Enhancing VMware Environments with InfoScale

Veritas InfoScale

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Executive Summary

Today's business problems often originate from interruptions and unforeseen circumstances that disrupt continuity and degrade performance. Veritas InfoScale enables organizations to ensure that their businesses continue operating efficiently despite disruptions. InfoScale offers solutions that provide resiliency and high availability to applications and virtual machines running in a VMware environment while complementing native VMware High Availability.

InfoScale is responsible for protecting the world's most mission-critical applications and databases across multiple industry verticals. InfoScale provides intelligent volume management, an advanced high-performance shared file system, and application-aware system clustering for applications running within VMware guests. InfoScale enables VMware administrators to rapidly deploy highly available, performant, multi-tier application services on nearly any type of infrastructure or operating system, in a VMware environment.

Solution Value

Veritas InfoScale can improve availability, resiliency, and performance in VMware environments by complementing native VMware functionality in a resource-efficient way.

InfoScale provides the following key benefits to a VMware environment:

Application Resiliency

- VMware vCenter integration for centralized management and monitoring
- Intelligent monitoring of application health and proactive instant failure detection
- Automated high availability management for virtual machines and multi-tier applications, complementing VMware High Availability
- Application-specific agent-based monitoring and automation that ensures maximum application availability

Storage Efficiency

- Scalable and fault-tolerant clustered file system
- Reduced storage costs with a flexible scale-out architecture
- Storage and performance optimization

Infrastructure Agility

- Intelligent replication for agility and mobility across geographical locations

While VMware enables a business to minimize infrastructure costs and increase efficiency, InfoScale maximizes application availability while also protecting critical data assets. InfoScale provides application-level availability and facilitates agile deployments, enabling migration and replication to heterogeneous platforms, including the public cloud.

Solution Components

InfoScale components that enable these benefits to a VMware environment include:

- **Veritas Cluster Server (VCS)** – Monitor mission-critical applications inside VMware virtual machines, singly or in groups, using an extensible Intelligent Monitoring Framework (IMF), and automate shutdowns and restarts. Eliminates planned and unplanned downtime by clustering mission-critical applications running inside VMware Virtual Machines. VCS monitors and detects failures in resources required to run a VM with the Intelligent Monitoring Framework (IMF) without the overhead of a polling-based system. Agent-based monitoring and automation ensure clean application shut down and restart after a failure. In a VMware environment, VCS provides the ability to manage the availability of a single VM or a cluster of VMs.

- **AppProtect: Just in Time High Availability** – Use VCS service monitoring capabilities in concert with VM management to fail over to instant-clone VMs. A high availability solution that eliminates the requirement for a standby VM, enabling a business to reduce resource usage by passive VMs. During a planned maintenance operation, Just in Time HA can be configured to clone a virtual machine, bring it online, and failover the applications running on that primary VM to the VM clone on the same ESX host. Unplanned recoveries are configured for specified VMs via policies.

- **Cluster File System (CFS)** – Provide clustered VMs with a with a highly-available, accessible-in-parallel filesystem for use with VCS for quick failovers. CFS provides highly available, parallel access to files so that standby VMs can quickly recover in case of a failover event. CFS can eliminate the need for separate shared storage systems to maintain high availability. This simplifies storage management and improves scalability.

- **Flexible Storage Sharing (FSS)** – InfoScale FSS is a feature of CFS that provides a more cost effective and higher performing shared storage solution than SANs. FSS allows network shared storage to co-exist with physically shared storage, and logical volumes to be created using both types of storage, enabling a common storage namespace. Logical volumes using network shared storage provide data redundancy, high availability, and disaster recovery capabilities, without requiring physically shared storage. FSS is transparent to file systems and applications. FSS can be implemented using Direct Attached Storage (DAS) on VMware vSphere nodes.

