OpenShift AddOns

Red Hat OpenShift

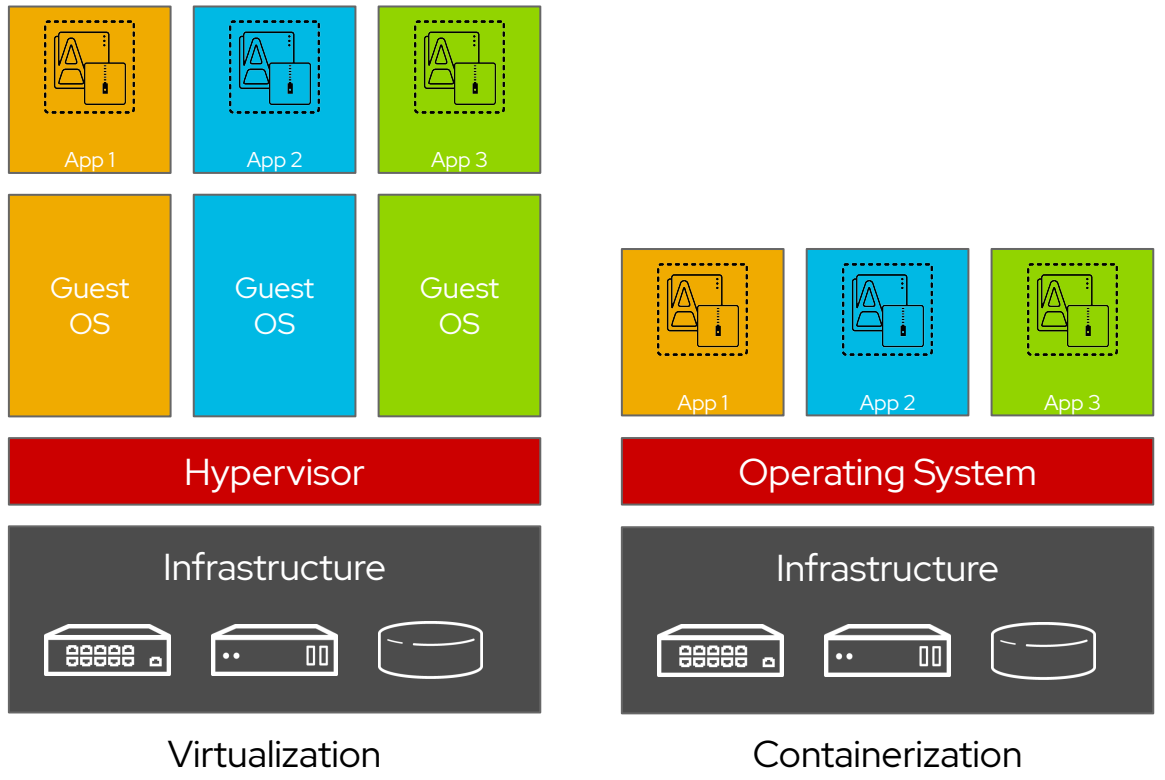
OpenShift Virtualization

Technical presentation

Red Hat

Containers are not virtual machines

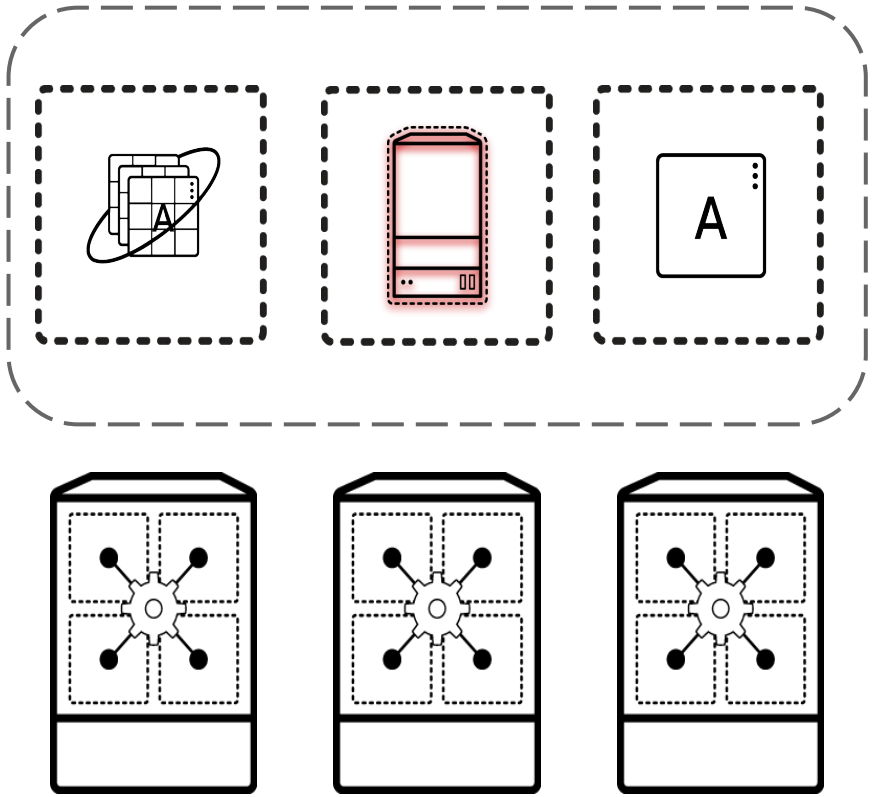
- Containers are process isolation
- Kernel namespaces provide isolation and cgroups provide resource controls
- No hypervisor needed for containers
- Contain only binaries, libraries, and tools which are needed by the application
- Ephemeral



Red Hat

Virtual machines can be put into containers

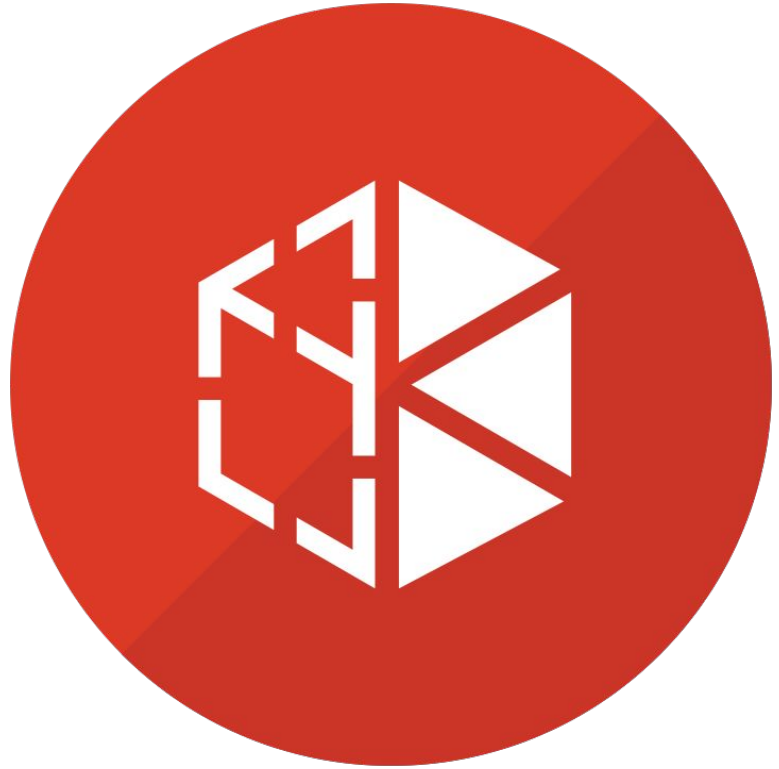
- A KVM virtual machine is a process
- Containers encapsulate processes
- Both have the same underlying resource needs:
  - Compute
  - Network
  - (sometimes) Storage



Red Hat

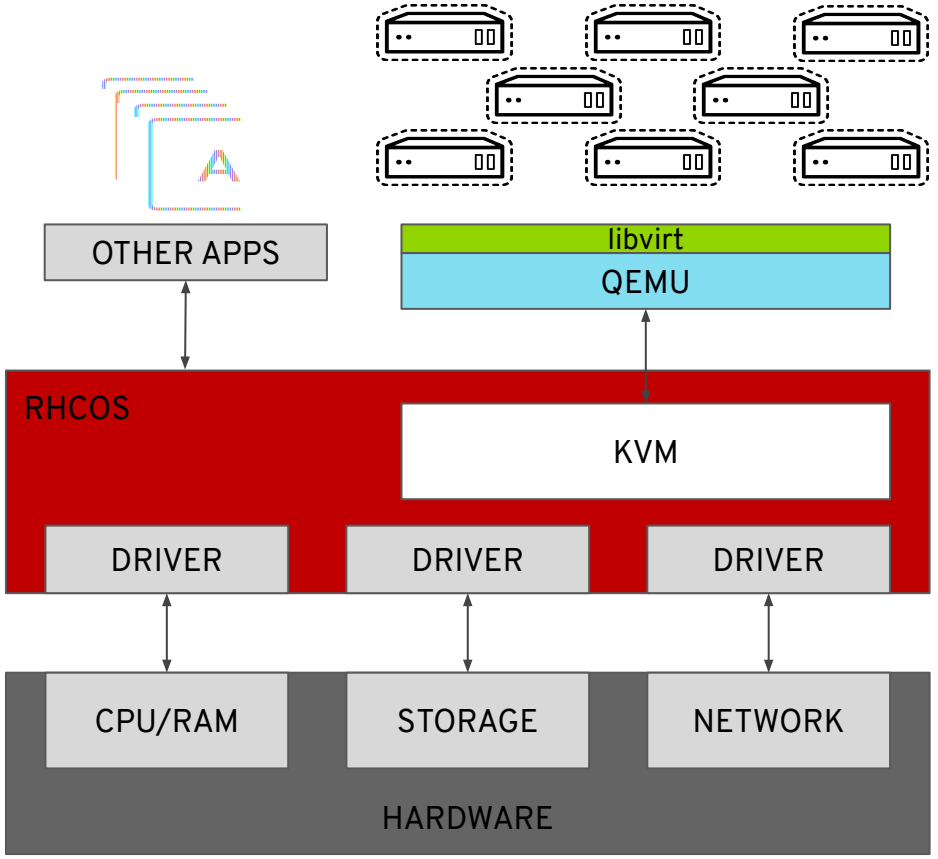
OpenShift Virtualization

- Virtual machines
  - Running in containers
  - 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)



VM containers use 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



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Built with Kubernetes

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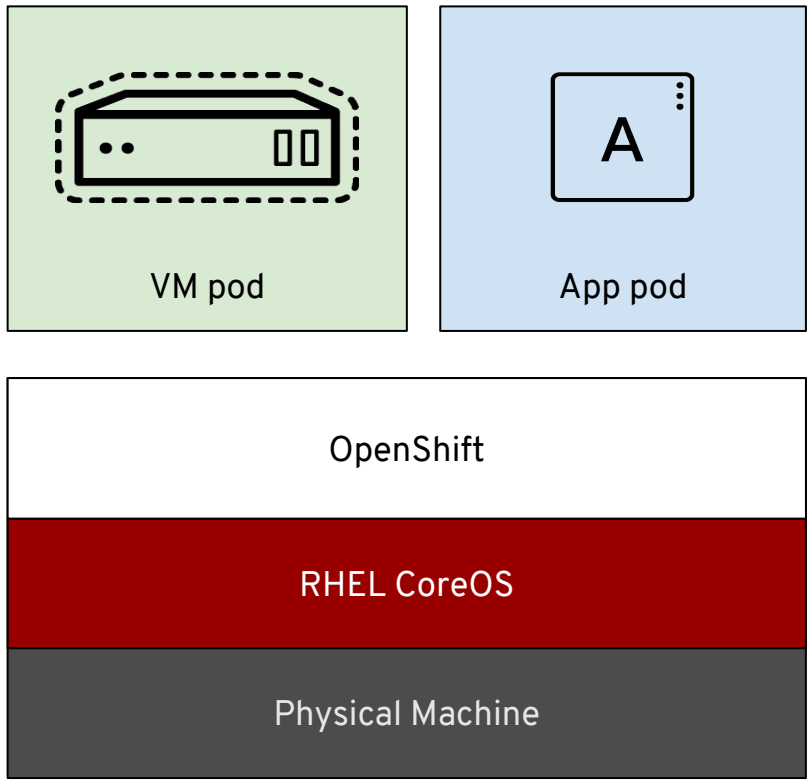
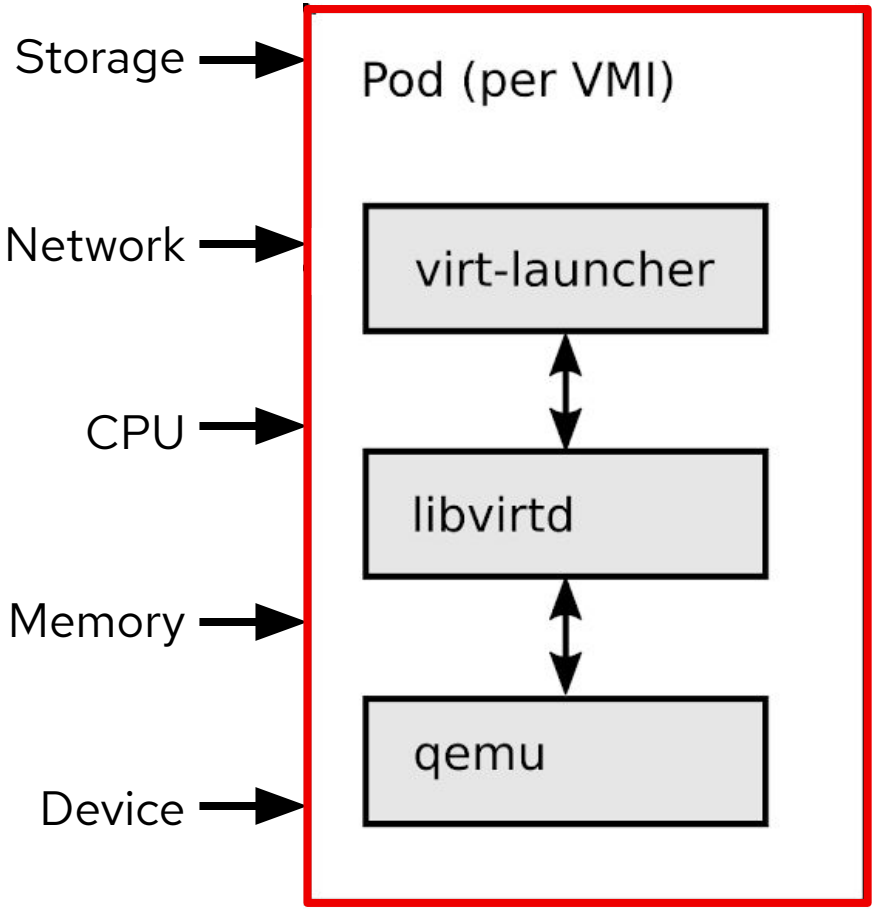
Virtual machines in a container world

