DELL Technologies

TVAR SOLUTIONS

ACCELERATING DIGITAL TRANSFORMATION

Unleashing the Power of OpenShift on Dell PowerFlex for Unmatched Agility, Efficiency, and Scalability

A CASE STUDY

TVAR: Optimizes RedHat OpenShift deployments on Dell PowerFlex for modern IT.

INTRODUCTION

Business Value of Redhat OpenShift

In today's rapidly evolving digital landscape, businesses are under immense pressure to innovate, adapt, and scale at an unprecedented pace. The ability to quickly deploy and manage applications across hybrid and multi-cloud environments has become a critical differentiator for organizations striving to stay ahead of the curve. TVAR Solutions, a trusted provider of enterprise solutions, understands these challenges and is committed to empowering businesses with cutting-edge technologies that drive digital transformation.

The transformative potential of pairing a leading Kubernetes platform like Red Hat OpenShift with the unmatched performance and flexibility of Dell PowerFlex software-defined storage requires deep expertise and a proven track record to fully realize its benefits and use cases for organizations.

Whether you are a C-suite executive seeking to reduce costs and drive strategic growth and profitability or a VP responsible for delivering IT excellence, drive efficiency and increase agility, this white paper will provide valuable insights into how TVAR solutions can help you leverage RedHat OpenShift on Dell PowerFlex to unlock the full potential of your enterprise.

OPENSHIFT

Accelerates Application Development & Deployment

Streamline the development lifecycle and enable rapid innovation through automated workflows and self-service provisioning.

Optimizes Resource Utilization & Cost Efficiency

Achieve greater flexibility and control over IT infrastructure, reducing operational overhead and maximizing return on investment by using OpenShift virtualization.

Enhances Application Availability & Resilience

Ensure business continuity with built-in high availability, disaster recovery, and data protection capabilities.

Simplifies Hybrid & Multi-Cloud Management

Seamlessly manage applications across diverse environments, enabling greater agility and portability.

Optimized Architecture for Superior Performance

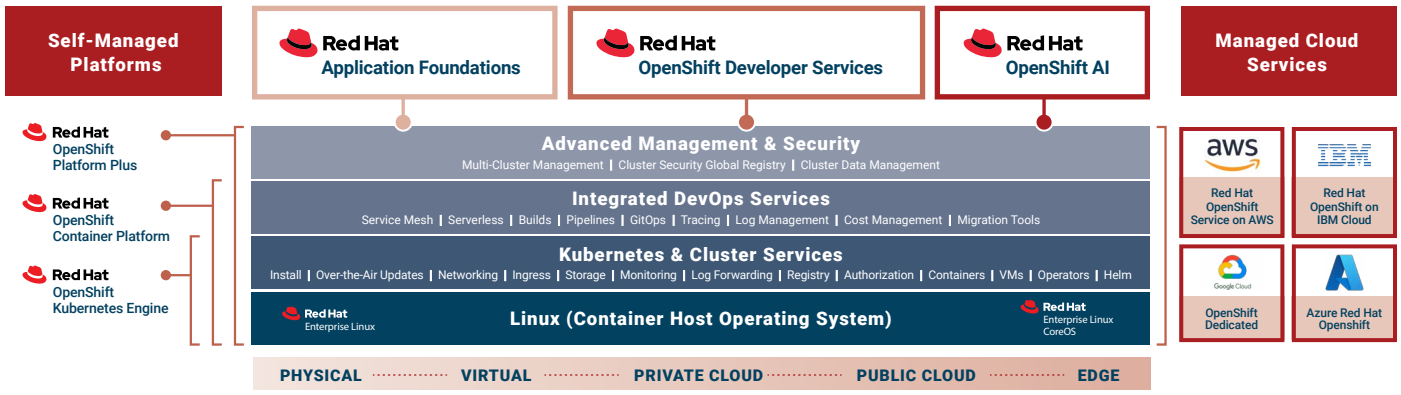
Dell PowerFlex: Software-Defined Infrastructure

PowerFlex is a flexible and scalable solution the foundation for a modern infrastructure agility and flexibility helps organizations meet the changing demands of your business. It offers:

- **Flexible Deployment Models**: It supports a range of deployment scenarios, including hyperconverged, disaggregated, and even bare-metal, giving you the freedom to choose the architecture that best aligns with your needs.
- **Multi-Cloud Integration**: Its compatibility with various cloud platforms, orchestration tools, and container environments simplifies hybrid and multi-cloud strategies. You gain a consistent operational model across your entire infrastructure, on-premises and in the cloud.
- **Simplified Management**: PowerFlex simplifies management with a unified console, automates routine tasks for greater efficiency, and integrates with DevOps tools for faster development and deployment.

