Red Hat OpenShift Acquisition and Deployment Options

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Agenda

- Consuming OpenShift – what are your options ?
- Design Decisions before even starting the software deployment
- Dell EMC ‘Ready Architectures’ – the value to an end user
- Sizing the hardware, prior to purchase – review the Dell EMC design
- Networking configuration
- Cabling it all up and deploying the software
- Validating your final deployment
- Questions

Build or Buy your OpenShift Solution

BUILD

BUY

Built from documentation

Deployed ‘on site’

Build or Buy your OpenShift Solution

	Build	Buy
Velocity: Time to production	Medium	Fast
Configuration Flexibility	Highest	Low
Software Customization	Unrestricted	None
Internal Resource requirement	High	Low
Level of Resource skill	High	Low

A definition of terms :

Complex solutions are a combination of many software modules and hardware components. OpenStack Cloud is a complex solution.

9 out of 10 IT folks agree*

COMPLEX SOLUTIONS are (a) hard to deploy and (b) difficult to know when done right!

Only solutions that are a partnership of the Software and Hardware vendors and have a phase of ‘validation’ carry the most value to an End User

* Pure gut feeling of the product manager responsible for the OpenShift program. Not based on any commissioned industry data, just customer input

Introducing …

Dell EMC Ready Architecture for Red Hat OpenShift Container Platform

- Scalable reference architecture designed to simplify and accelerate enterprise-grade container deployments
- Pre-validated with Dell EMC cloud infrastructure hardware and Red Hat OpenShift software
- Helps customers minimize adoption time and significantly reduce the time to develop and deploy containerized applications

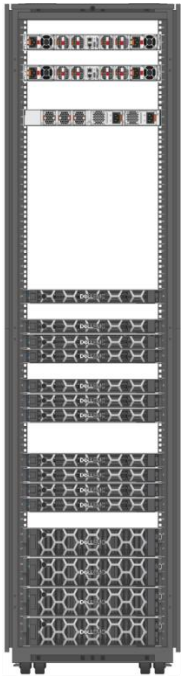
Key Values:

- Fully validated and documented
- Optimized for flexibility, scalability, and performance
- Enables enterprises to rapidly adopt DevOps methodology or manage pre-built containerized applications
- Rapidly deploy either POC or high availability production configurations
- Prescriptive yet customizable to meet container deployment needs of enterprises

Two documented configurations of the ready architecture

Full HA Production

A 15-node high availability production configuration using Dell EMC PowerEdge R640 and R740xd rack servers



Single Node POC

A full OpenShift deployment as single-node starter system (sometimes referred to as an All-In-One) on a Dell EMC PowerEdge R640 server

Hardware components for high availability production configuration

Networking

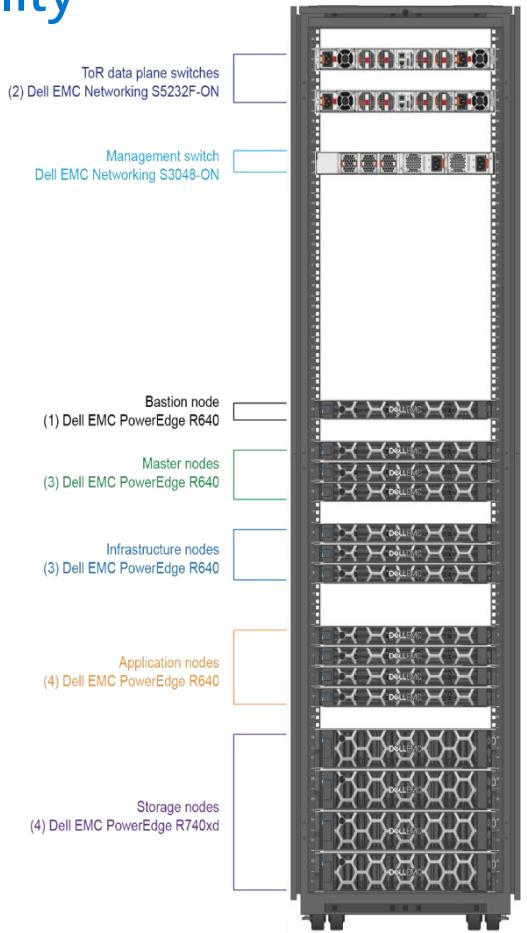
(2) S5232-ON TOR Switches
(1) S3048-ON iDRAC Management Switch