- **Veritas Volume Replicator (VVR)** – Platform-independent replication of VM data for disaster recovery purposes between different and public cloud environments. Enables platform-independent disaster recovery by intelligently managing the replication of VM data between sites, regardless of the underlying infrastructure. VVR can replicate VM data between on-premises data centers, from an on-premises data center to a public cloud environment or between different public cloud environments. When integrated with the InfoScale Global Cluster Option, VVR provides optimized data replication between geographically dispersed sites.

- **Virtual Business Services (VBS)** – Bring customized business logic and fine-grained control to high-availability and diaster-recovery scenarios with complex or interrelated application dependencies. Allows you to manage high availability and disaster recovery for applications running on disparate VMs. VBS manages dependencies between applications and the order in which the applications and their components are brought online and offline. VBS is aware of the overall business service provided by the applications and can take the appropriate action in the event of a failure to restore the entire service. This process ensures faster recovery and minimal downtime, with no manual intervention.

- **Veritas InfoScale Operations Manager (VIOM)** – Monitor, visualize, and manage system and storage resources, and leverage risk analysis and summary reports. VIOM is a platform and vendor agnostic centralized management console for Veritas InfoScale Availability, InfoScale Storage, and other third-party infrastructure. Veritas InfoScale Operations Manager is used for monitoring, visualization, and management of system and storage resources. VIOM is also a reporting engine and can generate multiple reports, including a risk analysis report that can summarize issues that may arise within an environment that could reduce high availability and disaster recovery readiness.

Availability

InfoScale provides a comprehensive solution at the application and hypervisor levels for monitoring resources and taking remediating action to allow them to continue to function through unforeseen circumstances.

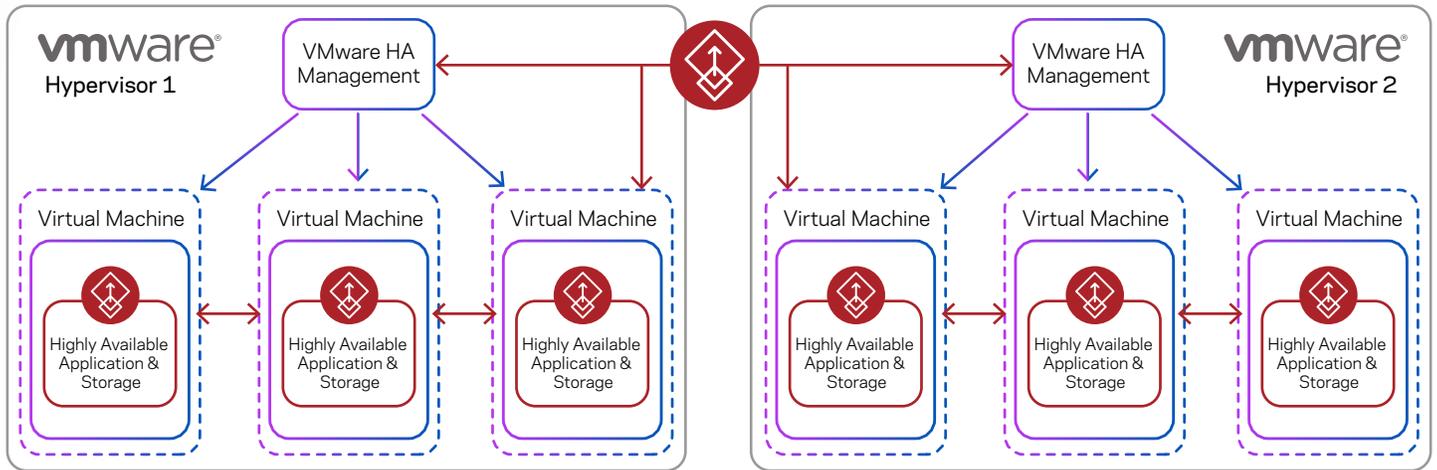**Veritas High Availability Solution for VMware**

Figure 1. VMware HA and InfoScale High Availability Co-existence.

