kubernetes methods:
  - Service
  - Route
  - Ingress
- Network policies apply to VM pods the same as application pods
- VM-to-pod, and vice-versa, communication happens over SDN or ingress depending on network connectivity



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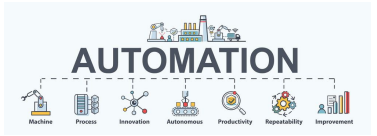
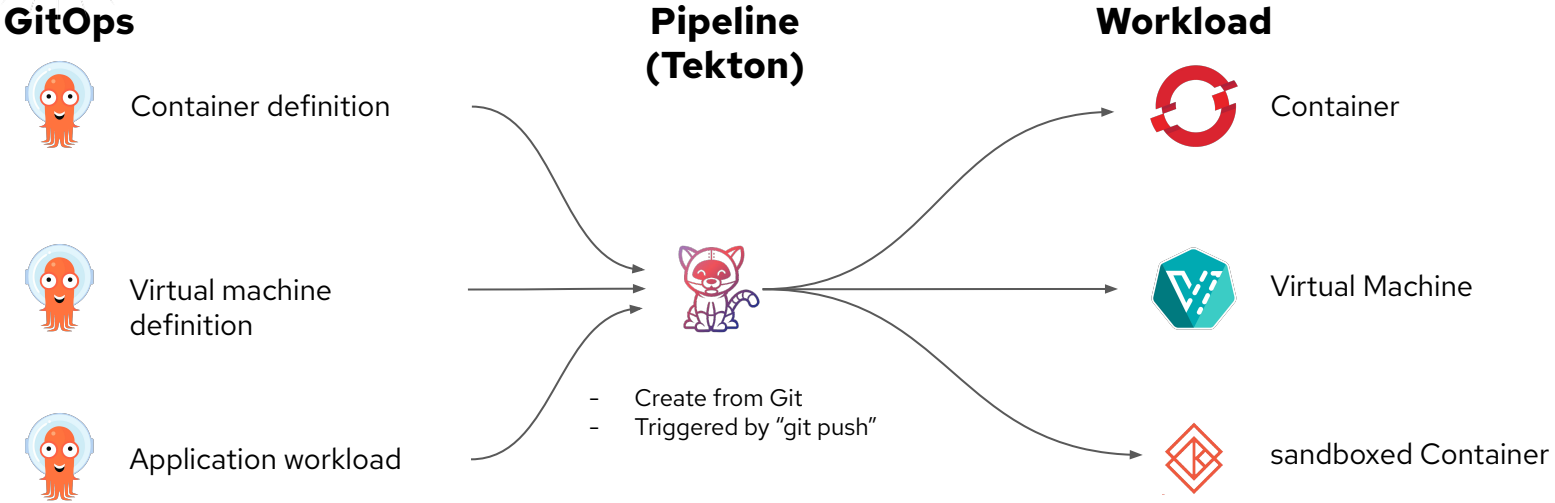
VMs as Code – CI/CD Use Case





- OCP-V Infrastructure to deploy three different security zones to run both composite applications of pods/VMs as well as traditional VM Workloads
- GitOps approach to deploy and automate Virtual Machines as Code with ArgoCD plus Helm and Pipeline
- OpenShift cluster deployment with Assisted Installer / ACM resonates well with this approach

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If you recall

Kubernetes Advantages

- Service discovery
- Load balancing
- Horizontal scaling
- Self-healing
- Automated rollouts and rollbacks
- Storage Orchestration
- Secrets management

Bring traditional VMs into OpenShift

Traditional VM behavior in a modern platform

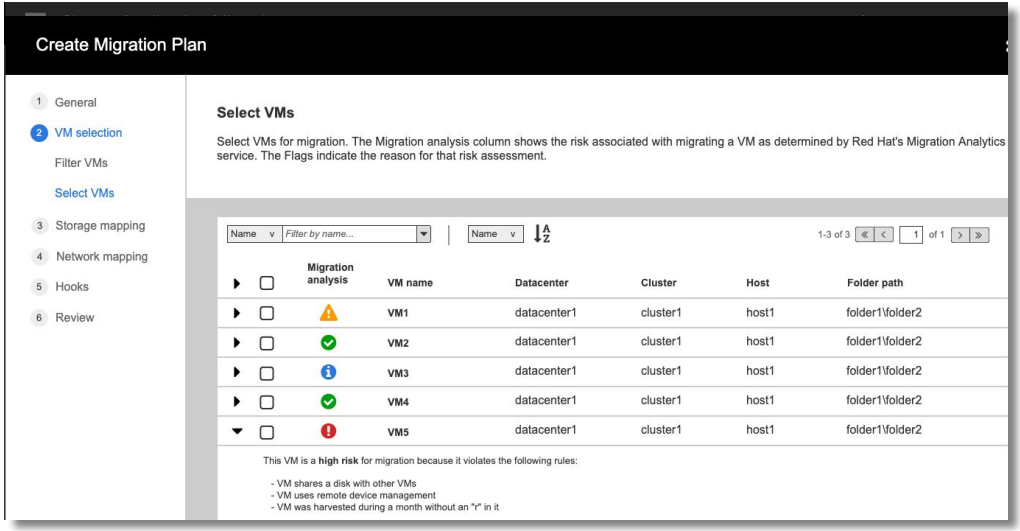
- Administrator concepts and actions
- Network connectivity
- Live migration

