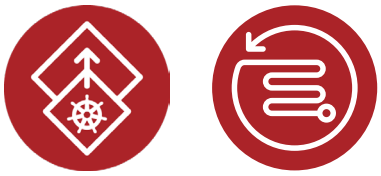
VERITAS

Veritas Enterprise Storage and Data Protection for Kubernetes

Solution Overview.



White Paper | September 2023

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Executive Summary

Containers are rapidly becoming a mainstream solution for building and running IT services that help businesses reduce management overhead and focus on delivering new innovations. Containers provide excellent application portability and also help improve efficiencies by making it easy to standardize the resources your applications require. However, containers and container orchestration engines like Kubernetes do not natively provide all the functionality enterprise applications running in containers need.

Veritas provides enterprise software-defined storage and data protection that is not natively available with container orchestration engines. This enables enterprises to deploy containerized applications in production with the performance and resiliency needed to ensure a smooth end user experience. With industry-leading storage management and data protection from Veritas, you can manage your containerized IT services confidently with key functionality needed by most enterprise applications:

- Data protection that ensures the integrity of containerized applications with advanced recoverability that provides distribution and platform mobility.
- Storage and availability management for stateful applications ranging from low-impact to mission-critical.
- A software-defined architecture that can improve application performance, reduce costs, and automate key operational processes.

This solution overview will discuss the Veritas data management and protection strategy for containerized applications in Kubernetes environments. Veritas offers a unique integrated solution that ensures your Kubernetes environment is unlocked, fortified, and optimized with the flexibility to run your containerized applications and IT services in any Kubernetes environment.

Solution Value

Kubernetes is a complex platform that consists of many abstractions for managing applications and their data to provide advanced container orchestration services. Organizations often provide enterprise storage and data protection for Kubernetes by using multiple independent tools, processes, and point products.

As a software-defined solution, Veritas offers a complete foundation for container and Kubernetes data management designed to provide enterprise-grade storage and data protection for containerized applications. This unique integrated approach to data management for containers has several key advantages:

- ✓ **Application portability**—Move containerized applications between platforms with cross-platform recoverability.
- ✓ **Autonomous data protection**—Define your backup requirements and all new Kubernetes namespaces are automatically protected when they come online.
- ✓ **Improved availability**—Ensure business continuity and high availability for containerized applications with integrated data integrity management and flexible disaster recovery.
- ✓ **Infrastructure optimization**—Use software-defined storage and data protection that provides advanced features and better performance at a lower cost than point products and traditional storage solutions.

The Veritas software-defined data management solution for Kubernetes offers storage, data protection, and application availability management to provide a foundation for running your containerized applications with confidence—using a single, unified strategy.

Solution Overview

With integrated storage, availability and data protection technology, Veritas provides a single source of data management for Kubernetes based on the following solutions:

Veritas InfoScale™ for Kubernetes—A software-defined optimization solution for mission-critical applications that abstracts applications from their underlying hardware and software resources. That abstraction enables enterprise-grade optimizations around business continuity, performance, and infrastructure agility across physical, virtual, cloud, and containerized environments. InfoScale for Kubernetes (InfoScale K8s) provides advanced ephmeral and persistent software-defined storage resiliency and disaster recovery management for applications running in Kubernetes. To learn more about InfoScale K8s and containers, visit our website.

Veritas NetBackup™—Provides enterprise-level heterogeneous data protection for any application in nearly any platform, including containers. It provides cross-platform data protection functionality for a large variety of operating systems and applications. NetBackup uses a centralized management architecture that can be easily scaled to manage data protection for vast enterprise environments. In Kubernetes environments, NetBackup has been designed to provide data protection for containerized applications by integrating with native constructs. This design enables flexible recoverability that can support any Kubernetes distribution. NetBackup provides comprehensive, autonomous, and unified data protection for all application components in a Kubernetes namespace using native tools—on-premises or in the cloud. To learn more about NetBackup, visit our website.

Figure 1 shows an overview of how Veritas provides data management and protection for applications and IT services running in a Kubernetes (K8s) environment.