InfoScale manages application health and availability with direct and customizable monitoring of the application itself, instead of the VM-level monitoring of VMware HA. Although the basic functionality of VMware HA will act to restart VMs when needed, it doesn't have the detailed view into application status available to VCS using its Intelligent Monitoring Framework (IMF). Using more advanced monitoring methods, InfoScale can work in concert with VMware's automation capabilities to provide maximum uptime to hosted applications.

Veritas High Availability Solutions for VMware eliminates planned and unplanned downtime by centrally monitoring and managing applications hosted inside VMware virtual machines to ensure maximum availability, restarting application services and ensuring necessary resources are available after a fault.

Veritas Cluster Server (VCS)

VCS eliminates planned and unplanned downtime by clustering applications and the required resources. VCS can and automate all the operations required to detect faults, fail services over to standby nodes, and ensure that they can be failed back once the fault is resolved. VCS includes an agent-based system to monitor, automate, and orchestrate high availability.

In the event of a disruption to the operation of an application hosted in a virtual machine, the VCS agent can perform any number of configured responses: restarting the service, initiating failover to another VM in the cluster,or to a node in a remote cluster hosted in a different datacenter, or even to a public cloud platform. VCS agents also ensure that storage and networking resources are available and can initiate a failover in case of disruption (if required).

During a recovery, resources in a VM (or multiple VMs) must be made available in a defined order. For example, it would make little sense for a database to be recovered by VCS if storage and networking resources could not be recovered first. VCS provides the intelligence to ensure that the database is only restarted if the dependent compute, storage and networking resources are available.

Coupled with VMware High Availability, VCS provides the assurance that mission-critical applications are gracefully shut down and completely recovered whenever possible.
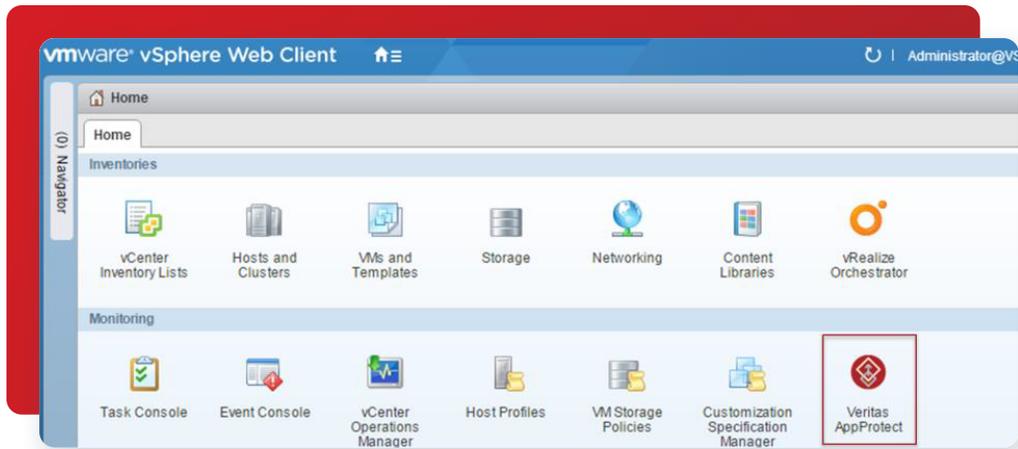
AppProtect

Figure 2. AppProtect and vSphere Integration.

For some organizations, the configuration of a passive standby node for an HA cluster consumes too many resources, including hardware, software, licenses, and the staff-hours required to maintain the node. Veritas AppProtect provides high availability without having to provision passive standby nodes.

Veritas AppProtect enables Just in Time availability of applications during planned maintenance and unplanned recovery of VMs in a VMware environment. For planned maintenance operations, VMs can be cloned, brought online, and applications can be failed over to the new secondary VM from the primary VM. After maintenance is complete, the application can be failed back to the primary VM, and the secondary VM can be deleted.