Leverage existing VM roles and responsibilities

- Maintain business critical application components
- Modernize skill sets over time

Migration Tooling

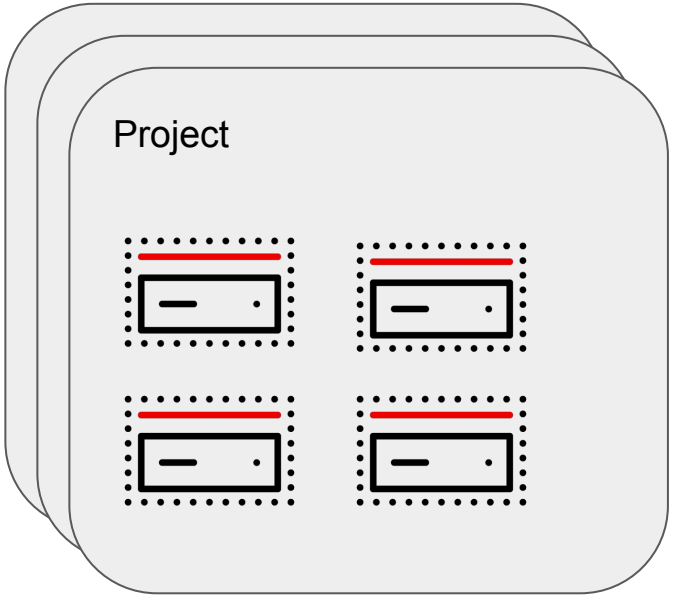
- **Migration Toolkit for Virtualization** (MTV)
- Warm migration of VMs at scale



Creating a migration plan with MTV

Self-service VM by Project

Assign roles and collaborate around Projects as you would in the cloud



Add users / groups
Set roles

Create / Delete
Start / Stop / Restart
Clone
Migrate

View status
Copy ssh command

Project owner

Project editor

Project viewer

Fragmented ‘approach’ to VM provisioning

A process that can take weeks trapped in queues and iterations

Virtual Machine
- CPU: 4 vCPU, 1 core
- Memory: 16GB
- Disk: 30 GB
- OS: RHEL

Additional filesystems
- data: 500GB, disk
- logs: 100GB, partition

Application platform
- JBoss 7.4 Update 11

Firewall rules
- Ingress: SSH, HTTPS
- Egress: *.redhat.com

DNS & LB
- api.service.org
- Healthcheck: HTTPS port

Execute workflow
- Review & approve
- Assign IP & hostname
- Configure DNS (host)

Networking team (1-3 days)

Execute workflow
- Review & approve
- Allocate volumes
- Whitelist source IP

Storage team (1-2 days)

Execute workflow
- Review & approve
- Install JBoss 7.4u11
- Configure MW

Platform team (1-2 days)

Execute workflow
- Review & approve
- Install security tools
- VM hardening

Security team (2-4 days)

Execute workflow
- Review & approve
- Configure LB & DNS
- Configure FW

Networking team (2-7 days)

Request for a new Virtual Machine

Virtualization team (1-3 days)

Execute workflow
- Review & approve
- Queue to networking & storage teams
- Create VM from virtualization template and custom parameters
- Add disks and partitions and re-configure OS with custom filesystems
- Install corporate tools and configure default users and permissions
- Queue to platform team
- Queue to security team
- Queue to networking team
- Hand over the VM: IP, credentials and metadata

VM Ready?

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Next Gen approach to VM provisioning

Automated VM provisioning in minutes

Virtual Machine
- CPU: 4 vCPU, 1 core
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DNS & LB
- api.service.org
- Healthcheck: HTTPS port

Request for a new Virtual Machine

Manage networks, storage, load balancers, etc.

VM template

VM image

cloud-init

Network

Security

Storage

OpenShift

VM Ready!

