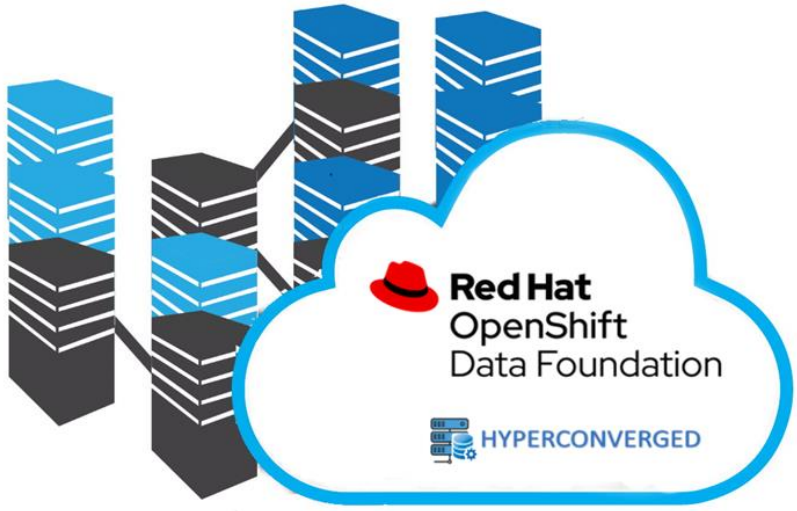
# Hyperconverged Red Hat OpenShift Container Platform with Data Foundation

Introduction

HYPERSCALERS with Red Hat




Monday, 20 March 2023

# INTRODUCTION

Red Hat® OpenShift® is an enterprise-ready Kubernetes container platform based on a unified architectural vision and supported by an open hybrid cloud strategy.

Using OpenShift, applications and the data centres that support them can expand safely and securely from just a few machine and application instances to thousands of instances that serve millions of clients.

Hyperscalers understands the need for Enterprise service providers and IT administrators to run and manage virtual machine (VM) and container workloads side by side on a single platform.

OpenShift can fulfill this requirement by allowing you to develop, manage, and deploy virtual machines side-by-side with containers and serverless across a common hyperconverged storage pool.

Hyperscalers has partnered with Red Hat to engineer and qualify a purpose-built, Hyperconverged Red Hat OpenShift Container Platform that incorporates all these features under a single hardware and software architecture that is jointly engineered and supported by Hyperscalers and Red Hat.

As a key part of this, the OpenShift Data Foundation supports a collection of on-demand storage and data service types that is tightly integrated within the OpenShift Platform.

The Hyperconverged OpenShift Platform enables you to leverage powerful storage technology breakthroughs that can deliver significant performance and/or capacity improvements such as you might require for your specific implementation.

These storage products have been tested within Hyperscalers rigorous laboratory environment for compatibility at all levels of the solution architecture, saving you from unexpected hardware, baseboard management, device driver and software stack issues.

Support for all components delivered within the Hyperconverged OpenShift Platform solution architecture is provided by Hyperscalers as part of initial solution delivery and during your ongoing support relationship with us.

Regardless of whether your primary focus is to leverage OpenShift continuous integration and continuous delivery (CI/CD) pipeline capabilities, and/or to support consistent management of hybrid cloud, multi-cloud, and edge deployments, the Hyperconverged Red Hat OpenShift Container Platform can provide you with the capacity, performance and availability capabilities and attributes that your organisation requires.

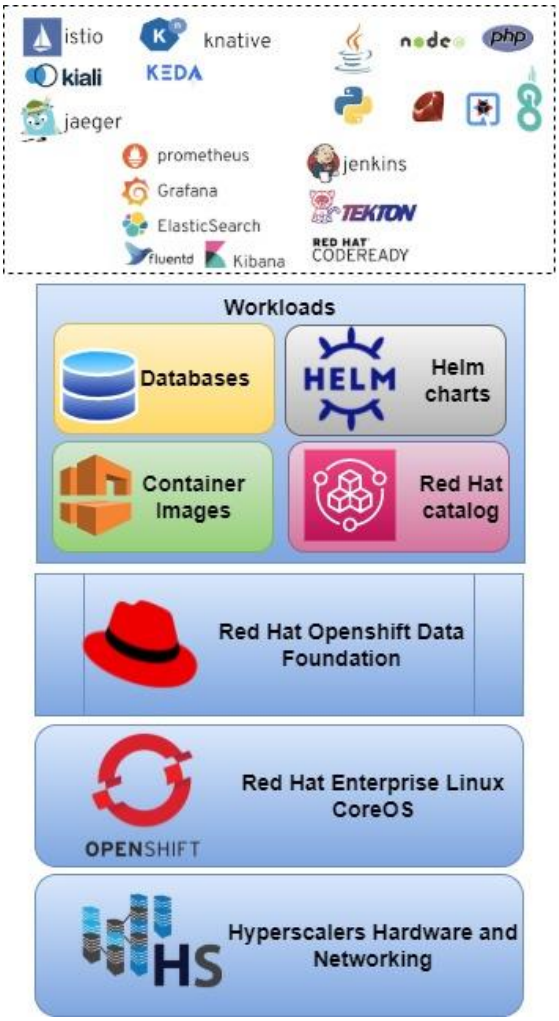



*Figure 1 System Functional Black Diagram for Red Hat OpenShift with Data Foundation*

## Features of Hyperconverged Red Hat OpenShift Container Platform with Data Foundation

Red Hat OpenShift is a comprehensive platform inclusive of core Kubernetes, Linux Kernel based Virtual Machine (KVM) and highly resilient Ceph storage technology. This makes Red Hat OpenShift production grade with not just a platform to run apps but a complete packaging of authentication, networking, security, monitoring, logs management, etc. Red Hat OpenShift integrates all the features of Kubernetes and provides add-on features to the platform as listed below[1]:

1. A trusted OS foundation: RHEL CoreOS or RHEL
2. Automated Operations
3. Developer Services
4. Application Services
5. Cluster Services

Red Hat OpenShift manages hybrid technologies and applications, helping you modernize existing applications and accelerate new cloud-native application development and delivery at scale across any infrastructure.