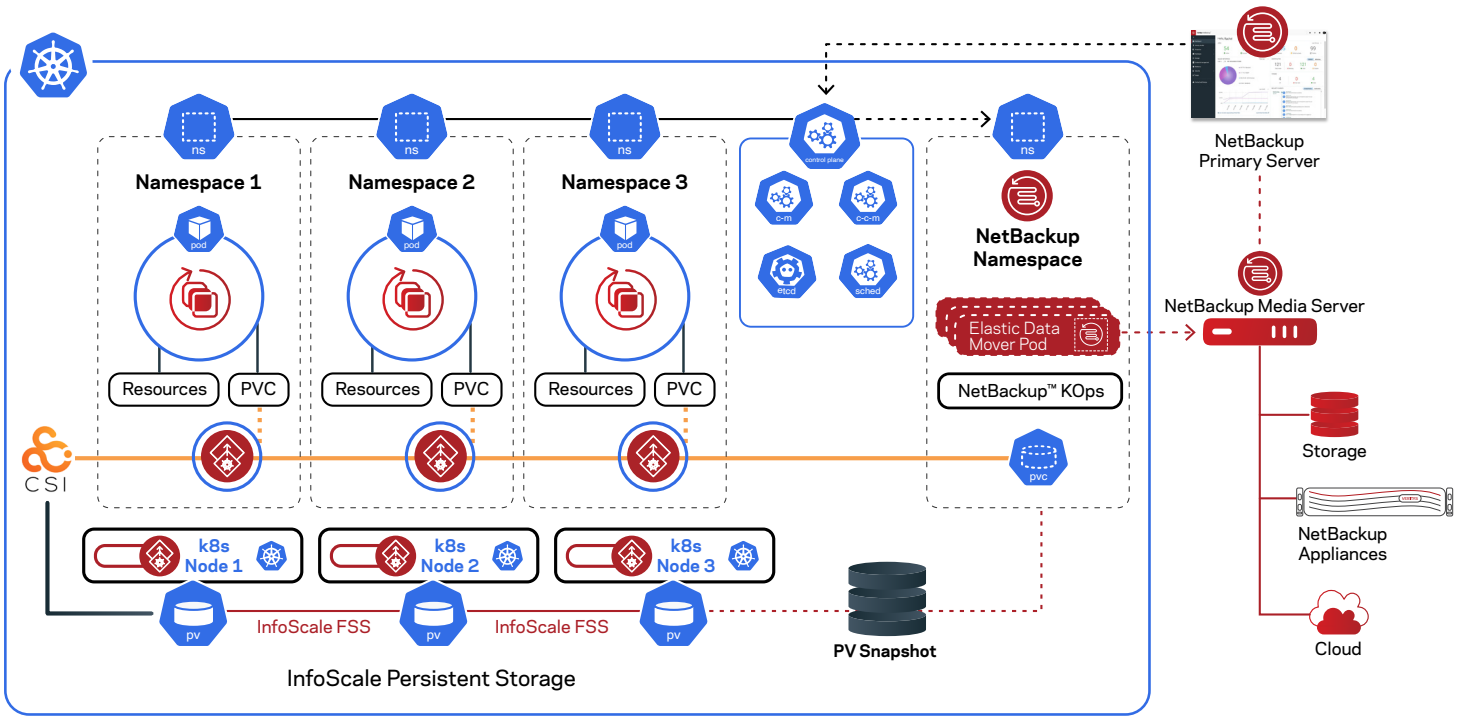

Figure 1. An overview of Veritas enterprise storage and data protection for Kubernetes environments.

Unlock

With several different operating models available within the Kubernetes landscape, it can be difficult to choose the right solution to manage your containerized applications. The flexibility and scalability benefits Kubernetes provides for applications also introduce some storage and data protection challenges. Veritas offers an API-driven solution for managing storage and data protection for Kubernetes, ensuring a streamlined process for delivering application mobility and data protection for containerized applications running in Kubernetes environments.

Veritas understands that you need both flexibility and agility to:

- Deliver the enterprise features and functionality your containerized applications need that is not available natively in Kubernetes.
- Avoid being locked into specific platforms and Kubernetes distributions if your container strategy changes and you need to adapt your containerized applications to run on other platforms.
- Efficiently manage CI/CD pipelines with solutions that are designed to use native Kubernetes processes.

Veritas provides a solution for both persistent storage and data protection that enables choice and flexibility for your containerized applications. With application mobility across physical, virtual, and cloud platforms, you can focus on delivering innovation and a smooth user experience with your IT services.

Flexibility

Veritas storage and data protection solutions for Kubernetes are designed to use native APIs to allow for a familiar user experience managing persistent storage, with the ability to back up and recover anywhere—on-premises and in the cloud. NetBackup data protection for Kubernetes is both simple and comprehensive, with a suite of APIs and Helm chart integration that provide the choice and flexibility you need to build custom workflows to fit into your CI/CD pipeline. Veritas provides comprehensive data management for Kubernetes that is not available natively and eliminates lock-in with:

- Data protection that can support any type of storage that uses the Container Storage Interface (CSI), with the ability to back up and recover to different Kubernetes distributions.
- Persistent storage using a CSI plug-in that can work with any direct-attached or SAN-based storage.

With autonomous and intuitive self-service management, Kubernetes operations teams can securely access the functionality needed to have complete control over storage and data protection for containerized applications—with the ability to recover Kubernetes namespaces anywhere.

