TheFuturum Group

Lab Insight

Dell APEX Cloud Platform for Red Hat OpenShift: Analysis of Operational Efficiency

AUTHOR

Russ Fellows
Head of Futurum Labs | The Futurum Group

IN PARTNERSHIP WITH

DELL Technologies

JULY 2024

Overview

According to Futurum Group's research, several of the biggest challenges companies face in IT include budgets, staffing, and other limitations for their IT departments. These issues along with a desire to align expenditures with revenue have helped drive the adoption of cloud computing models, Dell's APEX Cloud Platforms provide several options for companies who seek cloud operating efficiency. APEX Cloud Platform provides cloud operating models, along with the additional security, performance and control of running applications on premises.

As companies look to re-architect their applications to leverage micro-services and container native processes, they are evaluating new operating platforms. Red Hat OpenShift is one of the leading cloud native platforms leveraging Kubernetes for deploying applications consistently both in private and public cloud environments. Dell offers the APEX Cloud Platform for Red Hat OpenShift, which allows companies to run one of the leading virtualization and cloud native Kubernetes platforms on-premises or hosted in a datacenter of their choice. The Dell solution is co-engineered with RedHat and includes automation and orchestration integrated with the OpenShift management console. With APEX Cloud Platform for Red Hat OpenShift, IT organizations have additional tools and resources to improve their Kubernetes and virtualized application manageability, while increasing cyber resiliency by including integration of a leading scale-out storage platform, Dell PowerFlex.

The Futurum Group Labs compared and evaluated the implementation and overall efficiency of a traditional, do-it-yourself deployment of Red Hat OpenShift compared to Dell's APEX Cloud Platform for Red Hat OpenShift, combined with Dell's storage options for APEX Cloud which include PowerFlex scale out storage, which is deployed on either new or existing clusters. The Dell APEX solution includes installation as part of the included Dell ProSupport. This evaluation included a hands-on testing of the do-it-yourself (DIY) installation within The Futurum Group Lab, in comparison to the Dell APEX Cloud Platform installation which was performed in Dell's lab facilities.

The evaluation utilized two equivalent environments, one using generic servers with Red Hat OpenShift, including local Red Hat ODF storage running on the OpenShift worker nodes. For the analysis we compared a Dell APEX Cloud Platform for Red Hat OpenShift, utilizing Dell PowerFlex storage. While the application environments are similar, the Dell APEX platform provided several key advantages, including:

- The Dell platform was 5.8x faster to place into operation compared to an equivalent DIY OpenShift deployment
  - Dell required 4 h 6m, vs. nearly 24 hours for a DIY installation
- Day-1 operations were 5.5X faster, 20m for Dell vs. 1h 50m for DIY OpenShift
- Expansion of Dell APEX compute cluster was 12X faster and significantly easier than a DIY OpenShift expansion:
  - A DIY node expansion required more than 6 hours to become functional
  - The Dell expansion completed in under 30 minutes, more than 12X faster

Evaluation Overview

One reason cited by companies for moving applications into cloud environments is the ability to rapidly deploy infrastructure, without the need for significant planning, implementation or administrative configuration time. These benefits apply to public, private and hybrid cloud deployments which often include on-premises deployments.

The Futurum Group Labs was commissioned to compare the amount of time required to fully configure OpenShift clusters, comparing a Dell APEX Cloud Platform for Red Hat OpenShift which includes Dell's ProDeploy services, and a do it yourself (or DIY) implementation of Red Hat OpenShift, utilizing generic hardware infrastructure for the OpenShift deployment.

The evaluation included comparing the time to fully deploy a system, along with the time and effort required to scale up a cluster by adding an additional node.

Dell APEX Platforms

The capabilities of Dell APEX Cloud are derived from common software that helps APEX Cloud offerings integrate with the underlying partner operating environment, including Red Hat OpenShift, and Microsoft Azure. This common infrastructure, dubbed the Dell APEX Cloud Platform Software, helps enhance integration, thereby simplifying deployment and on-going management tasks utilizing common interfaces whenever possible.

The APEX platform accelerates time to value by providing an automated, wizard-based initial deployment process with automated node discovery, cluster configuration, and network topology setup. This reduces deployment complexity and eliminates potential errors resulting in significant reduction in deployment time for Red Hat OpenShift and Microsoft Azure when deployed on Dell APEX platforms. Helping to eliminate the complexities of deployments reduces the need for training and skills development, while also enabling companies realize faster time to value.