- Provides a way to transition application components which can't be directly containerized into a Kubernetes system
  - Integrates directly into existing k8s clusters
  - Follows Kubernetes paradigms:
    - Container Networking Interface (CNI)
    - Container Storage Interface (CSI)
    - Custom Resource Definitions (CRD, CR)
- Schedule, connect, and consume VM resources as container-native



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

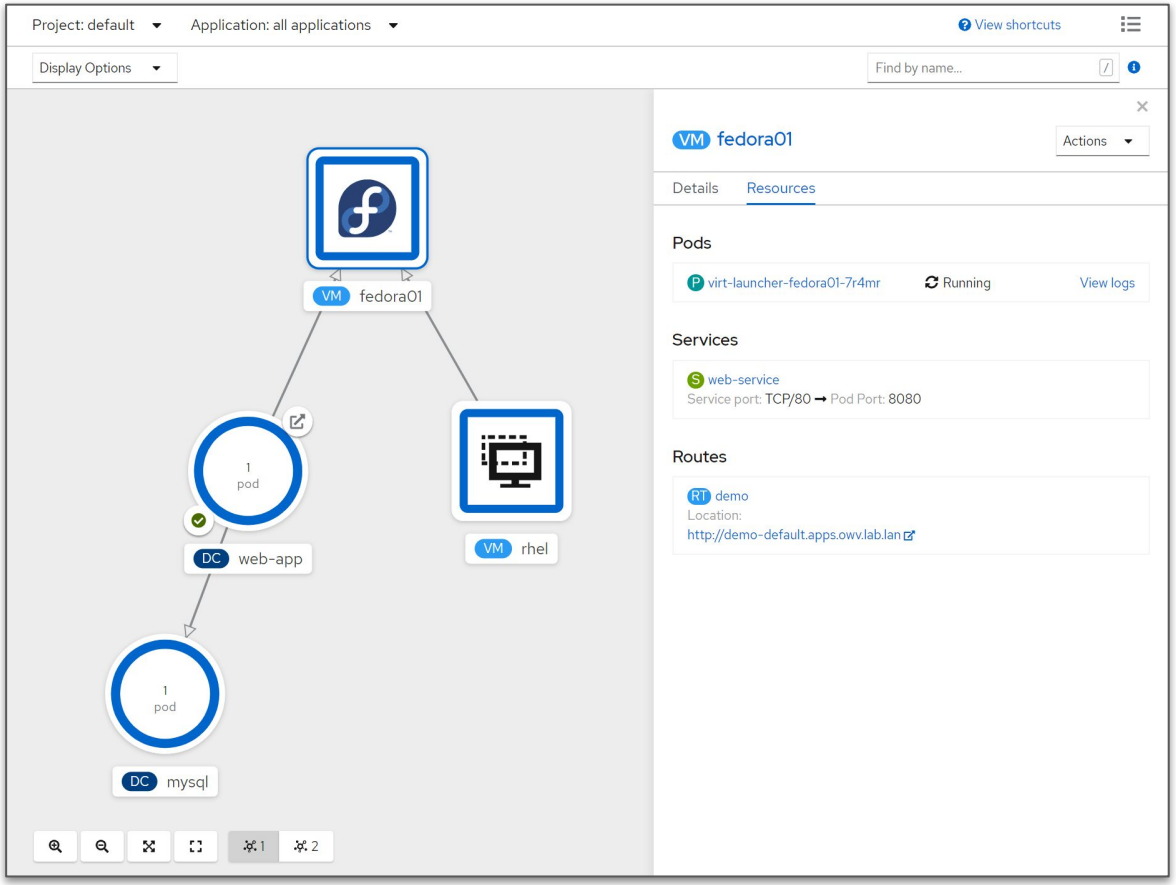
- libvirt and qemu from RHEL are mature, have high performance, provide stable abstractions, and have a minimal overhead.

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



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Managed with OpenShift

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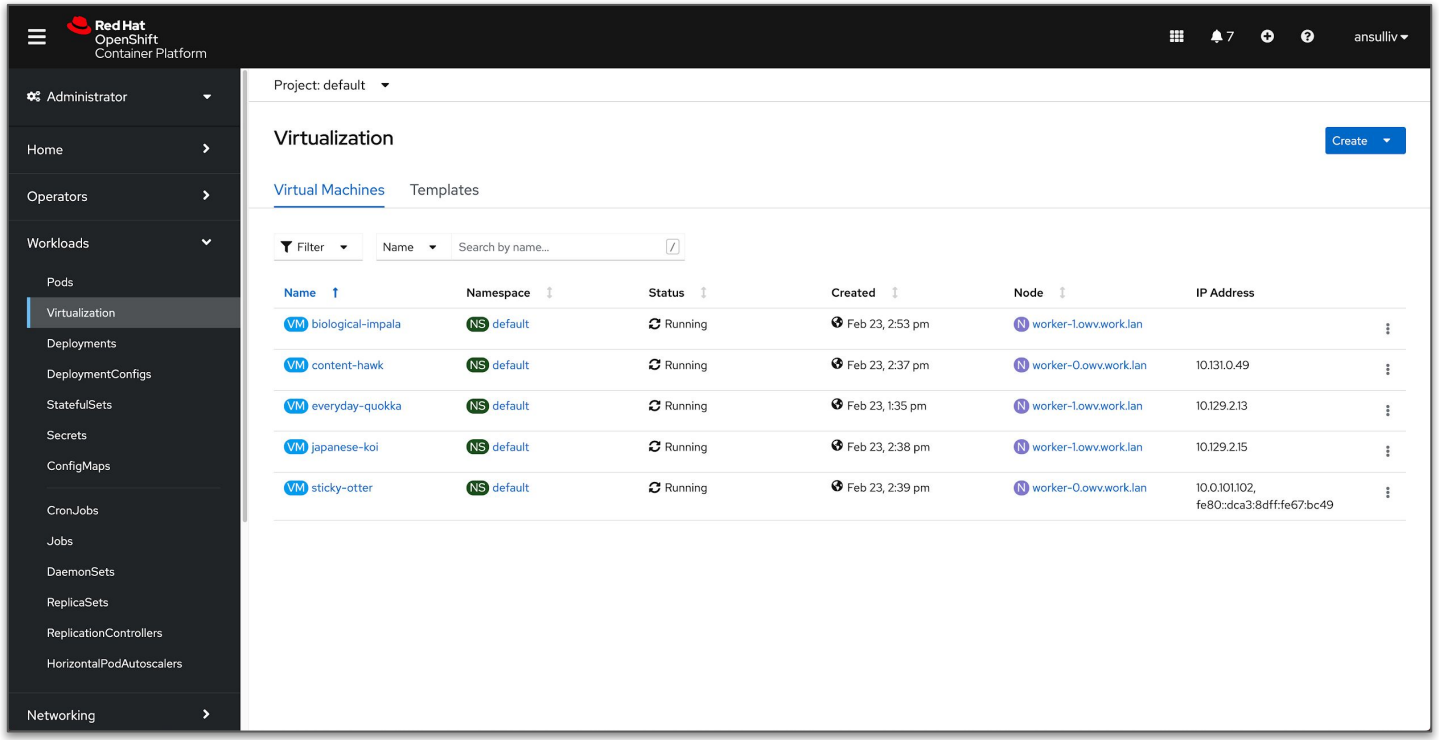
Virtual Machine Management

- Create, modify, and destroy virtual machines, and their resources, using the OpenShift web interface or CLI
- Use the `virtctl` command to simplify virtual machine interaction from the CLI



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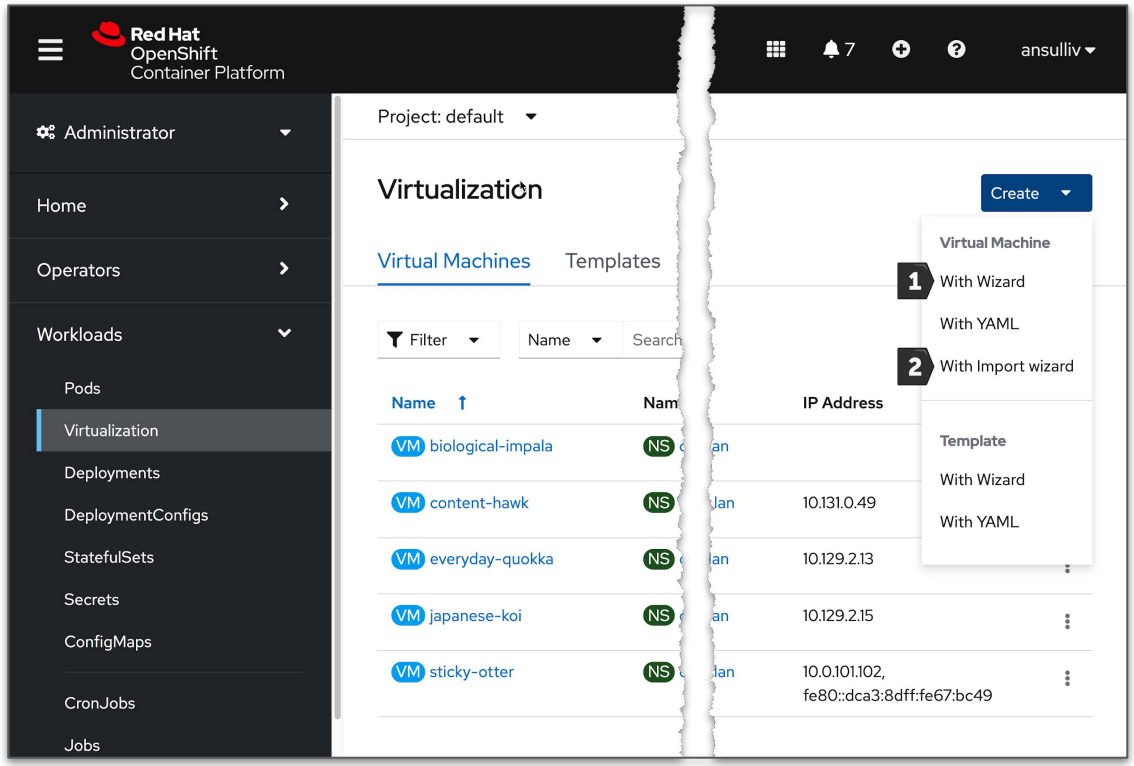
Create VMs

Virtual Machine creation

- Streamlined and simplified creation via the GUI or create VMs programmatically using YAML
- Full configuration options for compute, network, and storage resources
  - Clone VMs from templates or import disks using DataVolumes
  - Pre-defined and customizable presets for CPU/RAM allocations
  - Workload profile to tune KVM for expected behavior
- Import VMs from VMware vSphere or Red Hat Virtualization



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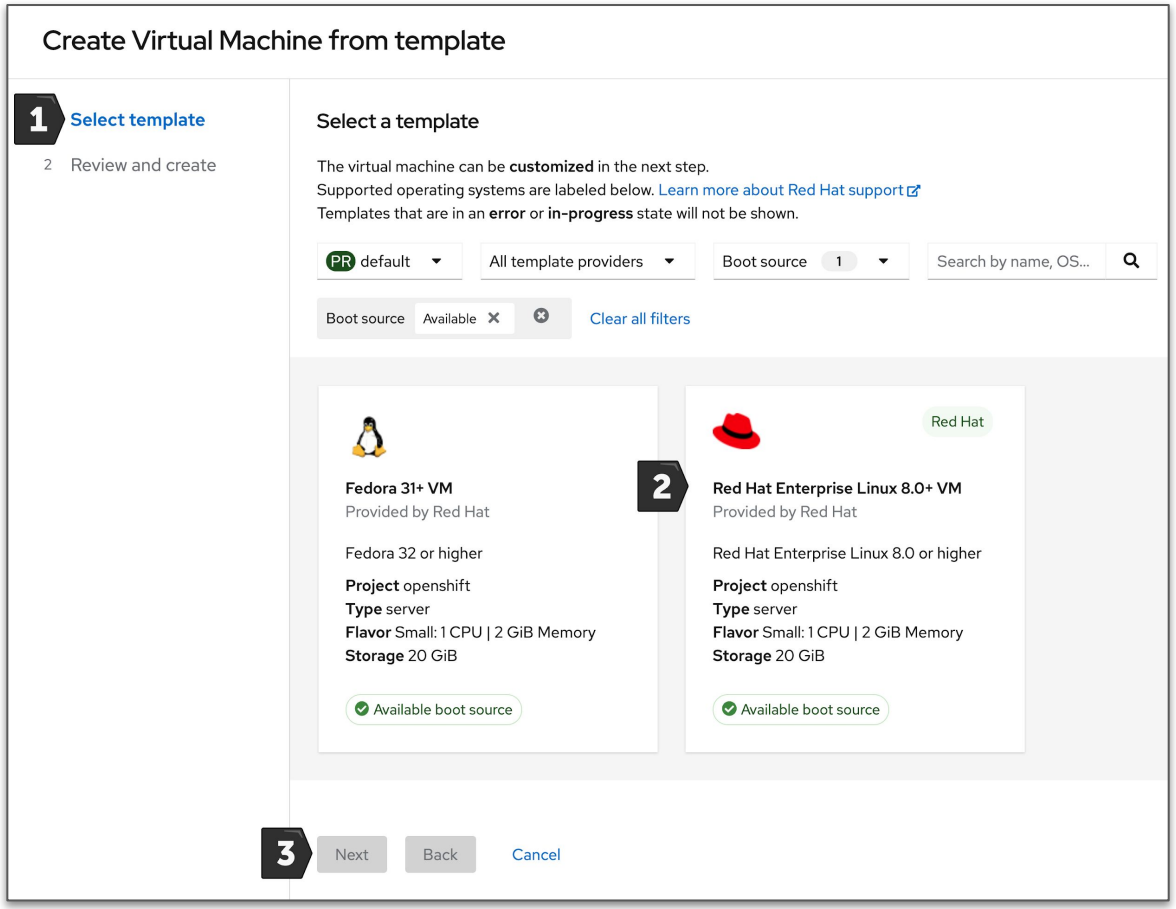
Using templates for virtual machines