Execute workflow
- Validated network, storage, and security against policies and permissions
- Provisioning of VM with corporate tools from template and custom parameters
- Publish VM: IP, credentials and metadata

Storage

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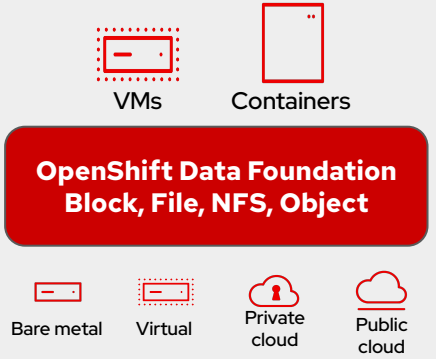
OpenShift Data Foundation

- Allows customers to **scale storage and compute independently**
  - Storage - Scale ***UP*** *or* ***OUT***
  - Compute - Scale number of VMs or expand VMs
- Disaster recovery
  - VMs can live-migrate within cluster
  - VMs can live migrate across data centers with Metro DR
- Networking
  - Multus - separate data networks and storage networks.
- Flexible deployment
  - Block, File, NFS, Object or just Block
- Data Transfer optimization using local read affinity
- Security - Encryption at rest and in-transit

Red Hat OpenShift Data Foundation



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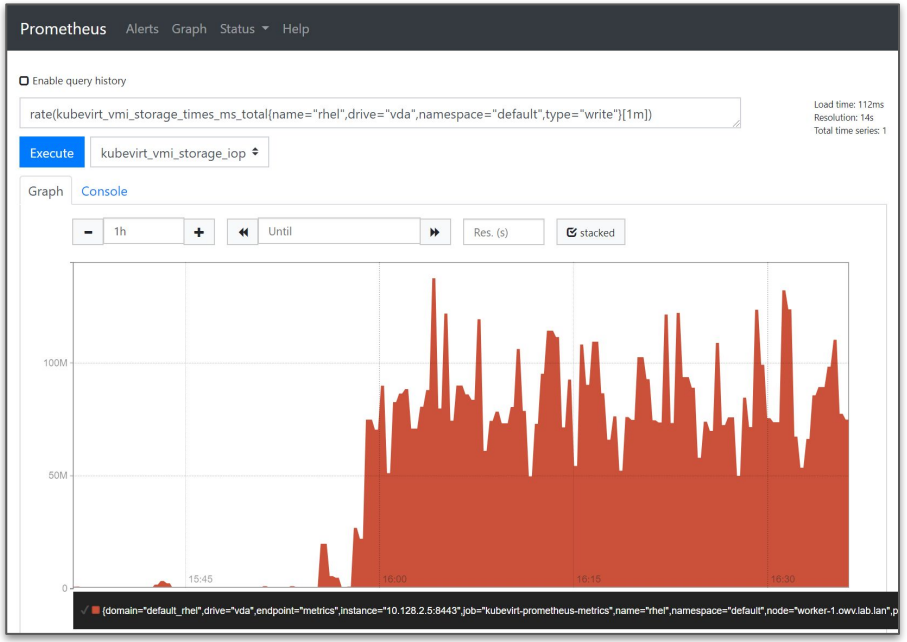
Metrics / Logging

Detailed Virtual Machine metrics

- Virtual machine, and VM pod, metrics are collected by the OpenShift metrics service
  - Available under the `kubevirt` namespace in Prometheus
- Available per-VM metrics include
  - Active memory
  - Active CPU time
  - Network in/out errors, packets, and bytes
  - Storage R/W IOPS, latency, and throughput
- VM metrics are for VMs, not for VM pods
  - Management overhead not included in output
  - Look at virt-launcher pod metrics for



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Logging

Components

- **Elasticsearch**: a search and analytics engine to store logs
- **Fluentd**: gathers logs and sends to Elasticsearch.
- **Kibana**: A web UI for Elasticsearch.
- **Loki**: An alternative to Elasticsearch as a log store for the logging subsystem.

Grafana Loki

Access control

- Cluster administrators can view all logs
- Users can only view logs for their projects

Ability to forward logs elsewhere

- External elasticsearch, Splunk, etc

Network

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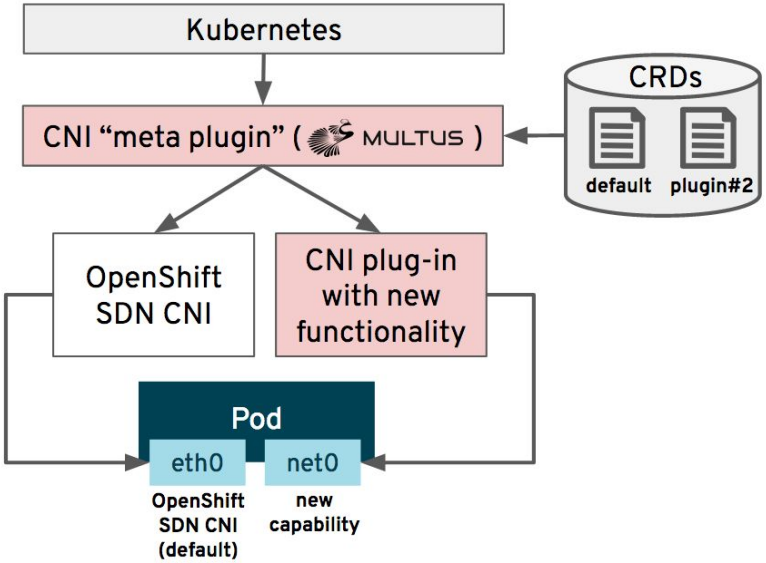
Virtual Machine Networking