Compute and Storage

(1) R640 Bastion Node
(3) R640 Master Nodes
(3) R640 Infrastructure Nodes

(4) R640 Application Nodes (scalable)

(4) R740xd Storage Servers running Red Hat Container Storage (scalable)



Hardware components

- The **Dell EMC PowerEdge R640 server** is a 2-socket, 1U platform designed for dense scale-out data center computing. With Intel Xeon scalable processors and support for up to 24 DIMMs, 12 of which can be non-volatile DIMMS (NVDIMMs), the scalable architecture enables you to customize the configuration to optimize your workload performance. With the PowerEdge R640, you can maximize storage performance with a non-volatile memory express (NVMe) cache pool of up to 10 NVMe drives or an array of twelve 2.5 in. drives.

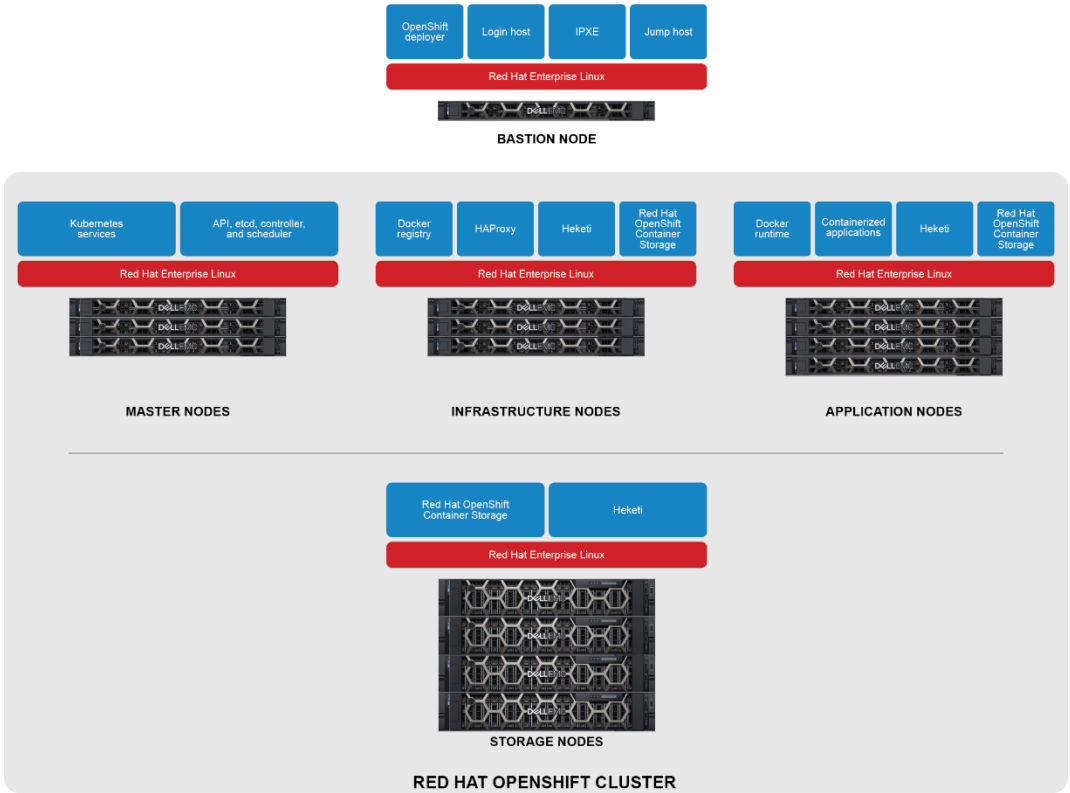
- The **Dell EMC PowerEdge R740xd server** is a 2-socket, 2U platform designed for scalable, high-performance, software-defined storage. The versatile system architecture of the R740xd server allows you to mix any drive types to create the optimum configuration of NVMe, SSD, and hard disk drive (HDD) to meet your storage needs, with support for up to 24 SAS SSD drives or up to 12x NVMe drives.