- Simplified and streamlined virtual machine creation experience for VM consumers
- Administrators configure templates with an OS disk, consumers select from the options



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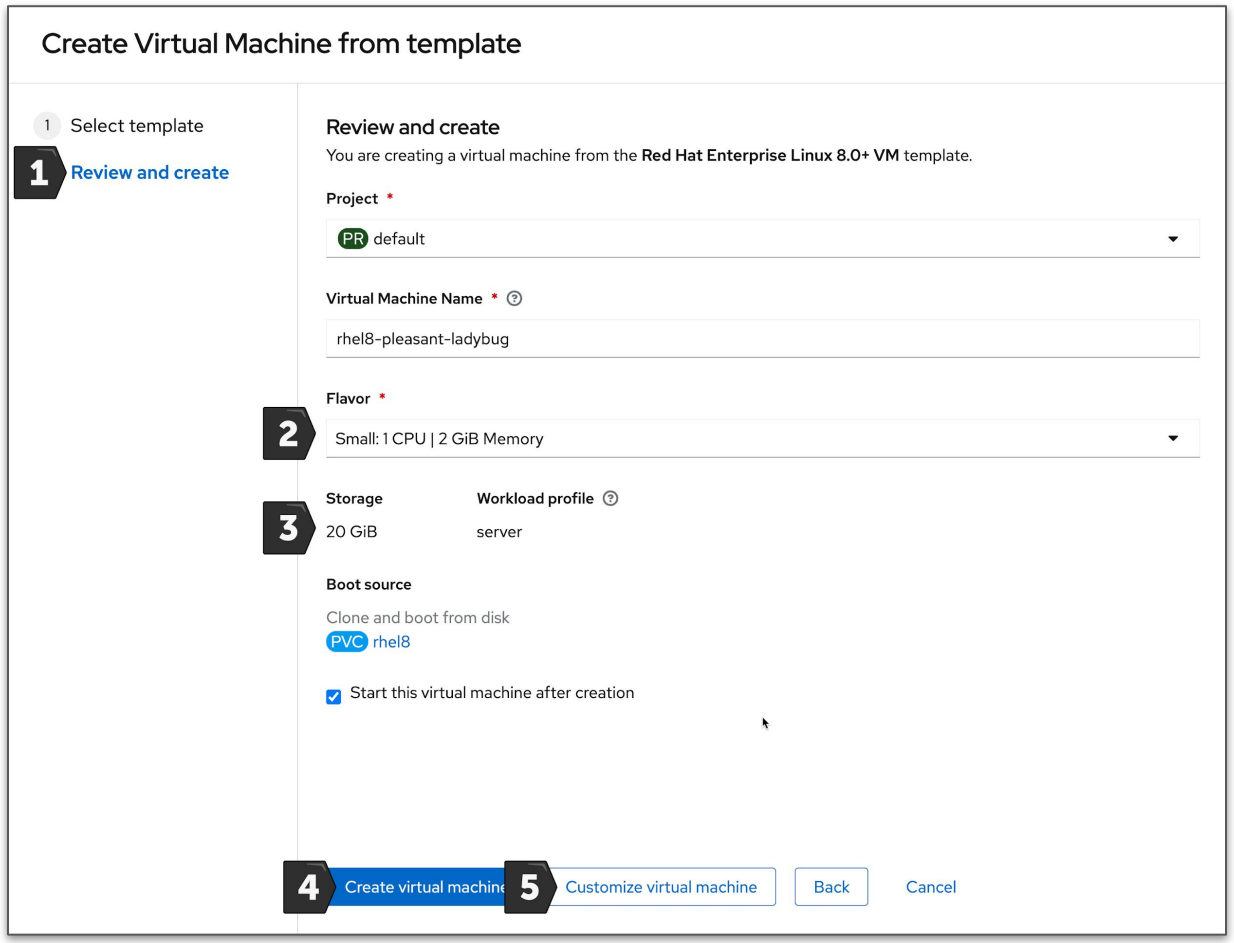
Creating a virtual machine

- Flavor represents the preconfigured CPU and RAM assignments
- Storage, including PVC size and storage class, are determined by the template administrator
- A default network configuration is defined in the template
- Workload profile defines the category of workload expected and is used to set KVM performance flags
- The VM can be further customized by selecting the option, or immediately created and deployed
  - Additional customization includes CPU/memory, storage, network, cloud-init, and more



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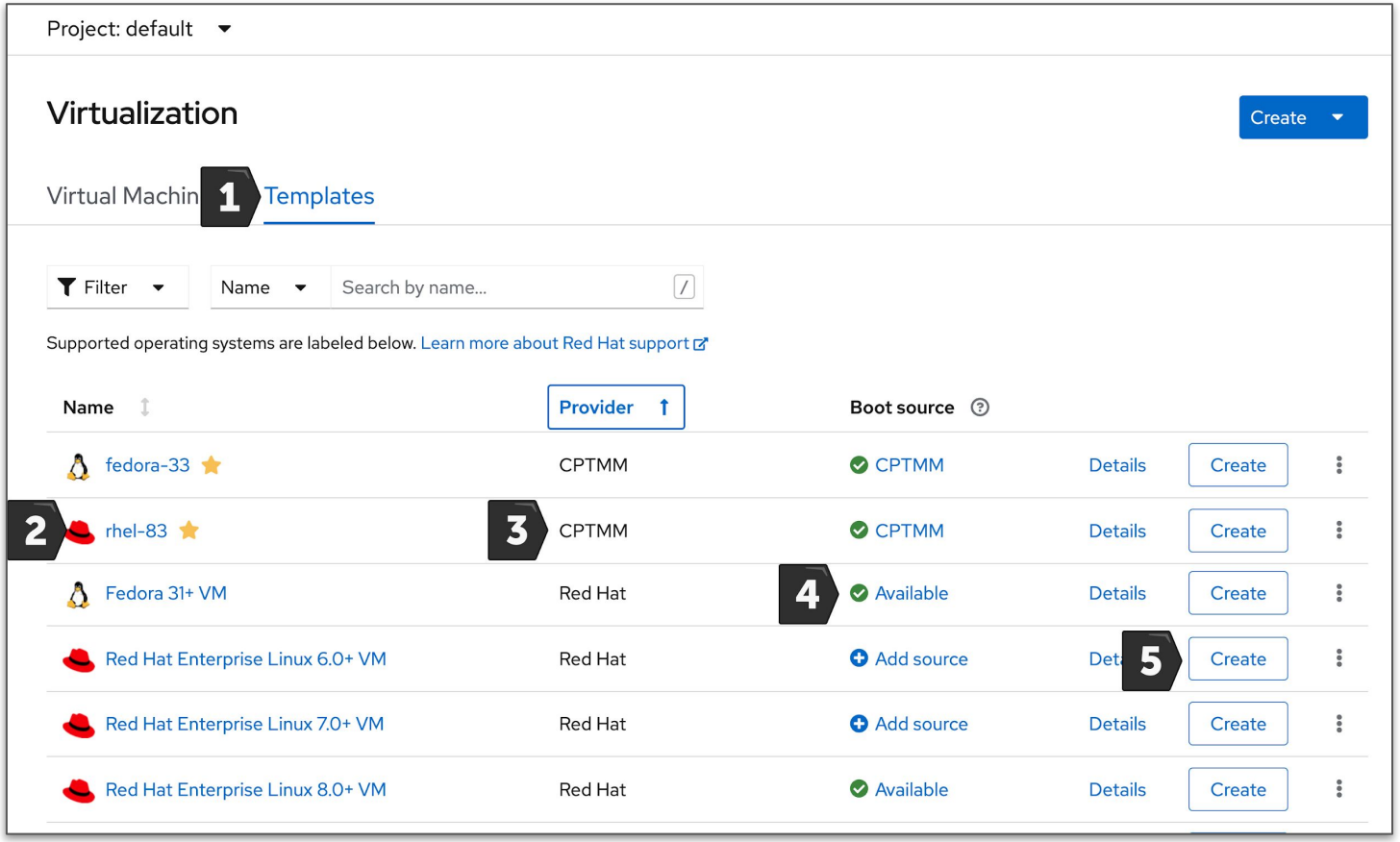
VM Templates

Templates

- Templates are a core concept for virtual machine creation with OpenShift Virtualization 2.6
- Red Hat provides default templates, administrators can create and customize additional as needed
- Boot sources provide disk images for the template
- Creating VMs can be done from the template page in just a few clicks



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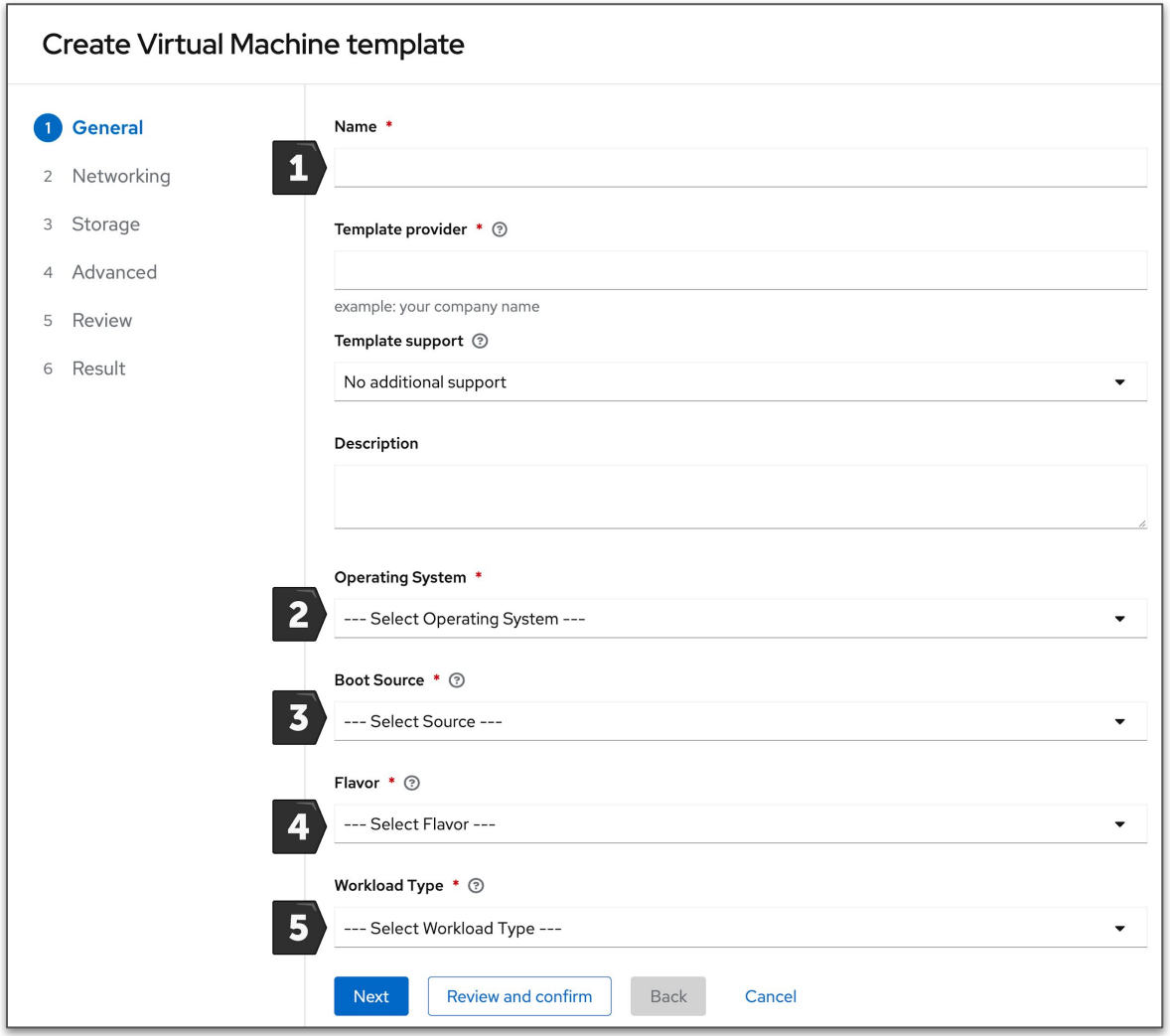
Create a template - General

- In addition to unique names, each template is associated with a provider
  - Providers represent who created the template, with optional support information
- The guest operating system and source boot disk are provided. A boot disk can be imported during the process, or an ISO can be used to boot and install the OS
- A default flavor, representing CPU and memory allotments, is provided
- Workload type determines KVM optimization to balance between performance and efficiency