- Virtual machines optionally connect to the standard pod network
  - OpenShift SDN, OVNKubernetes
  - Partners, such as Calico, are also supported
- Additional network interfaces accessible via Multus:
  - Bridge, SR-IOV
  - VLAN and other networks can be created at the host level using nmstate
- When using at least one interface on the default SDN, Service, Route, and Ingress configuration applies to VM pods the same as others



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Migration

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Migration Toolkit for Virtualization (MTV)

Migration at scale of virtual machines to OpenShift

Migration Analytics

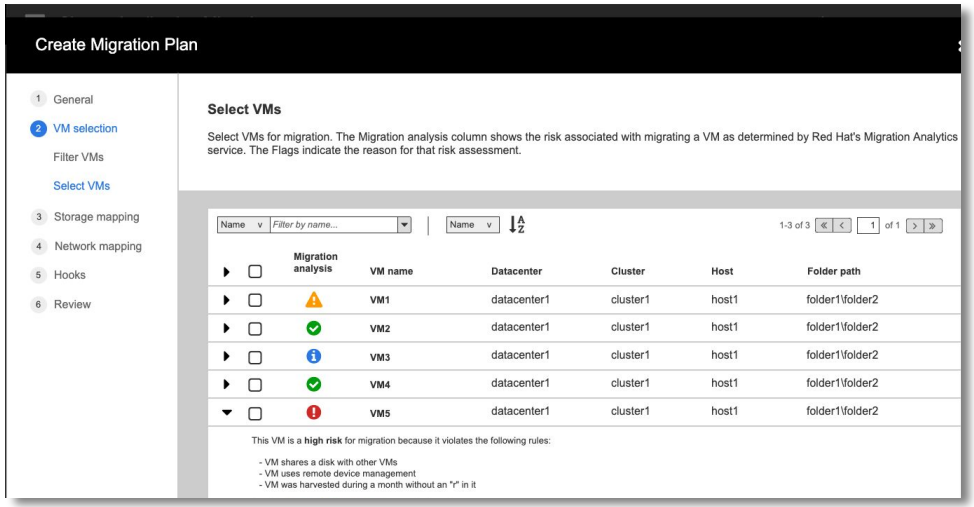
Detect potential compatibility issues before migrating to ensure a successful migration

Mass Migration of VMs

Migrate workloads at scale to OpenShift

- Provide source and destination credentials
- Map infrastructure
- Create migration plans

[Product Documentation for Migration Toolkit for Virtualization 2.3 | Red Hat Customer Portal]



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OpenShift Virtualization Glossary