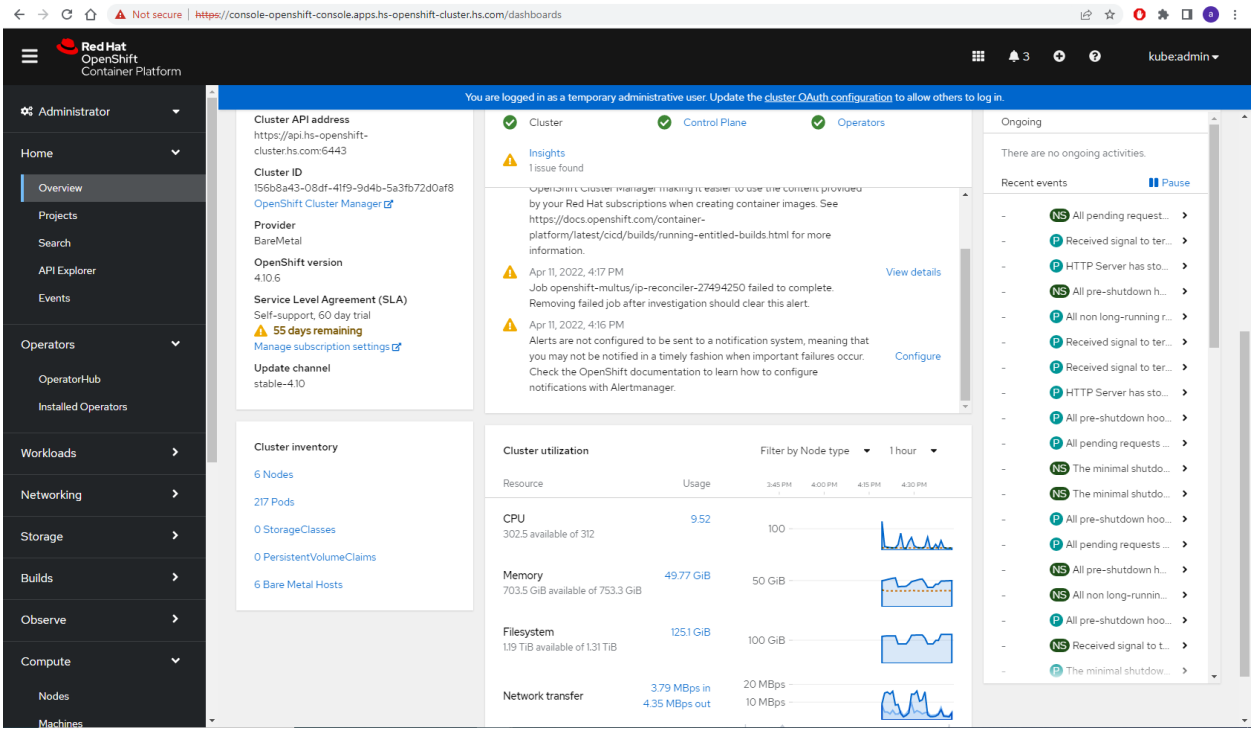



*Figure 2 Red Hat OpenShift Dashboard*

## Benefits of Red Hat OpenShift[2] :

### Scalability

Apps running on Red Hat OpenShift can scale to thousands of instances across hundreds of nodes in seconds.

### Flexibility:

Red Hat OpenShift simplifies deployment and management of a hybrid infrastructure, giving you the flexibility to have a self-managed or fully managed service, running on-premises or in cloud and hybrid environments.

### Open-source standards

Red Hat OpenShift incorporates Open Container Initiative (OCI) containers and Cloud Native Computing Foundation-certified Kubernetes for container orchestration, in addition to other open-source technologies.

### Container portability

Container images built on the OCI industry standard ensure portability between developer workstations and Red Hat OpenShift production environments.

### Enhanced developer experience

Red Hat OpenShift offers a comprehensive set of developer tools, multilanguage support, and command line and integrated development environment (IDE) integrations. Features include continuous integration/continuous delivery (CI/CD) pipelines based on Tekton and third-party CI/CD solutions, service mesh, serverless capabilities, and monitoring and logging capabilities.

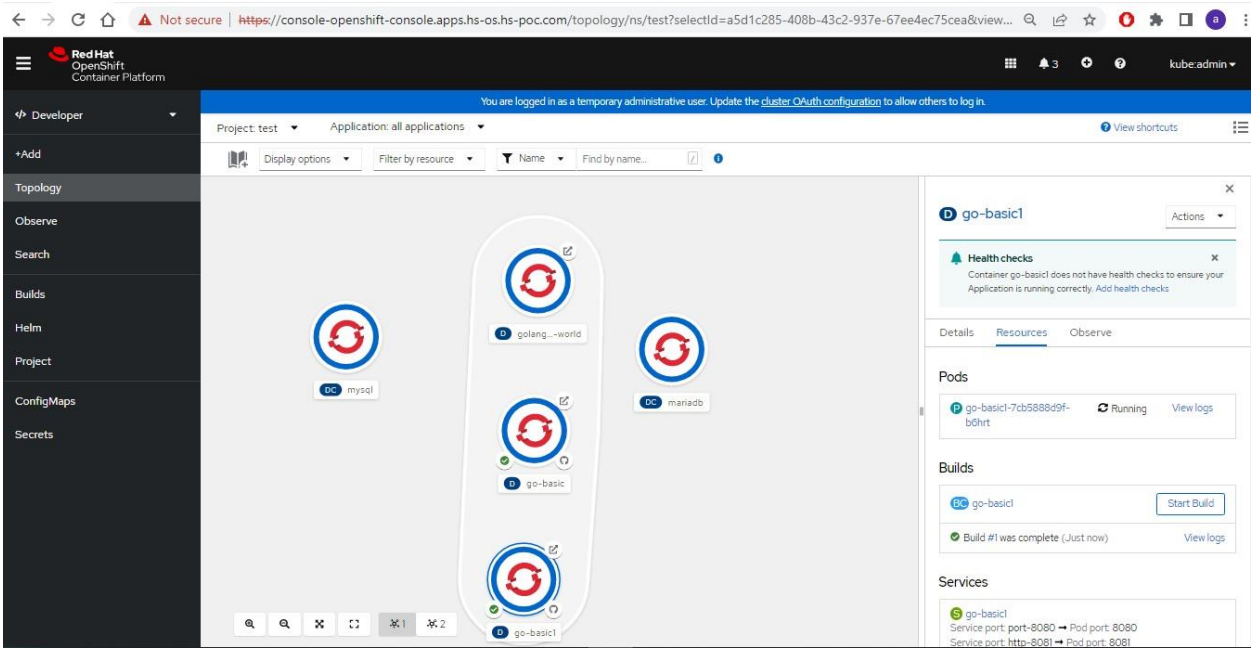



*Figure 3 Apps deployed with ease*

### Automated installation and upgrades

Automated installation and over-the-air platform upgrades are supported in cloud with Amazon Web Services, Google Cloud Platform, IBM Cloud, and Microsoft Azure, and on-premises using vSphere, Red Hat OpenStack Platform, Red Hat Virtualization, or bare metal. Services used from the Operator Hub can be deployed fully configured and are upgradable with 1 click.

