

Red Hat OpenShift Virtualization

VMA WorkShop Day One

Alfred Bach

Principal Learning and Development Instructor

AGENDA



- STRATEGY & FIELD POSITIONING
- TECHNICAL DISCOVERY & ASSESSMENT
- PLANNING & CUSTOMER ENGAGEMENT

Agenda Day 1

09:00 - 10:15

- Welcome and Introductions
- Sales Motion and Getting the Technical Win (GTM Strategy)
- OpenShift Virt Overview
- OpenShift Virt - Storage
- OpenShift Virt - Networking
- Access to the Hands-On Lab

10:30 - 12:00

- LAB - OpenShift Virtualization Basics
- LAB - Network Management
- LAB - Storage Management

12:00 - 13:00 Lunch

13:00 - 14:45

- VMware vSphere Overview Presentation
- VMware to OpenShift Presentation

14:45 - 15:00 BREAK

15:00 - 15:45

- LAB - Migration from VMware to OpenShift

15:45 - 17:00

- Migration Factory
- Deep Dive on the Migration Factory offering



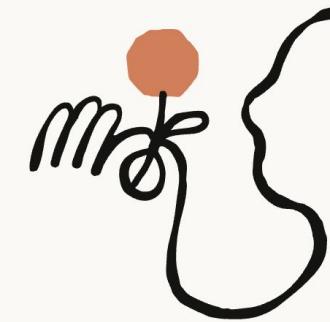
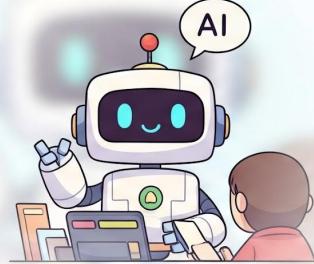
<https://github.com/RHEPDS/VMA-Partner-WS>

In our days

Let's use AI

claude.ia

NotebookLM

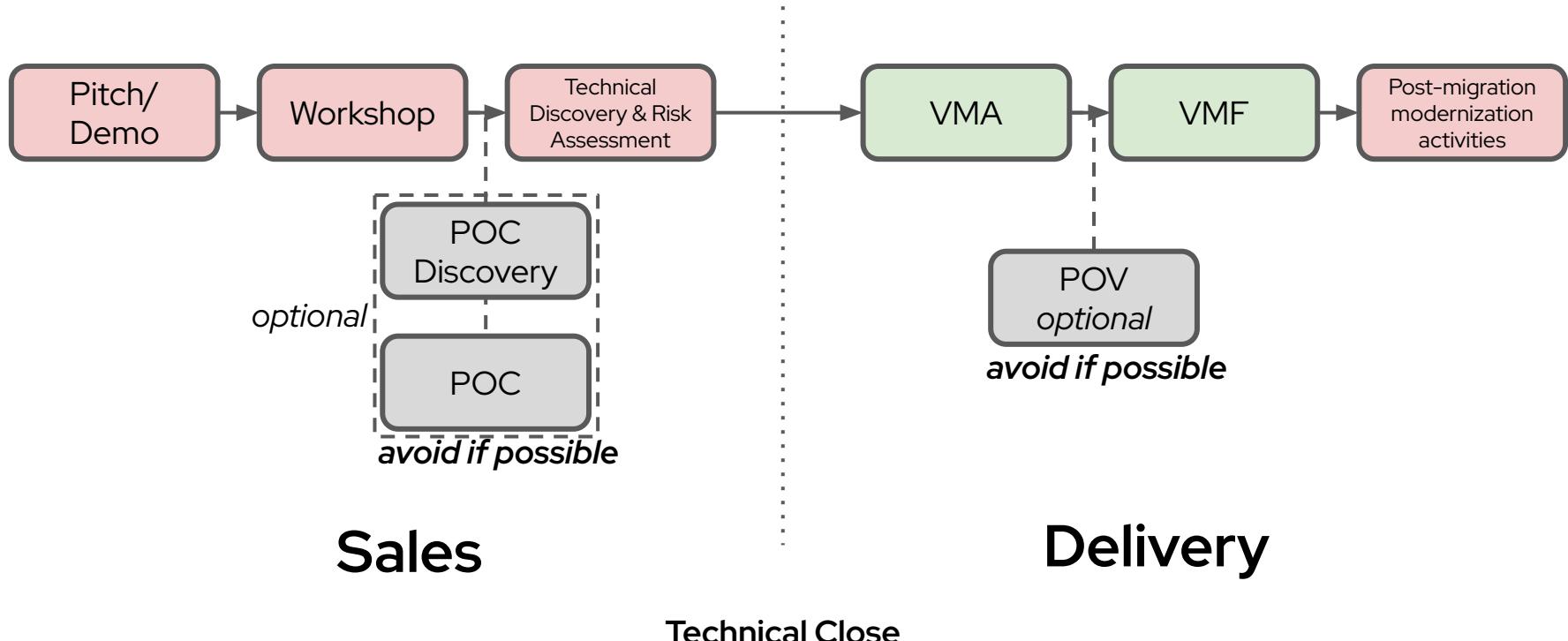


⟳ NotebookLM

Imagine you live here but the landlord



Optimal Virt sales and delivery path



Mentimeter



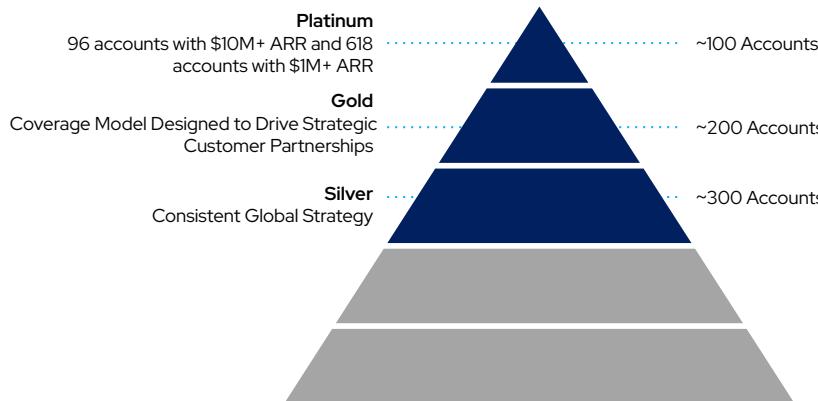
<https://www.menti.com/ala2jnwiypz>

[Link to Mentimeter](#)

The announcement of Broadcom to Acquire VMware has sparked concerns in the industry.

Technology Risk

With the announcement of the new Go-to-Market Model by Broadcom to focus on the **top 600 accounts** globally leaves many enterprises in open.



Increase of cost of virtualization software and subscription[#]



Reduction of enterprise support for non-focus accounts

[Partner Connect](#)[Your Profile](#)[Promotions](#)[Support Center](#)

VMware Partner Programs Termination Notice

For more than two years, VMware has outlined its plan to transition from a perpetual to a subscription-based business model. This is consistent with the overall market trend toward cloud operating models and was reinforced with the launch and evolution of VMware's Partner Connect Program.

On December 11, 2023, VMware by Broadcom announced its simplified licensing model and solution portfolio. Broadcom and VMware are driven by technology and innovation and have a shared passion for, and commitment to, partner profitability and success. You are now well positioned to capture substantial growth opportunities for delivering advanced, innovative cloud infrastructure and associated services wherever your customers need.

Disruptions to VMware Partners...

Broadcom Takes Top VMware Accounts Direct 'Effective Immediately'

BY O'RYAN JOHNSON ►

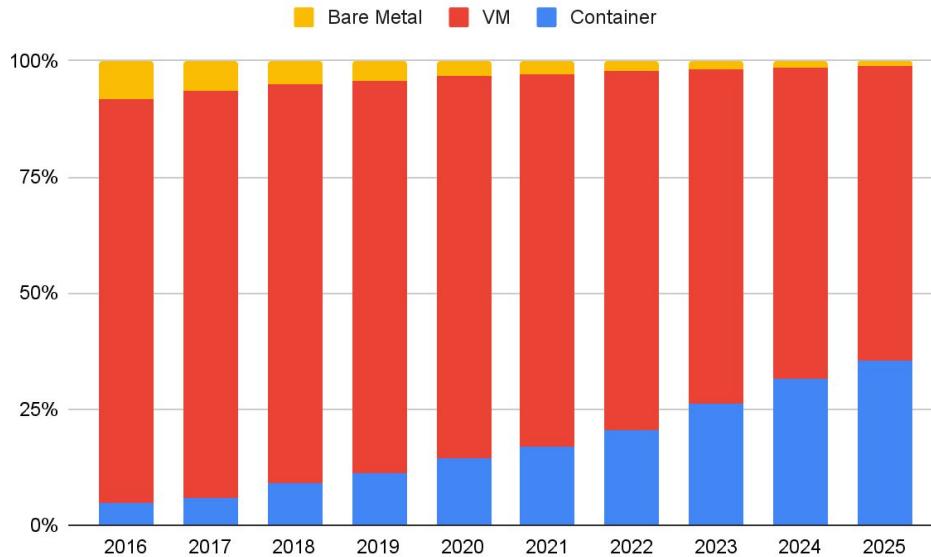
JANUARY 8, 2024, 8:42 AM EST

'Effective Immediately: Strategic customer segments are no longer eligible for Opportunity Registration,' Broadcom wrote to partners in a newly issued Opportunity Registration Policies, according to material obtained by CRN.



Virtualization is here to stay

But not as we know it today



Source: IDC Container Infrastructure Software Market Assessment: Container Deployment Forecast, 2022–2025 (IDC #US48670722, January 2022)

De-Risking Your Virtualisation Technology Investment

Future-Proof Your Virtualization Strategy

New and modern applications will be built on containers. They provide new levels of agility and empowers organisations to accelerate their digital capabilities.

However, **not all applications** can or are **ready** to be containerized and operate in microservices.

In most organizations, the **journey** will be a **multi-phased approach**, requiring IT operations to maintain and **coexist** workloads with both virtual machines and containers in their IT landscape.

1

Rehosting by “shifting” virtual machine workloads into the OpenShift platform

2

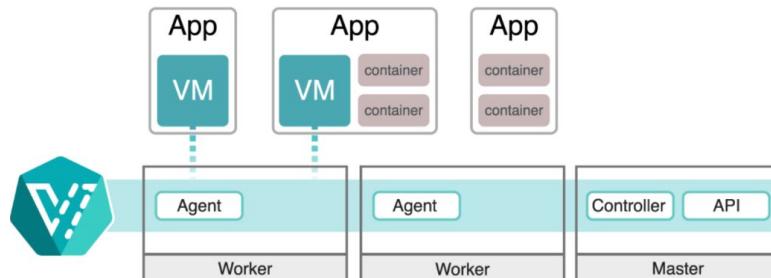
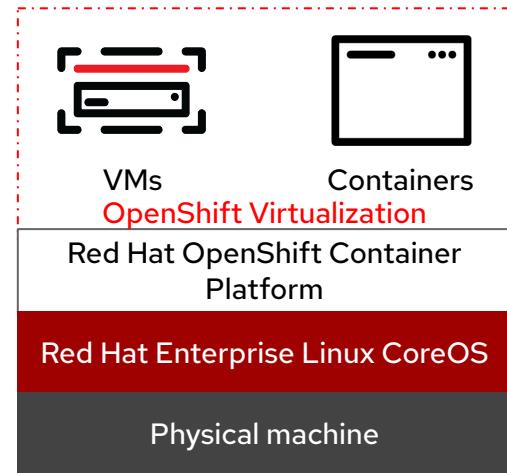
Replatform by “upgrading” the application into a container-based architecture

3

Refactor applications from monolithic to microservices

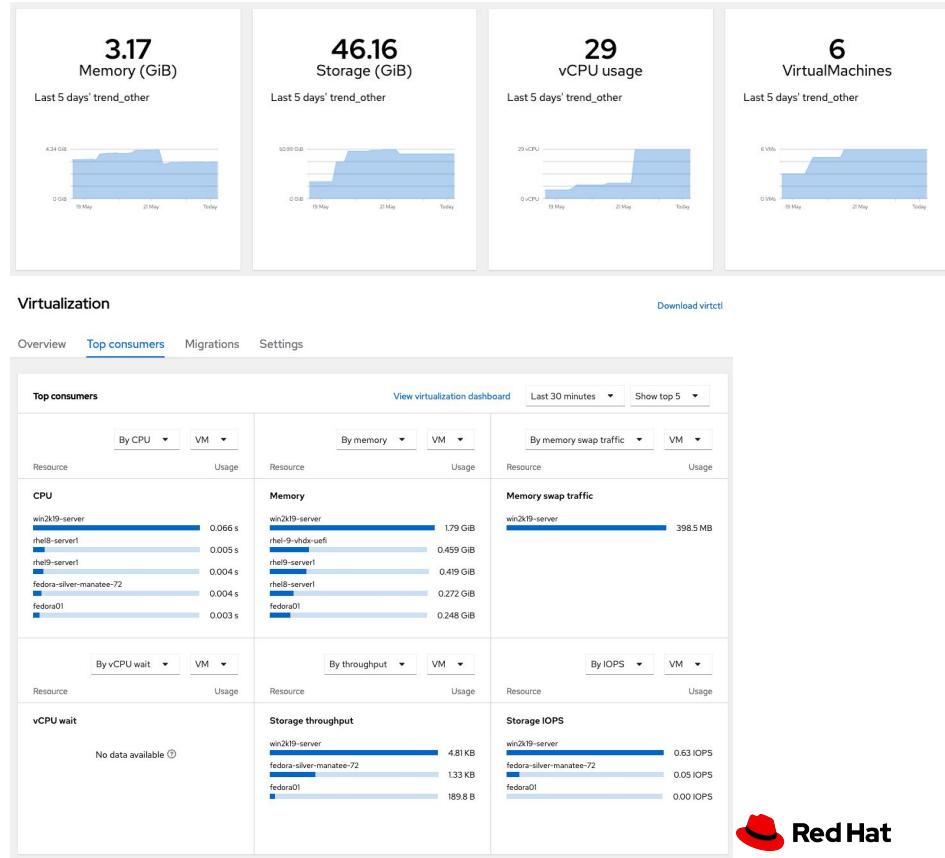
What is OpenShift Virtualization?

- Unified platform for running VMs and Containers
- Include features of the OpenShift application platform
- Run VMs in OpenShift
- Performance, stability, scalability, and reliability of KVM, the Linux kernel-based hypervisor
- Manageability and ecosystem of OpenShift
- Supports Microsoft Windows guests – Microsoft Server Virtualization Validation Program (SVVP)



OpenShift Virtualization Overview

- Virtual Machine
 - Provisioning, Deprovisioning
 - Life Cycle Management
 - Live Migration (vMotion equivalent)
- Platform
 - Storage
 - Software Defined (Block, File, NFS, Object Storage)
 - Traditional Storage with Container Storage Interface
 - Dell, EMC, HPE, Hitachi, IBM, Pure etc
 - Network
 - Software Defined (OpenShift OVN)
 - Multiple Networks with VLANs segregation (Multus)
 - Load Balancing
 - MetalLB, F5 etc
- Backup and Restore
 - OADP (Valero), Kasten, Portworx, NetApp, Veritas etc
- Migration to OpenShift
 - vSphere, ESXi, OVA
 - Red Hat Virtualization, OpenStack
 - Hyper-V and other KVM variants (Automate with Ansible)



Hybrid cloud application platform



**Red Hat
OpenShift**

Advanced Management & Security

Multicluster Management | Cluster Security | Global Registry | Cluster Data Management | Compliance & Policy Automation

Integrated DevOps Services

Service Mesh | Serverless | Builds | Pipelines | GitOps | Tracing | Log Management | Cost Management

Containers

Image Registry | Container Runtime | Pod Autoscaling | Resource Quotas & Limits | Namespace Isolation | Container Networking