Software components

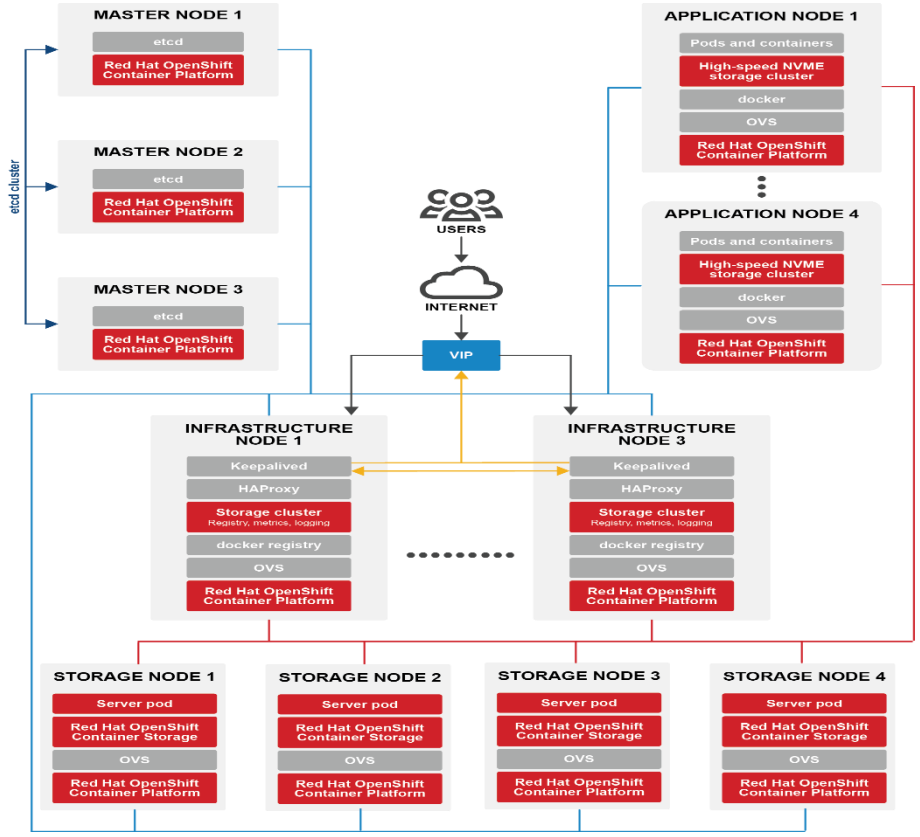
- **Red Hat Enterprise Linux** is the stable, reliable operating system for all nodes in the system. This solution uses RHEL 7.6.
- **Red Hat OpenShift Container Platform** is is a comprehensive enterprise-grade application platform, built for docker containers with Kubernetes for container cluster management, which allows you to automate the build, deployment, and management of applications. This solution uses Red Hat OpenShift Container Platform 3.11
- **Red Hat OpenShift Container Storage**, based on Red Hat Gluster storage, is integrated with OpenShift and provides high-performance, persistent storage for container environments. This solution uses Red Hat OpenShift Container Storage 3.11.
- **Red Hat Ansible Automation** is a simple, agentless IT automation technology that can be used to provision resources, deploy applications, and configure and manage infrastructure. This solution uses Ansible 2.6.15.