RedHat OpenShift: Empowering Enterprise Agility and Innovation

RedHat OpenShift provides a comprehensive, open-source platform that enables organizations to embrace containerization, accelerate application development, and simplify hybrid and multi-cloud management. It is the cornerstone for building a modern, agile, and secure IT infrastructure that can drive digital transformation and business success.



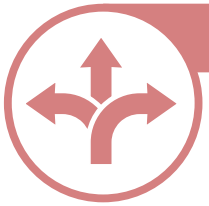
RedHat OpenShift, built on Kubernetes, provides a portable platform for streamlined application development and management across any infrastructure (on-premises, hybrid, or multi-cloud). Built-in DevOps tools and CI/CD pipelines empower developers to focus on innovation, while ensuring enterprise-grade security, scalability, and simplified operations. This enables you to adapt your infrastructure strategy based on business needs and optimize costs without sacrificing agility.

RedHat OpenShift on Dell PowerFlex: Better Together

In this rapidly evolving digital landscape, businesses face a complex web of challenges as they strive to innovate, adapt, and scale. Legacy IT infrastructure often struggles to keep pace with the demands of modern applications, leading to bottlenecks, inefficiencies, and missed opportunities. The ability to quickly deploy and manage applications empowering DevOps across virtualized, hybrid and multi-cloud environments has become a critical differentiator for organizations determined to stay ahead. This empowers organization to achieve greater agility and efficiency in application development and delivery. By leveraging OpenShift's container-centric platform and PowerFlex's high-performance storage, enabling:

Shorten Time-to-Market

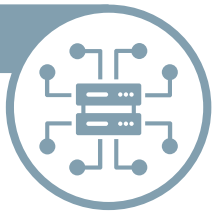
Streamlining development lifecycles, enabling DevOps best practices, and accelerate deployments through rapid provisioning and CI/CD. Combining Dell PowerFlex and OpenShift enables rapid deployment and configuration of the platform, accelerating the realization of benefits for containerization and virtualization initiatives.



Enhance Operational Flexibility

Breaks down infrastructure silos with a unified platform for application management across any environment. Leverage a single system to manage the underlying infrastructure, including hardware, software, and ongoing maintenance, freeing your IT team to focus on strategic initiatives rather than day-to-day operations.

Maximize Infrastructure Utilization



Optimizes resource allocation through container orchestration, achieving higher density and cost savings. Ensure the platform is optimized for performance and scalability, providing the resources needed to support demanding containerized and virtualized workloads.

Complex Hybrid and Multi-Cloud Management

Finally, ensuring that container data is persistent and protected, leveraging Dell PowerFlex's capabilities for seamless storage provisioning and management and with its expertise, streamlines the entire software development lifecycle, from code development to deployment and monitoring.

Dell PowerFlex with CSI (Container Storage Interface)

The Dell PowerFlex CSI driver enables seamless integration of PowerFlex software-defined storage with containerized environments like Kubernetes. This driver allows Kubernetes to dynamically provision and manage persistent storage volumes on PowerFlex, simplifying storage operations and enhancing application portability.