VMs

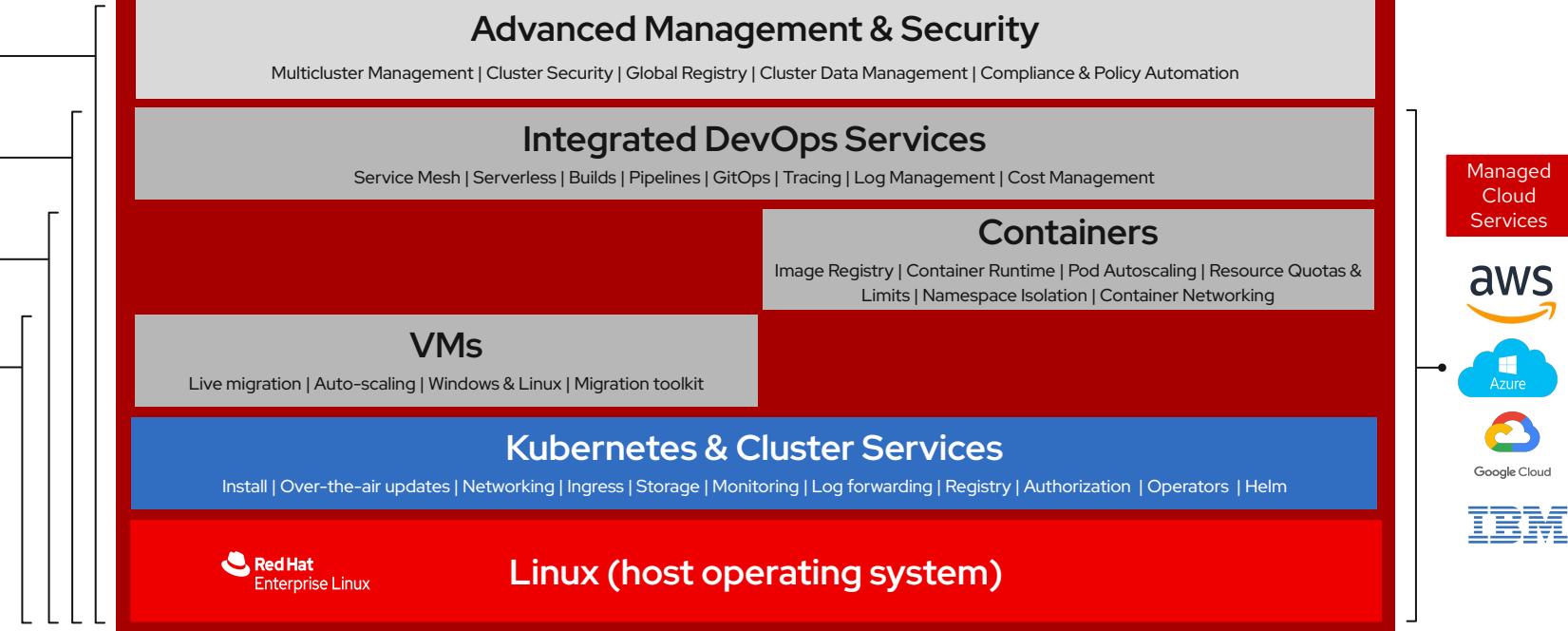
Live migration | Auto-scaling | Windows & Linux | Migration toolkit

Kubernetes & Cluster Services

Install | Over-the-air updates | Networking | Ingress | Storage | Monitoring | Log forwarding | Registry | Authorization | Operators | Helm



Linux (host operating system)



Physical



Virtual



Private cloud



Public cloud



Edge



Migration Toolkit for Virtualization (MTV)



Main Features:

- Easy to use UI
- Mass migration of VMs from VMware, Red Hat Virtualization, OpenStack to OpenShift and between OpenShift Clusters
- VM data pre-copied before shutdown (Warm Migration) for VMware and Red Hat Virtualization migrations
- VM validation service:
 - Runs checks on VM configuration to avoid migration issues
- Parallelized VM Conversion
 - Maximize Throughput
- Migration Network Selection
 - Avoid impact on other running workloads

The screenshot displays the Red Hat OpenShift MTV interface. It features two main panels: 'Providers' and 'NetworkMaps'.
Providers: This panel lists three providers: vSphere (VMware source), iHV (oVirt source), and KubeVirt. Each provider entry includes status (Ready), endpoint URL, type, number of VMs, network count, host count, and a detailed view button.
NetworkMaps: This panel shows a single NetworkMap named 'vSphere-map'. It maps a 'Mgmt Network' (Datacenter/network/Mgmt Network) to a 'Pod network'. The status of the map is 'Ready'. The interface includes a sidebar with navigation links like Home, Operators, Workloads, Migration (selected), and Virtualization.

Modernize at your own pace

Legacy Virtualization

Apps in VMs

Slow evolution
⌚

Increasing costs
💲



Developer toil

Infrastructure Modernization

Apps in VMs



Cloud elasticity + scalability



Reduced cost



Increase IT efficiency +
reliability

Migration
Toolkit for
VMs

DevOps & Infrastructure Modernization

Apps in VMs or Containers



Innovate at speed



Higher annual revenue



Increased developer output

Cloud
Native

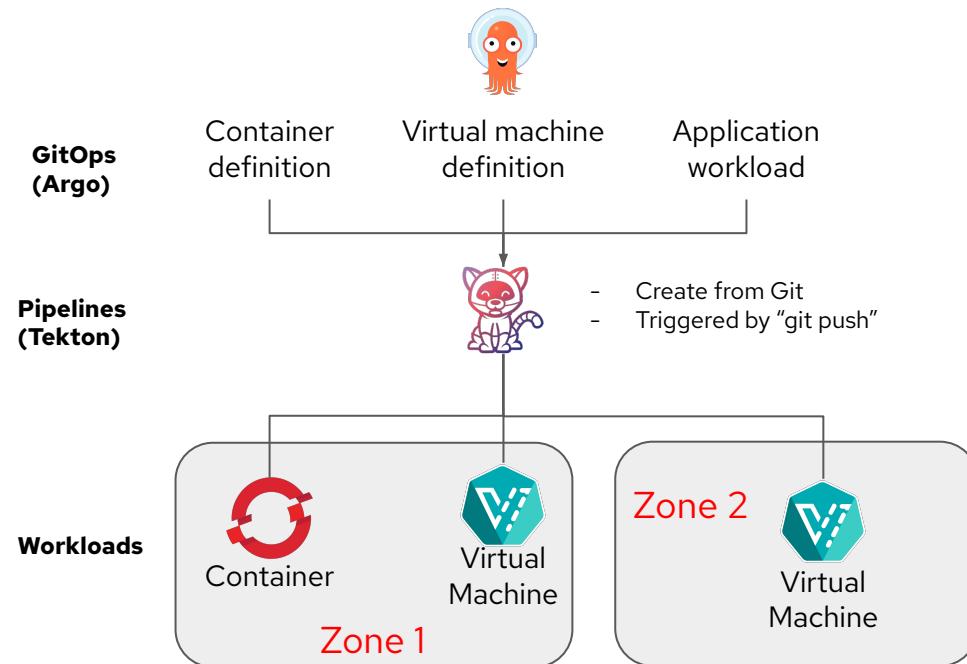
Direct path to cloud native

Speed of Infrastructure Deployment
Speed of Application Development



OpenShift Virtualization: Build Cloud-native VMs

Deploy VMs as Code with CI/CD



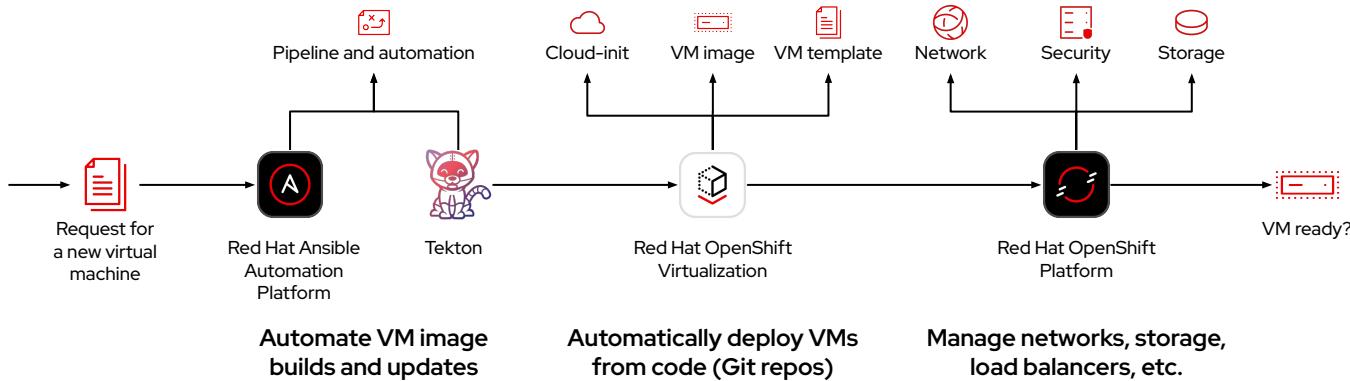
Integrate legacy VMs with a modern GitOps framework

- ▶ Deploy different security zones to run both composite applications of pods/VMs as well as traditional VM workloads
- ▶ Deploy and automate Virtual Machines as Code with GitOps

Next-generation approach to virtual machine provisioning

A process that can be optimized down to a few minutes

Virtual machine
▶ CPU: 4 vCPU, 1 core
▶ Memory: 16GB
▶ Disk: 30 GB
▶ OS: RHEL
Additional file systems
▶ Data: 500GB, disk
▶ Logs: 100GB, partition
Application platform
▶ JBoss 7.4 update 11
Firewall rules
▶ Ingress: SSH, HTTPS
▶ Egress: *.redhat.com
DNS and LB
▶ api.service.org
▶ Healthcheck: HTTPS port



Creating Mission Critical Virtualization with AAP



Virtualization Operations

Automate daily activities (remediation)

- ▶ Application deployments and CI/CD pipelines
- ▶ Life cycle management and enforcement
- ▶ OS patching (Windows and Linux) and maintenance
- ▶ Event Driven Remediation



Deployment and retirement

Provision, configure and teardown virtual instances

- ▶ Create turn key deployments for infrastructure teams
- ▶ Govern instance creation and enforce retirements
- ▶ Create service catalog items for ordering environments

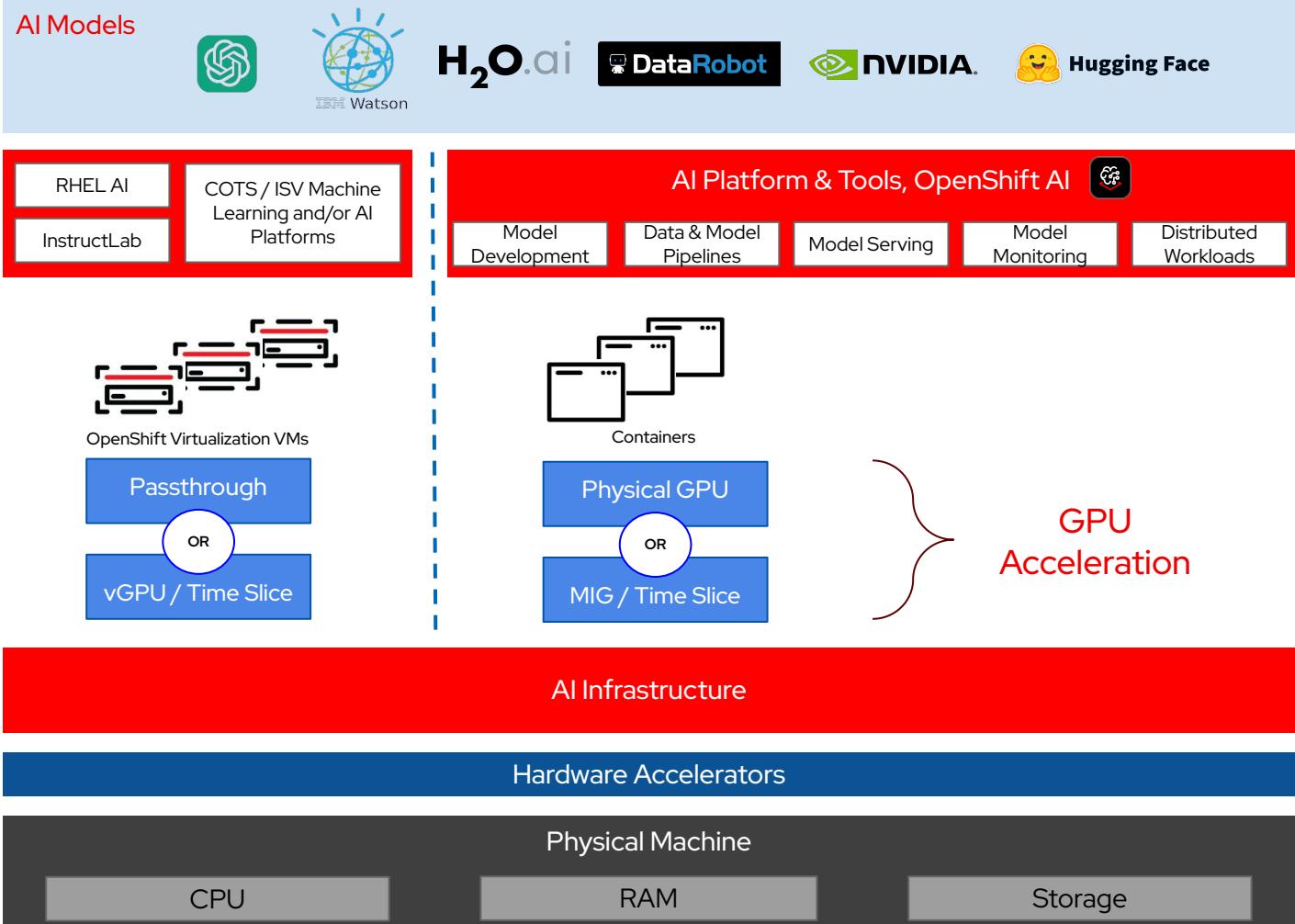


Virtual Machine migration

Move workloads to OpenShift safely

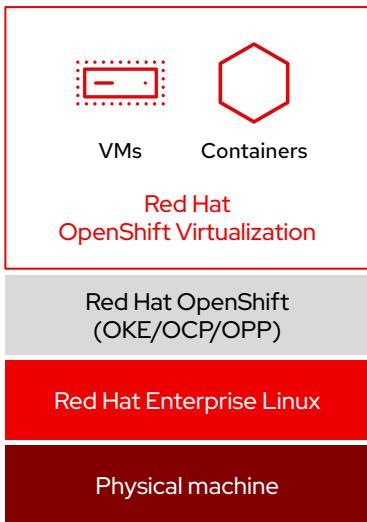
- ▶ Pre and Post processing for VM Migration from vSphere
- ▶ Last mile configuration checks

OpenShift Virtualization for AI



Red Hat OpenShift Virtualization

The modern option for general purpose virtualization



- ▶ **Unified platform**
for virtual machines and containers
- ▶ **Consistent management**
tools, interfaces, and APIs incl. ACM and AAP integrations
- ▶ **Performance and stability**
of Linux, KVM, and qemu
- ▶ **Healthy open source community**
the KubeVirt project is a top 10 CNCF active project, with 200+ contributing companies
- ▶ **Supports Microsoft Windows**
guests through Microsoft SVVP
- ▶ **Inbound guest migration**
using Ansible Automation Platform + Migration Toolkit for Virtualization, Training and Consulting
- ▶ **Diverse ecosystem**
of Red Hat & partner operators

OpenShift Virtualization Unlocks Tangible Value

COST EFFECTIVENESS



Lower TCO



Cloud-native approach to VM manageability minus the cost of proprietary SW

RISK MANAGEMENT



Highly resilient and scalable



Manage VM fleet with single-pane of glass with modern dashboard technology

ITERATIVE MODERNIZATION



Flexibility of approach



Traditional VM behavior while VMs participate in modern DevSecOps and GitOps pipelines via Infrastructure as Code



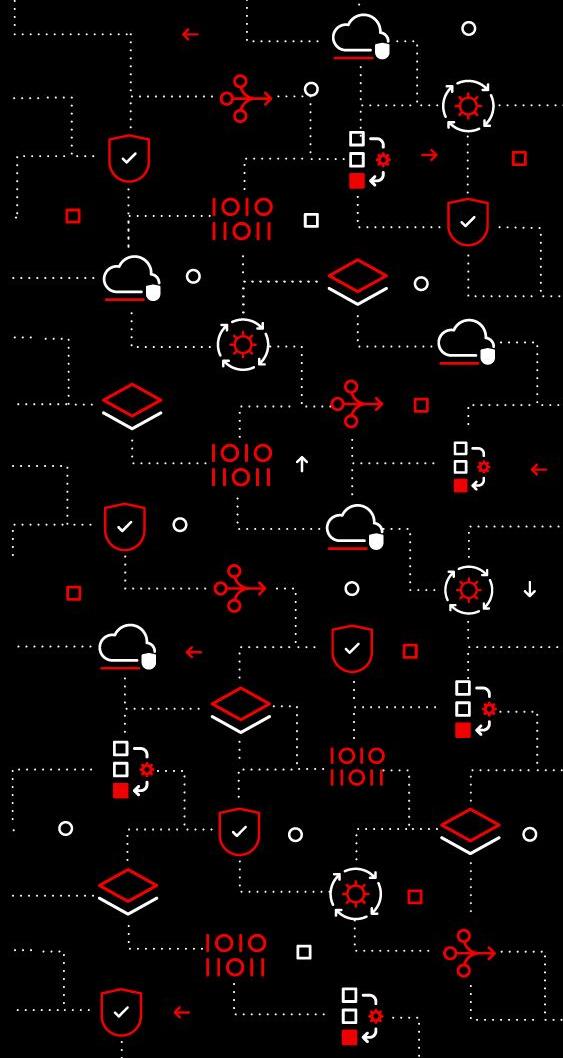
Up to 21% Higher Operational Infrastructure Efficiency*