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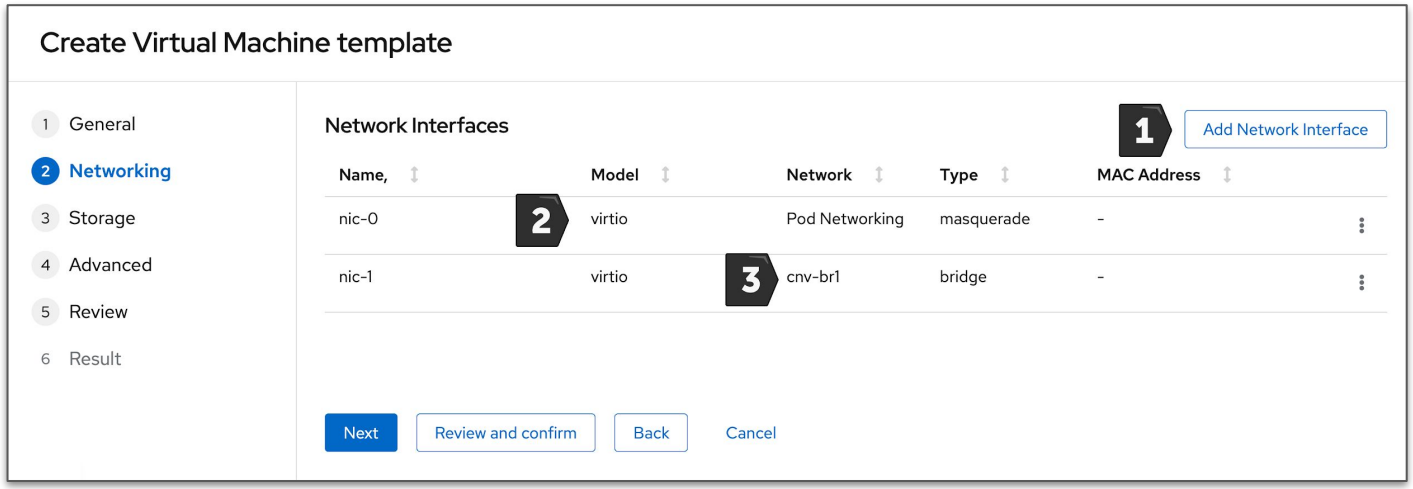
Create a template - Networks

- Add or edit network adapters
- One or more network connections
  - Pod network for the default SDN
  - Additional multus-based interfaces for specific connectivity
- Multiple NIC models for guest OS compatibility or paravirtualized performance with VirtIO
- Masquerade, bridge, or SR-IOV connection types
- MAC address customization if desired



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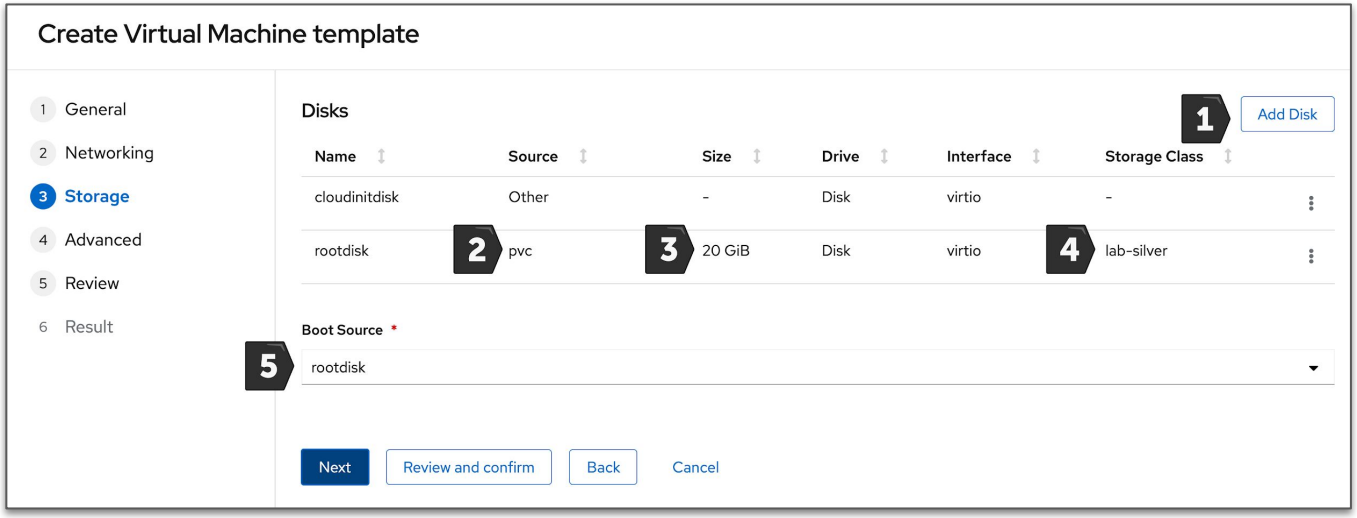
Create a template - Storage

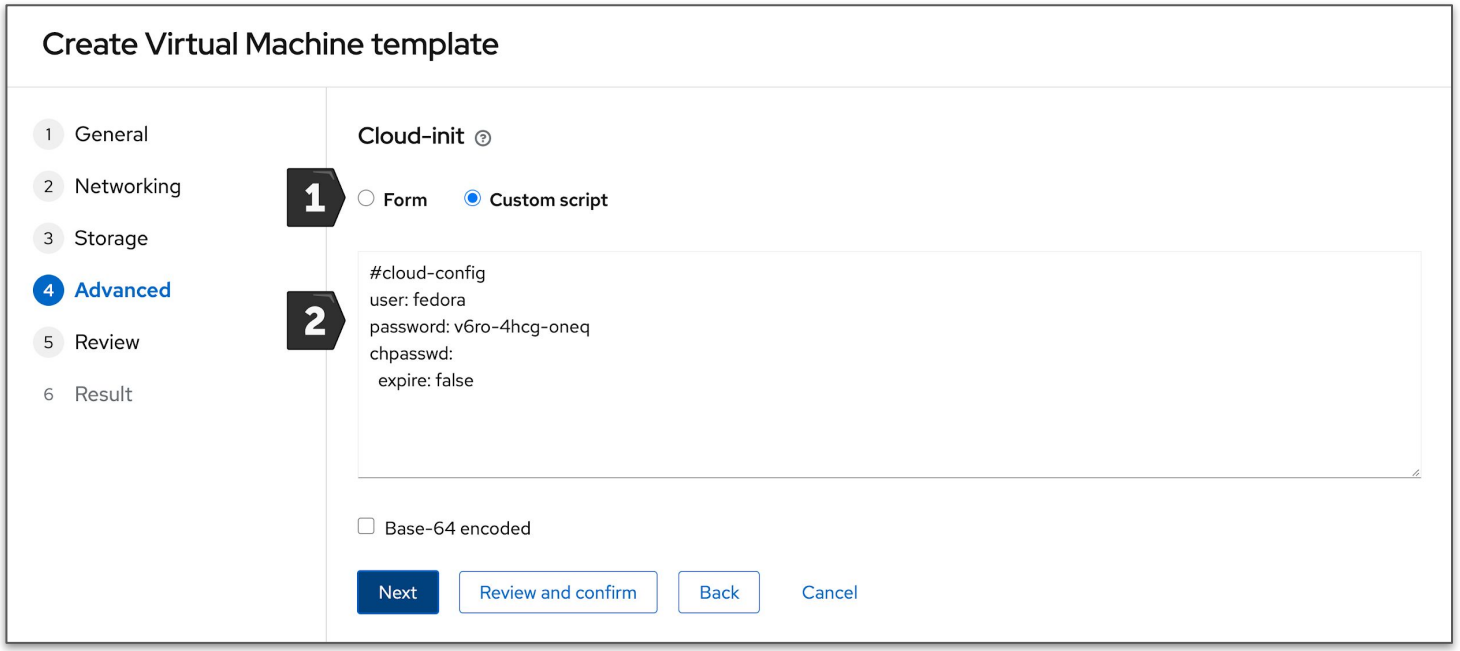
- Add or edit persistent storage
- Disks can be sourced from
  - Imported QCOW2 or raw images
  - New or existing PVCs
  - Clone existing PVCs
- Use SATA/SCSI interface for compatibility or VirtIO for paravirtual performance
- For new or cloned disks, select from available storage classes
  - Customize volume and access mode as needed
  - RWX PVCs are required for live migration



Red Hat

Create a template - Advanced

- Customize the operating system deployment using cloud-init scripts
  - Guest OS must have cloud-init installed
  - RHEL, Fedora, etc. cloud images
  - Default templates will auto-generate a simple `cloud-init` to set the password



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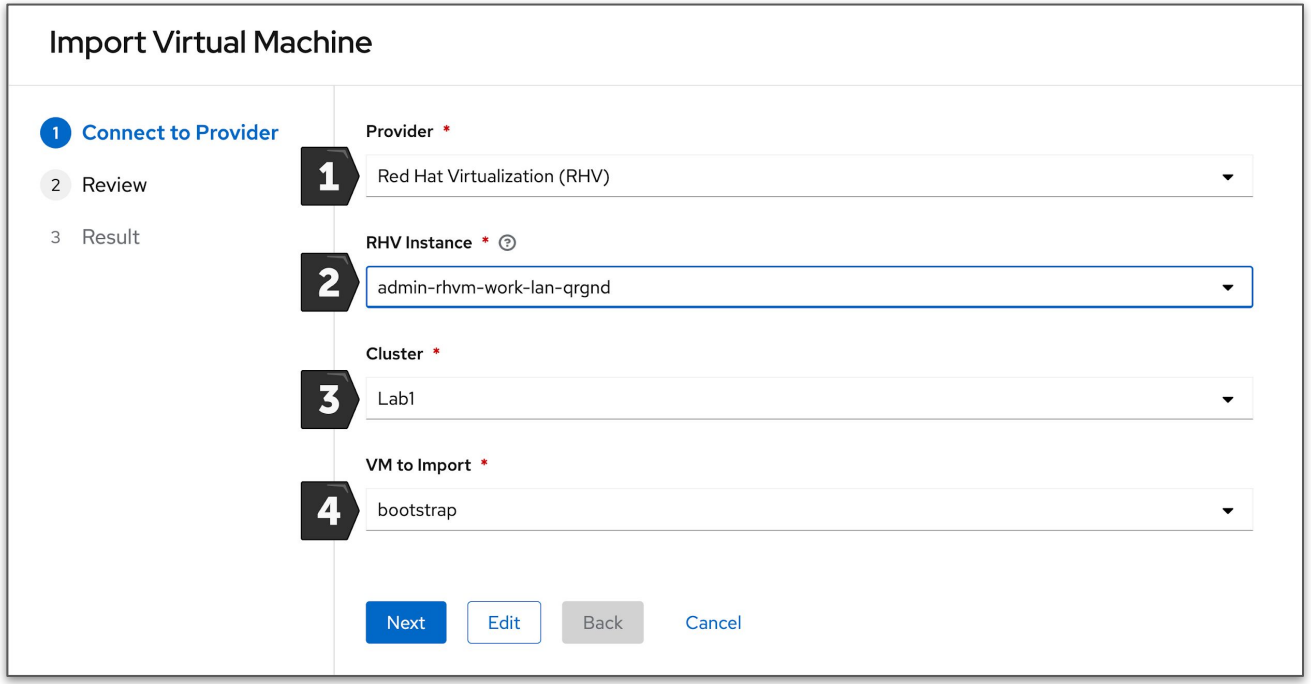
Import VMs

Red Hat

Virtual Machine Import

- Wizard supports importing from VMware or Red Hat Virtualization
  - Single-VM workflow
- VMware import uses VDDK to expedite the disk import process
  - User is responsible for downloading the VDDK from VMware and adding it to a container image
- Credentials stored as Secrets
- `ResourceMapping` CRD configures default source -> destination storage and network associations

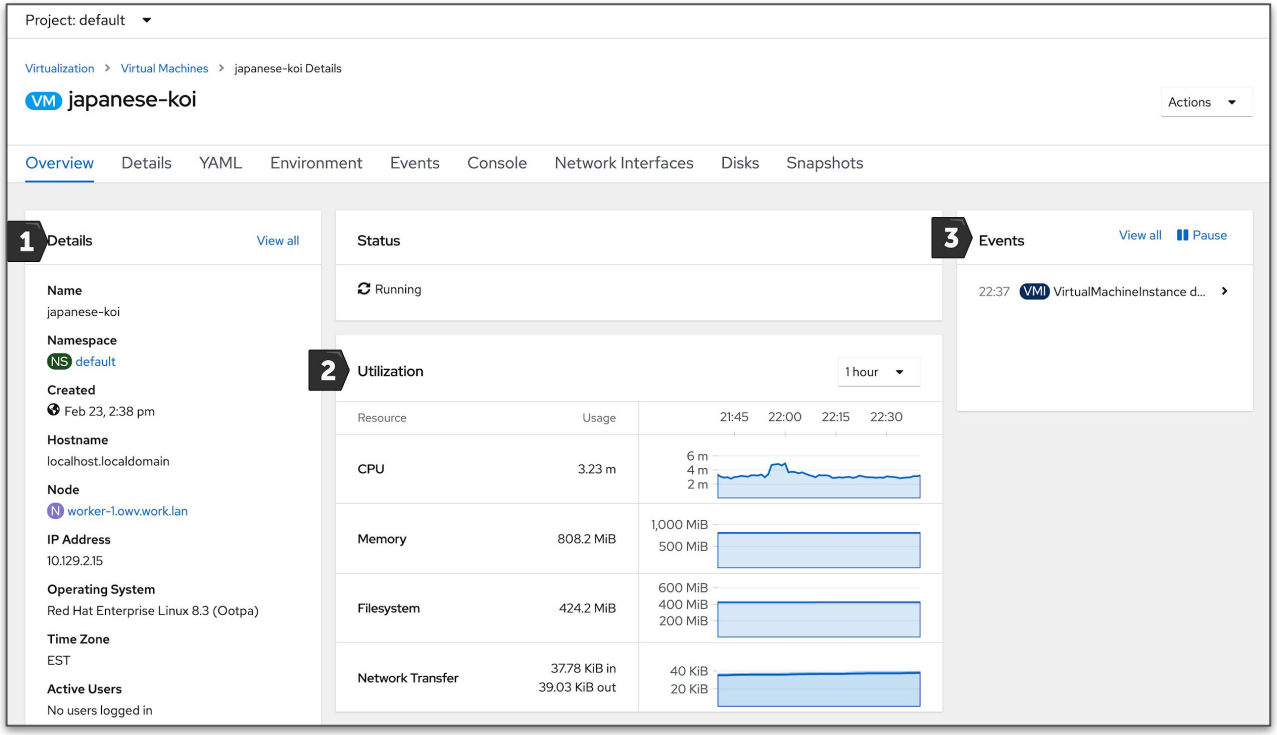


Red Hat

View / manage VMs

Virtual Machine - Overview

- General overview about the virtual machine
- Information populated from guest when integrations are available
  - IP address
- Inventory quickly shows configured hardware with access to view/manage
- Utilization reporting for CPU, RAM, disk, and network
- Events related to the Pod, scheduling, and resources are displayed