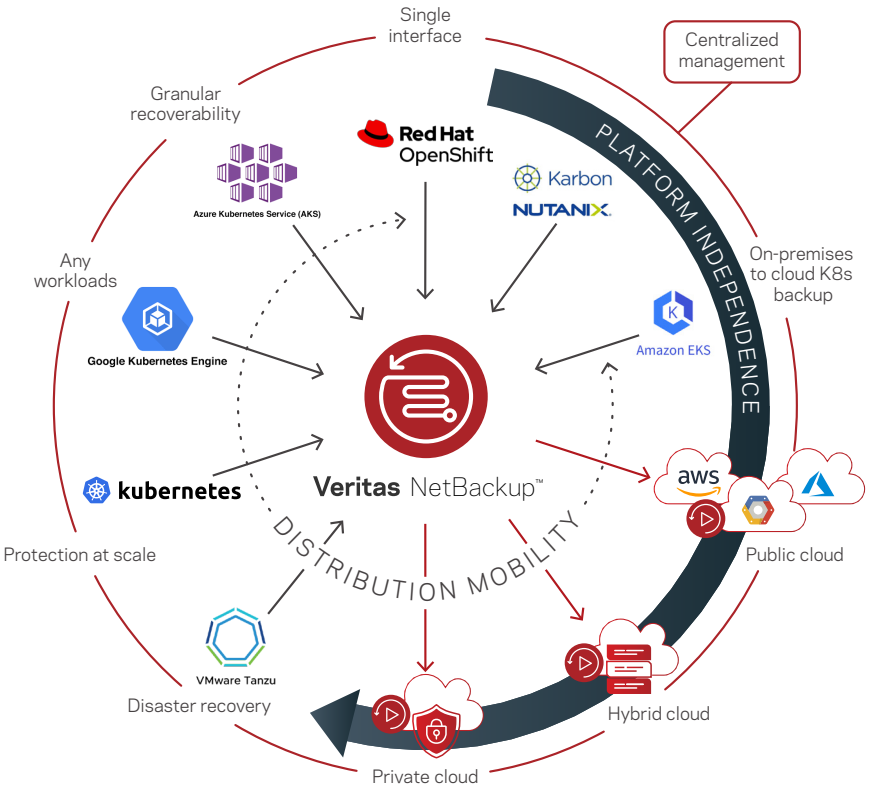

Figure 2. Distribution mobility with NetBackup for Kubernetes.

Software-Defined Persistent Storage

InfoScale's CSI plug-in works with Kubernetes to provide advanced storage management and high availability for containerized applications. As persistent storage in a Kubernetes environment, InfoScale K8s provides software-defined storage that is hardware and platform-agnostic, with the functionality needed by stateful applications running in production containers. InfoScale's enterprise functionality integrates with Kubernetes to provide a container management platform suitable for running stateful and mission-critical applications that require:

- **Advanced storage management**—InfoScale's CSI plug-in allows Kubernetes to provide InfoScale K8s persistent storage volumes to containerized applications being managed within a Kubernetes namespace. You can use InfoScale's Flexible Storage Sharing to provide high-performance storage within a Kubernetes cluster using either traditional SAN storage or disks directly attached to Kubernetes cluster nodes. This approach can result in better performance than traditional SAN-based storage solutions at a significantly reduced cost.
- **Data integrity and availability**—With advanced I/O fencing that prevents data from being written to volumes on nodes within a Kubernetes cluster that have failed due to hardware or network communication issues, InfoScale K8s provides higher data availability and prevents data corruption by allowing only the working nodes to continue normal operations. In the event of a disruption within the cluster, InfoScale's fencing driver helps manage a fast recovery by ensuring application pods are moved to another node and brought online to continue normal operations.
- **Disaster Recovery**—Achieve a near-zero recovery time objective (RTO)/recovery point objective (RPO) for mission critical applications with real-time namespace replication between Kubernetes clusters
- **Automated operations**—InfoScale K8s is a Red Hat certified solution for the OpenShift Container Platform that can provide full-stack automated operations with integrated monitoring, security, and lifecycle management for containerized applications both on-premises and in the cloud.

InfoScale K8s is deployed within a Kubernetes cluster as container images, and the InfoScale K8s CSI plug-in provides the interface between Kubernetes and InfoScale K8s. Figure 3 shows an overview of how InfoScale K8s integrates with Kubernetes to provide persistent storage for containerized applications.