Consistency of Management



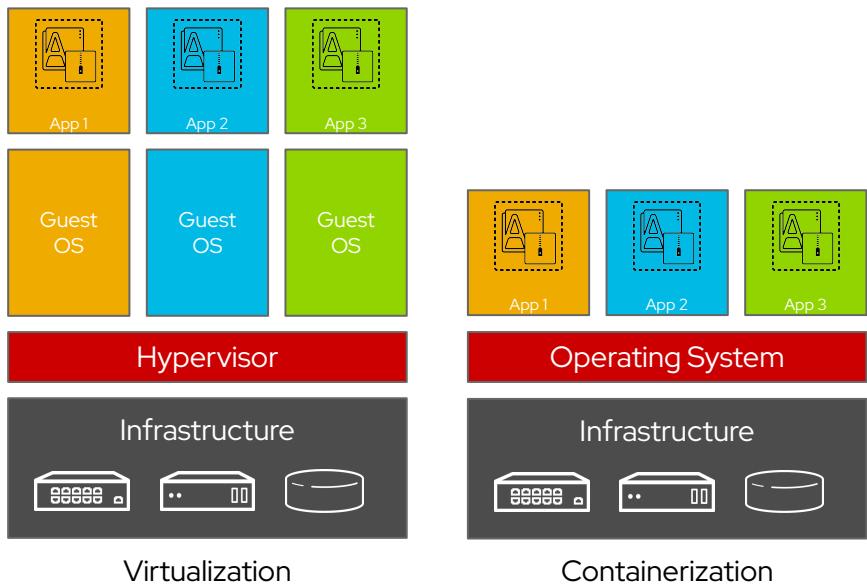
Up to 42% reduction of Unplanned Outages*



Deeper Dive into the Technology

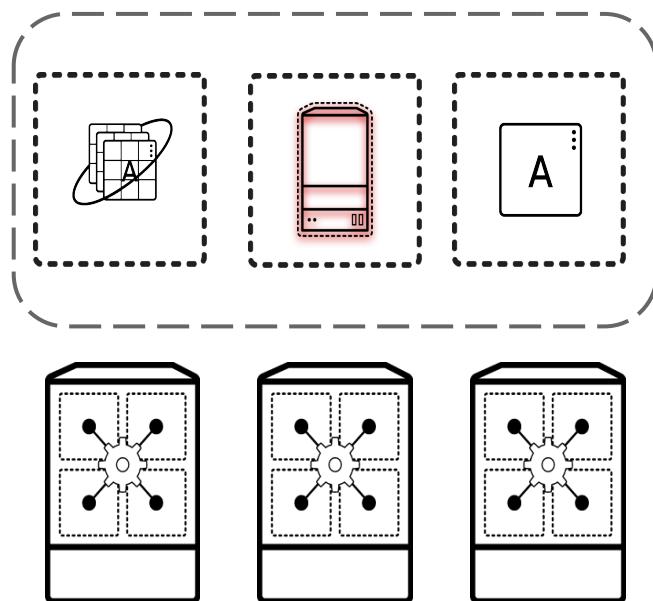
Containers are not Virtual Machines

- 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



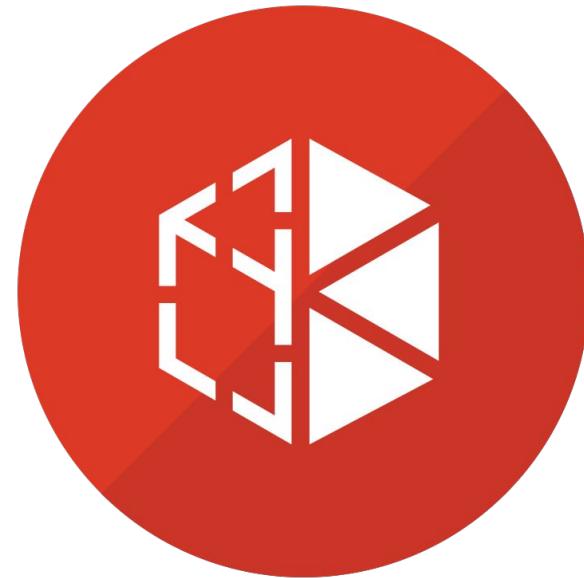
Virtual Machines can be put into Containers

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



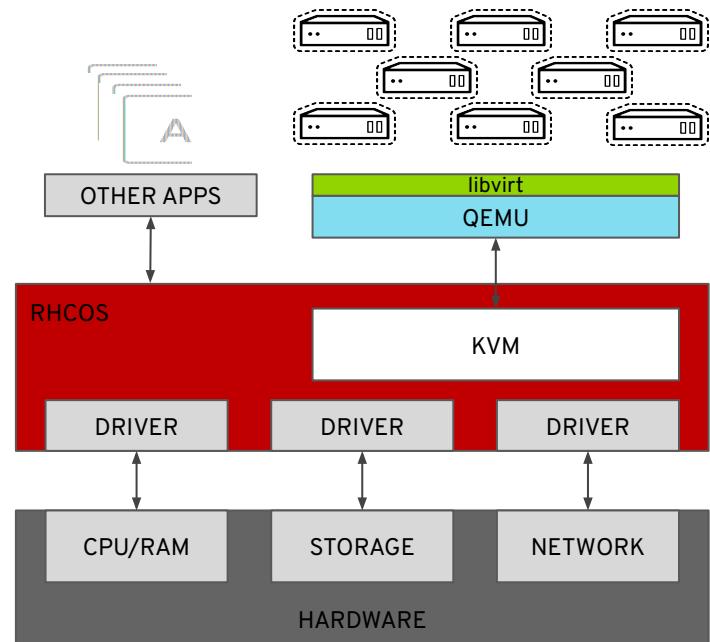
OpenShift Virtualization

- Virtual machines
 - Running in containers, managed as Pods
 - Using the KVM hypervisor
- Scheduled, deployed, and managed by Kubernetes
- Integrated with container orchestrator resources and services
 - Traditional Pod-like SDN connectivity and/or connectivity to external VLAN and other networks via multus
 - Persistent storage paradigm (PVC, PV, StorageClass)

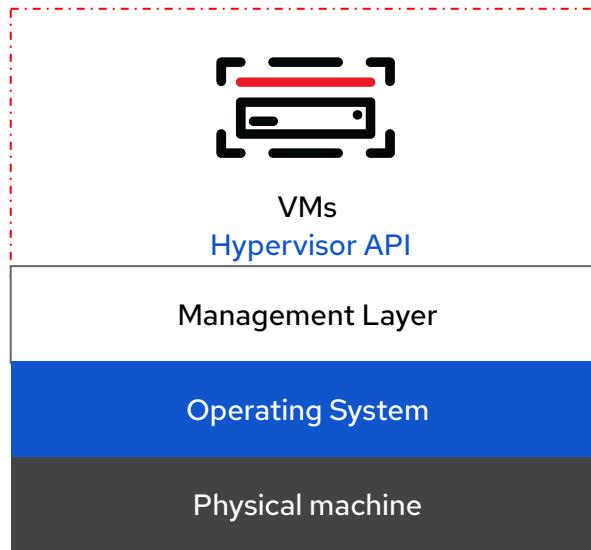


OpenShift Virtualization uses KVM

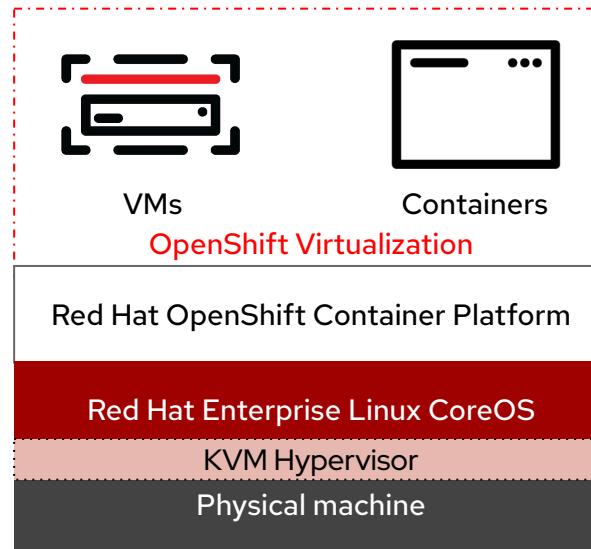
- OpenShift Virtualization uses KVM, the Linux kernel hypervisor
- KVM is a core component of the Red Hat Enterprise Linux kernel
 - KVM has 10+ years of production use: Red Hat Virtualization, Red Hat OpenStack Platform, and RHEL all leverage KVM, QEMU, and libvirt
- QEMU uses KVM to execute virtual machines
- libvirt provides a management abstraction layer
- Currently supported on x86 bare metal
- For other platforms contact Product Management for roadmap