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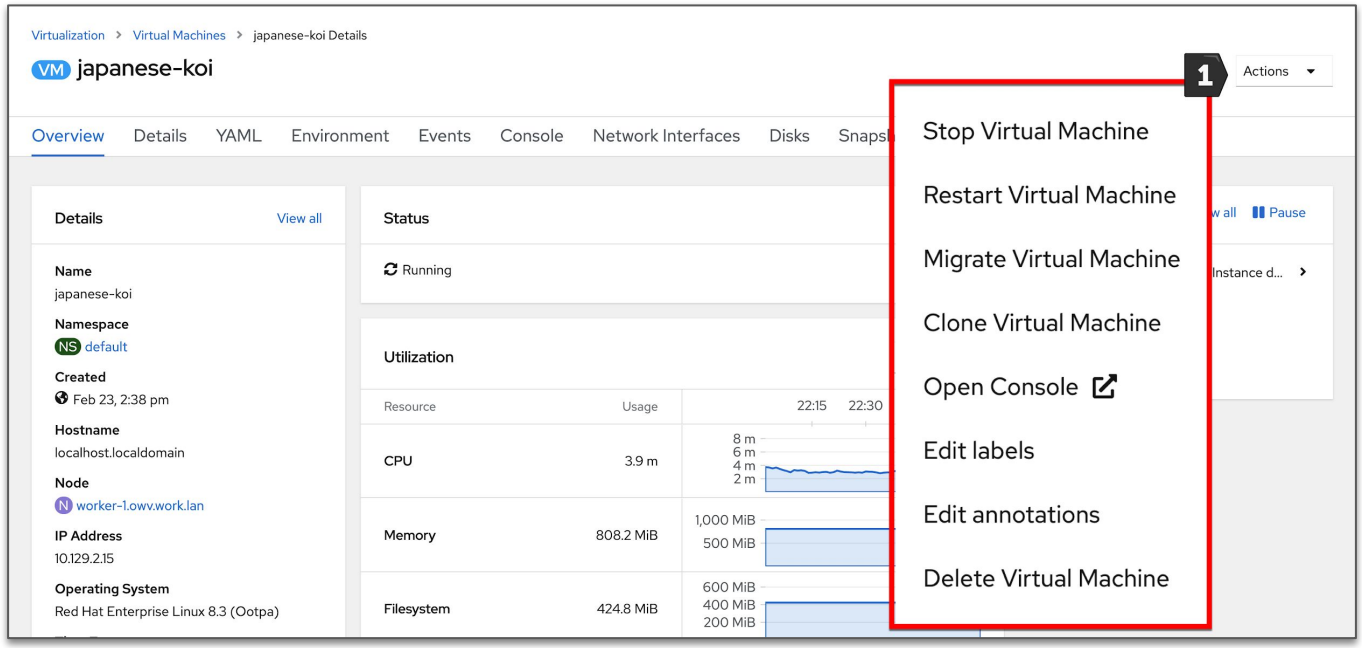
Virtual Machine - Actions

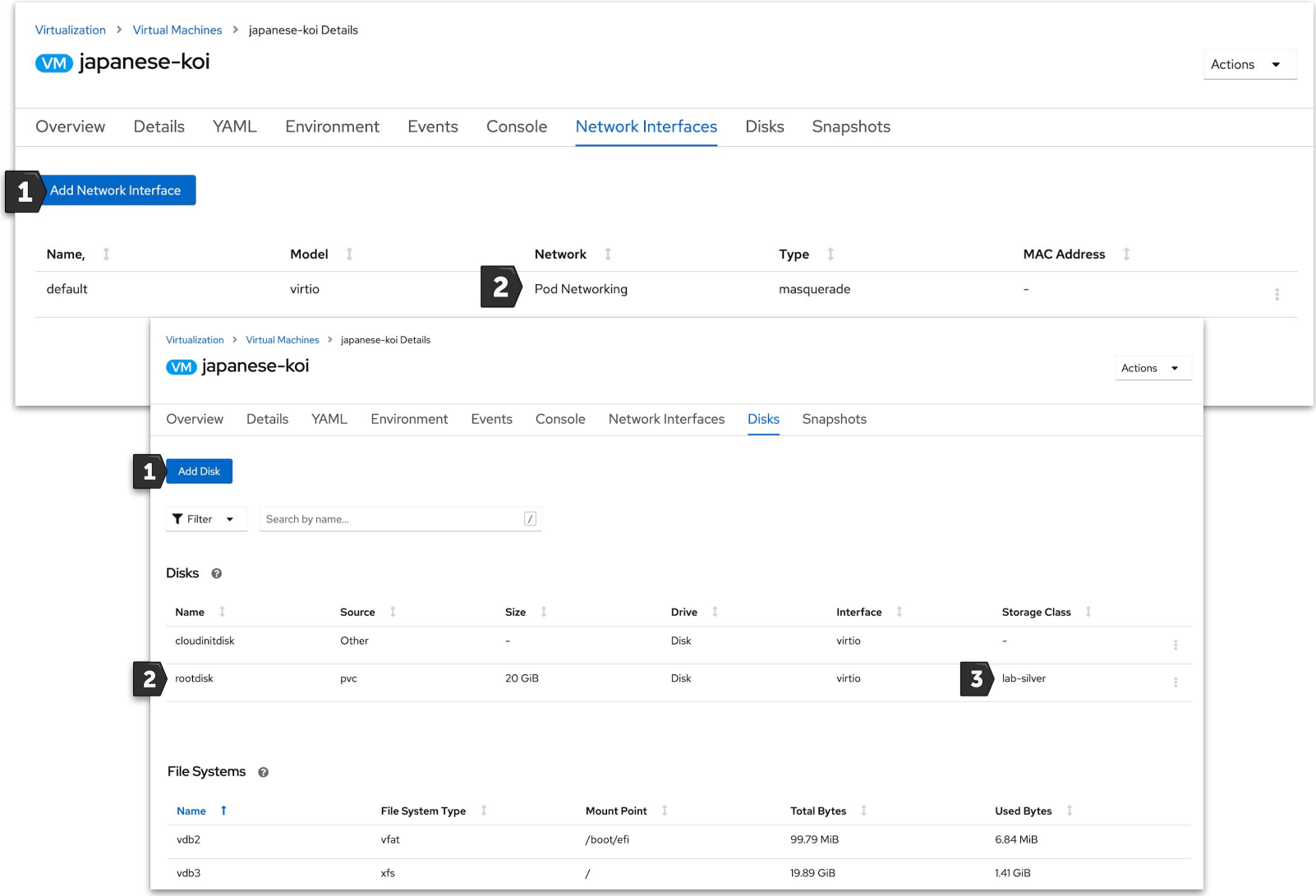
- Actions menu allows quick access to common VM tasks
  - Start/stop/restart
  - Live migration
  - Clone
  - Edit application group, labels, and annotations
  - Delete
- Accessible from all tabs of VM details screen and the VM list



Red Hat

Virtual Machine - Disks and NICs

- Add, edit, and remove NICs and disks for non-running virtual machines



Red Hat

Terminology comparison

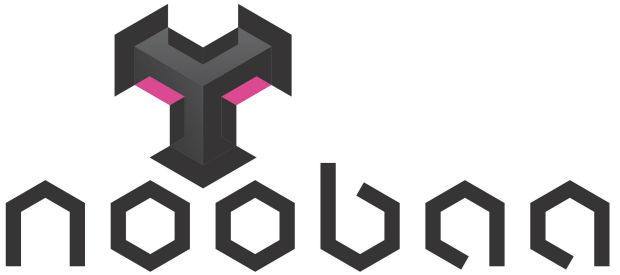
Feature	RHV	OpenShift Virtualization	vSphere
Where VM disks are stored	Storage Domain	PVC	datastore
Policy based storage	None	StorageClass	SPBM
Non-disruptive VM migration	Live migration	Live migration	vMotion
Non-disruptive VM storage migration	Storage live migration	N/A	Storage vMotion
Active resource balancing	Cluster scheduling policy	Pod eviction policy, descheduler	Dynamic Resource Scheduling (DRS)
Physical network configuration	Host network config (via nmstate w/4.4)	nmstate Operator, Multus	vSwitch / DvSwitch
Overlay network configuration	OVN	OCP SDN (OpenShiftSDN, OVNKubernetes, and partners), Multus	NSX-T
Host / VM metrics	Data warehouse + Grafana (RHV 4.4)	OpenShift Metrics, health checks	vCenter, vROps

Red Hat Storage

OpenShift Storage Foundation (OSF)

Red Hat

TECHNOLOGY STACK



Persistent Volume

Block

- Primary for DB and Transactional workloads
- Low latency
- Messaging

Provided by Rook-Ceph

Shared File System

- POSIX-compliant shared file system
- Interface for legacy workloads
- CI/CD Pipelines
- AI/ML Data Aggregation
- Messaging

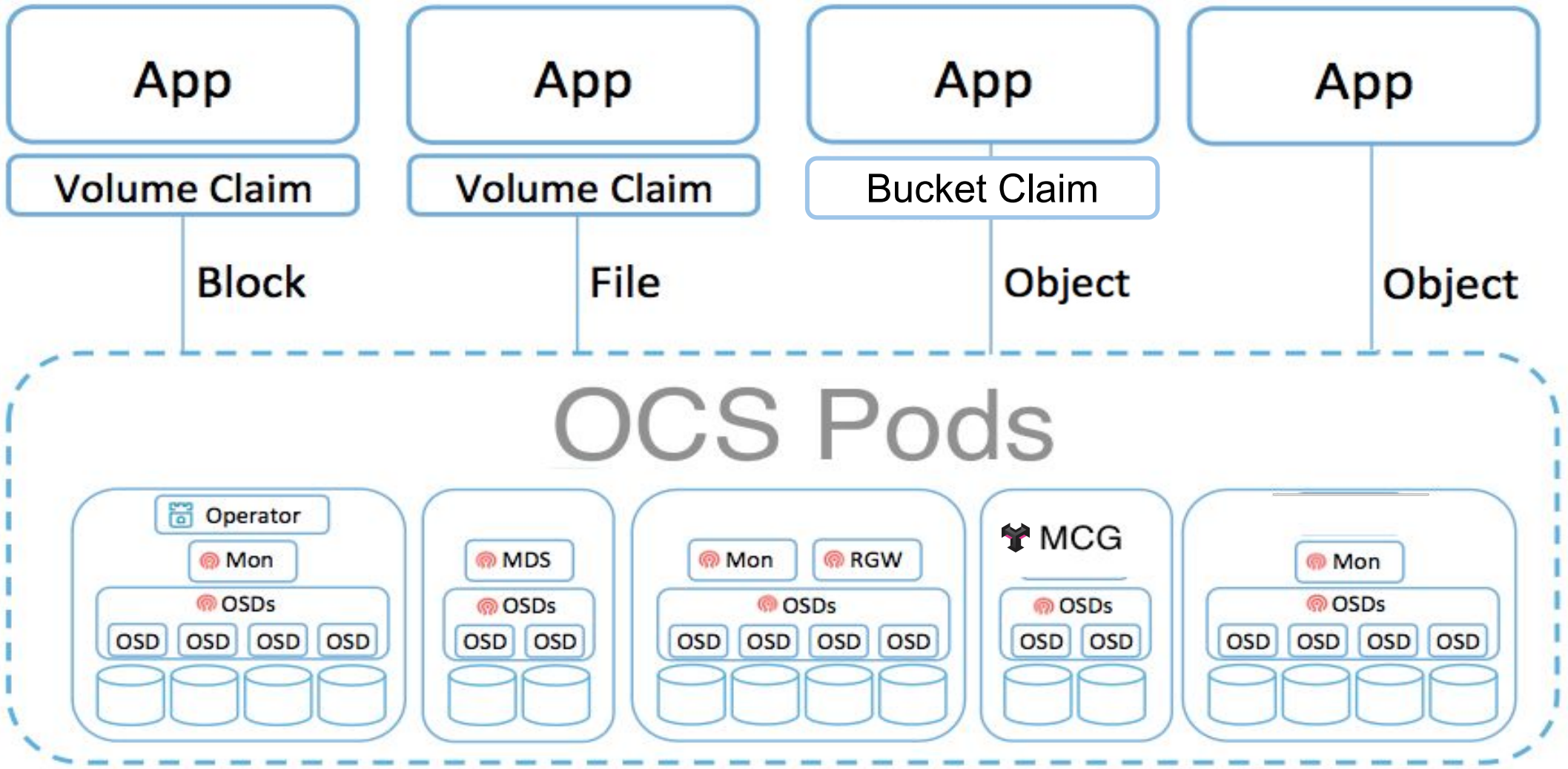
Provided by Rook-Ceph

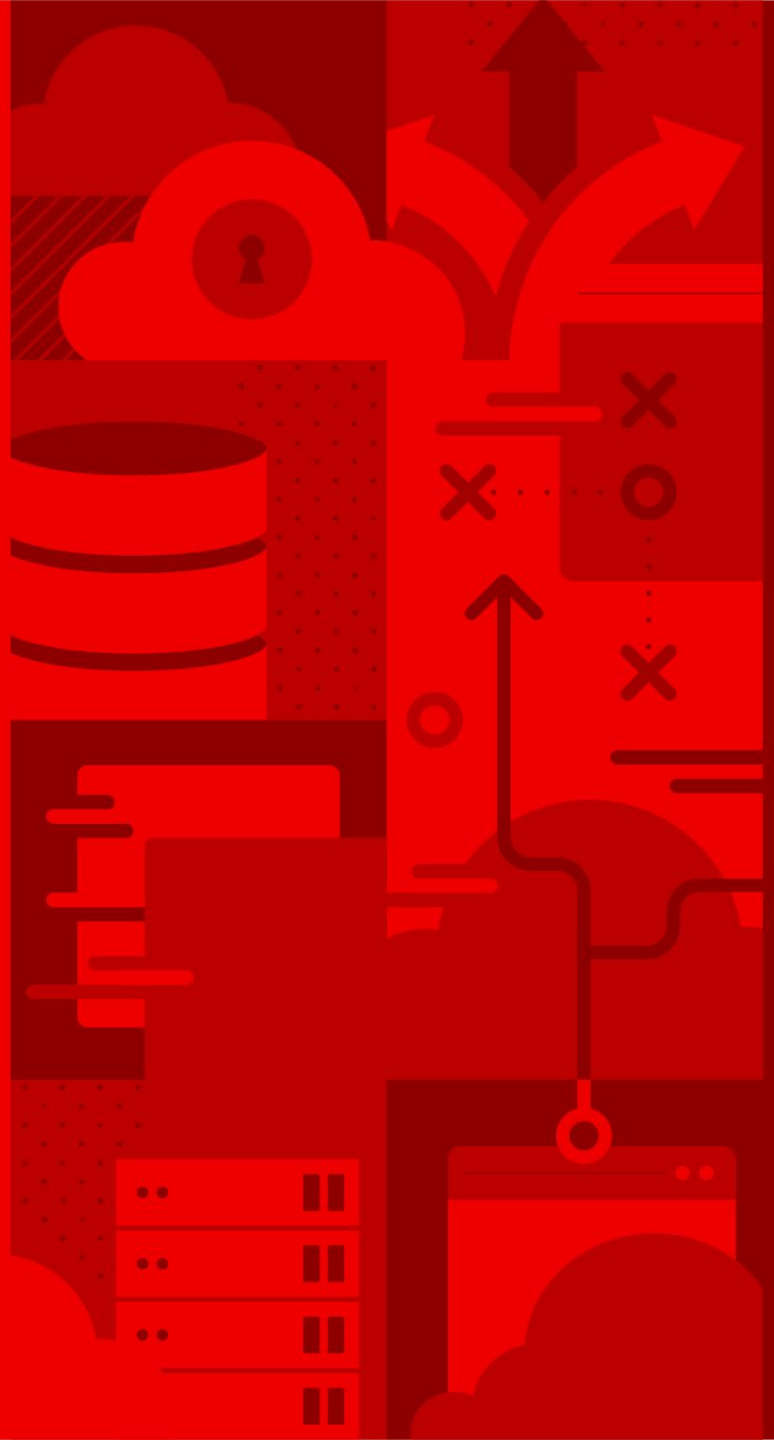
Object Service

- Media, AI/ML training data, Archiving, Backup, Health Records
- Great Bandwidth performance
- Object API (S3/Blob)