### Automation

Streamlined and automated container and app builds, deployments, scaling, health management, and more are included.

### Edge architecture support

Red Hat OpenShift enhances support of smaller-footprint topologies in edge scenarios that include 3-node clusters, single-node Red Hat OpenShift, and remote worker nodes, which better map to varying physical size, connectivity, and availability requirements of different edge sites. The edge use cases are further enhanced with support for Red Hat OpenShift clusters on ARM architecture, commonly used for low-power-consumption devices.

### Multi-cluster management

Red Hat OpenShift with Red Hat Advanced Cluster Management for Kubernetes can easily deploy apps, manage multiple clusters, and enforce policies across clusters at scale.

### Advanced security and compliance

Red Hat OpenShift offers core security capabilities like access controls, networking, and enterprise registry with built-in scanner. Red Hat Advanced Cluster Security for Kubernetes enhances this with security capabilities like runtime threat detection, full life cycle vulnerability management, and risk profiling.

### Persistent storage

Red Hat OpenShift supports a broad spectrum of enterprise storage solutions, including Red Hat OpenShift Data Foundation, for running both stateful and stateless apps.

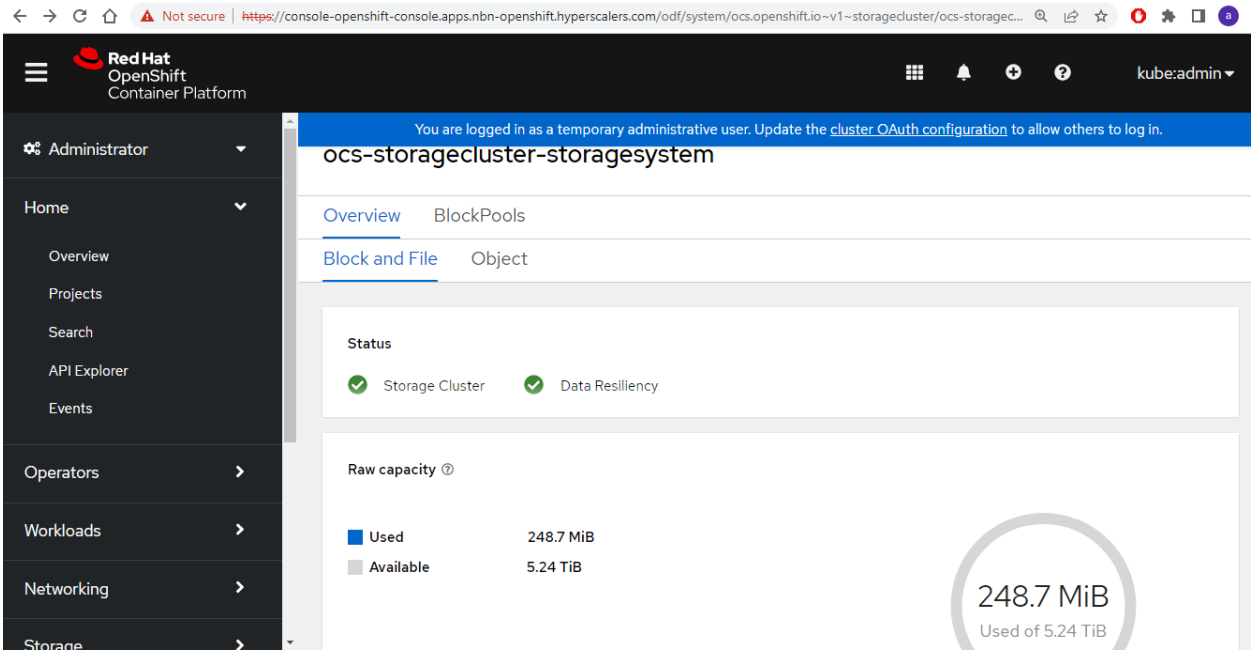



*Figure 4 Block, File and Object resilient data storage*

### Robust ecosystem

An expanding ecosystem of partners provides a wide variety of integrations. Third parties deliver additional storage and network providers, IDE, CI, integrations, independent software vendor solutions, and more.

### Power of Kubernetes

Within OpenShift Container Platform, Kubernetes manages containerized applications across a set of containers or hosts and provides mechanisms for deployment, maintenance, and application-scaling. The container runtime packages, instantiates, and runs containerized applications [3].

### Install Operators

Red Hat OpenShift platform provides several operators that are pre-engineered to perform specific applications like Elastic Search, Kafka, SSL certificate management etc. Please note that a subscription to individual services may be required to use the applications in Red Hat OpenShift environment.

### OpenShift Data Foundation

Ceph based persistent storage previously called Red Hat OpenShift Container Storage—is software-defined storage for containers. It provides cluster data management capabilities that lets organizations deploy their apps and data management as needs dictate, and then adjust as they move forward.