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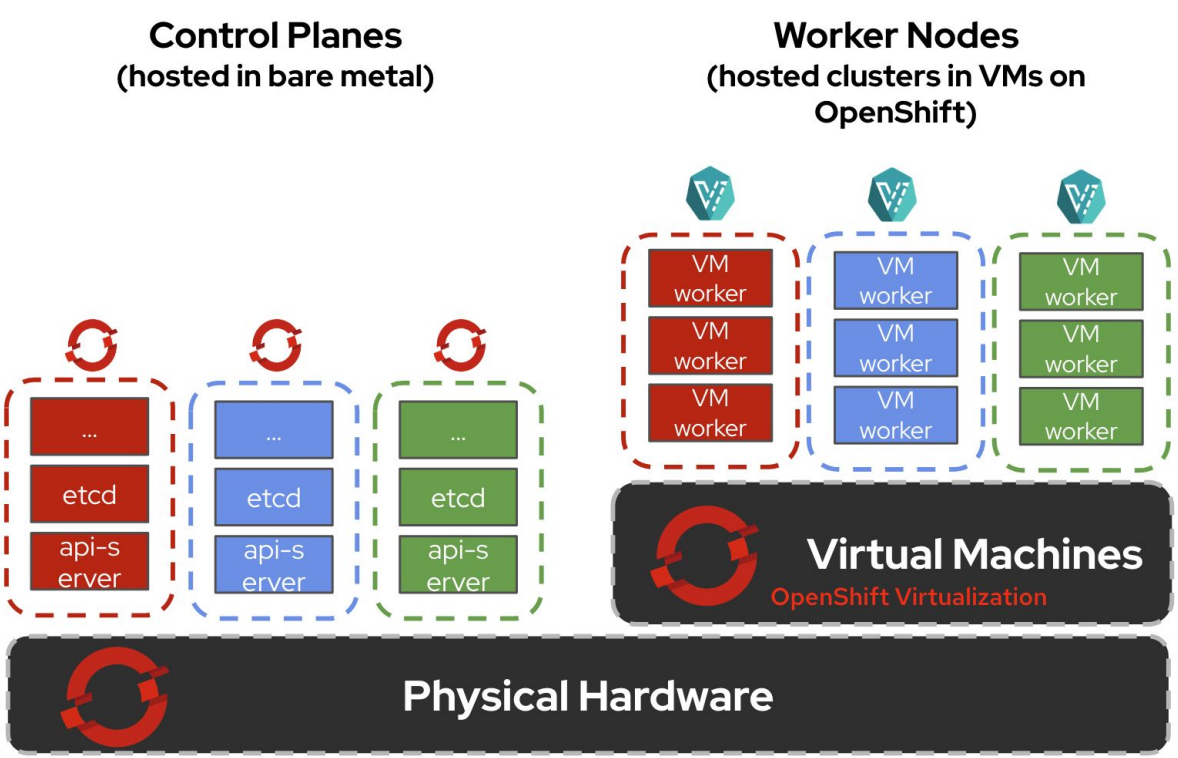
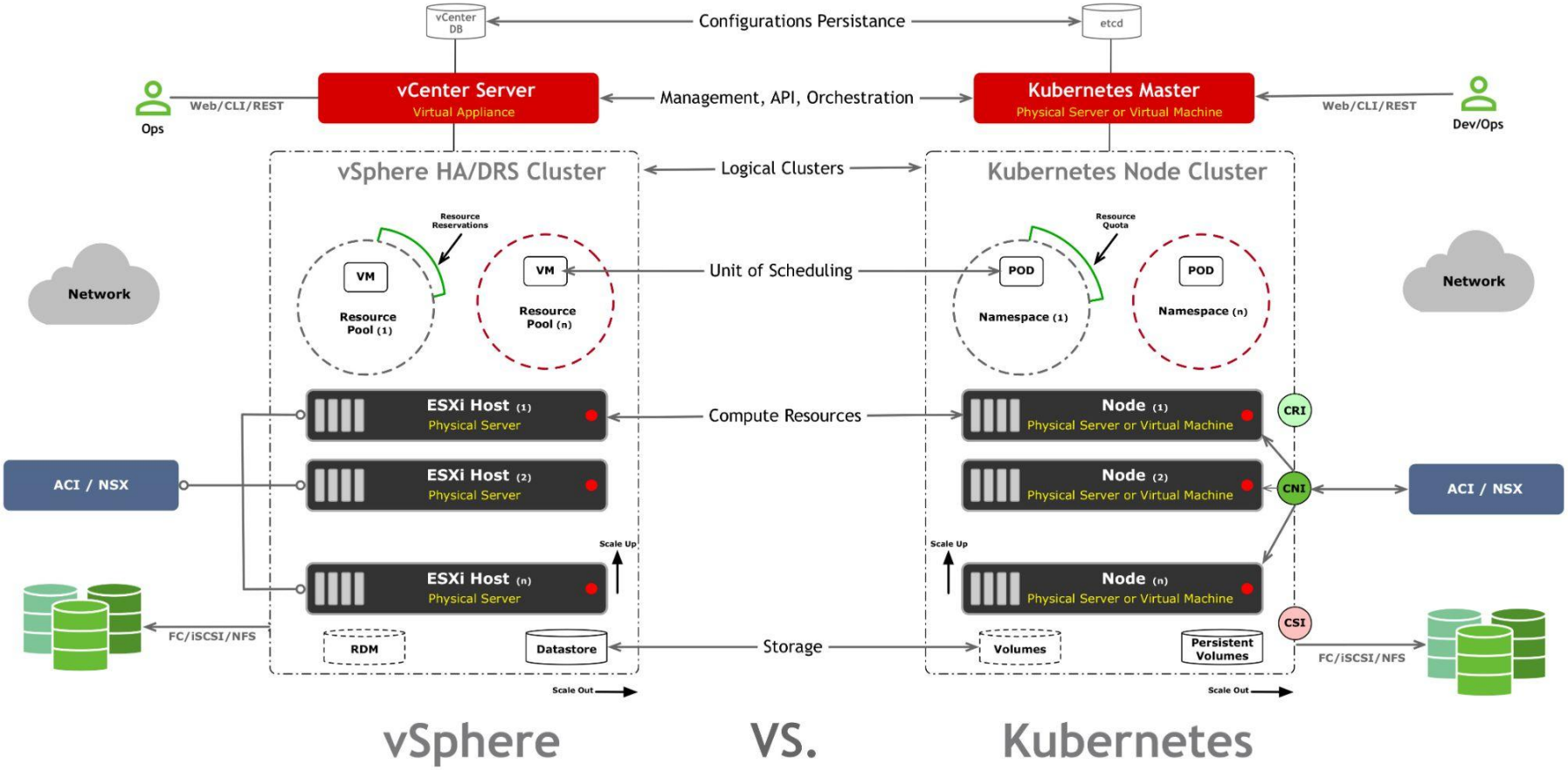