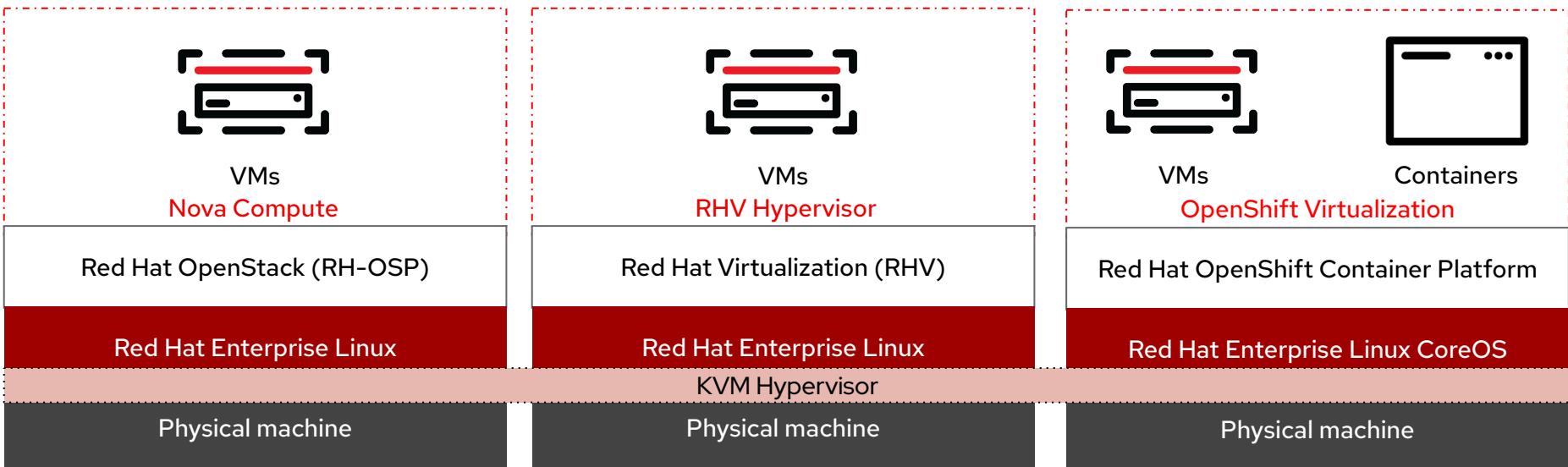
Traditional Type 1 Hypervisor



vs OpenShift Virtualization

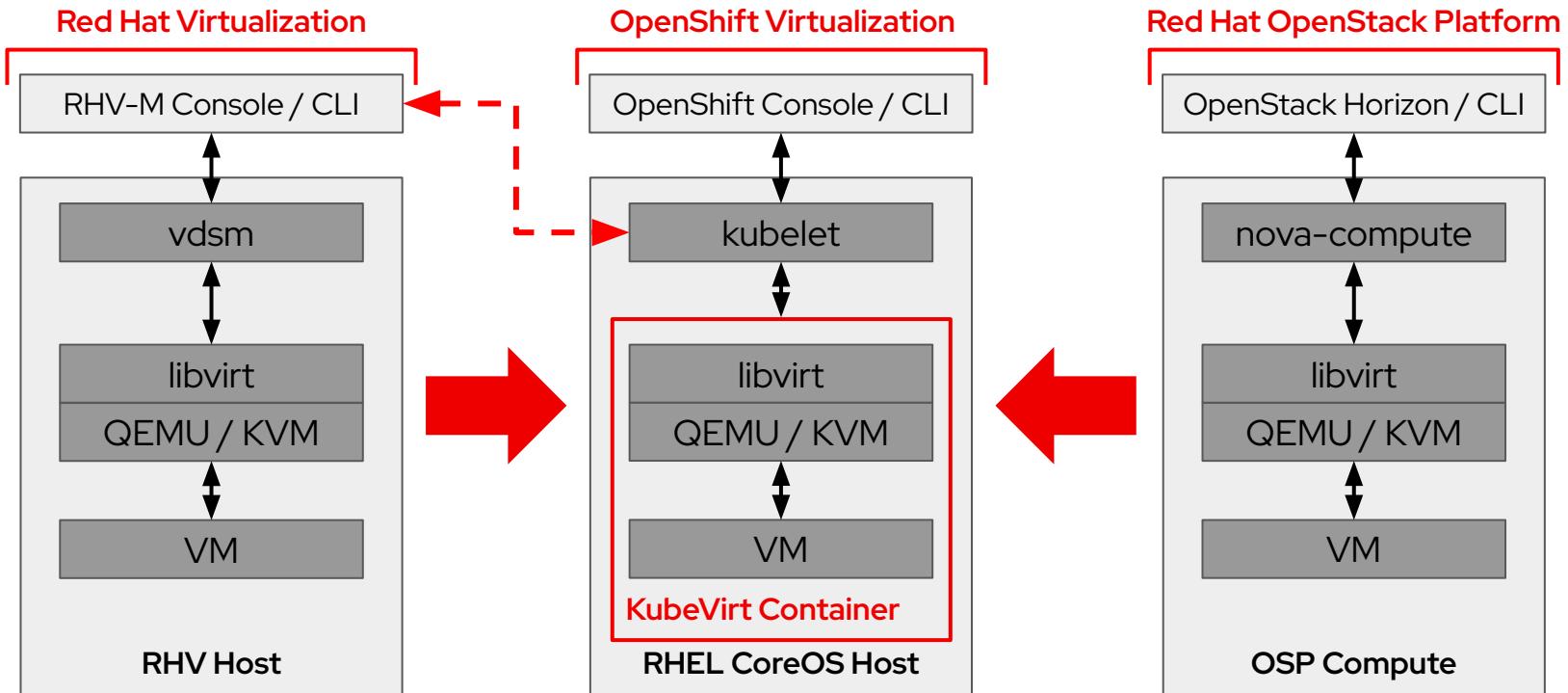


OpenStack vs RHV vs OpenShift Virtualization

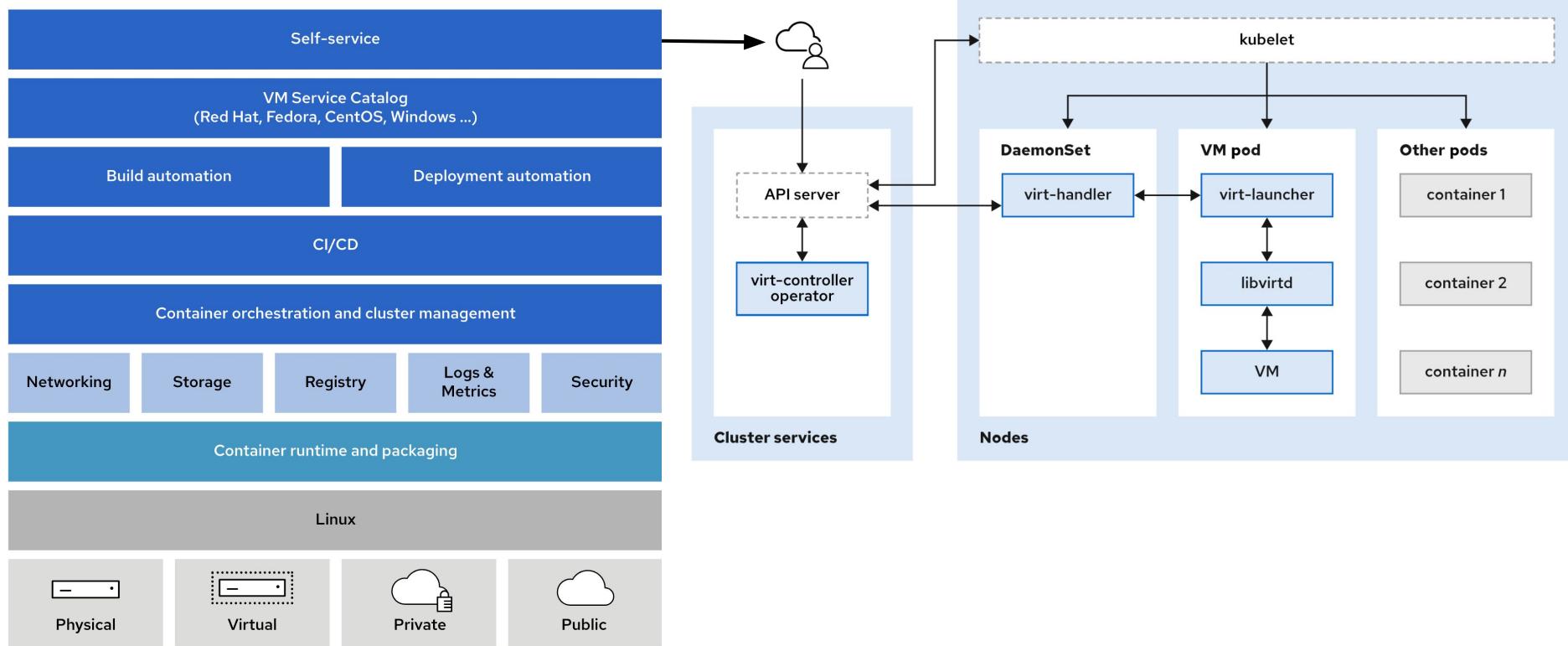


Containerizing KVM

Trusted, mature KVM wrapped in modern management and automation

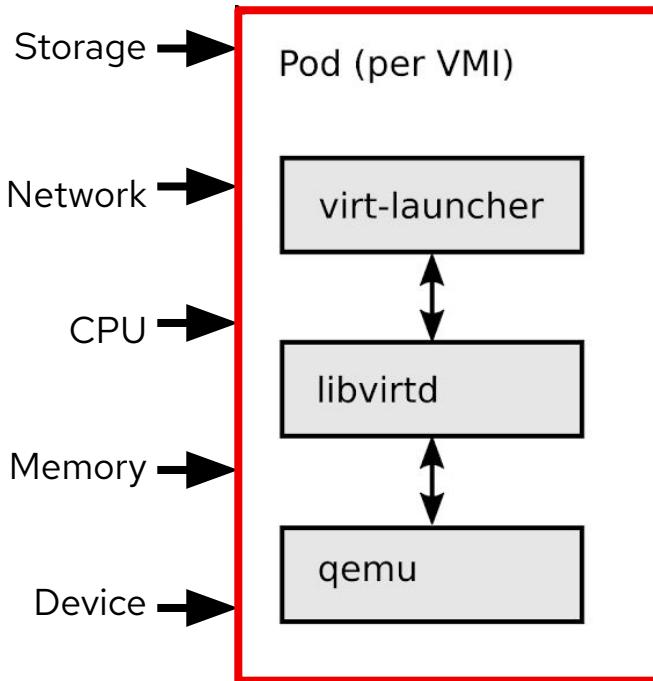


Red Hat OpenShift Virtualization Operator



Architecture of the OpenShift Virtualization Operator

Containerized Virtual Machines



Kubernetes resources

- Every VM runs in a launcher pod. The launcher process will supervise, using libvirt, and provide pod integration.

Red Hat Enterprise Linux

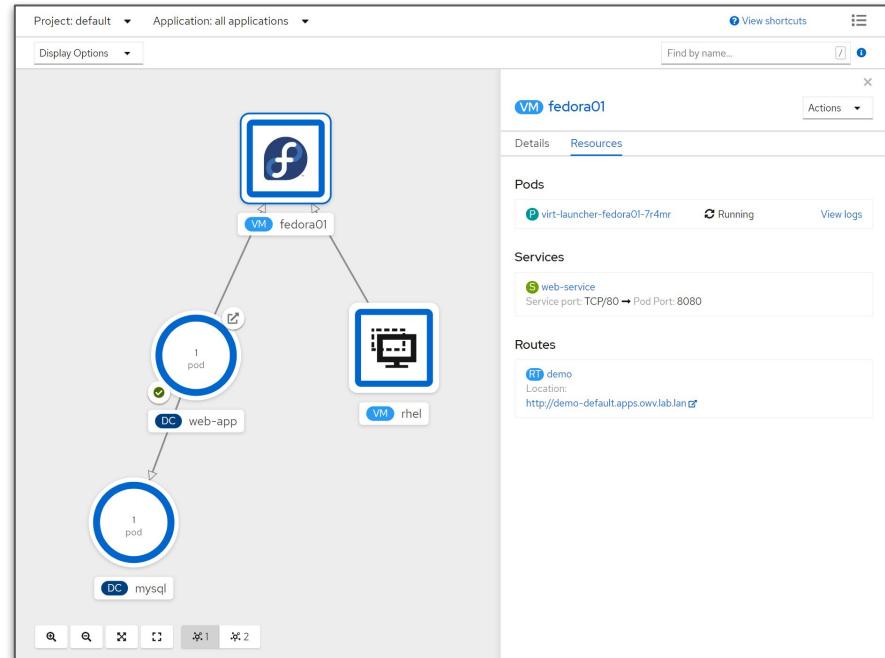
- libvirt and qemu from RHEL are mature, have high performance, provide stable abstractions, and have a minimal overhead.

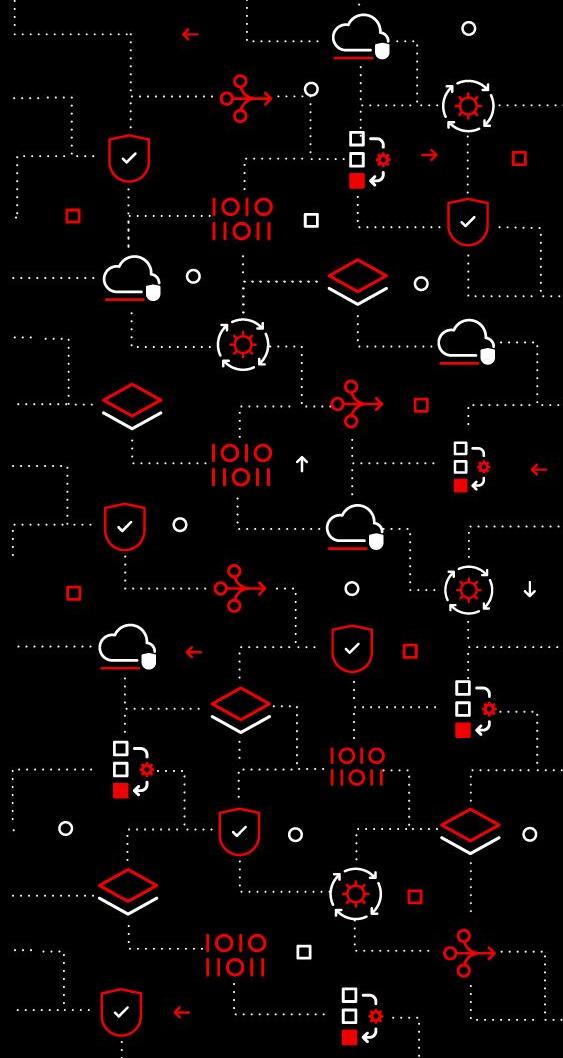
Security - Defense in depth

- Immutable RHCOS by default, SELinux MCS, plus KVM isolation - inherited from the Red Hat Portfolio stack

Using VMs and Containers Together

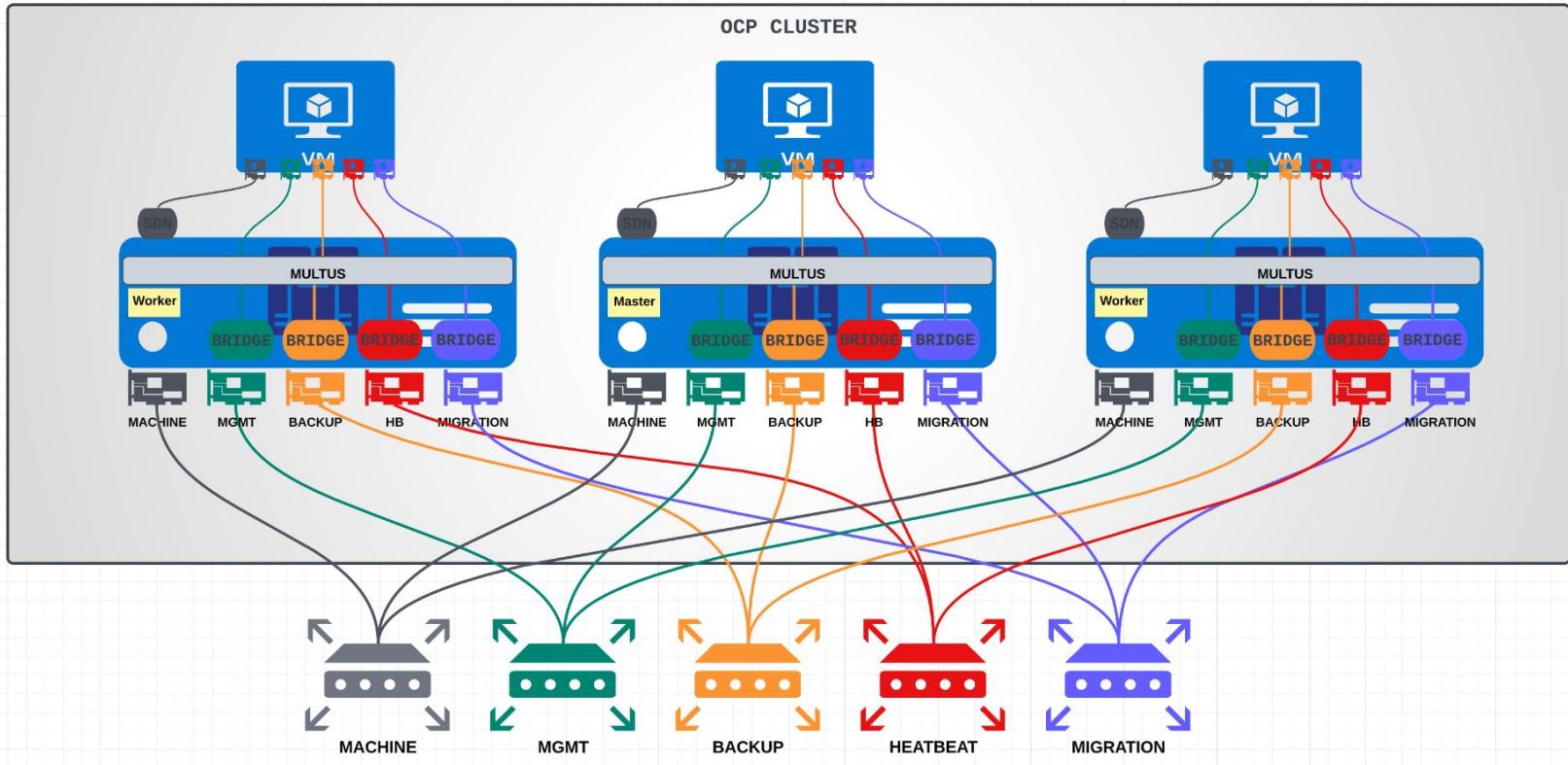
- Virtual machines connected to pod networks are accessible using standard Kubernetes methods:
 - Service
 - Route
 - Ingress
- Network policies apply to VM pods the same as application pods
- VM-to-pod, and vice-versa, communication happens over SDN or ingress depending on network connectivity





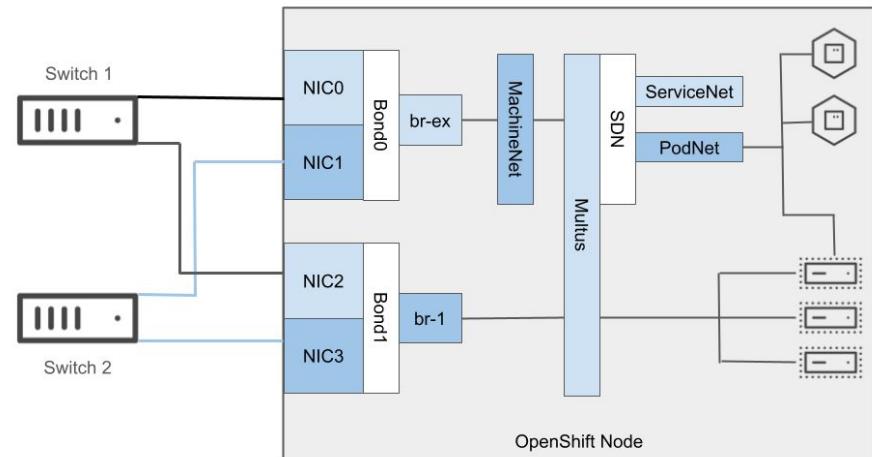
Networking

VM Multi-NIC High Level Architecture

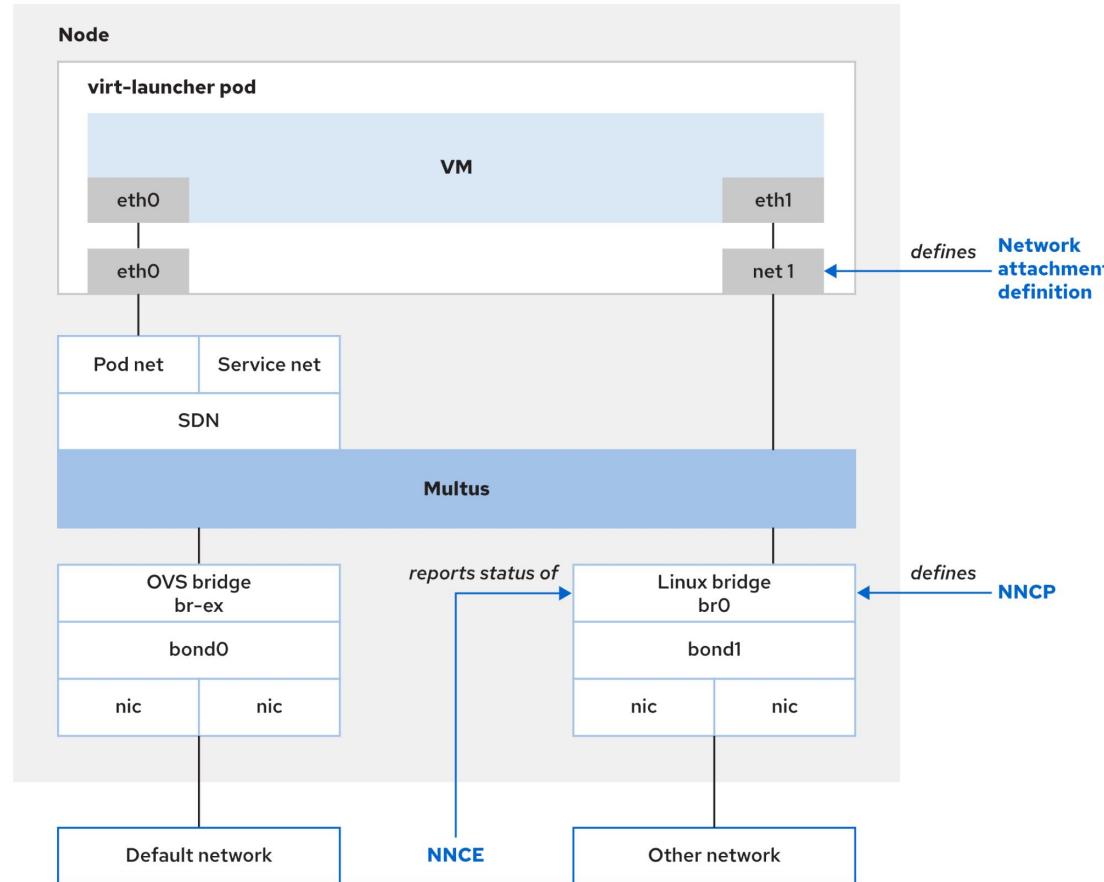


Physical Host Configuration, VM Connectivity

- Virtual machines optionally connect to the standard pod network
 - OVN-Kubernetes or partners (Tigera Calico/F5)
- Additional network interfaces accessible via Multus:
 - Bridge, SR-IOV, OVN secondary networks
 - VLAN and other networks
- NMstate applies declarative host network configuration to all machines which match the selector
 - Bond, bridge, OVS
- Node firewall and ingress/egress rules apply