Performance of Cassandra DB on Dell PowerFlex & OpenShift

A Case Study

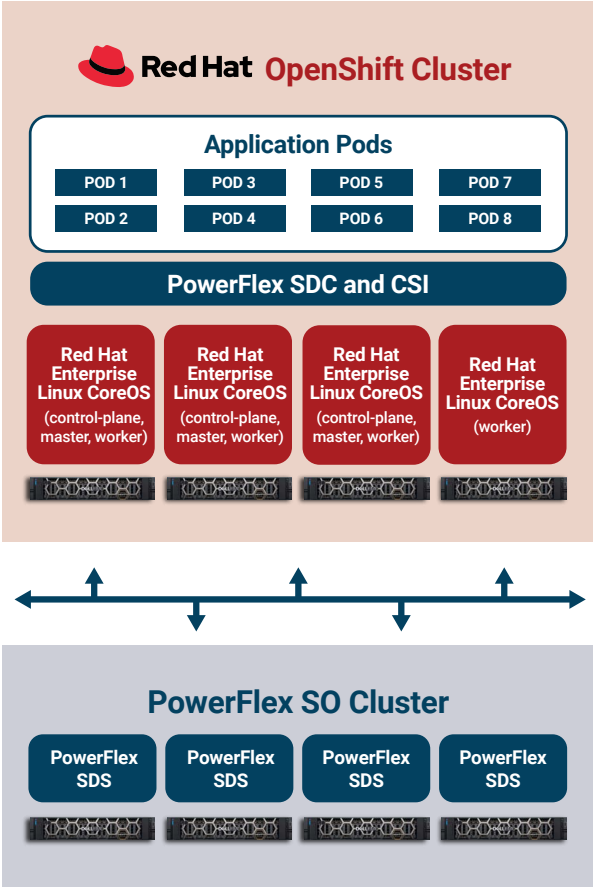
Together Dell Technologies, RedHat, and TVAR Solutions, committed to delivering tangible value to its clients, conducted rigorous benchmark tests to showcase the performance advantages of deploying Cassandra DB as containers within the RedHat OpenShift and Dell PowerFlex platform. These tests, designed to simulate real-world enterprise workloads, measured key performance indicators such as throughput, latency, and scalability. By leveraging OpenShift's container orchestration capabilities and PowerFlex's software-defined storage flexibility, Cassandra DB achieved enhanced performance, enabling faster data access and improved application responsiveness. These findings underscore the power of this combined solution to empower businesses with a high-performance, scalable, and resilient data infrastructure, capable of meeting the demands of today's data-driven enterprises.

This Dell PowerFlex setup, with its NVMe SSDs and powerful CPUs, provides an excellent foundation for a high-performance Cassandra database. Here's how it shines when handling 15 billion rows of real-time data.

Solution Architecture

To benchmark the performance of Cassandra DB containers on Dell PowerFlex and RedHat Openshift, an architecture consisting of following three layers was configured.

- **PowerFlex SO Cluster**: This cluster contains 4 instances of PowerFlex Software-Defined Storage on nodes each with 8 1.8TB of NVMe SSDs providing underlying storage to Cassandra PODS.
- **PowerFlex SDC and CSI**: This layer represents the integration between OpenShift and Dell PowerFlex storage.
    - **SDC (Storage Data Client)**: This software component runs on each OpenShift node, enabling communication with the PowerFlex storage cluster.
    - **CSI (Container Storage Interface)**: A standard interface that allows OpenShift to manage storage resources on PowerFlex.



- **RedHat OpenShift Cluster with Application PODS**: The OpenShift cluster comprises multiple nodes running RedHat Enterprise Linux CoreOS.
  - **Control Plane**: Three nodes function as the control plane, managing the cluster, scheduling pods, and providing core services.
  - **Worker Nodes**: Dedicated worker nodes run the application pods, each containing a single container running a Cassandra node.

In summary, deploying Cassandra on Dell PowerFlex with RedHat Openshift created a high-performance database solution capable of handling massive datasets with exceptional read performance. The system's architecture, coupled with Cassandra's strengths, ensures low latency, high throughput, and scalability, making it ideal for demanding real-time applications.

Test and Validation

Cassandra database performance validation on an OpenShift cluster, hosted on a PowerFlex infrastructure, was performed using industry-standard Cassandra-stress benchmarking tools. This section provides a detailed summary and description of these tests.