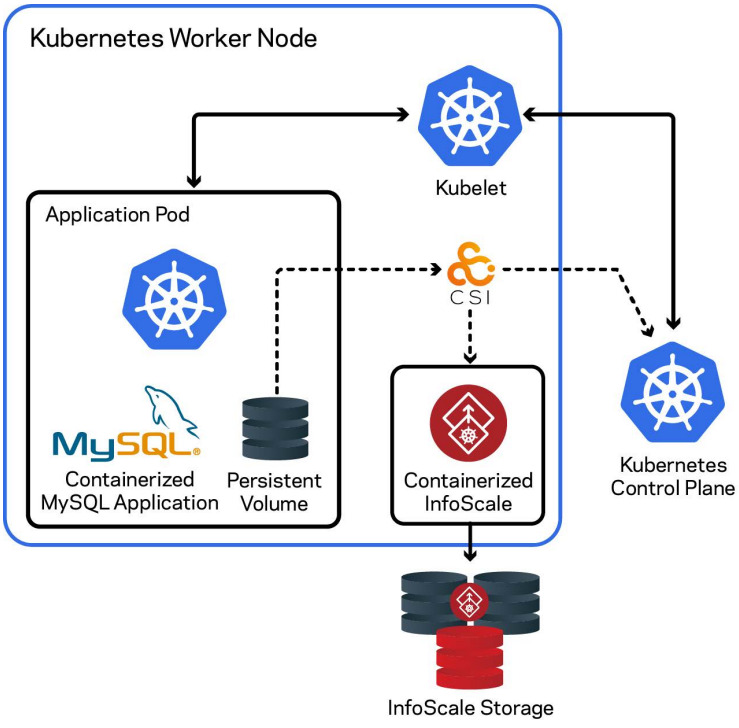

Figure 3. An overview of InfoScale K8s persistent storage for a containerized application running in Kubernetes.

Fortify

Modern, fast-changing container environments require a new approach to data protection to ensure all your applications are protected without limiting your recovery options. With NetBackup, you can fortify and protect your entire environment from a single interface and eliminate the need for point products that only provide limited protection. This capability helps reduce the costs, complexity and risks associated with a fragmented data protection and resiliency strategy. NetBackup is designed with an application-centric architecture that ensures Kubernetes workloads are easily protected and recoverable by automating discovery, protection, and recovery of all components of containerized applications.

Veritas provides advanced data protection and resiliency for containerized applications with a focus on:

- **Disaster recovery**—NetBackup provides protection for all components within a namespace and can protect any number of namespaces, protecting your entire environment in the event of a site failure. InfoScale K8s provides resiliency and disaster recovery for Kubernetes clusters with real-time replication that can provide a very low recovery point objective/recovery time objective (RPO/RTO) for your containerized applications.
- **Recovery flexibility**—NetBackup enables cross-distribution mobility, with the ability to back up and restore containerized applications across Kubernetes clusters and distributions on-premises or in the cloud.
- **Platform independence**—InfoScale K8s persistent storage and NetBackup data protection are platform agnostic and can work with nearly any infrastructure, with integrated lifecycle management supported in both Kubernetes and Docker environments.

Figure 4. An overview of the NetBackup solution for Kubernetes data protection.

High Availability and Disaster Recovery

The increased demand for running production applications and IT services in containers has resulted in a need to ensure business continuity in the event of a failure or service disruption. InfoScale K8s provides advanced cluster availability management with an integrated I/O fencing solution that protects against data corruption and downtime. InfoScale K8s can also provide disaster recovery for Kubernetes clusters with integrated cluster-level data replication that can manage data transfer between different Kubernetes clusters with a near-zero RPO.

InfoScale K8s has high availability and disaster recovery features designed specifically to augment Kubernetes native functionality and provide additional availability features for Kubernetes environments. Some of the key functionality in InfoScale K8s includes:

- **I/O fencing**—Ensure your applications are online in the event of a disruption within the cluster by identifying the failure and directing Kubernetes to quickly redeploy application pods on functional nodes.
- **Disaster recovery**—Geographically dispersed disaster recovery for Kubernetes clusters lets you recover an entire cluster to a second cluster in the event of a failure, helping eliminate the impact of localized outages.

- **Data consistency**—With several integrated replication options available, InfoScale can manage data replication between Kubernetes clusters using integrated replication functionality with that maintains data consistency and write order fidelity. InfoScale K8s can also support replication at the storage array level with out-of-the-box support for multiple storage vendors.