Provided by NooBaa

OCS Operator



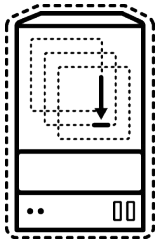


MULTI-CLOUD OBJECT GATEWAY

Red Hat

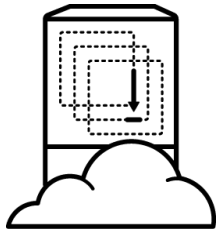
Start lean

A single lightweight pod for basic development and tests



Scale locally

Scale with local volumes or Red Hat Ceph Storage



Workload portability

Easily mirror data to other cluster or native cloud storage

MAJOR COMPONENTS

NOOBAA CORE

Managing the data flow

Providing the object service

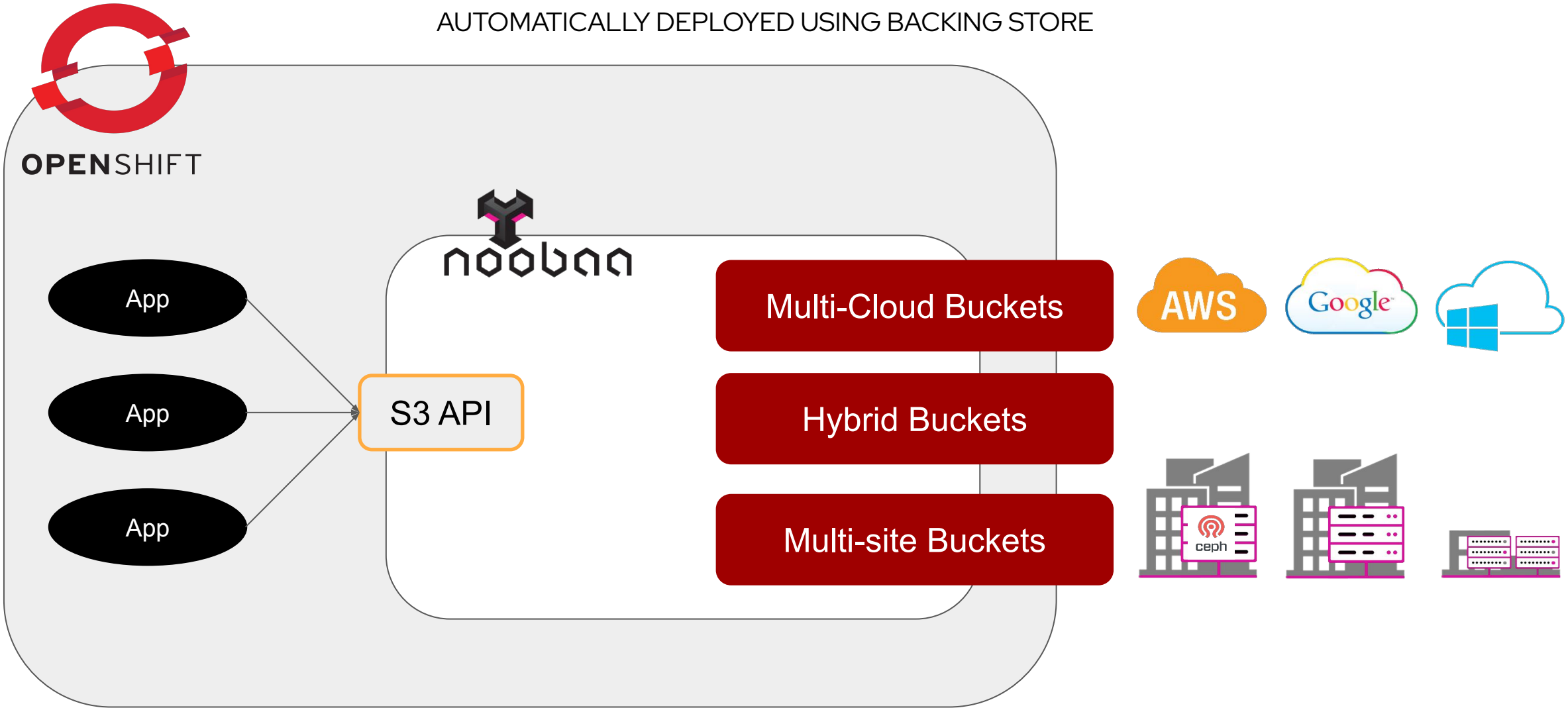
NOOBAA OPERATOR

Deployment and second day operations

COMMAND LINE

Bringing user experience to data management

MULTI CLOUD OBJECT GATEWAY



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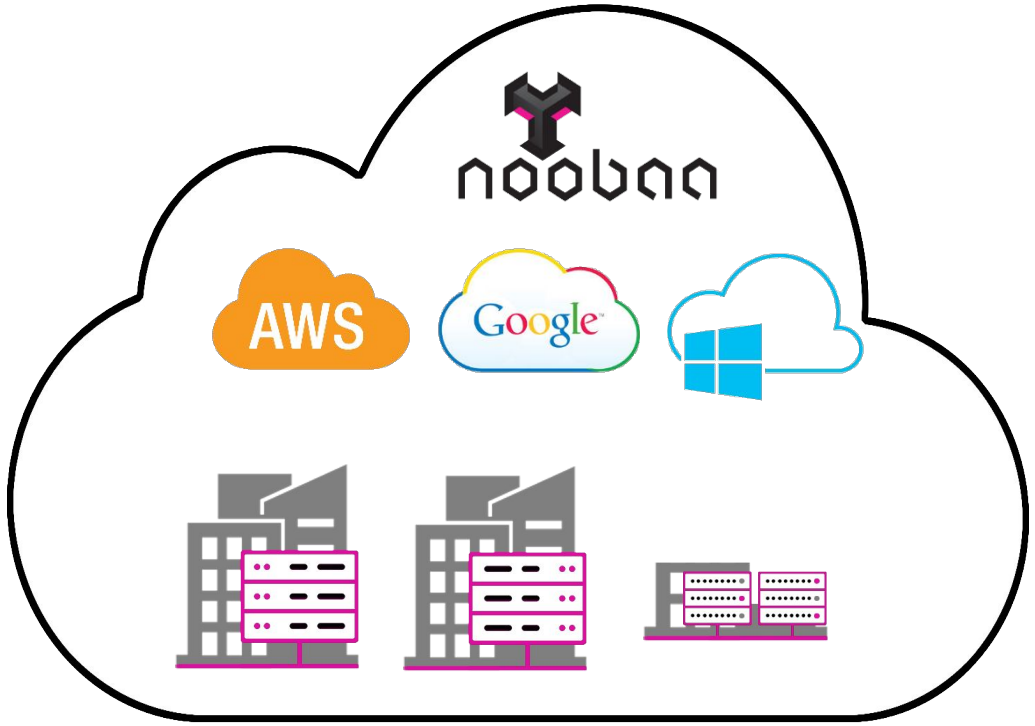
SPANNED ACROSS A CONTINUOUS FABRIC



HIGH STACK - DATA MANAGEMENT

- Active Active – Keep your data available
- Flexible – Any resource, on premises or cloud
- Secured – All data encrypted, managed

LOW STACK - DATA EFFICIENCY LAYER

- Compression
- Inline Deduplication

ENABLING THE OPEN HYBRID CLOUD

ENCRYPTION AT REST AND IN MOTION

Every chunked data is encrypted with its own key using AES 256. Separation between the key management and the data.

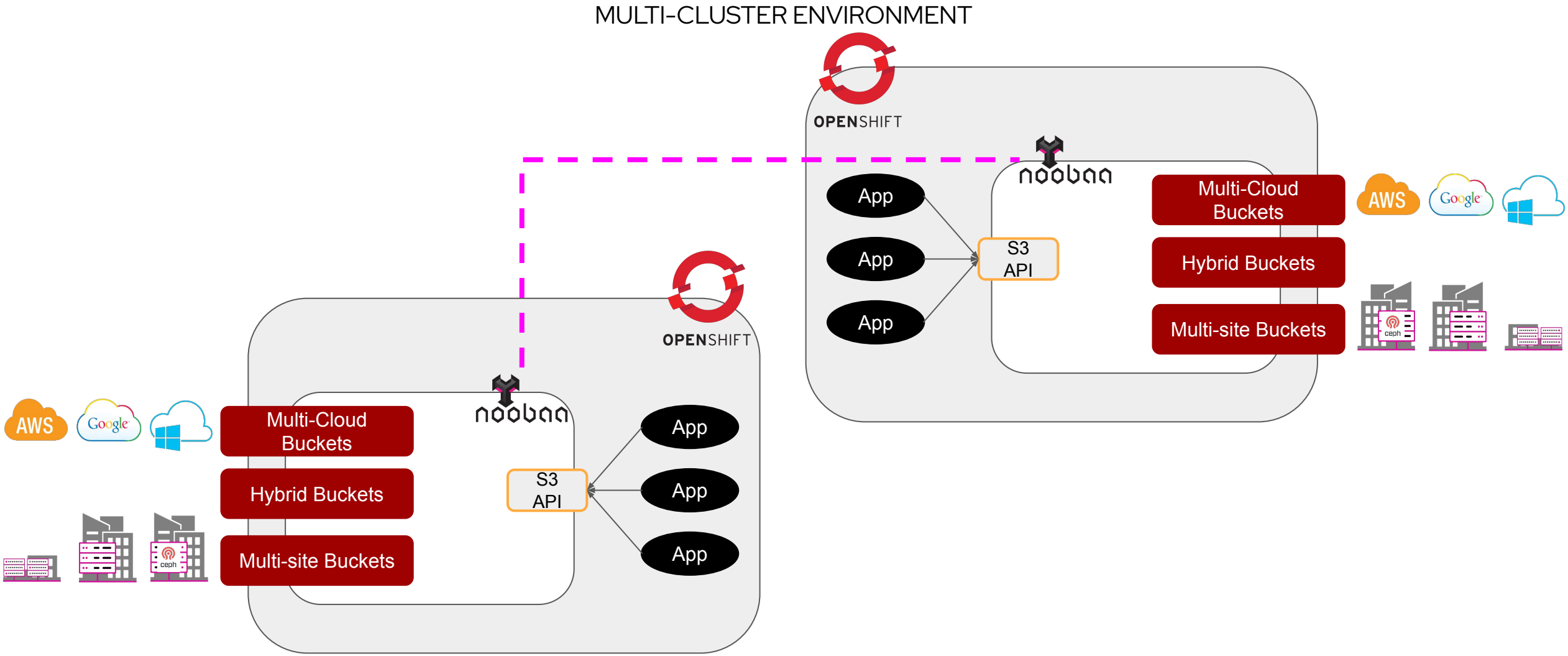
ANONYMIZATION & MASKING

Unique customizable data flow, that can anonymize or mask your own data before storing or collaborating

FINGERPRINTING

Automatic data fingerprinting with self-healing and trust management of the storage nodes