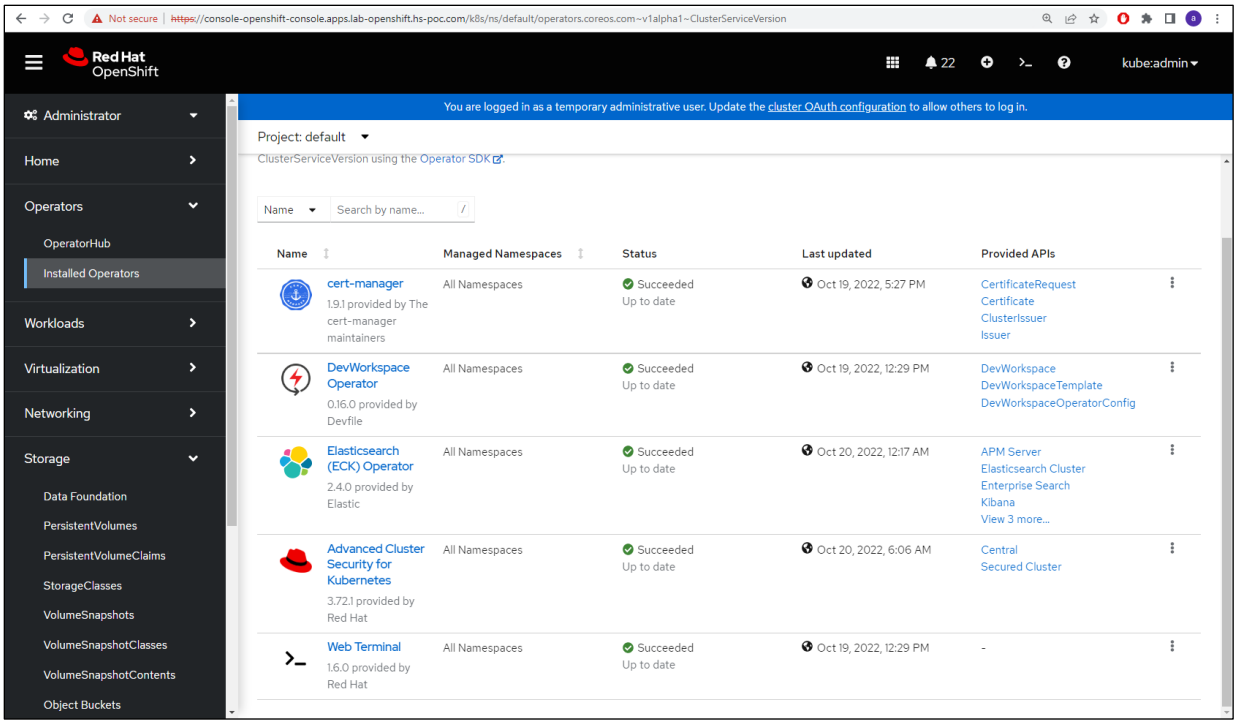



*Figure 5 Red Hat OpenShift Operators*

## Persistent volumes, Claims and Storage classes:

In a containerized environment, the storage is classified as Storage class which is consumed by the persistent volumes using the persistent volume claims. Each of the persistent volume claim is associated with an application which decides the size of the storage allocation to them. As mentioned earlier, Ceph is the underlying storage technology for the Red Hat OpenShift that can provide a block, filesystem, and object storage classes for the application to use from. Below are some of the screenshots that show the storage platform provided by the Red Hat Data Foundation.