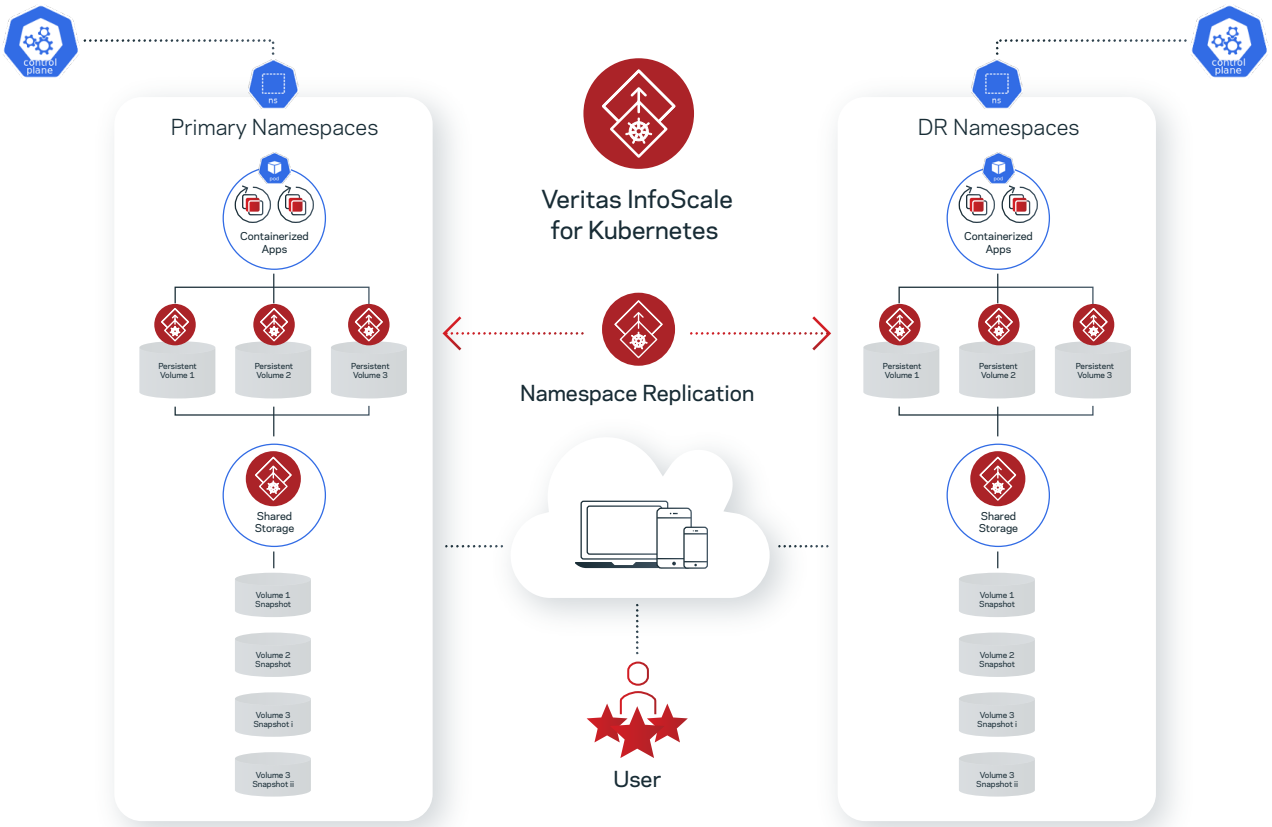

Figure 5. InfoScale for Kubernetes provides disaster recovery for Kubernetes clusters

Flexible Recoverability

NetBackup reduces complexity, scales with growth, and provides a foundation for container data protection that delivers broad platform support for container platforms and architectures. NetBackup protects all components of containerized applications at the namespace and individual volume level. NetBackup provides comprehensive protection and recovery options that give you:

- **Flexibility**—Easily roll back application namespaces from a snapshot or from an optimized longer-term copy for disaster recovery.
- **Advanced recoverability**—Restore an entire namespace or multiple namespaces within the same or to alternate Kubernetes cluster or distribution.
- **Granular recovery**—Recover individual resource and persistent volumes in a Kubernetes namespace to the same or alternate Kubernetes clusters.
- **Kubernetes resiliency**—backup and recover the cluster configuration for disaster recovery at the cluster level.

NetBackup is fully Kubernetes aware and protects your applications seamlessly by discovering and managing the snapshot and recovery of all components that make up a containerized application, including all persistent storage volumes, configuration files and custom resources. Figure 5 shows an example of a recovery operation in the NetBackup web console.

Recovery At Scale

NetBackup offers a single-click recovery model to reduce management overhead and complexity in large, complex environments. NetBackup supports the rapid recovery of Kubernetes workloads with the ability to recover individual resources, persistent volumes, or a single namespace—to the same or alternate Kubernetes clusters—as a simple process.