Control Planes
(hosted in bare metal)
Worker Nodes
(hosted clusters in VMs on OpenShift)
...
etcd
api-s erver
...
etcd
api-s erver
...
etcd
api-s erver
VM worker
VM worker
VM worker
VM worker
VM worker
VM worker
VM worker
VM worker
VM worker
Virtual Machines
OpenShift Virtualization
Physical Hardware

Red Hat



vSphere VS. Kubernetes

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Bare Metal ESXI

OpenShift Virtualization:

- ➔ Node/RHCoreOS
- ➔ A node is a virtual or bare-metal machine in a Kubernetes cluster
- ➔ Red Hat Enterprise Linux CoreOS (RHCOS) represents the next generation of single-purpose container operating system technology by providing the quality standards of Red Hat Enterprise Linux (RHEL) with automated, remote upgrade features.

Distributed Resource Scheduler

OpenShift Virtualization:

- ➔ The equivalent of VMware DRS (Distributed Resource Scheduler) in OpenShift Virtualization would be OpenShift's built-in Kubernetes scheduler and resource management features, such as pod and node affinity/anti-affinity rules, and resource limits/requests for pods.
- ➔ These features allow for the efficient scheduling and placement of workloads within the OpenShift cluster, and can be used to ensure high availability of applications by spreading them across multiple nodes.
- ➔ Additionally, OpenShift's support for Kubernetes Operators can also provide advanced automation of resource management and scaling.

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High Availability

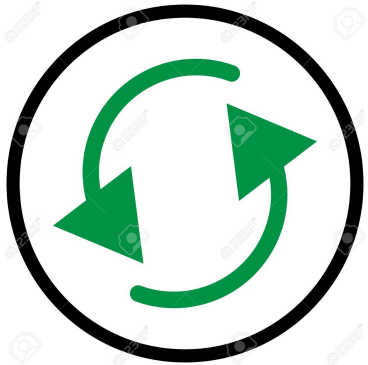
OpenShift Virtualization:

➔ The equivalent of VMware High Availability in OpenShift Virtualization is called HA Cluster, which allows for the automatic failover of virtual machines to a different host in the event of a host failure.

vMotion

OpenShift Virtualization:

- ➔ The equivalent of VMware vMotion in OpenShift Virtualization is called Live Migration.
- ➔ It allows for the live migration of virtual machines between nodes without any downtime, ensuring high availability and reducing maintenance windows.



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vSan

OpenShift Virtualization:

- ➔ OpenShift Virtualization, on the other hand, is built on top of Kubernetes and is designed to work with containers, rather than virtual machines.
- ➔ Our solution is Red Hat OpenShift Data Foundation which is software-defined storage for containers.

Red Hat

vCenter

OpenShift Virtualization:

- ➔ OpenShift Virtualization Manager, which is a web-based management console for managing and deploying virtual machines on OpenShift.
- ➔ It allows for creating and managing virtual machines, networks, and storage, as well as monitoring the performance and health of the virtualized environment.
- ➔ It also provides a centralized management interface for OpenShift Virtualization, similar to how vCenter provides centralized management for VMware environments.

Site Recovery Manager

OpenShift Virtualization:

- ➔ OpenShift Virtualization is the OpenShift Cluster-API, which allows for automated recovery and failover of OpenShift clusters in a disaster recovery scenario.
- ➔ Additionally, OpenShift Virtualization also supports the use of third-party disaster recovery solutions such as Velero (and more) to perform backup and restore operations of virtual machines.
- ➔ OpenShift Data Foundation also offers local and Metro failover/recovery options.

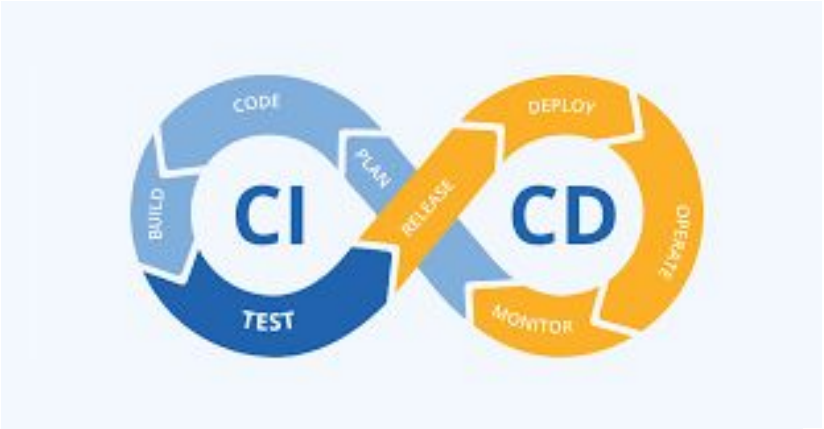
VMWare Tools

OpenShift Virtualization:

- ➔ The QEMU guest agent is a daemon that runs on the virtual machine (VM) and passes information to the host about the VM, users, file systems, and secondary networks.
- ➔ You must install the QEMU guest agent on VMs created from operating system images that are not provided by Red Hat.
- ➔ For Windows virtual machines (VMs), the QEMU guest agent is included in the VirtIO drivers. You can install the drivers during a Windows installation or on an existing Windows VM.

OpenShift Virtualization Automation Options

Open Source = Open Standards



PowerShell

Terraform

ANSIBLE

Jenkins

API

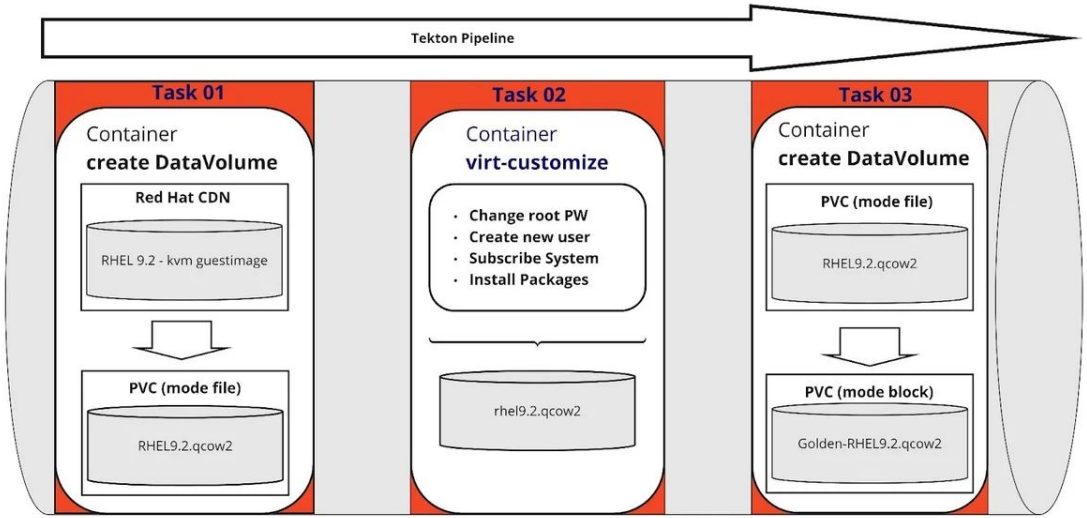
YAML

TEKTON

Bash

Red Hat

Building VM images using OpenShift Pipelines (Tekton)



- **Task 01** will supply a container which handles the creation of a DataVolume. This DataVolume is importing the RHEL KVM guest image in qcow2 format (source), into a PVC (target).The PVC will be created in volumeMode 'Filesystem' so it can be natively consumed by the virt-customize container in the next step.
- **Task 02** will supply a container which is running virt-customize and mounts the PVC containing the qcow2 image in a well-known path to execute the virt-customize commands upon. Both the name of the PVC and the customize commands are expected parameters of this task.
- **Task 03** acts very similarly to Task 01 as both create a DataVolume, but in this case the source is pointing towards your PVC, which contains the now manipulated qcow2 image and will transfer it into a PVC with volumeMode 'Block', which is then ready to be cloned and consumed by virtual machines in the OpenShift Cluster. This new PVC will be your ready-to-use, customized 'golden image.'