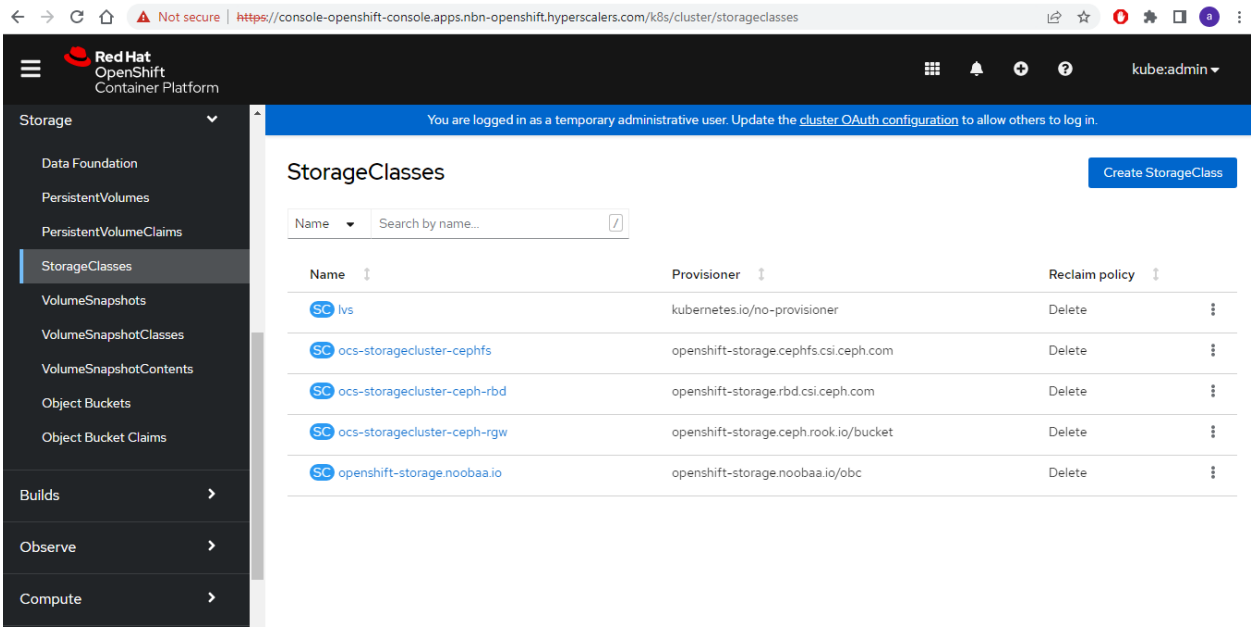



*Figure 6 OpenShift Block, File and Object storage classes*

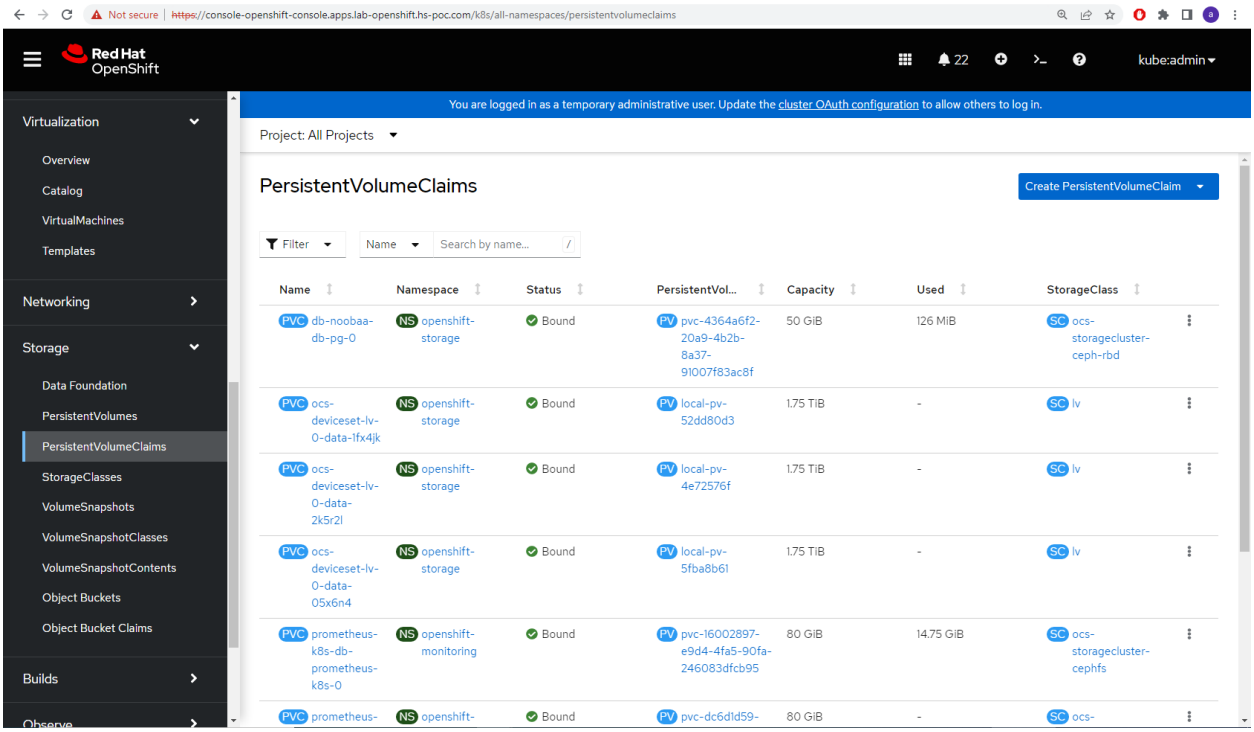



*Figure 7 Red Hat Data Foundation Persistent Volume Claims*

## Pods:

Pods are the basic unit of the containerized resource where an application resides. Pods can be replicated for high availability and the route to the application is defined in the pods. Every pod is associated with a namespace or project, and they can be accessed via SSH.

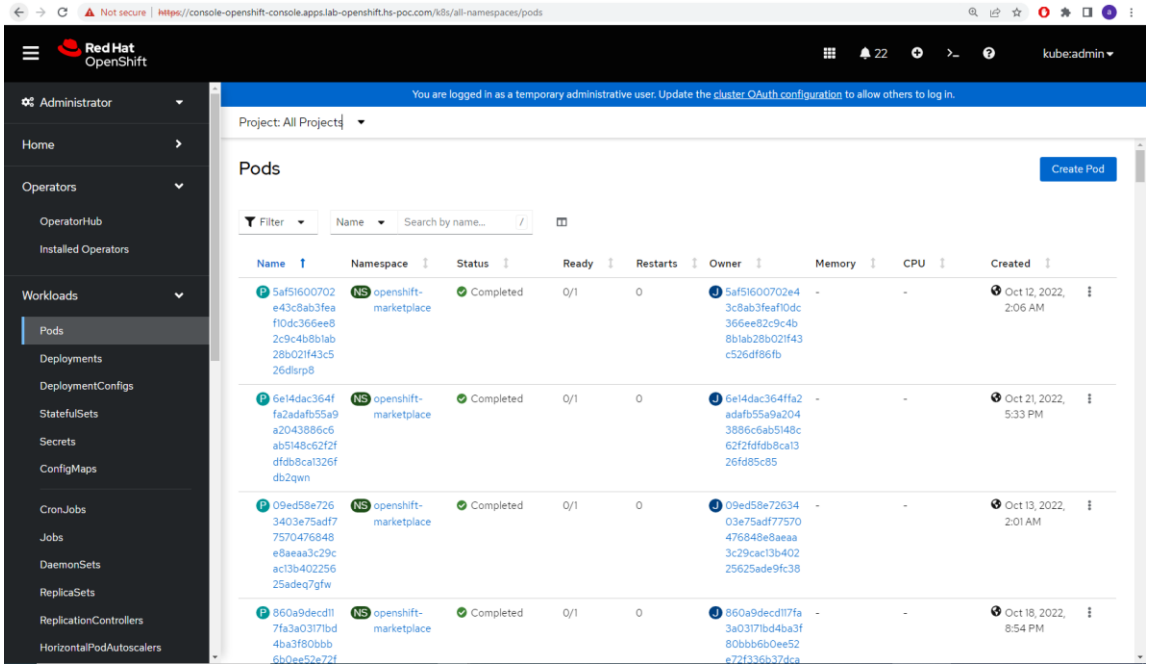



*Figure 8 Pods in Red Hat OpenShift*

## Virtualization:

Red Hat Virtualisation is enabled on the OpenShift using the Virtualization Operator. This enables the user to have the containers alongside the virtual machines to provide adaptability for application that are built for Kubernetes containers and those apps built for virtual machines. Hence, the same physical resource can used to deploy containerised as well as virtual machine-based workloads.