Additionally, APEX Foundation Software helps improve the manageability and ongoing operations required by integrating key elements, including lifecycle management and 3rd party components into the native user interface of each platform. As a result, key management features for Dell APEX are available with Red Hat OpenShift and Microsoft Azure on the APEX Cloud solution offerings.

Compared to using a build your own approach to running OpenShift, using Dell APEX Cloud Platform for Red Hat OpenShift provides the following features:

- Automated deployment – including the installation and configuration of all nodes in a cluster.
- Ability to easily scale-up the compute cluster with additional nodes, using the integrated APEX Cloud Manager section within the OpenShift console.
  - **Note:** Scaling storage was NOT part of analysis. However, the design of Dell APEX would permits easily scaling compute and storage independently, unlike the DIY alternative.
- Use of separate, scale-out Dell PowerFlex storage for workload isolation and predictable storage performance.

Part of Dell's APEX Cloud Platform strategy is to support Dell storage options including PowerFlex storage for new or existing APEX clusters. By separating the compute from storage, Dell APEX systems can independently scale up compute, or storage as desired. Dell PowerFlex enables shared storage across multiple APEX clusters, or the use of multiple PowerFlex clusters attached to a single APEX Cloud Platform.

Additionally, APEX Cloud support supports Dell ObjectScale for object workloads. By permitting a broad portfolio of storage options, IT users can optimize their compute and storage for their unique applications requirements. The Validated Design for the APEX Cloud Platform for Red Hat OpenShift AI provides a blueprint for attaching PowerFlex and Object Scale for running AI applications.