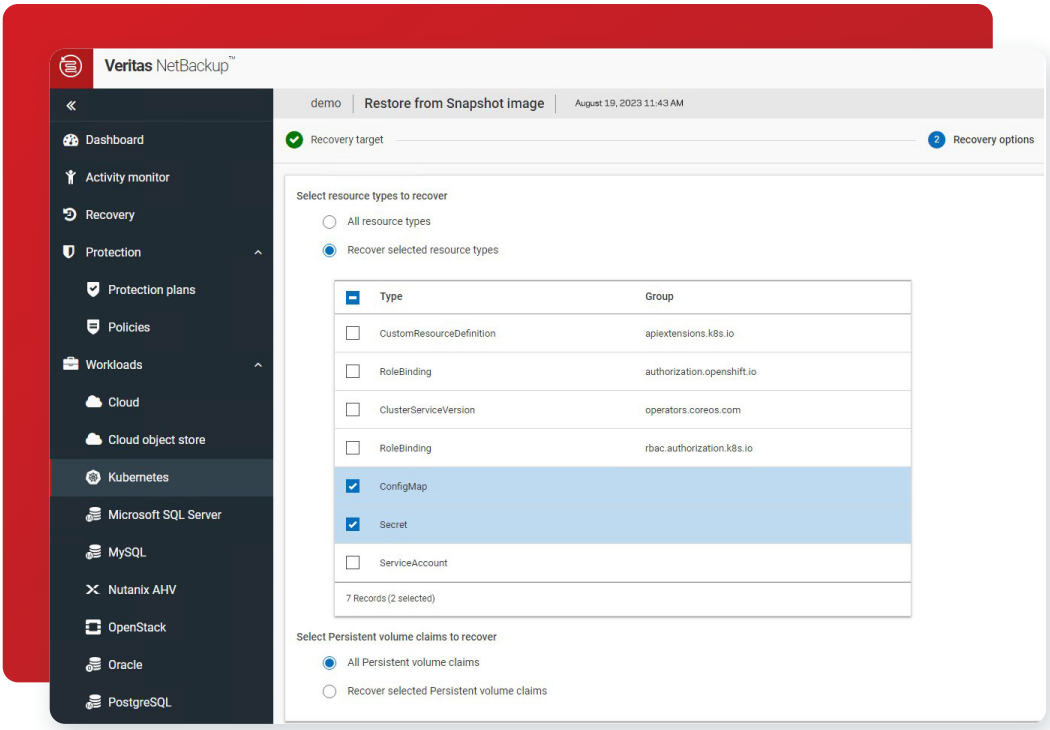

Figure 6. NetBackup for Kubernetes recovery options available from the management console.

Optimize

Ensuring that all storage and data protection for Kubernetes can be delivered dynamically is a key priority for Veritas. Both the Veritas storage and data protection solutions operate natively within a Kubernetes environment and can be scaled to support environments of nearly any size. This approach ensures the costs to keep environments flexible and fortified remains low while delivering performance and scalability as needed. Veritas storage management and data protection solutions for Kubernetes help optimize your resource utilization and operational efficiency with several key benefits:

- ✓ Optimize your storage infrastructure footprint by using your existing hardware without adding single-purpose hardware resources or appliances.
- ✓ Reduce the cost of managing development and testing environments with a software-defined solution that lets you use only the infrastructure you need without affecting production readiness.
- ✓ Use a single solution for data protection that can provide backup and recovery services for applications with any protection requirement within any Kubernetes environment.

Operational Simplicity

Although Kubernetes can be complex to deploy and manage, it provides a significant amount of functionality for applications running in containers. Veritas integrates seamlessly into Kubernetes environments to ensure a smooth operating experience that doesn't require you to be a Kubernetes expert. NetBackup provides a web-based user interface to manage data protection operations for Kubernetes. InfoScale K8s is supported within the Red Hat OpenShift Container Platform and as a stand-alone solution for Kubernetes storage management using the native Kubernetes command line interface.

Deployment Overview

Both InfoScale K8s and NetBackup offer an optimized deployment experience that is consistent with how you will deploy and manage other Kubernetes resources.

- NetBackup—Uses Helm charts for a streamlined deployment experience familiar to Kubernetes users. Helm charts help define, install and upgrade Kubernetes applications, making ongoing maintenance for the NetBackup components within Kubernetes easier to manage.
- InfoScale K8s—Available as a containerized deployment, InfoScale K8s can be easily deployed within a Kubernetes environment in a native container form factor. This option makes it easy to install and operate and reduces resource overhead on the physical Kubernetes infrastructure while delivering the same advanced storage management functionality for applications in containers.

NetBackup Deployment

NetBackup has been designed to protect your Kubernetes environment without impacting or disrupting your applications. With the ability to easily protect and recover workloads in the web-based interface, NetBackup lets you manage data protection operations without the need for deep operational knowledge of Kubernetes.

The Netbackup Kubernetes operator (NetBackup KOps) is the interface that manages scheduling, updates, and communications between NetBackup and Kubernetes. NetBackup leverages direct CSI integration for snapshots of the storage within the namespace. The NetBackup integrated data mover allows NetBackup to move data off the Kubernetes cluster to a storage target of choice with optimized and secure data movement. The NetBackup data mover can be scaled up and down dynamically based on the workload and the backup stream also includes integrated anomaly detection to help protect against ransomware.

Figure 6 provides an overview of how the NetBackup components are deployed and interact within a Kubernetes cluster.