Linux Bridge Node Networking with Multus and Kubernetes NMState

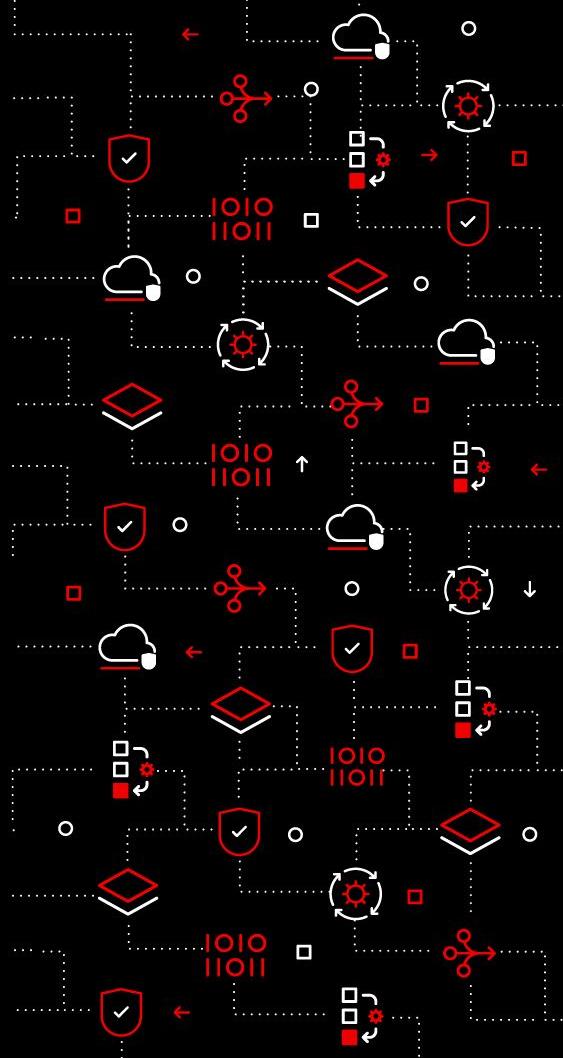


VM Networking in OpenShift Virtualization

- VMs connected to the SDN have the same functionality as Pods
 - Service-based discoverability and (internal) load balancing
 - Route-based external access
 - Ingress/egress throughput control
 - MetalLB for externally accessible load balanced connections
 - NetworkPolicy for microsegmentation
 - Service Mesh features and functions
- VMs connected to an OVN-K secondary network inherit functionality of OVN/OVS
 - MultiNetworkPolicy for microsegmentation
 - L2 topology for east-west isolated networks
 - Localnet topology for external access, including VLANs

OpenShift Virtualization Prior to 4.17+

- VMs connected to the SDN have the same functionality as Pods
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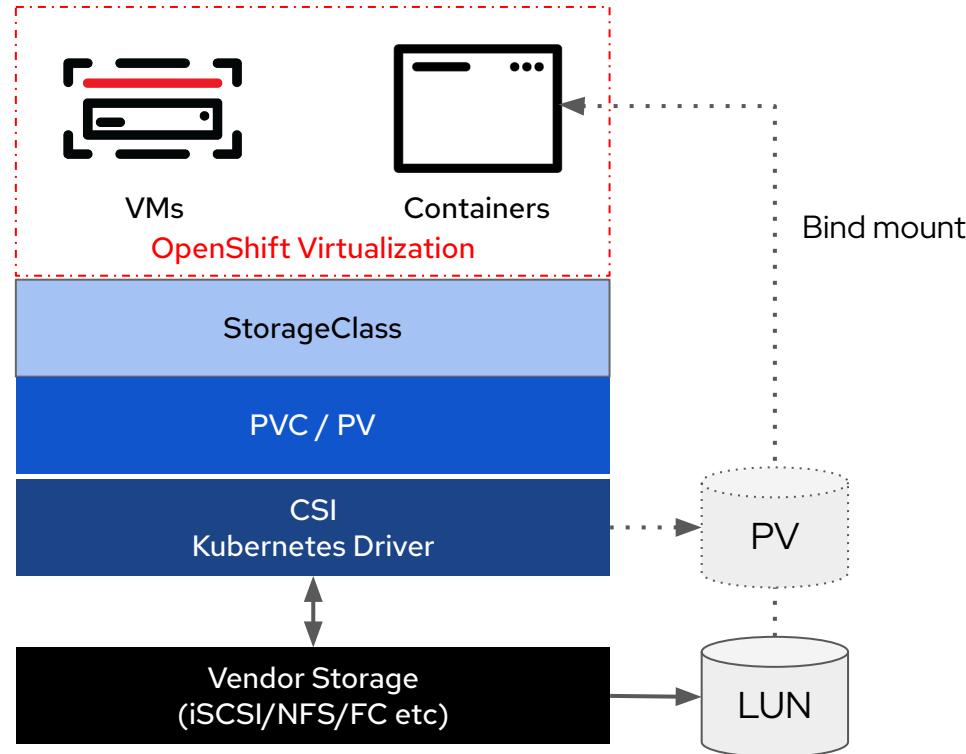


Storage

Policy Based Storage

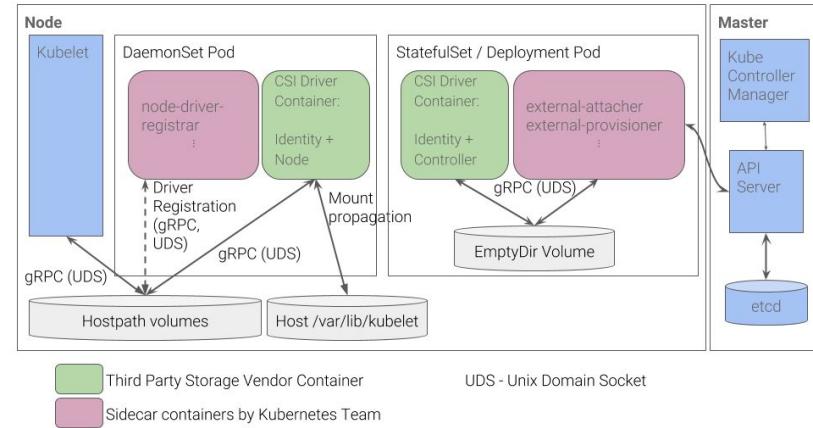
Type: Block, File or Object
 Gold, Silver or Bronze

Request: Block, 10GB
 Read-Write Many

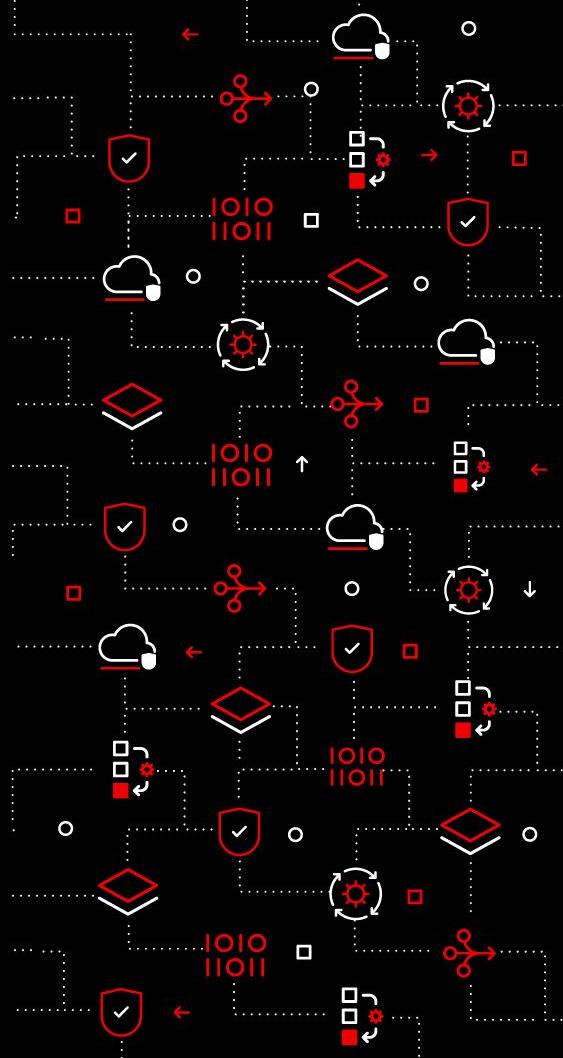


Container Storage Interface (CSI)

- Container Storage Interface (CSI) was proposed as a solution to problems faced by in-tree volume plugins
- CSI Specification defined APIs (RPCs) to enable:
 - Dynamic provisioning and deprovisioning of a volume
 - Attaching/detaching a volume from a node
 - Mounting/unmounting a volume from a node
 - Consumption of both block and mountable volumes
 - Creating and deleting a snapshot
 - Provisioning a new volume from a snapshot
- Storage vendors now had to develop only a single CSI Driver and it would work across a number of container orchestration (CO) systems.



CONTAINER
STORAGE
INTERFACE

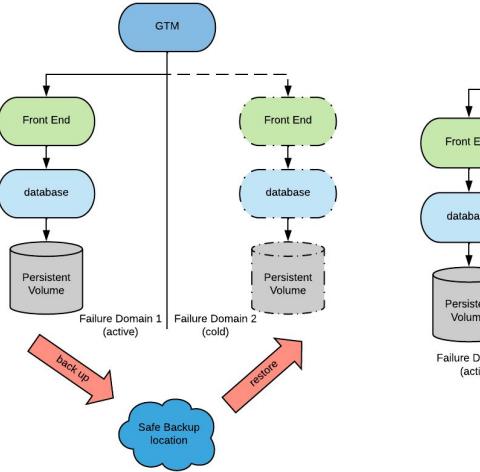


DR / HA

High-level DR Approaches

Failure Domain is either a data center or a cloud region

Active/Passive

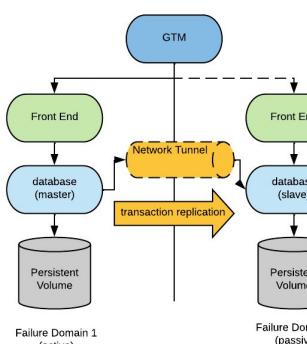


Backup / Restore

RPO ~= frequency of backup
RTO ~= hours

Storage-layer Replication

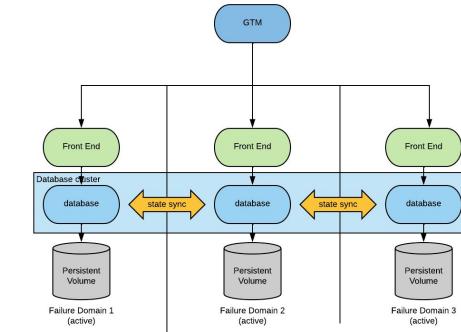
- Asynchronous:
 - RPO ~= unbounded (typically ms)
 - RTO ~= typically minutes *
- Synchronous:
 - RPO = 0
 - RTO ~= typically minutes*



Application-layer Replication

- Asynchronous:
 - RPO ~= unbounded (typically ms)
 - RTO ~= typically minutes *
- Synchronous:
 - RPO = 0
 - RTO ~= typically minutes*

Active/Active



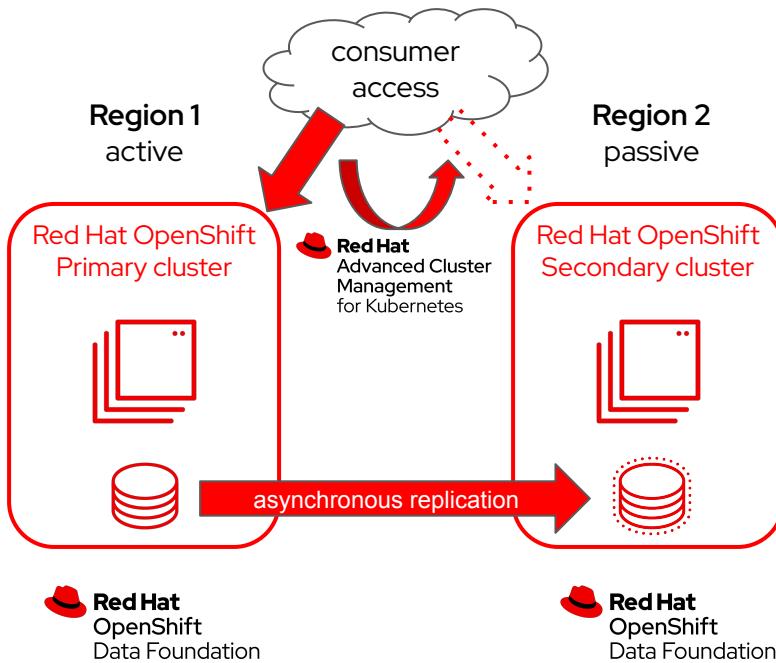
Distributed Stateful Workloads

- Strong Consistency:
 - RPO = 0
 - RTO ~= seconds
- Eventual Consistency (**)
 - RPO ~= 0
 - RTO ~= seconds

(*) a database can take an unbounded amount of time to recover from a crash consistent volume

(**) eventual consistency does not imply eventual correctness

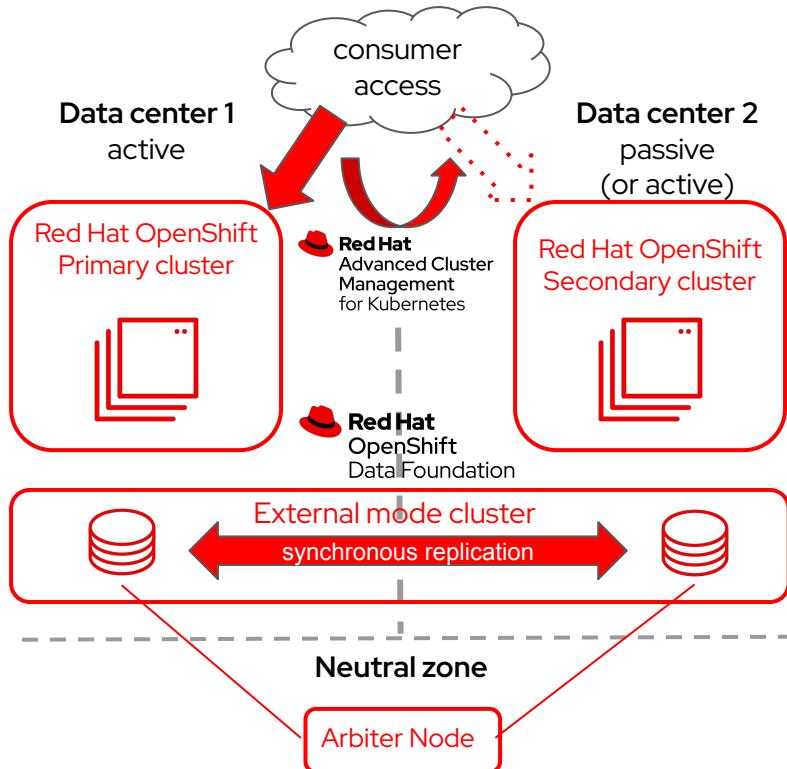
Red Hat OpenShift-Regional Disaster Recovery



Protection against geographic scale disasters

- ▶ OpenShift Data Foundation enables cross cluster replication of data volumes
- ▶ Storage operators synchronize both volume persistent data and kubernetes metadata
- ▶ Enables failover and fallback automation at application granularity, orchestrated by Red Hat Advanced Cluster Management