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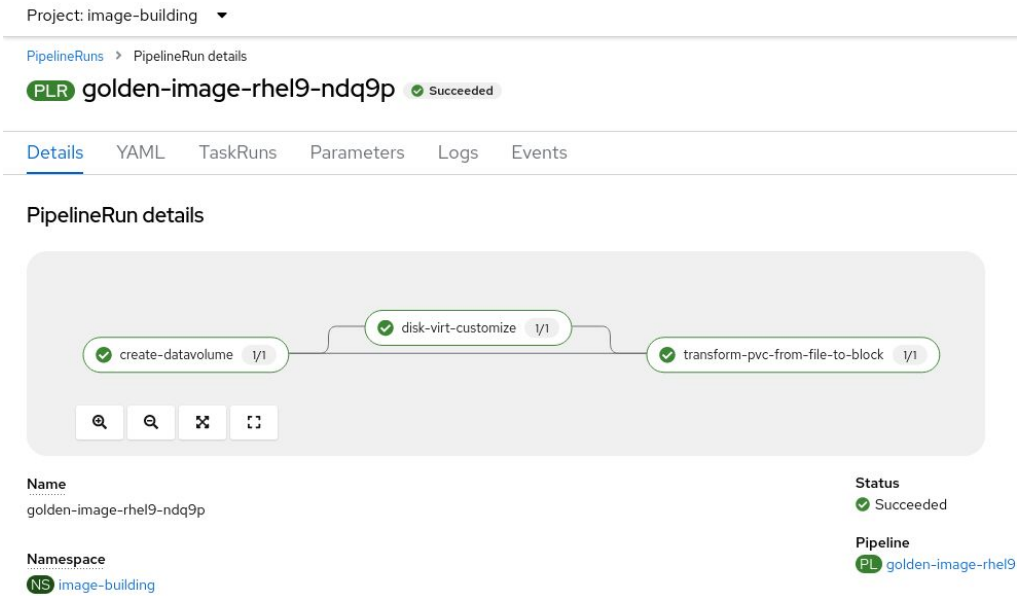
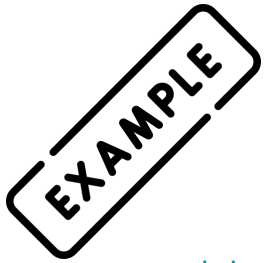
Openshift Pipelines Example





Let's see an example!

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OpenShift GitOps

Treat everything as code

➔ Define the state of infrastructure, applications, and configurations with declarative code across environments

Git as the single source of truth

➔ Infrastructure and applications are stored and versioned in Git allowing for traceability and visibility into changes that affect their entire state

Operations through Git workflows

➔ View history, apply and deploy changes directly to target infrastructure and applications through Git workflows

Enhanced security

➔ Preview changes, detect configuration drifts, and take action

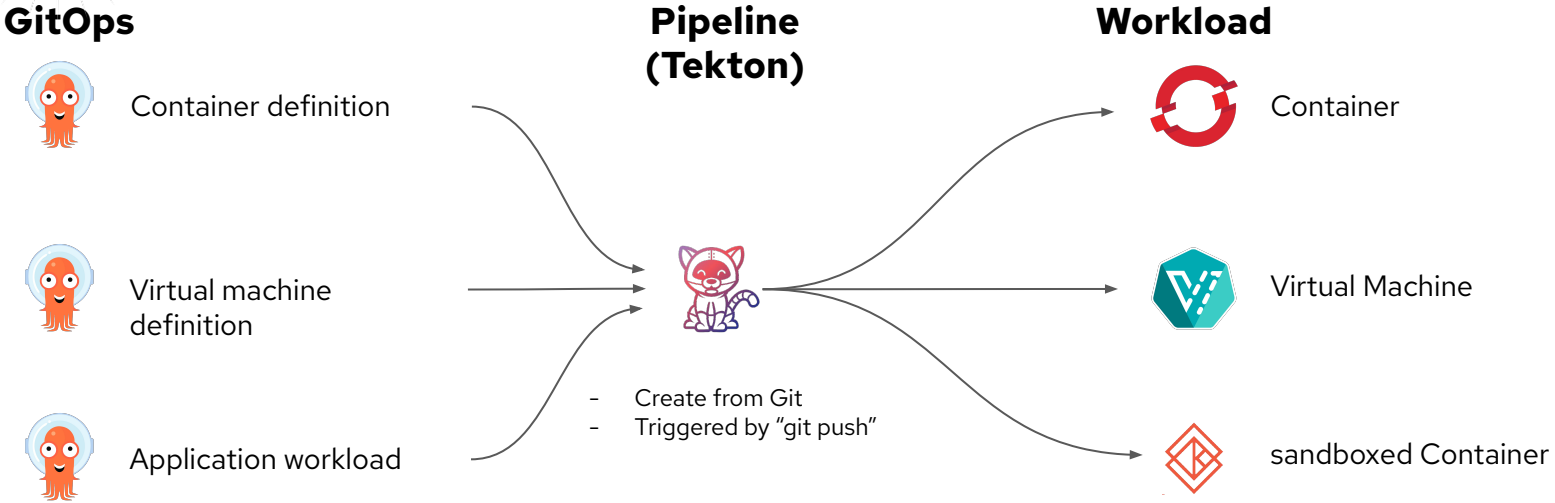
Visibility and audit

➔ Capture and trace any change to clusters through Git history

Multi-cluster consistency

➔ Combine GitOps with Advanced Cluster Manager for Kubernetes to configure multiple clusters and deployments reliably and consistently

VMs as Code-Wrapping it up



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Question #1

Is OpenShift Virtualization included in an Openshift Entitlement (Subscription)?

Question #2

Is there an additional charge to work with your Account Team outside of a Subscription?

Question #3

Red Hat Summit is in May of 2024?

Where is this being held?

Question #4

Red Hat announced Developer Hub in 2023 – what Community does this pull in support for?

Wrapping it Together