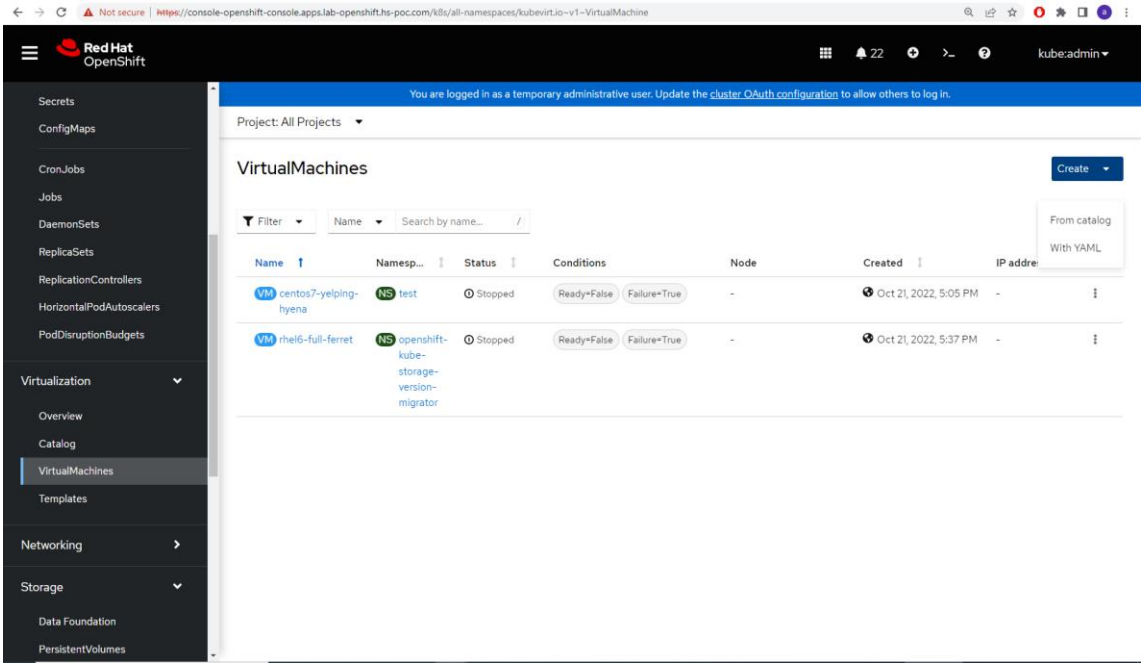



*Figure 9 Virtualization in Red Hat OpenShift*

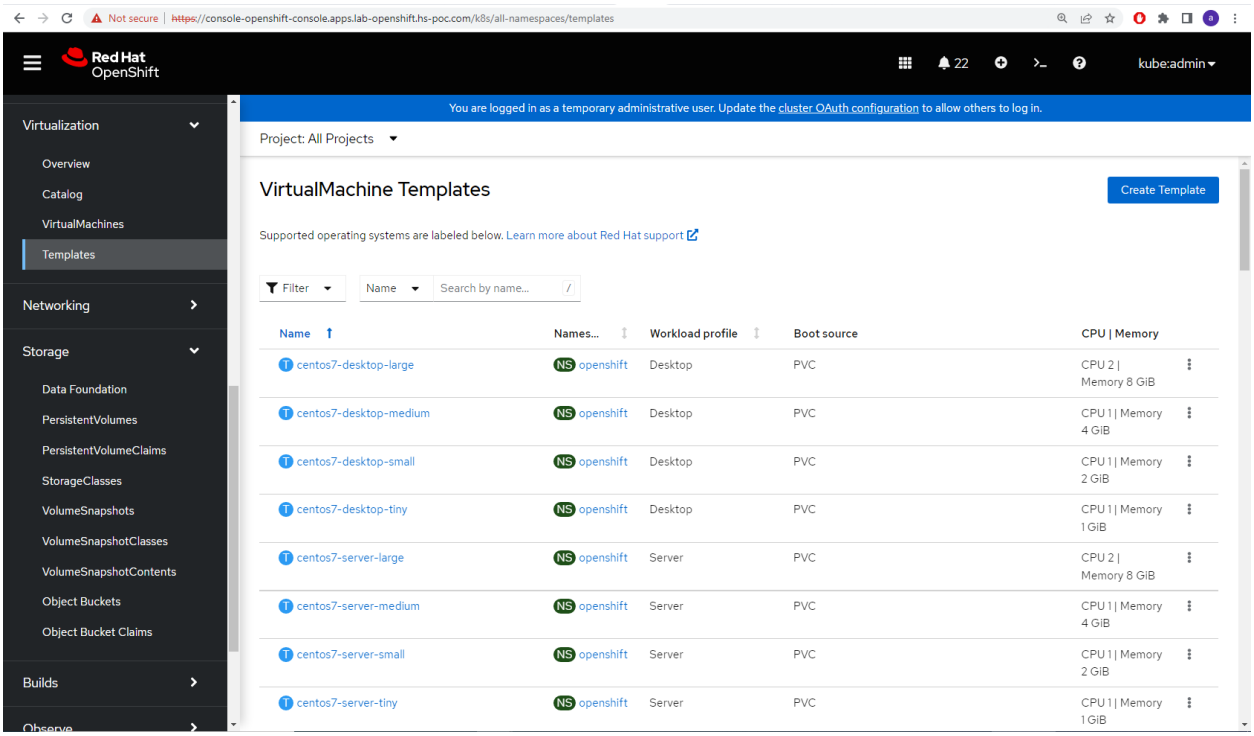



*Figure 10 Virtual Machine templates in Red Hat OpenShift*

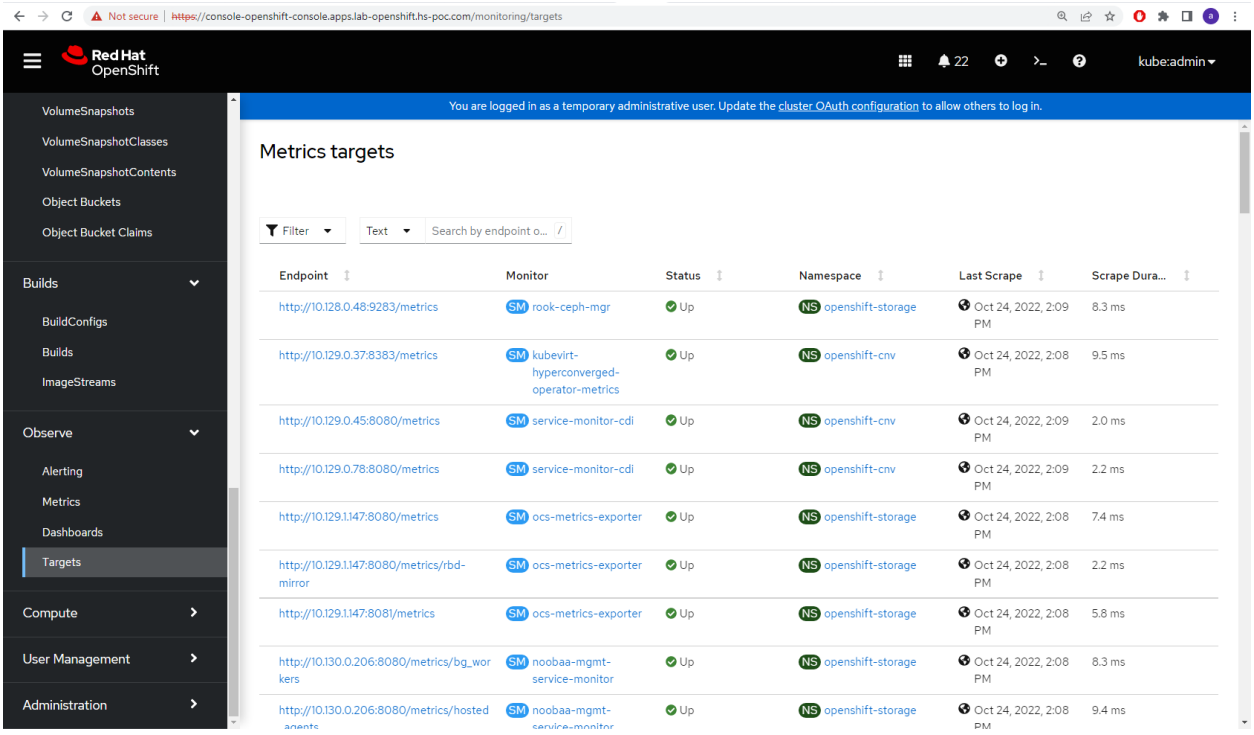



*Figure 11 Access Endpoints to Monitoring and Health Metrics*

## Cluster Upgrades and Subscription:

Red Hat OpenShift provides a 60-day free evaluation to setup and support your cluster deployment and then we can attach a license/subscription based on purchase period for the support and services. Cluster upgrade can run on the live environment without affecting the workload but it is highly recommended to understand the requirements of your workloads before upgrading as it could cause inter-operability issues within the apps in the container.

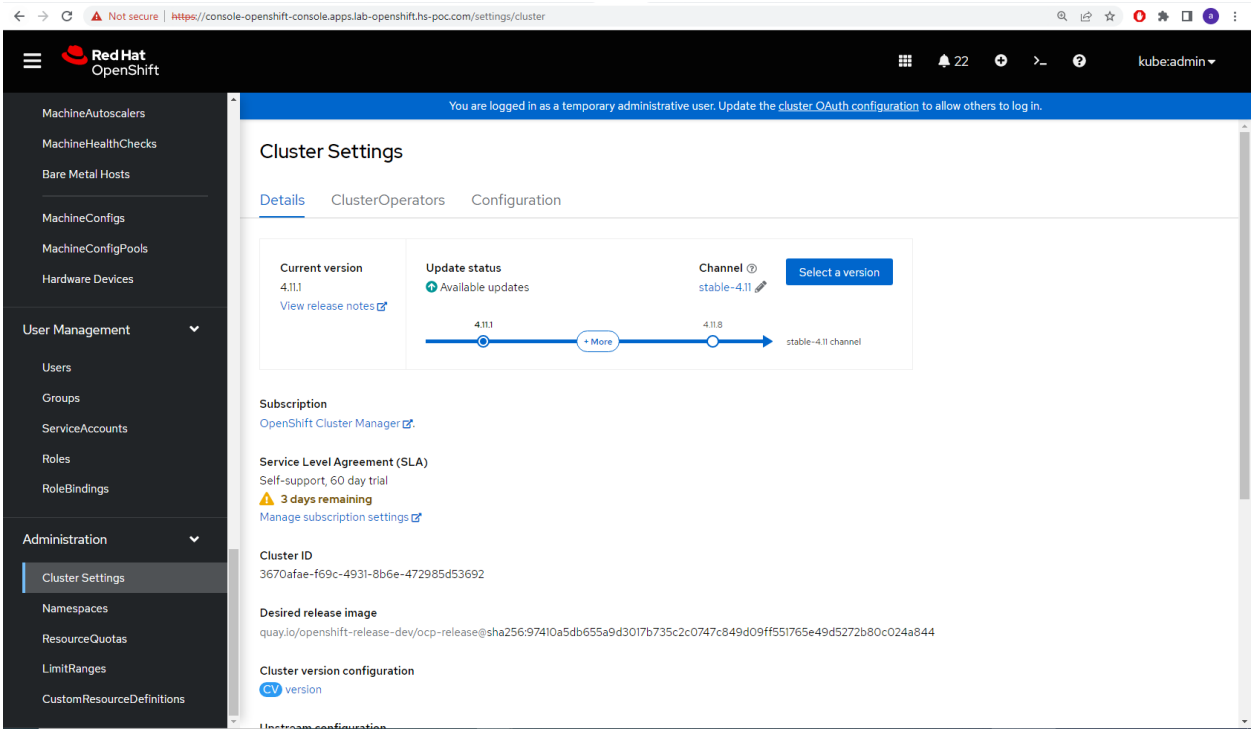



*Figure 12 Red Hat OpenShift Cluster maintenance and upgrade*

# Infrastructure

**Production level hardware requirements**

For production environments, the following recommendations apply:

- **Master hosts -** In a highly available OpenShift Container Platform cluster with external etcd, a master host needs to meet the minimum requirements and have 1 CPU core and 1.5 GB of memory for each 1000 pods. Therefore, the recommended size of a master host in an OpenShift Container Platform cluster of 2000 pods is the minimum requirements of 2 CPU cores and 16 GB of RAM, plus 2 CPU cores and 3 GB of RAM, totalling 4 CPU cores and 19 GB of RAM.
- **Worker hosts -** The size of a node host depends on the expected size of its workload. As an OpenShift Container Platform cluster administrator, you need to calculate the expected workload and add about 10 percent for overhead. For production environments, allocate enough resources so that a node host failure does not affect your maximum capacity.