MULTI CLOUD OBJECT GATEWAY



Red Hat

OpenShift Serverless

Alfred Bach
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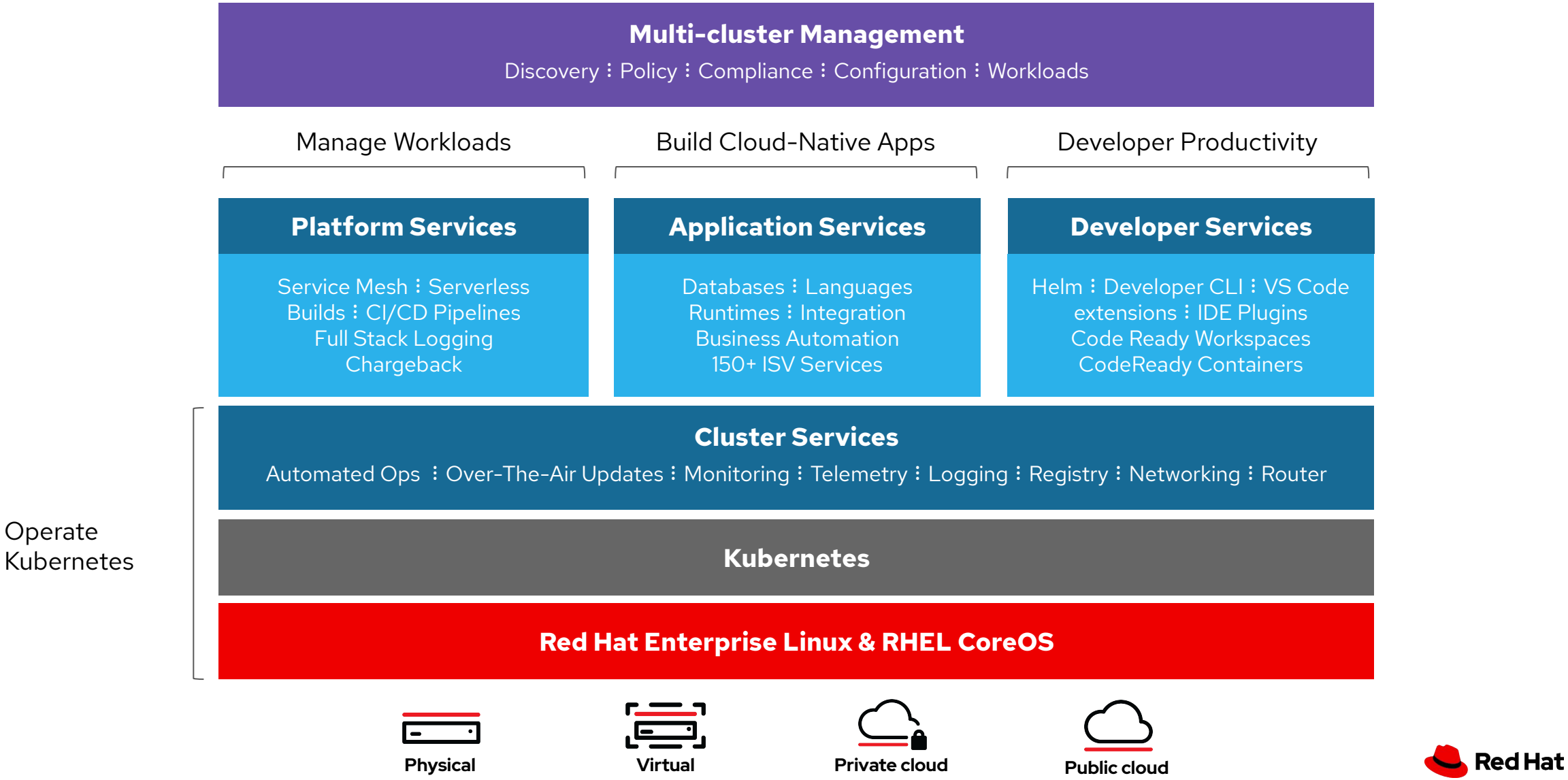
Updated: April 2020

Red Hat

OpenShift Container Platform



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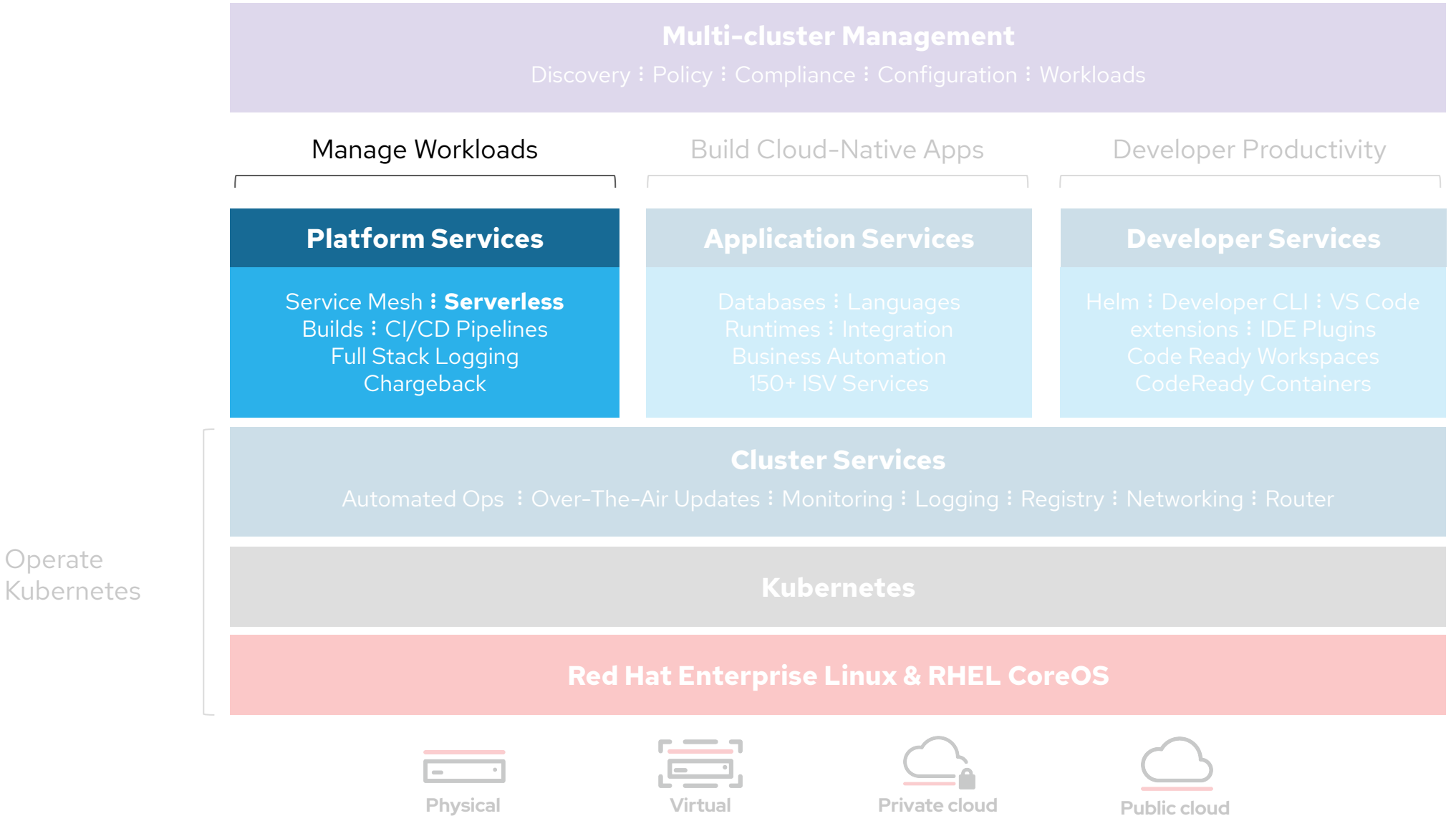
OpenShift Container Platform



Red Hat

Serverless Market Trends

"Use Serverless To optimize The Benefits of The cloud" [2]

40%

of enterprises adopted Serverless technologies or practices with expected growth coming in the next 12 to 18 months.[1]

Vendor lock-in is the second biggest concern when adopting Serverless technologies.[1]

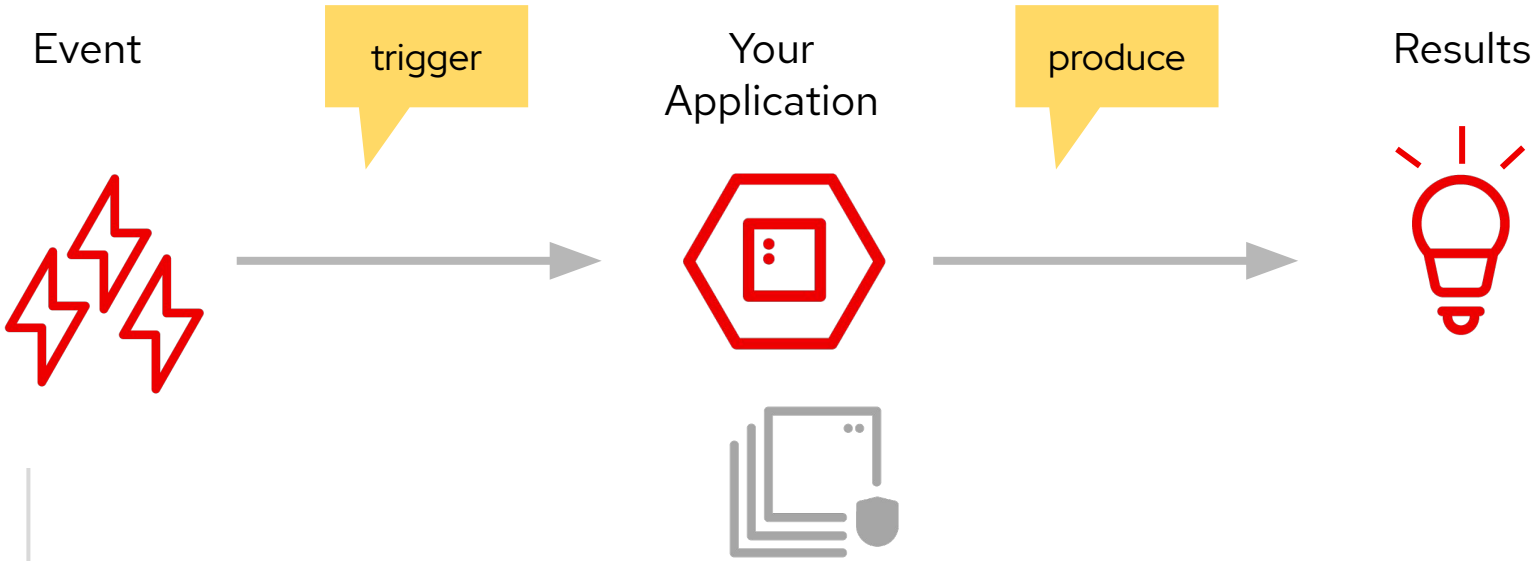
60%

of the serverless practitioners reported *"reduction of operational costs"* with the second biggest benefit being *"scale with demand automatically"*

Source:

1. https://www.oreilly.com/radar/oreilly-serverless-survey-2019-concerns-what-works-and-what-to-expect/
2. Forrester - Now Tech: Serverless, Q4 2019

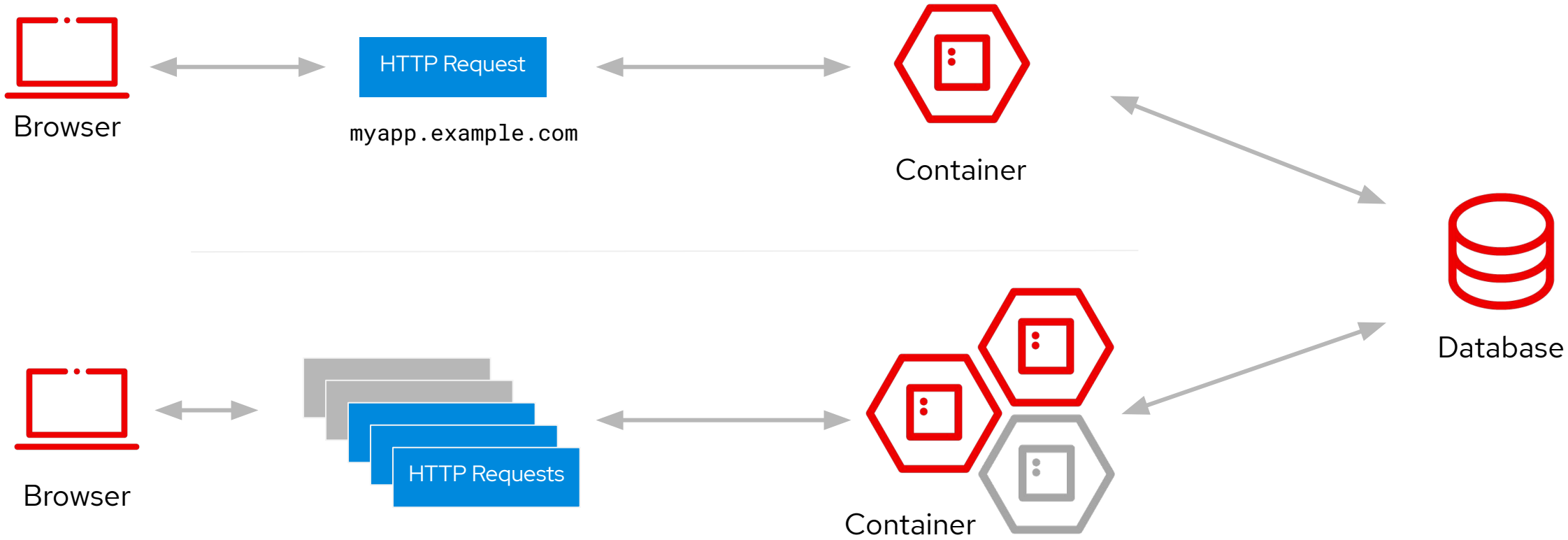
The "Serverless Pattern"



- HTTP Requests
- Kafka Messages
- Image Uploaded
- New Order
- Login from user

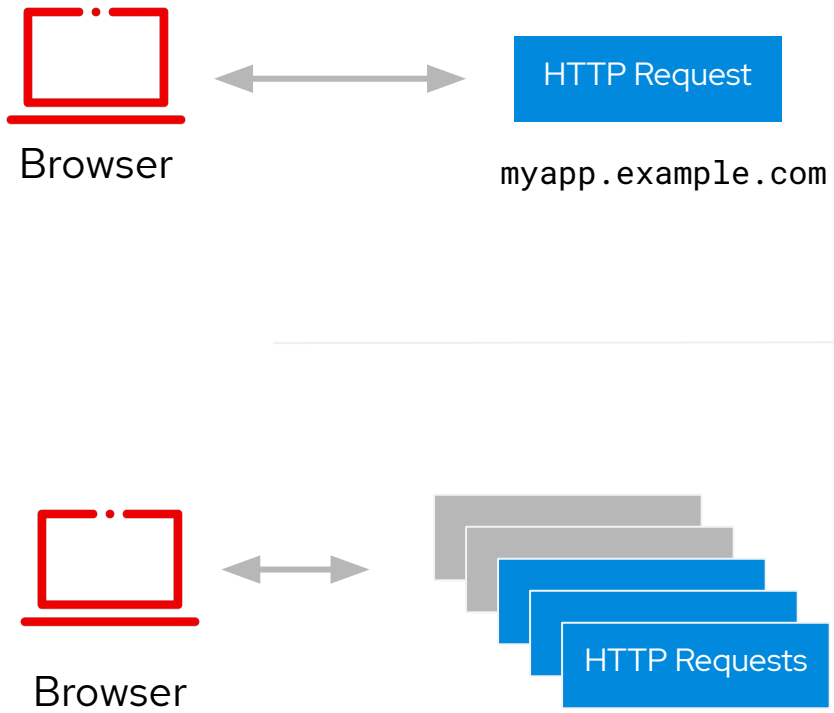
The "Serverless Pattern"