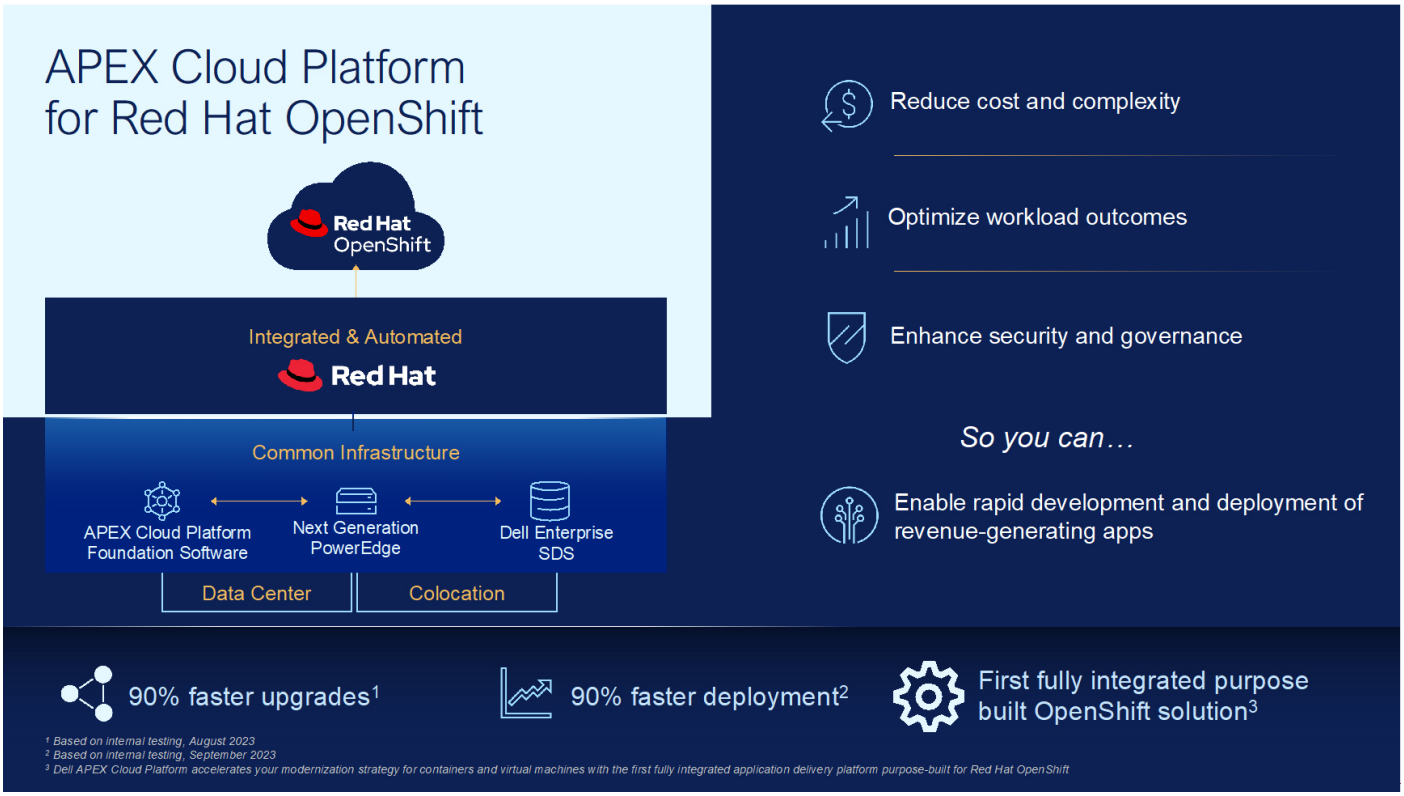


Figure 1: Dell APEX Cloud Platform for Red Hat OpenShift (Source: Dell Technologies)

While Red Hat integrated compute and storage using OpenShift Data Foundation (ODF) approach uses an HCI approach, requiring the scaling of compute and storage together. During analysis, our evaluation revealed several issues with this method of scaling including:

- Difficulty in scaling OpenShift with ODF.
  - **Note:** The process of adding a node was problematic and required multiple attempts to attain a fully operational cluster.

- Stranded capacity and performance is an issue often cited with HCI systems, in that the excess capacity or performance of one cluster is not readily accessible to another cluster.

- Unpredictable storage performance, particularly when overall system utilization on the HCI nodes is being utilized for applications.

The Dell APEX Cloud Platforms utilize Dell PowerFlex storage, which separates compute and storage, and enables storage nodes to scale from 4 nodes up to hundreds of nodes per cluster, with additional availability as the cluster grows to 7 or more nodes. PowerFlex provides a solid foundation for IT infrastructure modernization with multiple availability features including PowerFlex REST API, CSI drivers, and Dell Container Storage Modules (CSM) that help increase operational efficiency and business agility.

Futurum Group Comment: *Historically, storage has been an afterthought for OpenShift, lacking the capacity and performance monitoring capabilities provided for CPU, memory and network utilization, which impacts overall application manageability. Dell APEX Cloud with PowerFlex provides a scalable storage offering that includes easy access to storage administration, including capacity and performance data from the OpenShift console*

Dell Management Portfolio

Dell's management portfolio includes iDRAC, OpenManage Enterprise along with CloudIQ for remote management of server infrastructure, including Dell APEX appliances. Secure lifecycle management features are included with the solution, enabling updating systems to the latest firmware and drivers. Together, this portfolio of management tools adds additional security and management capabilities for nodes and attached devices. Enhancements include:

- Dell iDRAC: system level management software pre-installed on all Dell PowerEdge servers, providing secure out-of-the box management capabilities for individual systems.
- OpenManage Enterprise (OME): Designed for IT staff to monitor and manage Dell servers within a datacenter. OME provides roll-up features to aggregate information while still providing the ability to manage individual systems, either from within OME or via linking to iDRAC.
- CloudIQ: Enables multi-site and enterprise-wide monitoring and management, with high-level management and reporting. CloudIQ also provides drill-down system management of some features and functions.

Dell's CloudIQ service has continued to evolve since its storage system origins into a Dell product-wide SaaS application that effectively provides health monitoring and alerting, along with recommendations. Dell's overall management architecture provides robust security manageability, alerting and reporting capabilities that provide the critical link IT administrators require to effectively manage a secure IT environment.

Dell APEX Cloud Platform for Red Hat OpenShift

Use Cases

Kubernetes has become a leading platform for deploying and running production workloads of all types. While modern, container native applications are growing in numbers, many additional application and workload types are now routinely deployed alongside container apps, including High Performance Computing (HPC), traditional virtual machine applications using OpenShift Virtualization, and new server-less applications. Additionally, Kubernetes has become the platform of choice for developing and running Artificial Intelligence applications, AI/ML and new generative AI applications are routinely designed to run within a container instance.