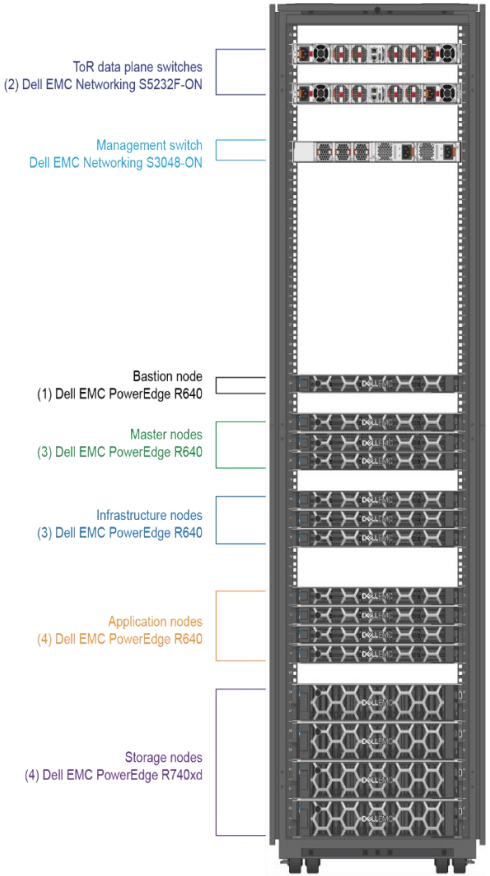
Node roles and assignments

- Dell EMC deployment automation installs all the software components as designed onto the proper node types, starting with the Bastion Node.



Full high availability production system





Node descriptions

- **The Bastion Node** serves as the main deployment and management server for the Red Hat OpenShift cluster.

- **Master Nodes** perform control functions for the entire cluster environment. They are responsible for the creation, scheduling, and management of all objects specific to OpenShift, including the API, controller management, and scheduler capabilities.

- **Infrastructure Nodes** execute a range of services, including an internal service, the OpenShift Container registry, the HAProxy router, and the Heketi service for storage volume lifecycle management.

- **Application Nodes** run the containerized workloads. They contain a single binary of Red Hat OpenShift node components and are used by Red Hat OpenShift master nodes to schedule and control containers.

- **Storage Nodes** provide persistent storage for the environment. These nodes can be configured to run in converged mode, providing both storage and compute services, and are capable of running user-facing, containerized applications.

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Scaling Basics

Size your cluster to avoid problems

Max nodes at max pods:

Max Pods @ Max Pods per node =

150000/250 = **600 nodes**

Max Pods per node :

Max pods / Max nodes =

150000 / 2000 = **75 pods / node**

Typical Max Pods per Core: **10**

Range of available Cores per node:

Min. = 75/10 **= 8 cores, Max.** = 250/10 **= 25 cores**

Limiting Factor	OpenShift v3.11 limit
Number of nodes	2,000
Number of pods	150,000
Number of pods per node	250
Number of pods per core	There is no default value. The maximum supported value is the number of pods per node.
Number of namespaces	10,000
Number of builds: Pipeline Strategy	10,000 (default pod RAM 512Mi)
Number of pods per namespace	3,000
Number of services	10,000
Number of services per namespace	5,000
Number of back-ends per service	5,000
Number of deployments per namespace	2,000

Application Node Resources

Dell EMC PowerEdge Server R640 resource planning – assuming workload saturates CPU cores

- R640 Node Configuration
  - Memory: (192, 384, 768) - 384 GB RAM
  - Processor: (Intel Gold 6126 – 6152) – 6138
  - NICs: 4x 25 GbE
  - Storage: 2x NVMe SSD
    - Capacity: (800, 1600, 3200, 6400 GB) – 1600 GB
- CPU provisioning:
  - 1 Core for host OS
  - 2 Cores for NIC I/O support
  - 10 Cores for NVMe SSD support for max IO
  - Baseline is 13 cores needed
- Minimum recommended CPU: Intel Gold 6126
  - 2x Processor 12 Core = 24 Cores.
  - 24 – 13 = 11 Cores for Workload handling will support approx. 110 Pods on the node
- Processor for Ready Architecture: Intel Gold 6138
  - 2x Processor 20 core = 40 cores
  - 40 – 13 = 27 Cores for Workload will support maximum permitted 250 Pods on the node.