In the event of a failure, Unplanned Recovery Policies enable the configuration of recovery policies to mitigate failures that interrupt the operation of applications. These include restarting the service or services, restarting the VM, restarting the VM on a different ESX server, restoring a VM to another ESX server, and failing back the VM to the original ESX server from its backup image.
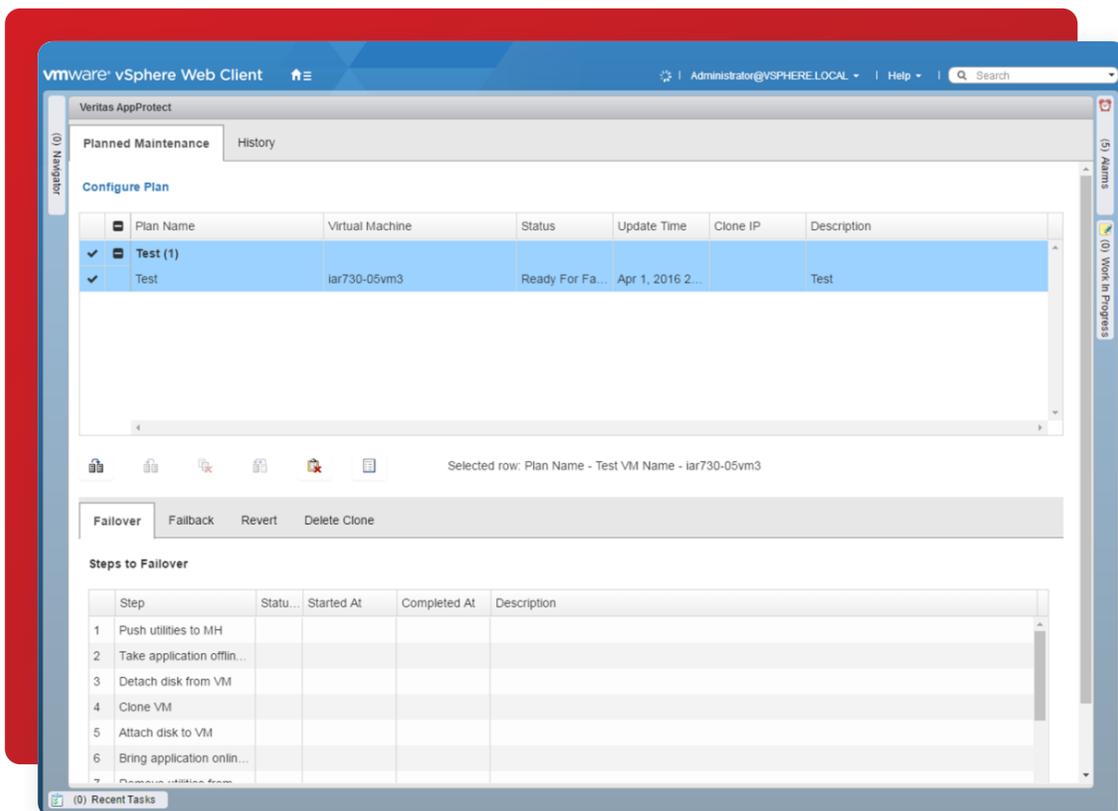

Figure 3. AppProtect Configuration.

Single Node High Availability

In situations where an application is only deployed on a single node, VCS provides standardized monitoring capabilities for applications running inside VMware virtual machines. This single node cluster adds a layer of application awareness to the core VMware HA functionality. It integrates directly into the vSphere Web Client, making it easier to manage applications across VMs. It also enables central control of applications, including start and stop functions.

Intelligent Monitoring

The InfoScale agent for VMware helps eliminate downtime and the potential for data corruption by using InfoScale's Intelligent Monitoring Framework (IMF), which reduces the time to action by allowing the agent to act immediately in the event of a system fault. It accomplishes this using a VMware specific InfoScale agent that registers the process ID's of the VMware processes with a kernel-level notification module that enables immediate (event-based) notification of resource state changes without having to periodically poll the resources to find the current state. This mechanism is processed by InfoScale befort an alert is sent to the administrator.