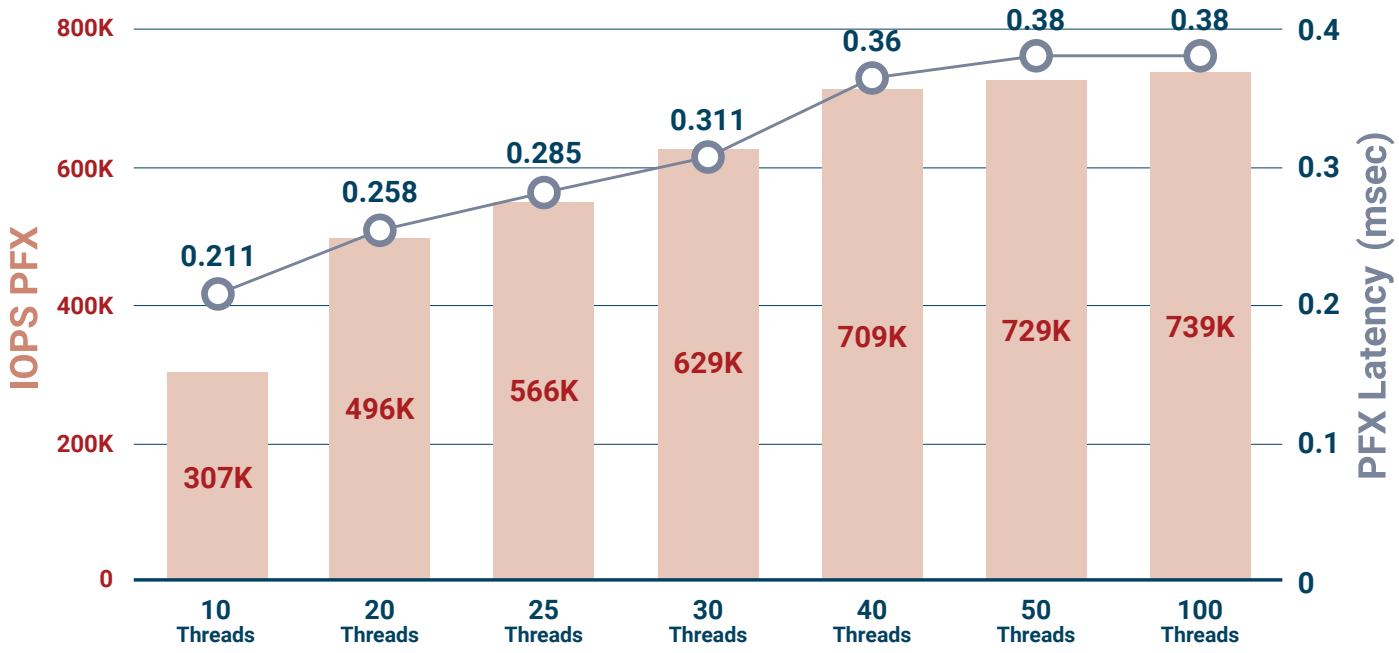
By examining prevalent Cassandra use cases, this paper shows that PowerFlex's software-defined infrastructure provides an ideal platform for deploying OpenShift clusters alongside Cassandra.

A real-world test, involving a substantial **15 billion rows, 3.72TB** Cassandra database, demonstrated the exceptional performance of Dell PowerFlex, validating its suitability for large-scale deployments within OpenShift clusters.The dataset's characteristics accurately reflect real-world scenarios, ensuring the evaluation's relevance showcasing PowerFlex's ability to deliver low latency and high throughput for demanding workloads includes but not limited to:

Real-Time Analytics Dashboards: Where users need to quickly access and analyze large datasets.

- **Content Delivery Networks (CDNs)**: Where fast retrieval of content is essential for a good user experience.
- **Online Catalogs and Product Listings**: Where users need to browse and search through large product catalogs with minimal delay.

In our testing, analysis of a read-only workload on a Cassandra database with 320 million rows showed exceptional performance:



High Read Throughput: The 652K operations per second with millisecond latency is even more impressive considering it was achieved with read-only operations. This highlights the system's ability to efficiently handle a high volume of read requests.