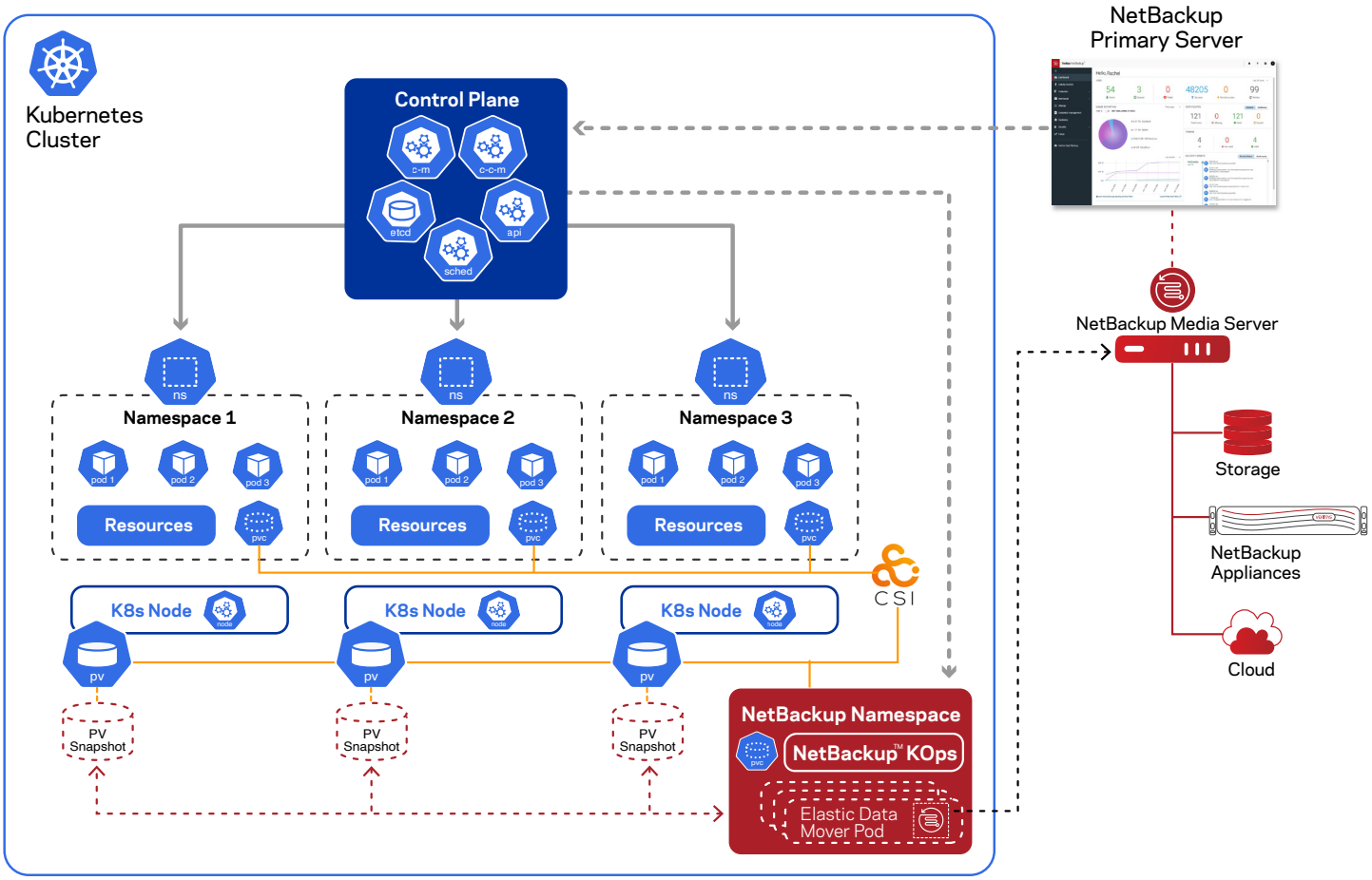

Figure 7. An overview of NetBackup data protection for Kubernetes clusters.

InfoScale for Kubernetes Deployment

InfoScale is available as a containerized application that can be deployed within both standard Kubernetes environments as well as the Red Hat OpenShift Container Platform. All the required InfoScale K8s components have been containerized and can be deployed as

containers within a Kubernetes environment.

You handle lifecycle management for InfoScale using a Kubernetes special resource operator that manages cluster configuration and an InfoScale K8s operator that manages operational processes such as upgrades, configuration changes and licensing.

Figure 7 shows an example of how InfoScale K8s is deployed within a Kubernetes cluster and provides persistent storage for containerized applications.