Dell is rapidly expanding their portfolio of curated, AI applications designed for a variety of use cases and industries. The Futurum Group Labs, together with Scalers.AI and Dell have created several examples and proof of concepts that demonstrate how companies can implement generative AI applications utilizing Dell systems, such as APEX Cloud Platform for OpenShift.

The Dell appliances can help companies rapidly grow, scale and manage their infrastructure for container native applications, including AI/ML and generative AI applications. Additionally, Dell provides a Validated Design for Red Hat OpenShift AI on the APEX Cloud Platform that provide a simplified guide for deploying AI based applications, such as digital assistants using a large language model (LLM) enhanced with Retrieval Augmented Generation (RAG) techniques. This curated solution provides AI practitioners and data scientists a scalable, standard platform to build and deploy AI-enabled applications at scale.

Implementation Efficiency Analysis

An overview of the differences between utilizing Dell APEX Cloud Platform for Red Hat OpenShift compared to a do-it-yourself Red Hat OpenShift approach are shown in Table 1.

Requirement	Dell APEX Cloud Platform for Red Hat OpenShift	DIY OpenShift	Dell APEX Cloud Platform Advantage
Ease of Deployment	**Excellent:** Installation is included as part of APEX Cloud Platform for Red Hat OpenShift professional service.	**Average:** Performing installation requires prior Red Hat OpenShift experience or specific training.	**83% less time:** Substantially less complexity with no on-site service. Reduced admin training.
Ease of Expansion	**Excellent:** Installation and expansion performed as part of APEX Cloud Platform for Red Hat OpenShift professional service.	**Poor:** Expanding a cluster is complicated and error prone, requires prior experience or specific training.	**92% less time:** Substantially less complexity with no on-site service. Reduced risk of downtime.
System Upgrades	**Excellent:** Dell tests and qualifies upgrades for APEX Cloud Platform for Red Hat OpenShift prior to release. In evaluation they average 19K hours of testing per release.	**Good:** Red Hat OpenShift updates are not tested on the platforms prior to release. Burden for pre-testing is on the systems admins.	**Expected Advantage:** Curated updates include firmware and software updates tested together. With Dell testing, expected limited issues with upgrades.

Table 1: Enterprise Data Protection Infrastructure Requirements (Source: The Futurum Group)

Initial Setup – Time to Value

As stated previously, the initial setup of the Dell APEX Cloud Platform for Red Hat OpenShift running on PowerFlex storage was performed by Dell's ProDeploy services team. Although IT staff were not required during the process, we measured the amount of time required to setup and establish a working environment.

The Dell solution can be setup, installed and brought online in several hours, with nearly all work performed by Dell personnel to ensure a clean, working environment is created. In contrast, the do-it-yourself process required significant amount of documentation review, the creation of custom YAML based upon documentation, followed by several attempts to configure and apply changes using the YAML, along with debugging in order to obtain an equivalent environment.

In summary, the time to install then configure additional items showed significant advantages using Dell appliances:

- Dell installation plus initial configuration: 4 hours, 26 minutes
- Build it yourself installation plus initial configuration: 25 hours, 46 minutes

Futurum Group Comment: *The time to install and configure a cluster was nearly 6 times less with Dell compared to a build-it-yourself approach. These values are based upon IT operations staff with moderate prior experience building and managing Red Hat OpenShift clusters. For staff with less experience, the build-it-yourself method can be daunting if any customization is desired, due to the need for extensive YAML file customization.*

Dell APEX Cloud Platform for Red Hat OpenShift Install

The Installation time was 4 hours and 6 minutes, only 1 hour of IT staff.

- Network Preparation (DNS entries, IP addresses, etc.) : 1 hour
- Dell Installation Process: 3 hours, 6 minutes

After installation was complete, there were several items setup to complete the cluster and make a fully operational environment, which included the creation of a local repository, service mesh and access to the Red Hat Operator Hub. These items required 20 minutes as follows:

- Operator Hub, and Service Mesh installation: 10 minutes
- Local Repository installation: 10 minutes

Do it Yourself Red Hat OpenShift Install

The Installation time was 23 hours and 45 minutes, all by IT staff.