ToR Switch Selection

Choosing the highest utility switches for ToR

Dell EMC Networking S5248F-ON

- 48 ports @ 25 GbE
- 6 ports @ 100 GbE for Uplink/VLT

- 4 ports 25 GbE in each node, HA
  - 48/2 – 24 nodes max per rack for HA dual switch config.
  - Full rack will require 4x S5248F-ON config.
  - Allocate 4x 100 GbE ports for Uplink to Core
  - Allocate 2x 200 GbE ports for VLT

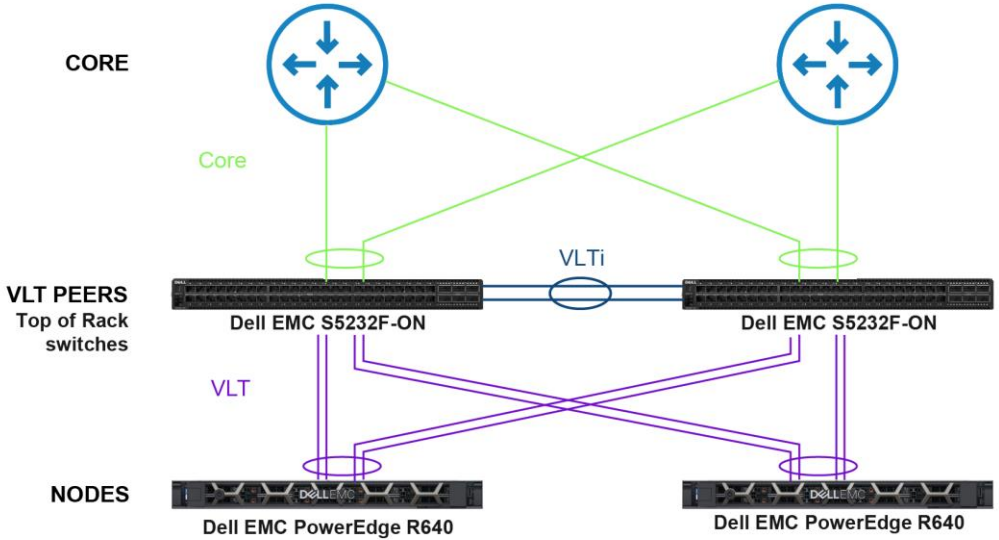
Dell EMC Networking S5232F-ON

- 32 ports @ 100 GbE

- 4 ports 25 GbE in each node, HA
  - Use 4-way fan-out cables
    - each 100 GbE port -> 4x 25 GbE
    - 28x4 = 112 ports @ 25 GbE
    - 2x Switches in HA provides 224 ports @ 25 GbE
      - 224 / 4 = 55 nodes with 4 ports each
  - Allocate 2x 100 GbE ports per switch for VLT
  - Allocate 2x 100 GbE ports for uplink to Core