PowerFlex Read Performance: The 709K IOPS from the PowerFlex infrastructure specifically demonstrates its strength in delivering fast read performance. This is crucial for applications that require rapid data retrieval.

Varying read intensive workloads were simulated to quantify the cluster performance by observing the total operations per second and the derived latency.

Exceptional IO Performance

- **High Throughput**: The system's architecture, featuring NVMe SSDs and a distributed Cassandra setup, allows for parallel reads across multiple nodes and disks. This translates to significantly higher read throughput compared to traditional storage systems, enabling rapid data retrieval even with 15 billion rows.
- **Low Latency**: NVMe SSDs offer incredibly fast response times, minimizing the delay in accessing data. This ensures that read operations on the Cassandra database are performed with very low latency, even with a massive dataset. This is crucial for real-time applications that demand immediate access to information.

- **Scalability**: The Dell PowerFlex architecture allows for easy scaling of both storage and compute resources. As the data volume grows beyond 15 billion rows, you can add more NVMe SSDs or compute nodes to maintain the desired performance levels.
- **Continuous Availability**: The combination of Cassandra's fault-tolerant design and Dell PowerFlex's reliable infrastructure ensures continuous availability, even with constant updates to the 15 billion rows of real-time data.
- **Fast Data Ingestion**: The high write performance of NVMe SSDs allows for rapid ingestion of real-time data into the Cassandra database. This ensures the data is always up-to-date and readily available for read operations.

Dell PowerFlex: Unleashing Cassandra's Potential on RedHat OpenShift

Dell PowerFlex is a software-defined storage platform that delivers exceptional performance, scalability, and resilience. When combined with Cassandra on RedHat OpenShift, the infrastructure provides a high-performance, scalable, and resilient storage foundation for Cassandra on OpenShift. In addition, it creates a powerful solution for handling demanding workloads with high throughput and low latency. By combining the strengths of these technologies, you can achieve exceptional performance, reduce your footprint, and simplify management. This makes it an ideal solution for organizations looking to deploy demanding Cassandra workloads in a cloud-native environment.

Small Footprint, Superior Performance

- **High IOPS and Throughput:** PowerFlex's architecture enables Cassandra to achieve impressive IOPS (Input/Output Operations Per Second) and throughput. With its distributed architecture and efficient data management, PowerFlex can handle the intense demands of Cassandra workloads, exceeding 500K IOPS and 200K operations per second.
- **Millisecond Latency**: PowerFlex's high-performance capabilities ensure that Cassandra operates with minimal latency. By optimizing data access and minimizing storage bottlenecks, PowerFlex allows Cassandra to achieve millisecond response times, critical for real-time applications and interactive experiences.
- **Reduced Footprint**: PowerFlex's software-defined nature allows it to run on industry-standard servers, reducing the physical footprint compared to traditional storage arrays. This makes it ideal for OpenShift deployments where space and resource efficiency are paramount.

Accelerate Innovation, Drive Efficiency, and Secure Your Digital Transformation

PowerFlex delivers a comprehensive solution that addresses the key challenges faced by modern IT infrastructures. It helps your organization save money, improve efficiency, and increase agility. This solution modernizes your IT infrastructure by

Eliminating Siloed infrastructure and inflexible IT

Accelerating application development

Optimizing resource utilization

From the design to the selection, procurement, and implementation of technology solutions, we understand the Federal Government, ensuring that projects are done on time and within budget.

For more information please reach out to sales@tvarsolutions.com, or visit our website tvarsolutions.com.

About TVAR Solutions

TVAR Solutions leverages its expertise in enterprise solutions to solve the complex technical challenges faced by the Federal Government and its Systems Integrators. TVAR brings integrity, vast industry knowledge, and unrivaled customer service to enable the success of our customers missions. Our seasoned team operates with a consultative approach leveraging vast mission experience and deep vendor relationships to deliver faster, smarter, and more cost-effective technology modernization.

Partnering with TVAR to implement Dell PowerFlex and OpenShift offers a compelling value proposition for organizations seeking to leverage containerization and virtualization technologies. By streamlining operations, optimizing performance, and providing expert guidance, TVAR enables businesses to focus on innovation and accelerate their digital transformation journey.