**Introduction**

This document provides an overview of an HPE Telco Blueprint that uses Red Hat OpenShift Container Platform (RH OCP) as the platform. The primary objective of this document is to identify a base Blueprint and add necessary enhancements to create a Minimum Viable Bill of Materials (MVB) that can be used to deploy RH OCP. Additionally, this document will outline key services that will be deployed and other services that are optional.

**HPE Telco Blueprint Core 7 – Specifications**

HPE Core Telco Blueprint C7 is a validated reference architecture for core data centres designed for enhanced performance and scale. This blueprint incorporates HPE ProLiant Gen10 servers, powered by 2nd Generation Intel® Xeon® Scalable processors, high-performance HPE Top of Rack switches (100G). The platform supports Open standards such as Redfish for multivendor platform management and is validated to host RH CEPH as a storage platform [3]

**RH OCP Architecture**

RH OCP provides a cluster of hosts capable of running containerized applications. These hosts are managed by Kubernetes (k8s) acting as a cluster manager. The deployment includes a cluster of master nodes that run k8s and its associated services. It also includes a collection of worker nodes that run a variety of compute-oriented services such as cri-o, a container engine, and kubelet, a k8s node agent.

The master and worker nodes will run Red Hat Core OS (RHCOS) that includes the necessary components required for a Kubernetes-managed, Container-engine enabled platform. Using RHCOS over Red Hat Enterprise Linux (RHEL) allows the platform to use a lighter host operating system and the additional advantage of automated system lifecycle management [1].

The master nodes host key functionalities such as the cluster API server, etcd which contains stateful information for the master node cluster and the Controller Manager Server which is used to enforce preferred state when changes occur. Master nodes also run the various Operator services provided by Red Hat to address Images, Cluster Networking among others.

The worker nodes run a container runtime environment, in this case cri-o, a Red Hat driven, CNCF-hosted project for an open container environment. The worker nodes also the kubelet which communicates with the Master nodes in hosting and managing containerized workloads. To enable networking, the worker nodes also run a service proxy which acts as a networking proxy connecting the various nodes through the internal network.

**RH OCP Components**

RH OCP provides two ways to provision infrastructure – installer provisioned and user provisioned. However, installer provisioned infrastructure is supported for AWS nodes. Since the HPE Telco Blueprints would use HPE bare-metal servers, the deployment model would be that of user provisioned infrastructure. This requires that the underlying infrastructure be provisioned by the administrator before deploying RH OCP.

RH OCP’s Ignition service contains details on the machine configurations and operates the Machine Config Service on the Master nodes. This helps in configuring the bare-metal nodes with the necessary OS components and configuring them as Worker nodes.

RH OCP requires Quay Container Registry, RH’s container packages delivery mechanism, to configure the nodes. Since all the RH OCP components themselves are containerized functions, the Quay Container Registry is used to deploy, update and manage the Control Plane and the host on which it runs very similar to the rest of containerized user applications.

Telemetry support for RH OCP ensures that cluster health and other necessary information is sent to the source while performing updates and can ensure the success of updates upon completion. Although telemetry is optional, it would be a recommended feature on the HPE Telco Blueprints to ensure system integrity in production environments.

**External Components**

Storage servers that provides Physical Volumes to the containerized workloads are external to the default RH OCP deployment. RH OCP supports a variety of storage back-ends including AWS S3 storage. The HPE Telco Blueprints would use CEPH as the storage provider. Configuring CEPH is outside the scope of RH OCP and would require the SDI toolkit to configure it.

RH OCP requires a Load Balancer to front end a variety of tasks coming in to the Master Nodes (API server and Machine Config server) and the Worker Nodes (Router pods). This would be hosted outside of the RH OCP Control Plane and within the Seed Node that hosts a variety of support functions including the Bootstrap service.

RH OCP nodes in user provisioned infrastructure mode require DNS/DHCP/PXE support for a variety of reasons. API servers and etcd instances need to be name resolvable for the services to communicate with. RH OCP requires DHCP during the initial phases of host configuration to pick up the Ignition configuration files among others from the RH portal. The RH COS worker nodes are configured using PXE booting.

RH OCP works with external identify providers such as LDAP/GitHub/Google among others. This allows RH OCP to independently add the RH OCP infrastructure to an existing set of administrators. Additionally, RH OCP requires a method (automatic or manual) that would verify the initial Certificate Signing Requests (CSRs) for the worker nodes.

Critically, RH OCP mandates Internet Access for accessing the Quay registry and Telemetry. It is a fundamental requirement for RH OCP and impacts the basic installation of the system.

**HPE Telco Blueprint for RH OCP**

The HPE Telco Core Blueprint C7 provides adequate resources and capabilities to host an RH OCP environment. The C7 Blueprint is built using HPE Proliant Gen 10 servers which are validated [2] to work with RH COS 4.1, the host OS for RH OCP 4.1.

Future iterations of this Blueprint might de-couple the Storage block from the base BOM and allow the user to independently add a new storage block or to connect to an existing storage block. Newer enhancements might include substituting the current Master Node servers with single socket servers or servers with Xeon-D and other sockets designed for micro-servers.

The Proliant DL360 Gen10 servers that will host the Worker Nodes are certified to work with 10, 25 and 100G NICs and would be adequately be able to handle the currently configured 25G NICs.

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| **Role** | **Services** | **Minimum Configuration** | **Preferred Configuration** |
| Seed Node | Tool kit, Bootstrap, Load Balancer | 4 VCPU, 16 GB RAM, 120 GB Disk | Xeon Silver 4216, 96GB RAM, 2x 1.2TB Disk |
| Master Node Cluster (3x) | API Server, Machine Config Server, Image Registry Operator, Cluster Network Operator and other Operator Services | 4 VCPU, 16 GB RAM, 120 GB Disk | Xeon Silver 4216, 96GB RAM, 2x 1.2TB Disk |
| Worker Node Cluster (2x+, increments of 1) | Kubelet, router pods, function pods | 4 VCPU, 16 GB RAM, 120 GB Disk | Xeon Silver Gold 6252, 384 GB RAM, 2x 1.2TB Disk |
| Storage Node Cluster (3x, increments of 2) | Ceph rados, osd, physical volumes | NA | Xeon Silver 4216, 96GB RAM, 14x 1.2TB Disk |
| Switch Cluster (2x+, in increments of 2) | 25/100 networking, routing, clustering | NA | 16QSFP28 switches running Cumulus |

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| **Software Component** | **Purpose** | **Preferred Version** |
| RH OCP | Kubernetes/Container based platform | 4.1 |
| RH COS | Master and worker node host operating system | 4.1 |
| RH CEPH | Storage back-end to provide Physical Volumes | 3.1 |
| SDI Toolkit | User provisioned infrastructure, Validations, Benchmarks | R 20.02 |

**References**

1. [Red Hat OpenShift Container Platform Tested Integrations](https://access.redhat.com/articles/4128421)
2. [Red Hat Proliant DL360 Gen 10 Hardware Certifications](https://access.redhat.com/ecosystem/hardware/3108061)
3. [HPE Telco Core Blueprint C7](https://h20195.www2.hpe.com/v2/Getdocument.aspx?docname=a50000037enw)