A serverless web application



The "Serverless Pattern"

A serverless web application

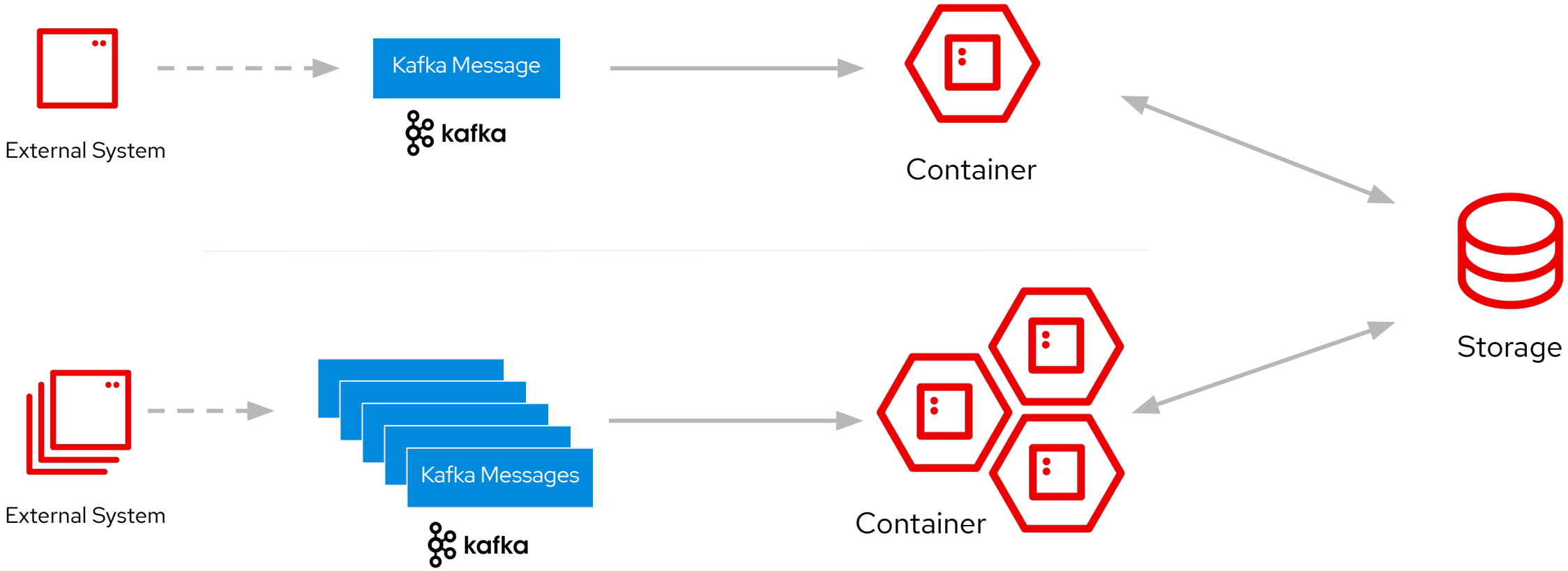


Benefits of this model:

- No need to setup auto-scaling and load balancers
  - Scale down and save resources when needed.
  - Scale up to meet the demand.
- No tickets to configure SSL for applications
- Enable Event Driven Architectures (EDA) patterns
- Enable teams to associate cost with IT
- Modernize existing applications to run as serverless containers

The "Serverless Pattern"

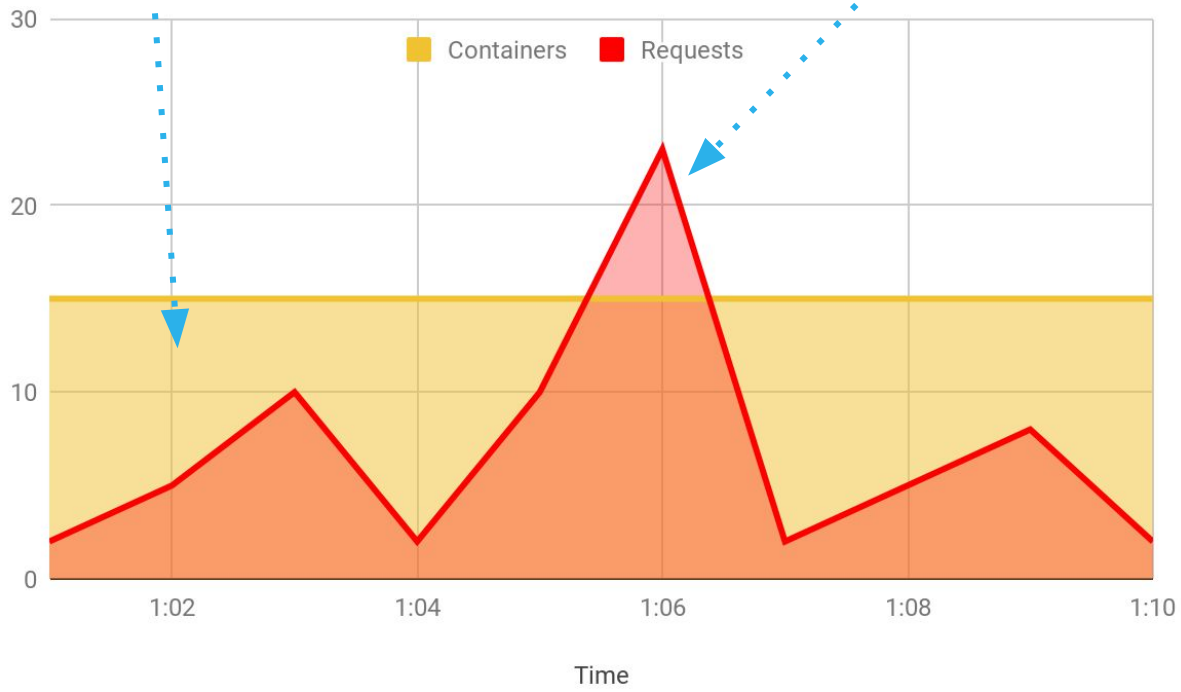
Processing a Kafka message



Serverless Operational Benefits

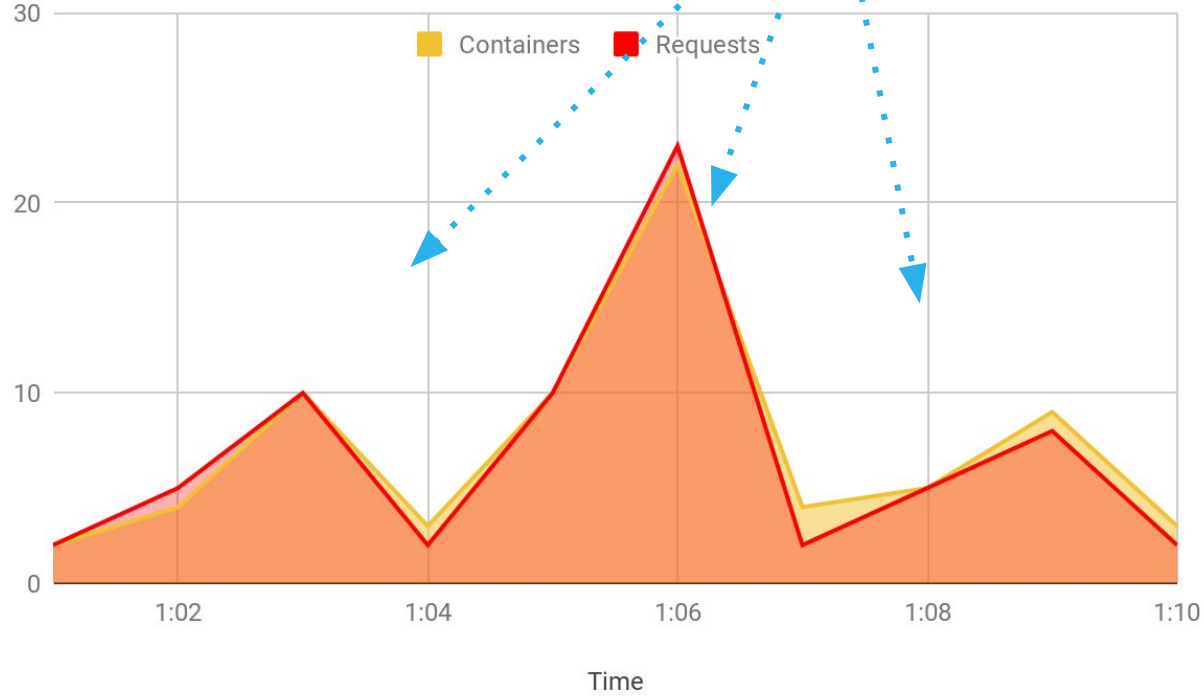
Over provisioning
Time in capacity planning
IT cost of idle resources

Under provisioning
Lost business revenue
Poor quality of service



NOT Serverless

More applications
Direct line between IT
costs & business revenue



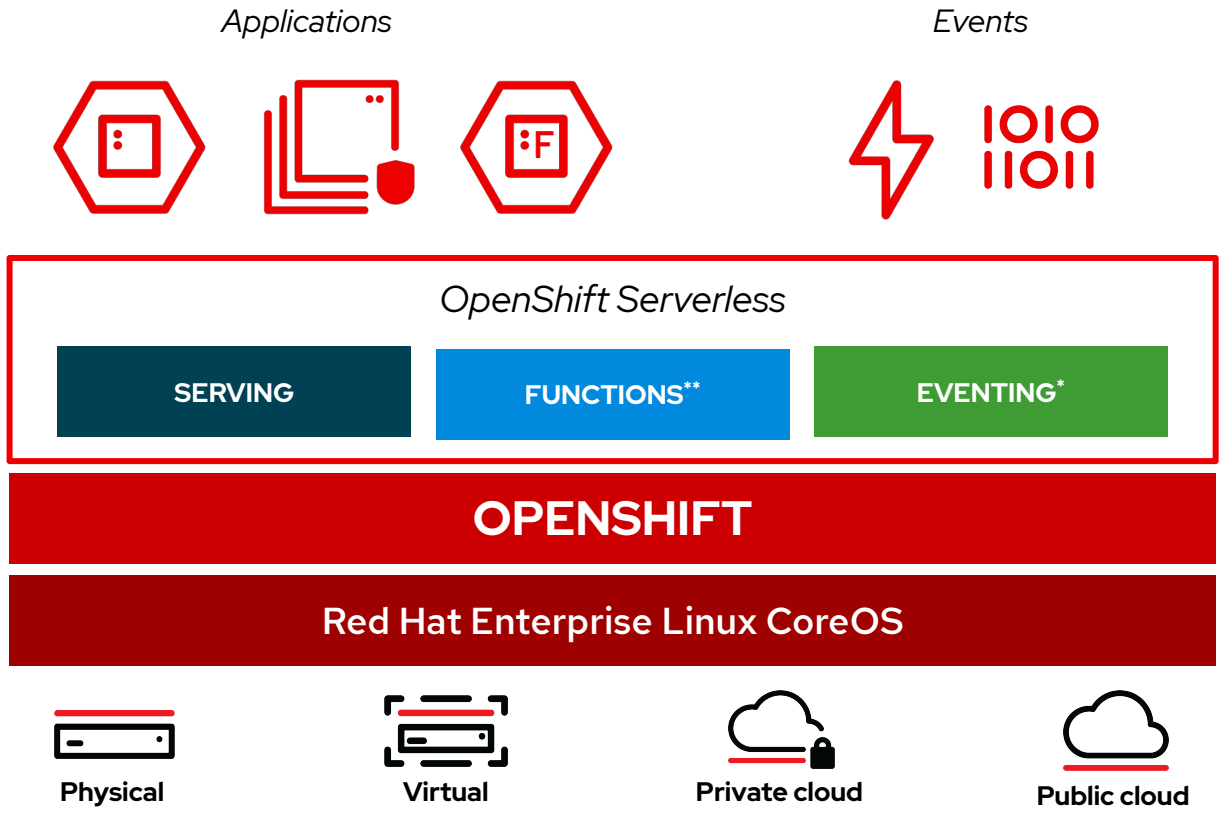
with Serverless

Generally Available

Openshift Serverless

Event-driven serverless containers and functions

- Deploy and run **serverless containers**
- Use any programming language or runtime
- Modernize existing applications to run serverless
- Powered by a rich ecosystem of event sources
- Manage serverless apps natively in Kubernetes
- Based on open source project **Knative**
- Run anywhere OpenShift runs



* Eventing is currently in Technology Preview

** Functions are currently a work in progress initiative

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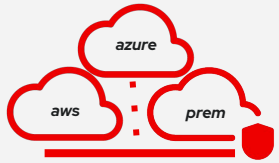
OpenShift Serverless

Key Features

Containers made easy

Simplified developer experience to deploy applications/code on serverless containers abstracting infrastructure & focusing on what matters.

Ready for the Hybrid Cloud



Truly portable serverless running anywhere OpenShift runs, that is on-premises or on any public cloud. Leverage data locality and SaaS when needed.

Immutable revisions

Deploy new features: performing canary, A/B or blue-green testing with gradual traffic rollout with no sweat and following best practices.

Any programming language

Use any programming language or runtime of choice. From Java, Python, Go and JavaScript to Quarkus, SpringBoot or Node.js.

Automatic scaling

No need to configure number of replicas, or idling. Scale to zero when not in use, auto scale to thousands during peak, with built-in reliability and fault-tolerance.

Event Driven Architectures

Build loosely coupled & distributed apps connecting with a variety of built-in or third-party event sources or connectors powered by Operators.

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Thank you

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