Red Hat OpenShift-Metropolitan Disaster Recovery



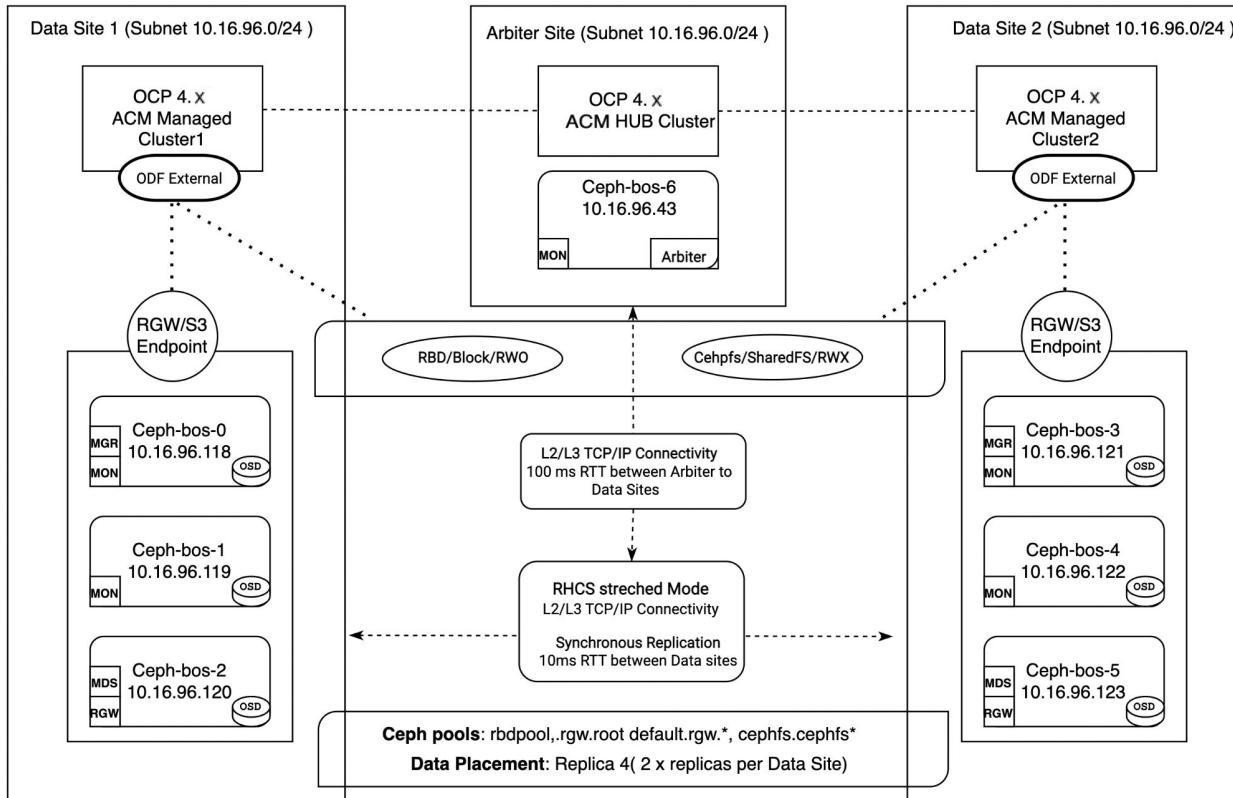
Protection against data loss across multiple clusters with Metropolitan disaster recovery

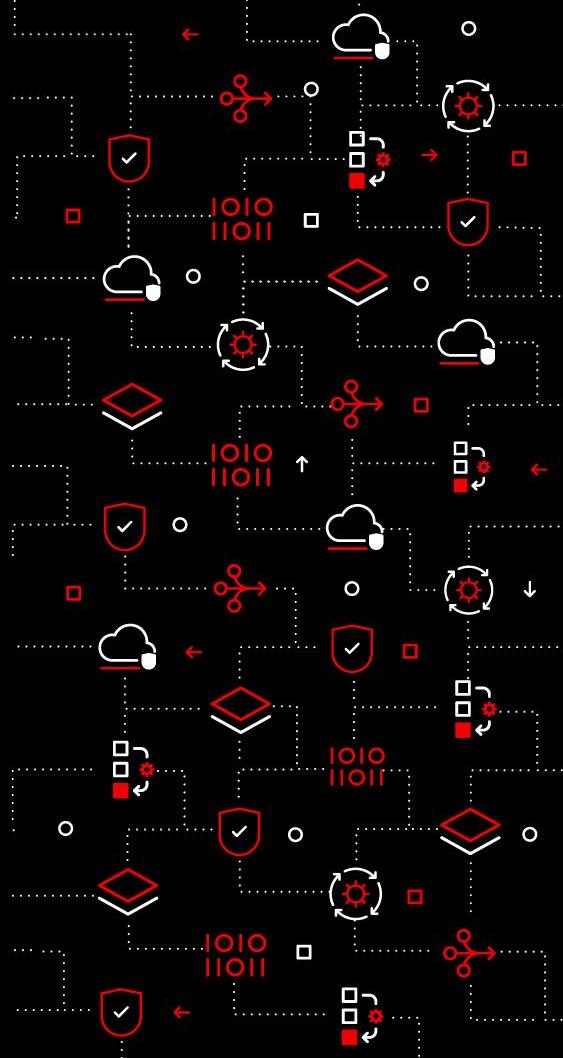
- ▶ Clusters deployed in different datacenters provide a fault isolated configuration
- ▶ External mode OpenShift Data Foundation cluster provides synchronous replicated volumes across the datacenters
- ▶ Enables failover and fallback automation at application granularity, orchestrated by Red Hat Advanced Cluster Management



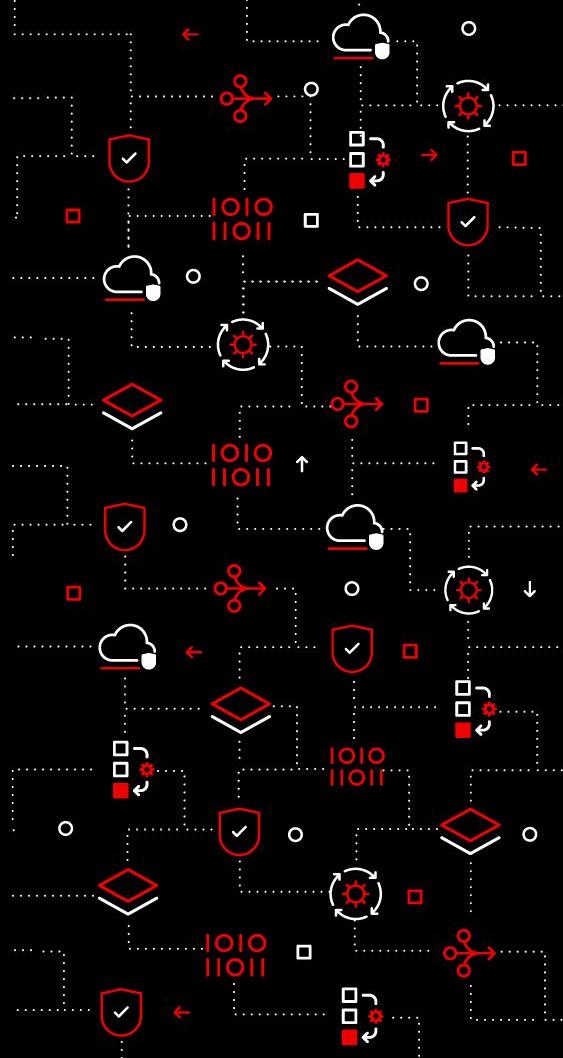
Disaster Recovery for Red Hat OpenShift workloads

Stretched Ceph Storage Deployment Architecture





BREAK
till 10:45



Hands-On Lab 1



Experience OpenShift Virtualization

Introduction

Virtual Machine Management

Switch to the Virtualization Persona

Exploring OpenShift Virtualization

Create a New Project

Create a Linux Virtual Machine

Administering Virtual Machines

Controlling Virtual Machine State

Live Migrate a Virtual Machine

Migrating Existing Virtual Machines

Storage Management

Backup and Recovery for Virtual Machines

Template and InstanceType Management

Working with Virtual Machines and Applications

Network Management for Virtual Machines

Conclusion

Experience OpenShift Virtualization / Virtual Machine Management

Virtual Machine Management

Introduction

The beginning section of this lab will introduce you to the basics of creating and managing VMs in OpenShift Virtualization. Starting with OpenShift 4.18 there is a new Virtualization persona and a tree view for virtual machines that make it easier to visualize and manage your virtualization-based assets. After exploring the UI changes, you will see how the web console guides you through the whole process of creating a virtual machine from a pre-defined template. We will then review the properties of that VM, do some basic customizations, and perform actions like live migration, that are often expected of virtual machine administrators.

Goals

- Create a new virtual machine
- Review and modify resources for virtual machines
- Understand how VM power states are managed using the OpenShift console
- Live migrate a VM between two hosts

As a reminder, here are your credentials for the OpenShift Console:

Your OpenShift cluster console is available [here](#).

Your login is available with:

- User: user3
- Password: KXxg4klOWI9C3PHu

Contents

Introduction

Switch to the Virtualization Persona

Exploring OpenShift Virtualization

Create a New Project

Create a Linux Virtual Machine

Administering Virtual Machines

Controlling Virtual Machine State

Live Migrate a Virtual Machine

Summary



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[Virtual Machine Management](#)

Migrating Existing Virtual Machines

Storage Management

Backup and Recovery for Virtual Machines

Template and InstanceType Management

Working with Virtual Machines and Applications

[Network Management for Virtual Machines](#)

Review Environment

Create Network Attachment Definition

Attach Virtual Machine to Network

User Defined Networks

Conclusion

Network Management for Virtual Machines

Introduction

As mentioned in the previous section, all virtual machines are attached to the OpenShift software-defined network (SDN) by default, which enables access from other workloads on the OpenShift cluster, including other VMs and any OpenShift native applications, and for the virtual machines and the applications they host to be managed in a more modernized workflow.

- The SDN provides additional features for abstracting, connecting, and exposing applications in a controlled manner, whether deployed as VMs or Pods in the cluster. These include the **Service** and **Route** features of OpenShift.
- OpenShift's network policy engine allows the VM user or administrator to create rules which allow or deny network traffic to and from individual VMs or entire projects/namespaces.

However, it is also possible for virtual machines to connect directly to one or more physical networks, such as untagged network or VLANs, when needed. This is in addition to the SDN, which means that, for example, the administrator can connect to the VM from an external IP address and VMs can connect directly using a Layer2 network.

At a high level, this is done by configuring the host networking, such as a Linux bridge. This workshop segment will walk through the next step in that process, creating a network attachment definition to allow VMs to connect to that bridge and, therefore, directly to the physical network.

NOTE

The OpenShift environment has already been configured with a Linux Bridge on each compute node your virtual machines will connect to, thus allowing for easy connectivity with/from outside network resources.

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Review environment

Create Network Attachment Definition

Attach Virtual Machine to Network

User Defined Networks

User Defined Networks with OpenShift Virtualization

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- ▶ Virtual Machine Management
- ▶ Migrating Existing Virtual Machines
- ▶ Storage Management
- ▶ Backup and Recovery for Virtual Machines
- ▶ Template and InstanceType Management
- ▼ Working with Virtual Machines and Applications
 - Exposing an Application with a Service/Route
 - ▶ Network Management for Virtual Machines
 - ▶ Conclusion

[Home](#) Experience OpenShift Virtualization / Working with Virtual Machines and Applications

Working with Virtual Machines and Applications

Introduction

This section of our lab is dedicated to the Day-2 operations that many administrators would need to perform when working with virtual machines in their OpenShift Virtualization environment. We will make use of the understanding we have developed throughout this roadshow of how VMs operate in an OpenShift environment, and use those skills to complete the tasks in this section. In this particular case, we are going to work with the three virtual machines that we imported from VMware vSphere earlier in this roadshow, and we are going to make some minor configuration changes to enable the applications hosted on those servers to be accessed as they now run in OpenShift Virtualization. To accomplish this, we will expose our applications using the service/route method that is the default when making use of the OpenShift SDN pod network so that the application is reachable from outside of the cluster. Doing so provides a more modernized approach to virtual machine management by directly exposing the applications that reside on the VMs.

Exposing an Application with a Service/Route

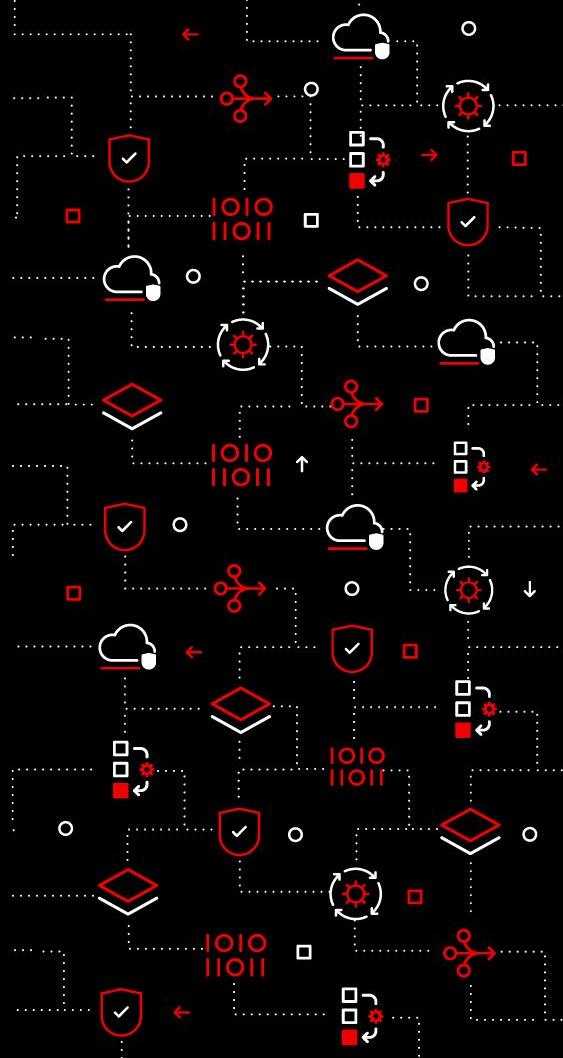
By default, virtual machines are connected to the SDN, which is a convenient and easy way to give them access to the rest of the network. However, it can be challenging for the virtual machines, and other pods in the OpenShift cluster, to find and connect to the virtualized applications. To solve this, we will use a **Service** to balance connections across the two Windows-based web servers, and create a DNS entry for each service discovery, then create a **Route** to allow external clients to access the application hosted within the virtual machines.

IMPORTANT

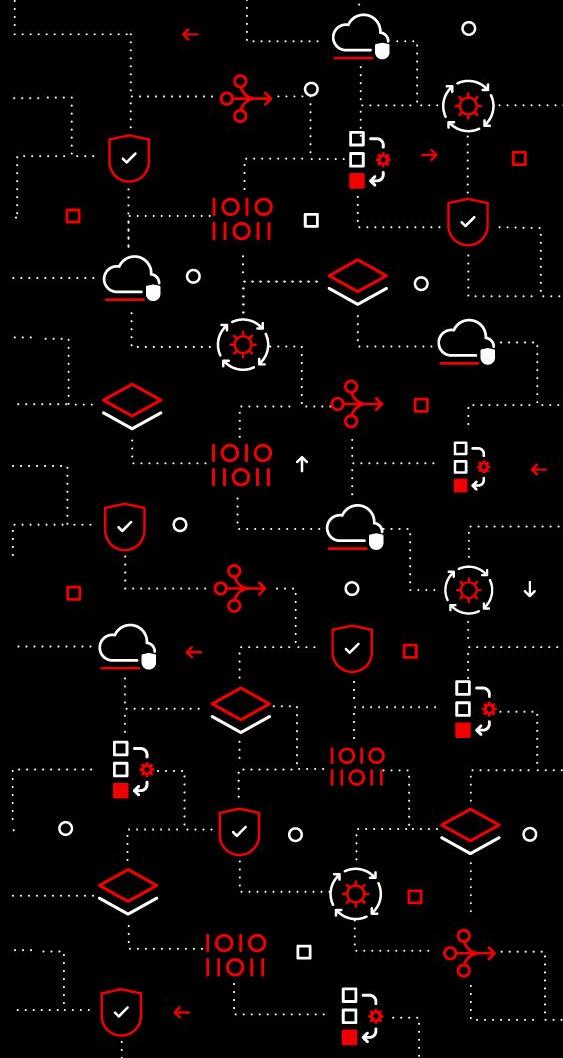
If you have not completed the module *Migrating Existing Virtual Machines*, it is recommended that you...

Contents

- Introduction
- Exposing an Application with a Service/Route
 - Introduction to Services
 - Label the Virtual Machines
 - Create the Service
 - Create the Route
- Summary



Lunch Break
Till 1:00 PM



Migration from VMware

Terminology Comparison

Feature	OpenShift Virtualization	vSphere
Where VM disks are stored	PVC / PV (Persistent Volume/Persistent Volume Claim)	Datastore
Policy based storage	StorageClass	Storage Policy Based Management (SPBM)
Non-disruptive VM migration	Live migration	vMotion
Non-disruptive VM storage migration	N/A (See Slide 11 & Slide 12)	Storage vMotion
Active resource balancing	Pod eviction policy , descheduler	Dynamic Resource Scheduling (DRS)
Physical network configuration	NMstate Operator , Multus	vSwitch / DvSwitch
Overlay network configuration	OVN-Kubernetes , CNI partners , Multus	NSX-T
Host / VM metrics	OpenShift Metrics and Monitoring	vCenter, vRealize Operations

How do I manage virtual machines?

VMware

- vCenter provides GUI-based VM management for both devs/app teams and virtualization admins
- Multiple ways to access vCenter API: Ansible/SaltStack/etc., PowerCLI, Python/Java/etc. SDKs

OpenShift Virtualization

- The OpenShift console for GUI-based access for creating and managing VMs
- The developer and admin consoles both provide access to VM-centric management features
- The OpenShift/Kubernetes API includes the ability to create and manage VMs using standard methodologies. This includes any scripting language or SDK which can use a REST API
- In addition to `kubectl` and `oc` CLI tools, the `virtctl` command simplifies VM management

How do I manage the virtualization environment?