- Network Preparation (DNS entries, IP addresses, etc.) : 1 hour
- Read / understand documentation: 4 hours
- Create OpenShift Installation Image using YAML 2 hours
- Debug / Fix Image Creation issues 12 hours
- Debug / Fix Installation after semi successful install 4 hours, 45 minutes

After installation was complete, we completed the same items as the Dell installation to make a fully operational environment, which included the creation of a local repository, service mesh and access to the Red Hat Operator Hub. These items required 1 hour 50 minutes as follows:

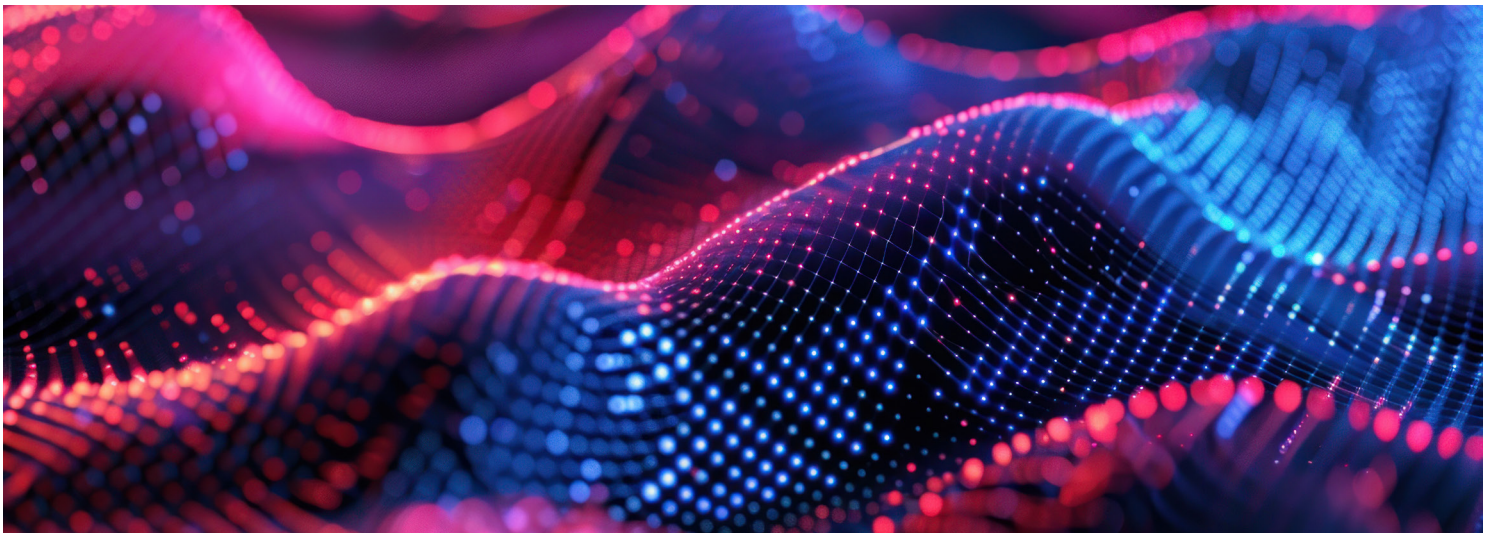
- Read / understand RedHat documentation: 30 minutes
- Create custom YAML files as needed: 30 minutes
- Install Operator Hub and Service Mesh: 10 minutes
- Local Repository: 10 minutes
- Debug / Fix Hub, Service mesh and Repository: 30 minutes

Expansion – Ongoing Operations

While installation is typically a one-time event, it is often likely that a cluster may need to be expanded, to accommodate additional workloads. As part of our evaluation, we examined the process of expanding a working cluster, by adding an additional worker node.

Expanding an existing Red Hat OpenShift cluster is an operation that can be desirable for many reasons, including to add availability to applications by providing additional worker, or deployment nodes available for use in an existing cluster. Although logically quite straightforward, the process itself can be complicated when using a build-it-yourself method of implementing Red Hat OpenShift.

Futurum Group Comment: *The difficulty in fixing or repairing an existing Kubernetes cluster is well known. It can be faster to deploy a new working cluster than attempt to "fix" or repair a mis-behaving cluster. During our testing, we performed the DIY cluster expansion two times. The first attempt resulted in a cluster that was not fully operational. We then started over with a fresh installation, performed the node addition a second time, correcting our mistakes. For companies without additional Red Hat OpenShift clusters available, the loss of an operational cluster could inflict downtime on their operations.*



Dell Expansion

The cluster expansion time was 30 minutes, with majority performed by Dell staff.