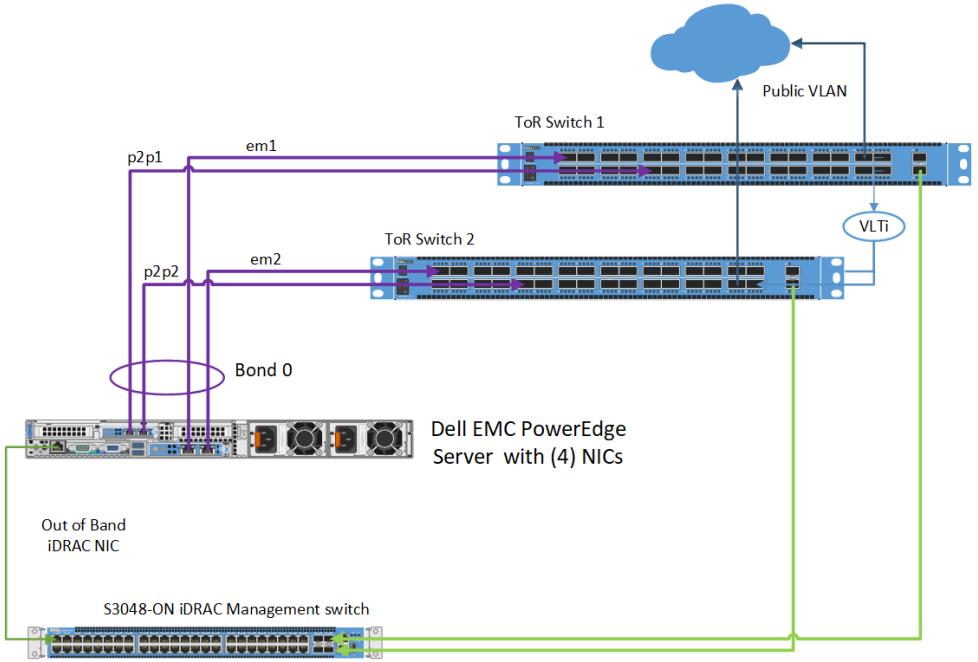
High performance network design

- 25 GbE networking is used for maximum performance between application and storage servers
- Each server has 4 x 25 GbE NIC ports cross-wired to the network switches
- Virtual Link Trunking (VLT) provides redundant, load-balancing connections



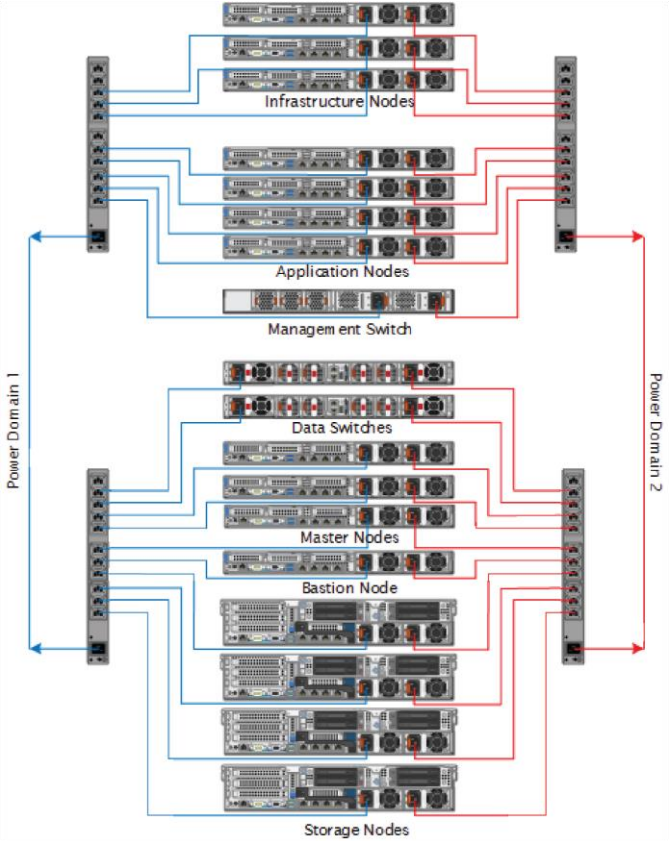
Logical network design

- The external network is used for the public API, the Red Hat OpenShift Container Platform web interface, and exposed applications.
- The internal network is the primary, non-routable network for cluster management, internode communication, and server provisioning.
- The OOB management network is a secured and isolated network for switch and server hardware management, including access to the server iDRAC9 ports.



Power configuration for high availability

- For HA operation, each server is equipped with redundant power supplies.
- Each rack is configured with pairs of Power Distribution Units (PDUs).