VMware

- Install ESXi to hypervisor nodes and configure basic network connectivity, then use vCenter to join the nodes and configure additional properties
- Configuration can be done manually, semi-automated using DvSwitches and host profiles, and otherwise automated using traditional tools (Ansible, PowerCLI, etc.)

OpenShift Virtualization Getting Started

- Deploying OpenShift to physical servers using [full stack automation](#) (IPI), [Assisted Installer](#), or UPI
- [Install OpenShift Virtualization Operator](#)
- Configure with standard OpenShift methodologies
 - [Machine Config](#), [NMstate](#), [Low Latency tuning](#), [Node Tuning Operator](#), etc.

Alternate View: How do I connect VMs and containers/k8s?

VMware

- Kubernetes is deployed in VMs to the vSphere environment
- When using standard networking, e.g. (D)vSwitches, for VM connectivity, Pod-to-VM traffic traverses the k8s ingress/egress stack
- When using NSX-T as the SDN, VMs and containers can be connected to the same logical network
- Additional functionality, e.g. microsegmentation, for Pods relies on NSX-T

OpenShift Virtualization

- OpenShift Virtualization uses the same SDN for both Pods and VMs, they are native peers.
- VMs access the same SDN features as Pods, including network policies, Service Mesh, Service and Route abstractions, etc.
- VMs can also connect directly to external L2 network, e.g. VLAN, or other networks defined using Multus

Capability Mapping

Leverage the document repositories

Summary

	OpenShift Virtualization	VMware
Infrastructure Automation	RHACM , Ansible , and GitOps	Aria Automation Config (SaltStack) and PowerShell
Application Automation	RHACM , Ansible , Pipelines , and GitOps	Aria Automation Orchestrator (vRealize Orchestrator) and Aria Automation (vRealize Automation)
Networking	Multus / OVN-Kubernetes / Third party CNI	NSX
Storage	ODF , Optimizing Storage and partner ecosystem for CSI	vSAN, Partner Ecosystem
Observability	RHACM , OpenShift Logging & Metrics , Service Mesh , Distributed Tracing	Wavefront
Data Protection	OpenShift API for Data Protection (OADP) Partner ecosystem	vSphere Replication, partner ecosystem  Red Hat

Automation

	OpenShift	VMware
Declarative infrastructure (platform)	OpenShift supports infrastructure as code for both OpenShift-hosted workloads and OpenShift infrastructure itself.	Third party solutions
Declarative configuration	OpenShift GitOps (Argo CD) included. Governance enforcement using RHACM	Terraform and other ecosystem partners
CI/CD	Automate build and configuration of VMs with included OpenShift pipelines (Tekton)	Aria Automation (vRealize Automation)
Multi-cluster management	Red Hat ACM (includes Submariner)	Aria Automation & Aria Automation Orchestrator (vRealize Orchestrator)

Storage - the bigger story

- OpenShift Virtualization uses Kubernetes CSI abstractions for VM storage
 - In vSphere, static pools of capacity are given to the hypervisor (datastore), each VM disk is one or more file(s). Each datastore holds one or many VM disks. The virtualization admin is responsible for storage capacity management.
 - OpenShift / k8s uses dynamic PV/PVC provisioning of a CSI compliant storage provider. Each PV holds one VM disk. The storage admin is responsible for storage capacity management
- Local storage - maximize host resource utilization via [LocalStorageOperator](#), [TopoLVM](#) to provide PVs to VMs, Pods, or hosted storage solutions
- Both vSphere and OpenShift have converged hypervisor and storage offerings
 - Use [OpenShift Data Foundation](#), or a partner offering with a CSI provider, e.g. Portworx, to host VMs in a converged storage + OpenShift deployment
 - VMware has VSAN and multiple ecosystem partners offering hyperconverged features, e.g. Nutanix

Storage - Core feature/capability matrix

	OpenShift	VMware
Accessing legacy storage arrays	<u>All major storage vendors have a CSI compliant driver</u>	Compatible with all major storage vendors
Storage accelerated cloning	Yes, depending on CSI driver	Yes, via VAAI
Disk resizing	Yes	Yes
Policy based storage management	Implicit to the platform (StorageClasses)	vVols, SPBM
Disk / VM snapshots	Yes	Yes
Non-disruptive storage migration	*[see speaker notes]	Storage vMotion

Data Protection and Disaster Recovery

	OpenShift	VMware
Backup / restore	<p>OpenShift API for Data Protection (OADP) EX: Kasten K10 by Veeam supports VMs. Additionally working with Dell, IBM, Veritas, Trilio, Storware to support.</p> <ul style="list-style-type: none"> • Kasten K10 by VEEAM • Trilio for Kubernetes • Storware Backup and Recovery • Portworx PX-Backup and Metro-DR <p>Search for additional vendors here https://marketplace.redhat.com/en-us</p>	Strong ecosystem of backup partners.
<u>Disaster Recovery - Regional (async)</u>	GitOps, Infrastructure-as-Code, RHACM + ODF Future - other storage providers	Site Recovery Manager (SRM) vSphere Replication
<u>Disaster Recovery - Metro (sync)</u>	RHACM + ODF - Tech Preview OCP 4.15 Future - other storage providers	Stretched clusters Fault Tolerance

Networking

	OpenShift	VMware
Host network configuration and management	Kubernetes-native configuration management using the NMstate Operator and Multus	Per-host configuration via vSwitch or single point management via Distributed Virtual Switch (DvSwitch)
Software-defined networking: protect/limit/control VM-to-VM communication	Network policies using any SDN provide {Pod VM}-to-{Pod VM} traffic control. Multiple distinct SDNs are possible using the partner ecosystem, e.g. the Tigera Calico Operator .	Multiple capabilities here, e.g. QinQ, but this is most often referring to NSX's microsegmentation, a.k.a. distributed firewall
Disaster Recovery - Metro (sync)	VMs are connected to one or more L2 (VLAN) networks using Multus and/or connected to the cluster SDN	VMs are connected to one or more L2 (VLAN) networks using (D)vSwitches and/or NSX

Networking

	OpenShift	VMware
Pod-to-VM and VM-to-Pod connectivity	VMs and Pods are native peers <u>when connected to the SDN</u> , with all of the features and capabilities equally available to both	Traffic between Pods and VMs must traverse through the Kubernetes ingress or similar mechanism, e.g. NodePort unless NST-T is being used for the SDN
Application observability	<u>Service Mesh</u> provides robust abilities to ingest and analyze network flows and application level data to assist with debugging, performance troubleshooting, and more for both containerized and virtualized application components in the same cluster	NSX traffic analysis for security purposes, no - or little - native visibility without NSX

VM Administration

	OpenShift	VMware
Template Management	Can use OVAs and VM (template) Library with performance tuned VM templates. Two-click VM creation wizard flow	Template VMs, OVA/OVF deployment, and content libraries offer the ability to provision VMs using a simplified process
VM lifecycle management	Utilize sysprep and cloud-init	Guest OS customization is an abstraction for sysprep/cloud-init
VM Export/Import	Import OVA using Migration Toolkit for Virtualization	Import and export VMs using the OVF and OVA formats

VM Optimization

	OpenShift	VMware
High Performance VMs	NUMA aware node scheduling for best performance, huge pages for data warehousing and in-memory databases, reserve/protect resources using standard Kubernetes mechanisms	NUMA awareness, large/huge pages, latency sensitivity, resource reservations, SIOC, NIOC, and shares mechanism for fairness during contention
Compute Acceleration	GPU passthrough supported , (NVIDIA) vGPU supported	PCI passthrough for GPUs, vGPU supported
Dynamic reconfiguration	Supports storage , SR-IOV and Bridge Network hot-plug CPU hot-plug became available in 4.16, and memory in 4.17	CPU, memory, disk, network adapter, and some additional hardware is supported for hot add/remove and reconfiguration

High Availability

	OpenShift	VMware
Infrastructure HA Node Failure	Supported through fencing agents for IPI and non-IPI environments. See KCS for HA configuration.	Node failure detection and VM rescheduling happens within 15-30 seconds, even without vCenter
Application level HA	RHEL HA (pacemaker) and Windows Server Failover Clustering (WSFC) are supported.	RHEL HA (pacemaker) and Windows Server Failover Clustering (WSFC) are supported.

Resource Management and Optimization

	OpenShift	VMware
Compute live migration	Yes, " Live Migration "	Yes, "vMotion"
Adaptive resource scheduling / resource rebalancing	Descheduler and eviction policies, (anti)affinity rules for VMs, Pods, and hosts	Dynamic Resource Scheduling (DRS), (anti)affinity rules for VMs to VMs and VMs to hosts
Memory overcommitment	KSM and free page reporting supported 4.15, CPU & Memory hot swap as of 4.16 & 4.17	Ballooning and Transparent Page Sharing (TPS)
CPU overcommitment	Yes	Yes

Hosted Kubernetes Integration

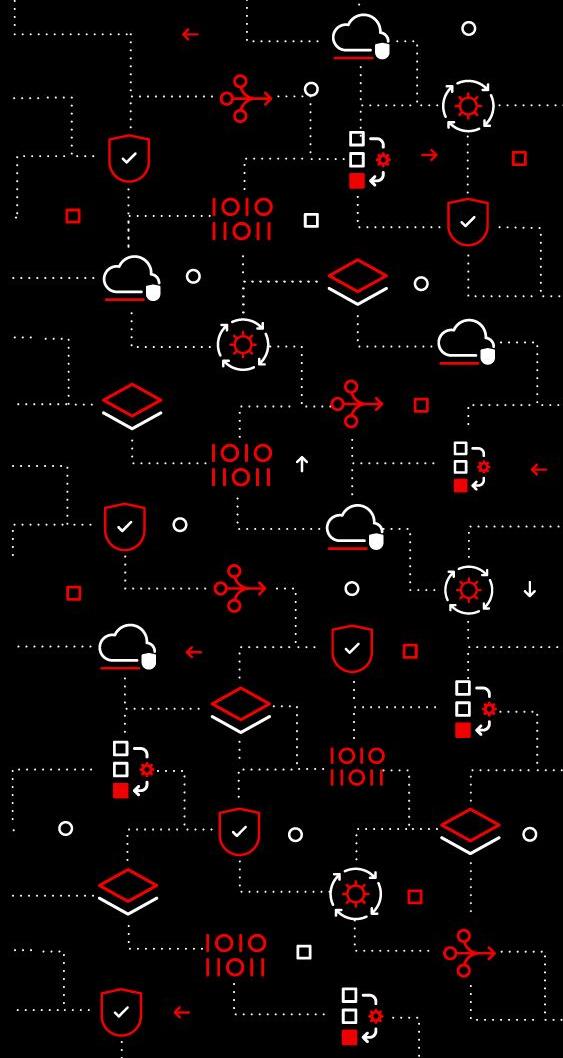
	OpenShift	VMware
Hosting pods on hypervisor nodes	<p>Pods and VMs are native peers, there is no difference between them with OpenShift Virtualization</p>	<p>vSphere with Kubernetes allows “native” Pods to be deployed against the cluster, however they are still running using a VM shim</p>
Efficient cluster provisioning	<p>Hosted Control Planes enable rapid creation of tenant OpenShift clusters with cloud provider integration using the KubeVirt provider.</p>	<p>Tanzu Kubernetes Grid abstracts provisioning Kubernetes clusters using Cluster API</p>

Access Control

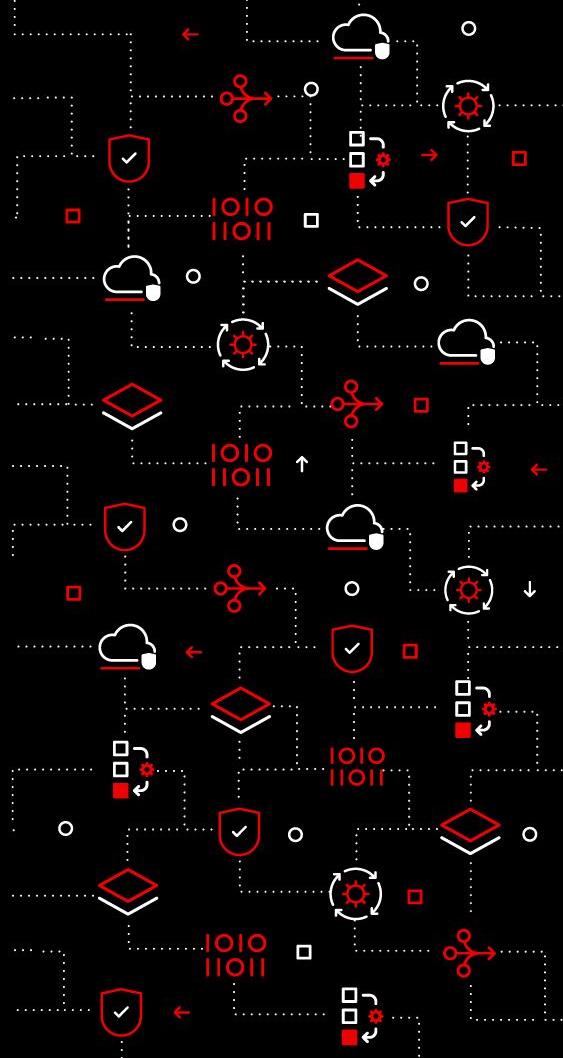
	OpenShift	VMware
Resource Scoping	Top-level organization starts at the cluster level. Organizing VMs in folders can be represented by namespaces . Resources such as network, storage, VM templates are stored within namespaces and can be isolated via network policies .	Scoped access to resources: datacenters, clusters, folders, networks, storage, templates, content.
Action Permissions	Provides three default roles : cluster admin, admin by namespace, and view. Custom RBAC can be mimic any existing roles or permissions down to the Kubernetes object level.	Roles and Permissions structure for different user/group archetypes.

Monitoring, Alerts/Events, Logs

	OpenShift	VMware
Notification/Alarm on Triggers	<p>Prometheus and Alertmanager provide rules definition on all cluster objects including VMs. Severity levels can be set and have discrete actions for each level.</p>	Custom Alarm provides rules definition on event, condition, or state triggers. Severity levels can be set.
Variety of Notification Targets	<p>Alertmanager provides default handlers for email, webhook, and several 3rd party apps including Slack, PagerDuty, and MSTeams (See Notes for full list)</p>	Custom Alarm provides for emails and SNMP traps configuration as well as script execution
VM Event Logging	<p>Vector/Loki/Logging Console plugin has replaced the traditional Elasticsearch/Fluentd/Kibana stack to provide greater insights and better observability</p>	Provides a per-VM advanced option to Enable logging to a log file called vmware-n.log
Log Shipping	<p>Vector multi log forwarder feature supports multiple Red Hat and 3rd party logging applications</p>	Host logs can be shipped from vCenter to alternate locations/3rd party logging apps



BREAK
till 15:00



Hands-On Lab 2

Migration from VMware



Experience OpenShift Virtualization

- ▶ Introduction
- ▶ Virtual Machine Management
- ◀ **Migrating Existing Virtual Machines**
- ▶ Prerequisites for Migrations
- ▶ Migrating Virtual Machines from VMware
- ▶ Storage Management
- ▶ Backup and Recovery for Virtual Machines
- ▶ Template and InstanceType Management
- ▶ Working with Virtual Machines and Applications
- ▶ Network Management for Virtual Machines
- ▶ Conclusion

Migrating Existing Virtual Machines

Introduction

This portion of our lab uses the [Migration Toolkit for Virtualization](#) (MTV) to import virtual machines from VMware vSphere to OpenShift. The migration toolkit supports two "modes" of import:

- Cold migration turns off the source virtual machine before starting the migration. This is the default migration type.
- Warm migration copies data while the source virtual machine continues to run. Once the bulk of data has been migrated, the VM is shutdown and the final data is copied to the destination. The new VM can then be started, resulting in a much shorter period of downtime for the VM-hosted application.

NOTE

The migration toolkit has already been deployed to your cluster using the Operator available in OperatorHub.

Documentation for how to install and configure the Operator can be found [here](#).