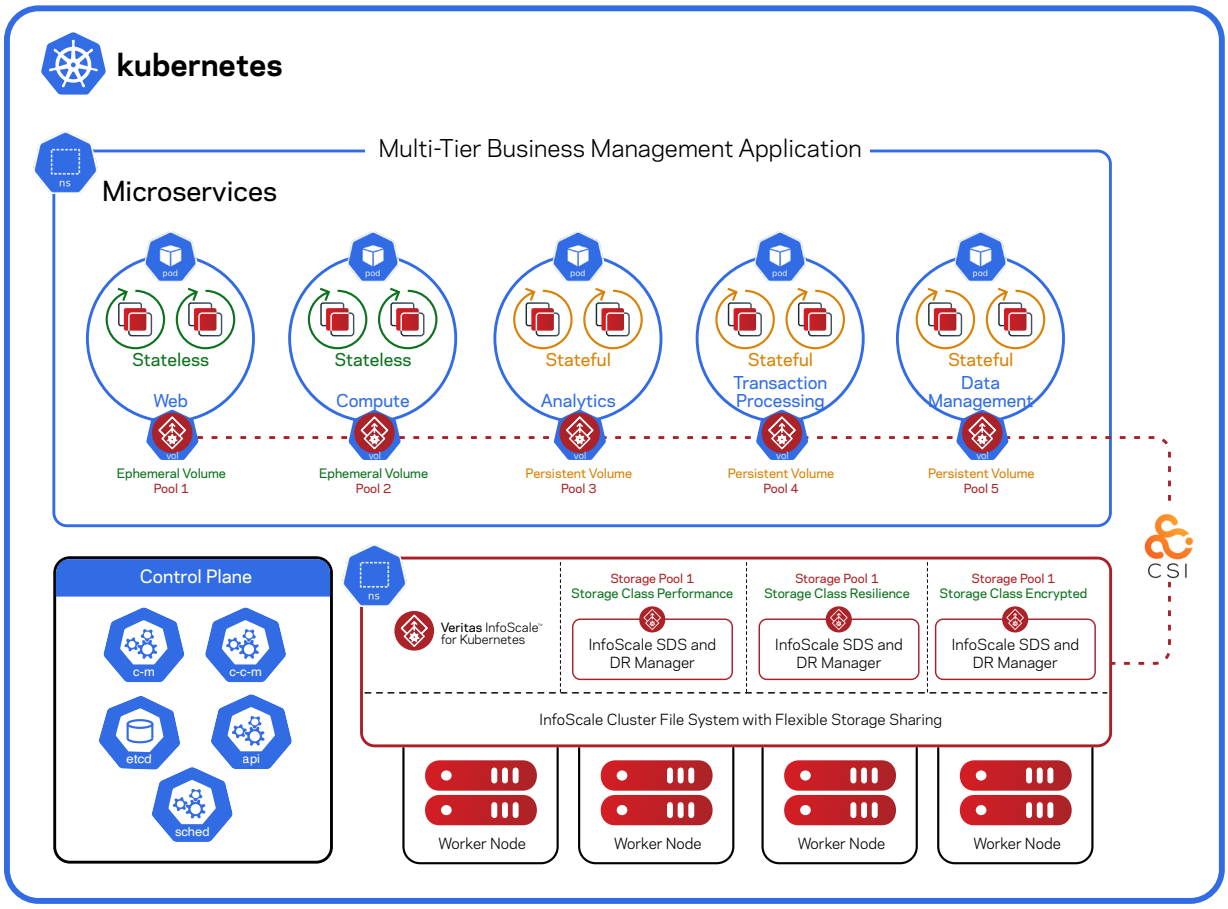

Figure 8. A Kubernetes cluster with InfoScale K8s software-defined persistent storage.

Summary

Digital transformation has driven enterprises toward IT solutions that provide better efficiency and scalability for their IT services. Containerizing applications and managing operations with orchestration engines like Kubernetes can help businesses deliver more efficient innovation, but this operating model has several gaps in the enterprise functionality needed by most applications. Veritas solves this problem by providing an enterprise-focused foundation for storage management and data protection for containers and Kubernetes that can operate at scale. This unique solution has several key benefits:

- ✓ **Unlock** your container environment with advanced platform-agnostic storage and protection that lets you run your containerized applications on any infrastructure, with distribution mobility to move applications between platforms.
- ✓ **Fortify** your container operations with enterprise-grade persistent storage and data protection and disaster recovery for any application that can operate at scale.
- ✓ **Optimize** operations by eliminating point products and reducing overhead with a storage and data protection solution designed to integrate seamlessly with native processes and infrastructure.

With a focus on usability and functionality, Veritas enables businesses to take advantage of the benefits of containerization with advanced protection and storage management that integrates seamlessly with containerized environments. Designed for flexibility and scalability to support the largest container environments, Veritas delivers an enterprise software-defined storage and data protection solution that provides the confidence you need to run your applications in containers with maximum availability and protection.

Table of Figures

About Veritas

Veritas Technologies is the leader in secure multi-cloud data management. Over 80,000 customers—including 91% of the Fortune 100—rely on Veritas to help ensure the protection, recoverability and compliance of their data. Veritas has a reputation for reliability at scale, which delivers the resilience its customers need against the disruptions threatened by cyberattacks, like ransomware. No other vendor is able to match the ability of Veritas to execute, with support for 800+ data sources, 100+ operating systems and 1,400+ storage targets through a single, unified approach. Powered by Cloud Scale Technology, Veritas is delivering today on its strategy for Autonomous Data Management that reduces operational overhead while delivering greater value. Learn more at www.veritas.com. Follow us on X at @veritastechllc.

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