- Network Preparation (DNS entries, IP addresses, etc.): 10 minutes
- Dell Installation Process: 20 minutes

Do it Yourself Expansion

The amount of time noted below to perform the Red Hat DIY cluster expansion included our debugging time but did not include the additional time to create a fresh installation, for our second attempt. The time to complete the second attempt to expand the cluster required 6 hours and 10 minutes, all by IT staff.

- Network Preparation (DNS entries, IP addresses, etc.): 10 minutes
- Read / understand documentation: 1 hour
- Create and install using customized ISO image: 30 minutes
- Debug expansion and join to cluster: 4 hours, 30 minutes

System Updates

System updates and new releases require preparation and testing prior to rollout. Dell APEX Cloud Platform team conducts rigorous testing prior to rollout of each new release. Their engineering team conducts an average of approximately 19,000 test hours prior to releasing an upgrade. While we do not expect a systems administrator to exercise a system to this level, there is a reasonable amount of testing and assuring compatibility with the configuration, this includes the underlying hardware (server, networking and storage), before roll-out. While we cannot quantify the hours precisely, it is likely outages and rollbacks are avoided through Dell's rigorous testing in addition to preparation time.

Operational Benefits of Dell APEX Cloud Platform for Red Hat OpenShift

Beyond initial configuration and upgrades, the ongoing operational efficiency of the Dell APEX Cloud Platform provides several advantages compared to using a DIY approach to running Red Hat OpenShift, including the following.

Requirement	Dell APEX Cloud Platform for Red Hat OpenShift	DIY OpenShift	Dell APEX Cloud Platform Advantage
Storage Capacity Analysis and Remediation	**Excellent:** PowerFlex capacity monitoring and remediation provides more options compared to ODF.	**Average:** ODF capacity within OpenShift console but lacks remediation options. Other storage has no integration.	**Additional Options:** ACP with PowerFlex enables migration to differentiated storage tiers. Red Hat ODF DR requires additional components (See Appendix).
Disaster Recovery Capabilities	**Excellent:** PowerFlex capacity monitoring and remediation provides more options compared to ODF.	**Average:** ODF capacity within OpenShift console but lacks remediation options. Other storage has no integration.	**Additional Options:** ACP with PowerFlex enables migration to differentiated storage tiers. Red Hat ODF DR requires additional components (See Appendix).
Storage Performance Analysis and Remediation	**Very Good:** Detailed performance at the cluster and node level. All remediation is automated.	**Good:** ODF performance available, limited details. Few if any remediation options. Other storage has no integration.	**Additional Options:** Performance information is available at the cluster level, with a single HA pool of capacity.
System Security and Cyber Resilience	**Very Good:** Integrated lifecycle management via iDRAC, OME, PowerFlex manager and CloudIQ in addition to OpenShift tools.	**Average – Good:** Achieving cyber resiliency requires substantially more effort and lacks integrated hardware lifecycle tools.	**Enhanced Resiliency:** The integrated security tools enhance resiliency and make implementing security recommendations easier.

Operational Benefits of Dell APEX Cloud Platform for Red Hat OpenShift

Container native environments are the architecture of choice for new application development and deployments, including AI/ML and Generative AI applications, all of which typically operate utilizing containers running on Kubernetes. Red Hat OpenShift is a leading solution for running production Kubernetes, particularly for on-premises or private cloud environments. While Red Hat OpenShift provides a production level runtime environment, the initial setup and configuration can be difficult if default options, or customized deployments are desired.

Additionally, scaling existing Red Hat OpenShift clusters can be difficult and error prone, with multiple manual steps required including editing of multiple YAML files. Any mistake can result in an inoperable cluster, leading to downtime, outages, or other impacts on productivity. Finally, without integrated tools for Red Hat OpenShift and hardware lifecycle management, security and cyber resiliency may be compromised.

In a separate evaluation, The Futurum Group evaluated Dell's PowerEdge servers using The Futurum Group's Security Framework. In that evaluation we found that the systems meet or exceed requirements in all categories. One reason for this is the extensive integration with management tools including iDRAC for baseboard management, with OpenManage Enterprise for datacenter management, coupled with CloudIQ for global monitoring, alerting and reporting of multiple datacenters. Together these products add significant security alerting and recommendations to assist IT administrators taking actions focused on the most important configuration or security issues.