If you would like to learn more about how to configure the Migration Toolkit for Virtualization for your own needs, please see the documentation at the following links for:

- [OpenStack](#)
- [Red Hat Virtualization](#)
- [VMware vSphere](#)

Goals**Contents**

- ▶ Introduction
- ▶ Prerequisites for Migrations
- ▶ Migrating Virtual Machines from VMware
 - ▶ Review the VMware environment
 - ▶ Review the VMware provider to the migration toolkit
 - ▶ Create a Migration Plan
- ▶ Summary

Red Hat OpenShift

Administrator

Home >

Operators >

Workloads >

Virtualization >

Migration >

Providers for virtualization

Plans for virtualization

StorageMaps for virtualization

NetworkMaps for virtualization

Networking >

Storage >

PersistentVolumeClaims

StorageClasses

VolumeSnapshots

VolumeSnapshotClasses

Object Storage

Builds >

User Management >

Administration >

Project: mtv-user3

Providers > Provider Details

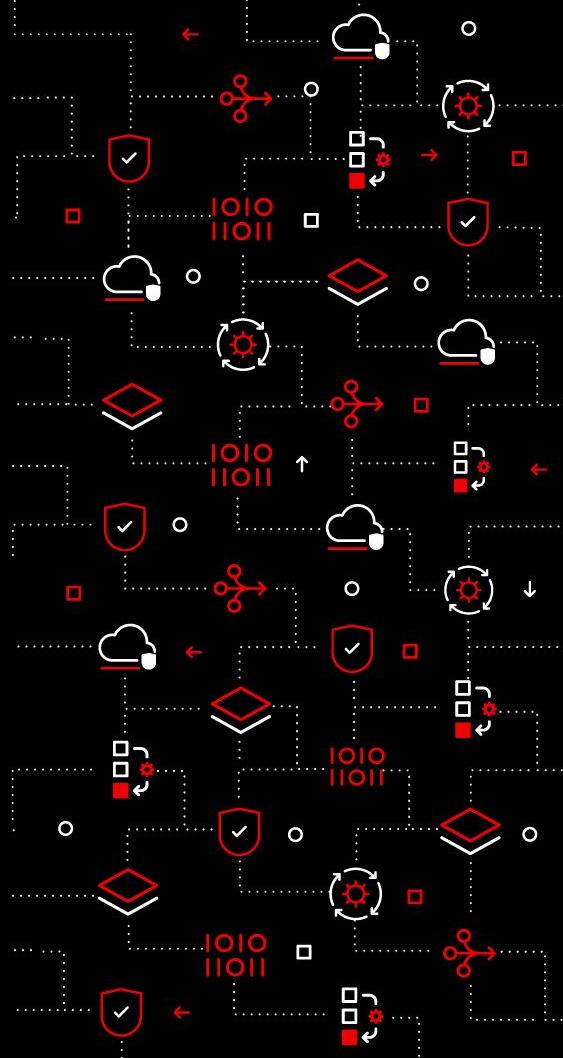
PR VMware Ready

Details YAML Credentials Virtual Machines Hosts

How to create a migration plan
To migrate virtual machines from **vmware** provider, select the virtual machines to migrate from the list of available virtual machines and click the **Create migration plan** button.

Virtual Machines

Concerns	Name	Concerns	Template	Host	Folder
> □	database-user3	(1) (4)	false	esxi-02002.infra.demo.redhat.com	Roadshow
> □	etx-rhel9-trouble-template	(1) (3)	true	esxi-02001.infra.demo.redhat.com	ETX-Templates
> □	etx-rhel86-template	(1) (3)	true	esxi-02001.infra.demo.redhat.com	ETX-Templates
> □	etx-rhel93-template	(1) (3)	true	esxi-02000.infra.demo.redhat.com	ETX-Templates
> □	etx-win2019-template	(1) (3)	true	esxi-02000.infra.demo.redhat.com	ETX-Templates
> □	haproxy-user3	(1) (3)	false	esxi-02001.infra.demo.redhat.com	Roadshow
> □	rhel9-tpl	(1) (3)	true	esxi-02001.infra.demo.redhat.com	RHEL
> □	rhel86-tpl	(1) (3)	true	esxi-02001.infra.demo.redhat.com	RHEL
> □	rhel93-tpl	(1) (3)	true	esxi-02001.infra.demo.redhat.com	RHEL
> □	roadshow-tpl-database	(1) (4)	true	esxi-02001.infra.demo.redhat.com	OcpVirtRoadShow



Migration Factory

Virtualization Migration Factory

Migrate virtual machines at scale

Strategy

Foundation

Expand

Evolve



Evaluate your workload portfolio, **plan and prioritize** to **migrate and modernize at scale**



Create iterative migration of batches of workloads



Reduce IT management effort to increase productivity



Prepare teams for scaled app operations and production readiness



Red Hat
Learning

Accelerating Migrations at Scale with AAP

A Migration factory from Day-0 to Day-2 with Ansible automation

0 Evaluate and scope

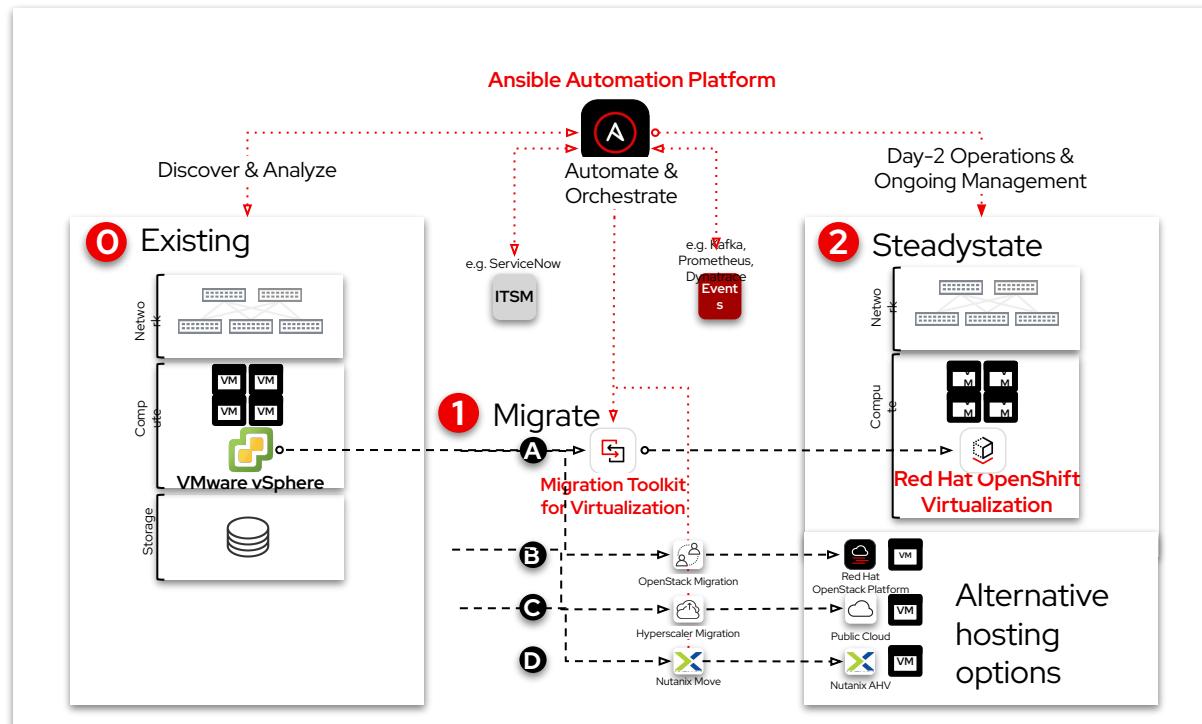
Evaluate the existing data center setup

1 Migrate

Use MTV to migrate virtual machines to OpenShift Virtualization. Ansible helps automate orchestrate as needed.

Red Hat Steadystate

2 VMs are now hosted on OpenShift Virtualization alongside container workloads. Ansible Automation Platform handle day two operations.



Squad Model

Red Hat Consulting, Training, and TAM

Advise on patterns, architecture,
and enablement

Design reference
architectures



Enable teams with OpenShift
Virtualization



Deploy automation

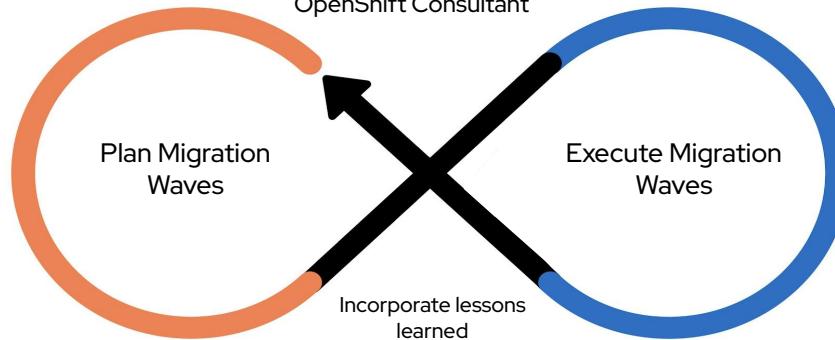


Evolve process



Migration Squad

VM Batch Customer Stakeholders +
OpenShift Consultant



Build the knowledge base
Minimize downtime and failover



Evolve a repeatable approach
to migration waves



Accelerate migration rate
Complete migration

Core Migration Team
Customer Infrastructure Lead +
TAM, Architect, and Automation Consultant

Customer Infrastructure teams and VM owners

Advise on requirements,
processes, and challenges



Define requirements



Support migration wave



Navigate internal
processes



Validate migration



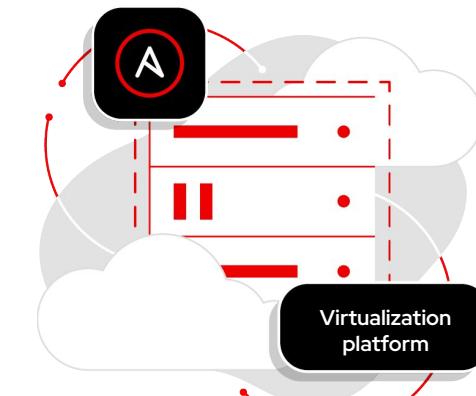
Red Hat
Learning

Collection Overview

Accelerating Engagement with the Ansible for OpenShift Virtualization Migration Content Collection

Red Hat Services supports customers at every stage of their [**Virtualization Migration journey**](#). Helping organizations in managing costs and minimizing risks by prioritizing, planning, migrating, and ultimately retiring legacy virtual machine (VM) workloads. This approach lays the groundwork for accelerated application modernization in the future.

Ansible for OpenShift Virtualization Migration Content Collection accelerates this process by leveraging the power and flexibility of Ansible automation. Developed by Red Hat Consultants, **automates key steps**, from assessment to execution and Day 2 operation in line with the [**Virtualization Migration Factory \(VMF\)**](#) Solution.



This collection will first be **deployed in pilot consulting engagements**, followed by a robust launch in early Q3 of 2025 for partners eager to provide their own migration services. Customers are strongly encouraged to utilize Red Hat and partner migration services as the recommended starting point for their migration journey.

How Services Leverage the Collection

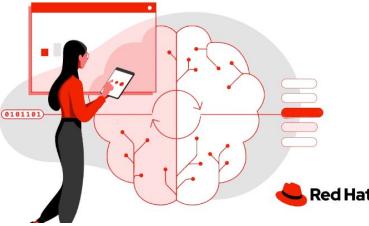
Pilot Resources



A new content collection for OpenShift Virtualization Migration is [now available](#) in the Automation Hub. Currently **in pilot**, it is meant for **targeted consulting engagements with specific customers**. This collection enhances the Ansible Automation Platform and OpenShift Virtualization subscriptions through a services-led approach. (Internal use only).

You can find the download link for collection, along with key resources such as documentation and relevant information, on the solution's Source page.

https://source.redhat.com/projects_and_programs/ansible_for_openshift_virtualization_migration



Ready to Migrate, Ready to Scale

Virtualization Migration Assessment (VMA) First!!

VMA Comes First – Understand Before You Automate

The VMA is the discovery and scoping phase. It helps identify:

- What workloads are being migrated
- The source/target infrastructure details
- Application dependencies, complexity, and risks
- This phase produces the insights needed to plan and design the migration properly.

The Collection is Leveraged for Migration Tasks

Once the migration is scoped and planned via the VMA, the Ansible Collection is used to:

- Automate migration steps (e.g., VM export/import, network/storage configuration)
- Ensure repeatable, reliable processes across large-scale environments
- Support both Red Hat Consulting and partner-led migrations

Controlled Usage – Not for Self-Service

The collection is **validated (not certified)**, meaning:

- It works as tested but is not officially supported by Red Hat Support
- It is **highly recommended to be used by trained consultants/partners – not end customers directly.**
- Messaging around the collection always points back to using Red Hat Consulting or certified partners

Maximizing Value with the Ansible for OpenShift Virtualization Migration

0

Pre-Migration Configuration - Made Easy!



Accelerate your migration journey with streamlined, automated pre-configuration. Our solution simplifies the discovery and setup process, ensuring your infrastructure is ready for seamless transformation.

Bootstrapping Environments.



Whether you're starting from scratch or building on existing infrastructure, our Environment Bootstrap process sets the foundation for a successful migration.

- AAP Deployment on OpenShift
- Deploy and configure OpenShift Virtualization and the Migration Toolkit for Virtualization (MTV) to power your migration efforts
- Accelerate your migration factory setup with a fully configured, operator-driven OpenShift environment—designed for automation, scalability, and ease of use.

1

Migration & Inventory: Smarter, Faster, Scalable



* **Quickly assess the existing environment.** Gather information about the VM inventory to create recommendations on what and how to migrate—fast and without missing anything.

* **Automate at-scale migrations.** Migrate multiple VMs in one playbook run. Streamline tasks like VM migration, network or load balancer connection, and security tool enrollment.

* **Streamline post-migration operations,** with automated management for provisioning new VMs, patching, drift remediation, security, and decommissioning unused VMs.

2

Steadystate Day 2 Operations: Take the control Beyond Migration.



The journey doesn't stop at migration—and neither does our automation. With a full suite of Day 2 Operations, manage and optimize virtual machines with confidence, flexibility, and ease.





Red Hat Training for VMware Migration

What training does Red Hat recommend for customers who are migrating from VMware?



Essentials

- [OpenShift Virtualization Technical Overview](#)
- [OpenShift Technical Overview](#)
- Ansible Technical Overview D007 (Update Coming Q1 CY25)
- ACM Technical Overview (Coming Q2 CY25)



Day 1

- DO346: Migrating Virtual Machines to Red Hat OpenShift Virtualization with Ansible Automation Platform (Coming Q2 CY25)
- [DO316: Managing Virtual Machines with Red Hat OpenShift Virtualization](#)



Day 2

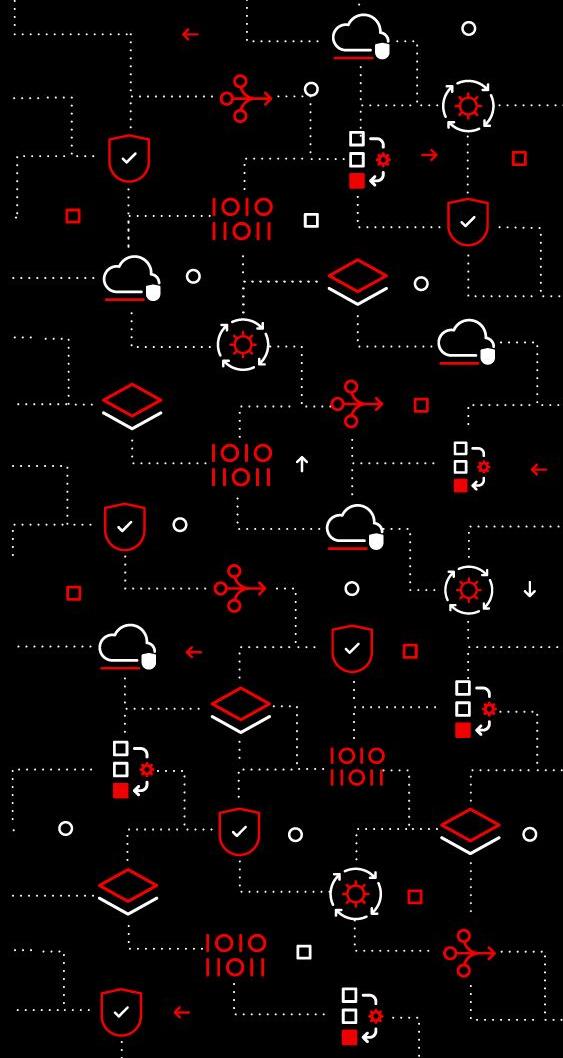
- DO336: Automate and Manage Red Hat OpenShift Virtualization with Ansible (Coming Q2 CY25)
- DO432: Red Hat Advanced Cluster Management for Kubernetes (Update Coming Q1 CY25)



Prerequisites for Day 1

- [DO180: Red Hat OpenShift Administration I: Operating a Production Cluster](#)
- [DO280: Red Hat OpenShift Administration II: Configuring a Production Cluster](#)





End of Day One

Thank you

Red Hat is the world's leading provider of enterprise open source software solutions.

Award-winning support, training, and consulting services make

Red Hat a trusted adviser to the Fortune 500.



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