Network bandwidth and Disk IO

Assumptions based on max IOPS

- Max 250 Pods per node
- Max 1000 IOPS per Pod
  - https://docs.openshift.com/container-platform/3.6/scaling_performance/host_practices.html
- Total max. 250,000 IOPS per node
- Assume max. 4K block size
- 250,000 IOPS = 1 GByte/sec per node

- Need to allow for latency, delays and overheads – say 4x

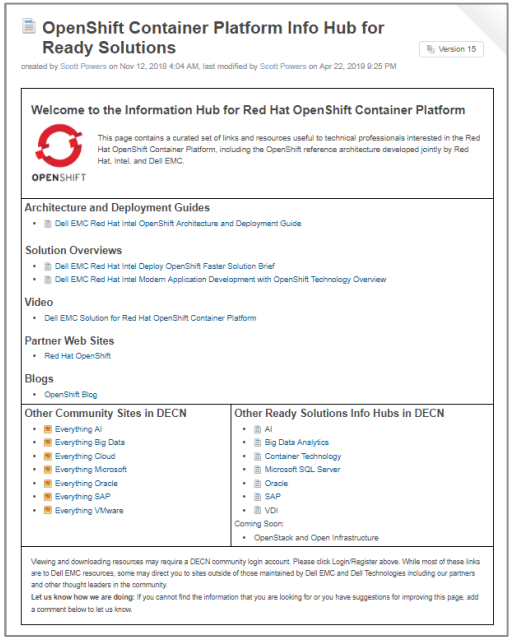
- Network IO per node should handle
  - 4 Gbyte/sec = 40 GbE
  - Requires: 2x 25 GbE NICs
  - With HA requires 4x 25 GbE NICS per node

Assumption based on disk IO

- Each node has 2x NVMe SSD
- Each NVMe SSD can IO @ 2 GBytes/sec
- Need 2x 2 = 4 GBytes /sec = 40 GbE

- Same IO requirement per node as for max Application-driven IO
  - 4x 25 GbE NICs per node

Resources and documentation



OpenShift Container Platform Info Hub for Ready Solutions

Version 15

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Welcome to the Information Hub for Red Hat OpenShift Container Platform

OPENSHIFT

This page contains a curated set of links and resources useful to technical professionals interested in the Red Hat OpenShift Container Platform, including the OpenShift reference architecture developed jointly by Red Hat, Intel, and Dell EMC.

Architecture and Deployment Guides

- Dell EMC Red Hat Intel OpenShift Architecture and Deployment Guide

Solution Overviews

- Dell EMC Red Hat Intel Deploy OpenShift Faster Solution Brief
- Dell EMC Red Hat Intel Modern Application Development with OpenShift Technology Overview

Video

- Dell EMC Solution for Red Hat OpenShift Container Platform

Partner Web Sites

- Red Hat OpenShift

Blogs

- OpenShift Blog

Other Community Sites in DECN

- Everything AI
- Everything Big Data
- Everything Cloud
- Everything Microsoft
- Everything Oracle
- Everything SAP
- Everything VMware

Other Ready Solutions Info Hubs in DECN

- AI
- Big Data Analytics
- Container Technology
- Microsoft SQL Server
- Oracle
- SAP
- VDI

Coming Soon:

- OpenStack and Open Infrastructure

Viewing and downloading resources may require a DECN community login account. Please click Login/Register above. While most of these links are to Dell EMC resources, some may direct you to sites outside of those maintained by Dell EMC and Dell Technologies including our partners and other thought leaders in the community.

Let us know how we are doing: If you cannot find the information that you are looking for or you have suggestions for improving this page, add a comment below to let us know.

The OpenShift Container Platform Info Hub for Ready Solutions on the Dell EMC Community Network contains all documentation, including architecture and deployment guides, solution briefs, videos, blogs, and other resources: DellEMC.com/openshift

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Downloadable open source automation

Deployment Automation

Deployment Validation

Dell EMC's GITHUB repository at github.com/dell-esg/openshift-bare-metal contains all the downloadable open source scripts and setup files for both deployment and validation