The ability for IT organizations to effectively manage container native environments is critical for ensuring efficiency. However, the complexity of Red Hat OpenShift can lead to obstacles when deploying, or issues with ongoing management of a Kubernetes platform. Dell APEX's approach helps eliminate these obstacles by utilizing appliances that are purpose-built to run cloud native applications in Kubernetes environments. As a result, this lowers the barriers to entry and helps ensure IT operations and are able to effectively manage their critical environments. While utilizing an appliance can help companies just beginning their adoption of OpenShift, while also providing benefits for organizations with deep Kubernetes experience benefit from streamlined management of Red Hat OpenShift and their Kubernetes app environments.

Our analysis found that the Dell APEX Cloud Platform enable organizations to rapidly deploy, scale and enhance their Kubernetes clusters' resiliency. These features help organizations to deploy Red Hat OpenShift confidently and quickly into production regardless of their size or prior Kubernetes experience. The enhanced manageability and expansion features of the Dell solution also enables companies to effectively manage and grow their Kubernetes deployments necessary to support cloud native, AI and other emerging workloads.

Appendix

Dell APEX Cloud for Red Hat OpenShift Installation Process

The deployment wizard provides a sequence of steps for configuring the major elements of the Dell APEX Cloud Platform for Red Hat OpenShift system. Our evaluation found that apart from establishing network settings, the entire installation process was completed in approximately 4 hours. With installation included as part of the installation service, there was no time or involvement required by IT staff, enabling companies to rapidly deploy equipment into production.

Dell installation steps performed by ProDeploy service team were as follows:

1. Point to the bootstrap node's IP address
2. Accept the license agreement
3. Discover Resources, and verify all hosts have been discovered, then select next
4. In the discover resources Menu, enable Repository and Factory versions are selected, then next
5. Ensure all nodes are listed, and selected with the Software Compatible check mark, then click Finish
6. On the main, "Configure" page, add the information for networking including: DNS< NTP cluster management and ingress IP addresses, DNS subdomain name for cluster, SSH publick key to use along with the password for the OpenShift cluster manager username of "kubeadmin" which is the only accepted management username.
7. Optional items including different Dell TPM security passphrase for each system, the nodes role, hostname, and IP addressing.

Red Hat OpenShift Data Foundation (ODF) Storage

Per Red Hat documentation for the most recent release (Red Hat OpenShift Data Foundation version 4.15), the Disaster Recovery feature is available only for "metropolitan" distances, where latencies do not exceed 10 ms. (See link below).

The Red Hat Metro_DR f for ODF feature, additionally requires two distinct OpenShift Container platform clusters, along with a third OpenShift container platform cluster that is used as the Red Hat Advanced Cluster Management hub. Metro-DR is composed of Red Hat Advanced Cluster Management for Kubernetes, Red Hat Ceph Storage and OpenShift Data Foundation components to provide application and data mobility across OpenShift Container Platform clusters.

Link to Red Hat ODF Documentation, version 4.15 as of May 2024 Click here

Futurum Group Security Framework Click here

Dell POC for Scalable and Heterogeneous Gen-AI Platform Click here

Important Information About this Report

CONTRIBUTORS

Russ Fellows
Head of Futurum Labs | The Futurum Group

PUBLISHER

Daniel Newman
CEO | The Futurum Group

INQUIRIES

Contact us if you would like to discuss this report and The Futurum Group will respond promptly.

CITATIONS

This paper can be cited by accredited press and analysts, but must be cited in-context, displaying author's name, author's title, and "The Futurum Group." Non-press and non-analysts must receive prior written permission by The Futurum Group for any citations.

LICENSING

DISCLOSURES

The Futurum Group provides research, analysis, advising, and consulting to many high-tech companies, including those mentioned in this paper. No employees at the firm hold any equity positions with any companies cited in this document.

ABOUT DELL TECHNOLOGIES INC

Dell Technologies Inc engages in designing, developing, manufacturing, marketing, selling, and providing support for information technology infrastructure such as laptops, desktops, mobile devices, workstations, storage devices, software, cloud solutions, and notebooks.

ABOUT THE FUTURUM GROUP

The Futurum Group is an independent research, analysis, and advisory firm, focused on digital innovation and market-disrupting technologies and trends. Every day our analysts, researchers, and advisors help business leaders from around the world anticipate tectonic shifts in their industries and leverage disruptive innovation to either gain or maintain a competitive advantage in their markets.

CONTACT INFORMATION

The Futurum Group LLC | futurumgroup.com | (833) 722-5337 |