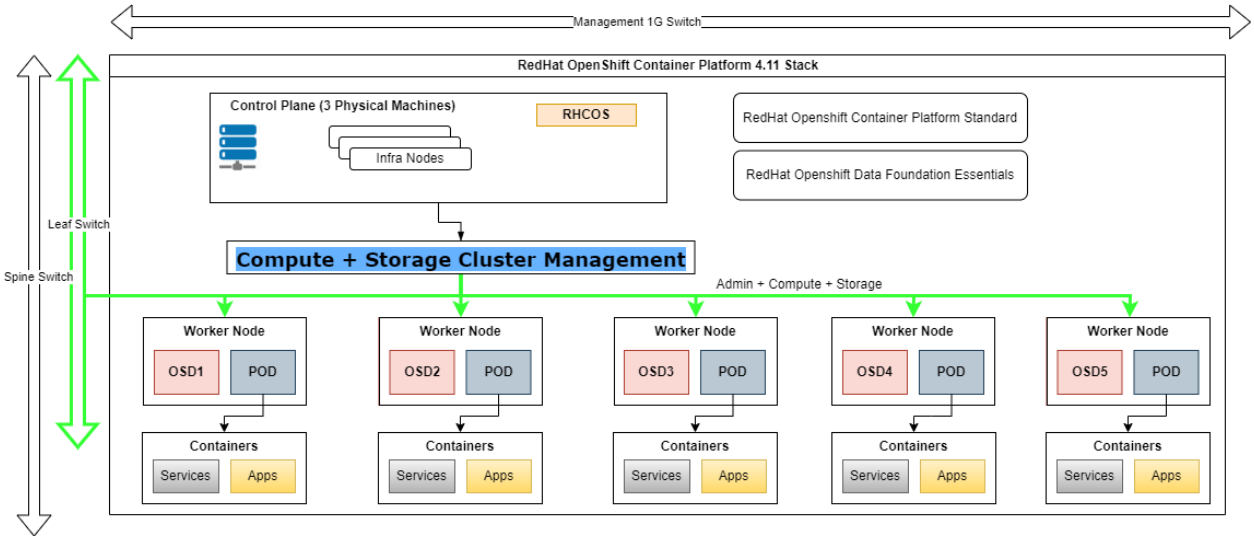



*Figure 13 System Architecture for Red Hat OpenShift*

# Why Hyperscalers

Hyperscalers [1] is the world's first open supply chain Original Equipment Manufacturer- OEM, solving Information Technology challenges through standardization of best practices and hyperscale inspired practices and efficiencies. Hyperscalers offers choice across two open hardware architectures:

- Hyperscale - high efficiency open compute equipment as used by macro service providers
- Tier 1 Original – conventional equipment as per established Tier 1 OEM suppliers.

Each architecture is complete with network, compute, storage, and converged GP GPU infrastructure elements, and is open / free from vendor lock-in.

Hyperscalers' appliance solutions are packaged complete with hardware, software and pre-built (customisable) configurations. These were all pre-engineered using an in-house IP Appliance Design Process and validated in partnership with associated major software manufacturers. Many can be "test-driven" using Hyperscalers Lab as a Service (LaaS). Hyperscalers appliance solutions are ideally suited to IaaS, PaaS and SaaS providers looking to implement their services from anywhere.

The Red Hat OpenShift Appliance by Hyperscalers is a complete package including high performance CPU, memory, and network resources coupled with highly sophisticated hyperconverged Red Hat Data foundation to provide persistent container storage to the enterprise IT workloads. The detailed deployment steps including Hyperscalers IP appliance design process is described in this document.

## Building Blocks:

S5X 2.5" | D53X-1U Ultimate 1U Server for Intel Xeon 3rd Gen Processors

The S5X 2.5" (D53X-1U) based on PCIe Gen 4.0 and Intel's 3rd Generation Processor Family (Ice-lake) offers: Two (2) CPU Sockets for up to 80 cores using Intel® Xeon® Platinum 8380 Processor 40cores each. 32 Memory slots for up to 8TB DIMM or Up to 12TB DIMM+DCPM (PMEM 200 series). 12 Front Storage drive bays 2.5" hot-plug U.2 NVMe or SATA/SAS. Five (5) x PCIe 4.0 expansions slots for Network Interface Cards NIC. Two (2) M.2 onboard storage. Three (3) accelerators like NVIDIA T4 GPU.

## S5K | D43K-1U Ultimate 1U Server for AMD EPYC Milan 3rd Gen Processors

Native design for AMD EPYC™ 7003 Processors, ready for PCIe 4.0 eco-system deployment. Up to 128-core within 1U form factor, optimized for HPC workloads. With 4 AMD xGMI-2 between dual EPYC™ processors up to 16GT/sec of CPU interconnect speed. Up to 5 PCIe expansion slots in a 1U chassis. Flexible I/O options with a variety of SAS mezzanine and OCP mezzanine option for diverse configurations. Flexible storage configurations, tailored for diversified software defined workloads. NUMA balanced PCIe topology for NVMe drives.


## S5Z | T43Z-2U The Power of Hyper Convergence

The S5Z | T43Z-2U based on PCIe Gen 4.0 and Intel's 3rd Generation Processor Family (Ice-lake) is a high performance, multi node server offering eight (8) CPU in 2RU as part of four (4) independent nodes. Each node offers two (2) CPU Sockets for up to 80 cores using Intel® Xeon® Platinum 8380 Processor 40cores each, 16 Memory slots for up to 4TB DIMM or up to 6TB DIMM+DCPM (PMEM 200 series), four (4) 2.5" U.2 NVMe front storage drive bays with two (2) M.2 NVMe for OS or caching, and three (3) x PCIe 4.0 expansions slots for Network Interface Cards NIC or accelerators like GPU.

## S9CA | S43CA-2U AMD Density Optimized "EPYC" Multi-node Server

The QuantaPlex S43CA-2U is a multi-node server that supports the next generation of powerful AMD EPYC™ processors. Each of the 4 nodes in this compact 2U chassis is capable of supporting a single-P top bin Rome CPU, boasting a dominant 64-cores while still providing 16 DIMM slots that meets the most intense computing environment needs.

## • REFERENCES

[1] Hyperscalers, "About HS," [Online]. Available: https://www.hyperscalers.com/about-us-hyperscalers.

[2] Chraibi, J. (2020) A guide to enterprise kubernetes with OpenShift, Develop, deploy, and evolve with Red Hat Hybrid Cloud. Available at: https://cloud.redhat.com/blog/enterprise-kubernetes-with-openshift-part-one?extIdCarryOver=true&sc_cid=701f2000001Css5AAC (Accessed: November 2, 2022).

[3] Features and benefits of Red Hat openshift (no date) Features and benefits of Red Hat OpenShift. Available at: https://www.redhat.com/en/technologies/cloud-computing/openshift/features (Accessed: November 2, 2022).