Virtual Business Service

Enterprise applications typically consist of multiple systems deployed in tiers that work together to provide an overall business service. The Virtual Business Service (VBS) feature is designed to manage complex, multi-tier applications as a single logical entity that represents the overall business service that the application tiers are providing. For example, Microsoft SQL databases provide data services to business applications. VBS can ensure that both applications and databases are highly available if a failure event were to occur. See Figure 4 for an example of how a VBS is configured.

With VBS, you can work across a heterogeneous environment which enables IT to ensure the availability of multi-tiered applications across almost any platform or infrastructure. It doesn't matter if the webserver sits in a VMware virtual machine, the application server in KVM on Linux, and the database on a physical system. If the platform falls within the InfoScale support matrix, it can be included as a tier in a VBS. A VBS can also be designed to fail over to disaster recovery sites that can be either on-premises or in a public cloud platform.

VBS manages dependencies between the service tiers by allowing you to configure the order in which the service groups contained within the VBS are brought online in a start operation and taken offline in a stop operation. VBS does not alter the dependencies that are configured for clusters included in the VBS tiers.

Veritas InfoScale Operations Manager provides the management framework and is required to create and manage a VBS.
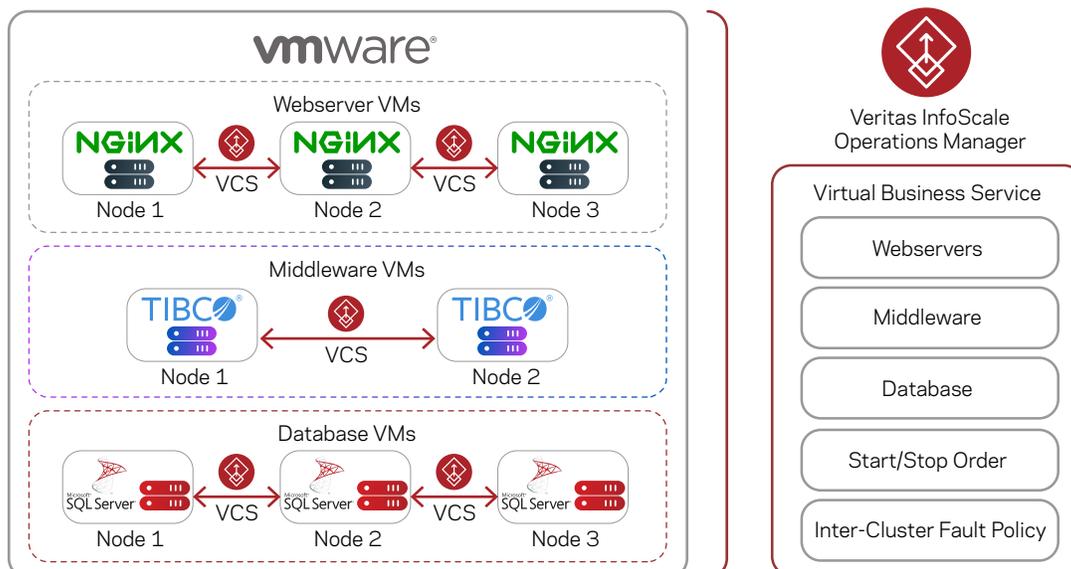

Figure 4. VBS Example.

Performance and Optimization

InfoScale includes several features to enable more efficient resource utilization in a VMware environment. InfoScale's software-defined architecture allows filesystems to be scaled up in both capacity and performance.

Cluster File System

InfoScale CFS provides a highly available, fully POSIX-compliant shared file system that delivers the availability and performance needed by mission-critical applications. Using CFS in conjunction with the InfoScale agent for VMware disk results in a highly available storage solution with best in class performance and data resiliency, on-premises or in the cloud.
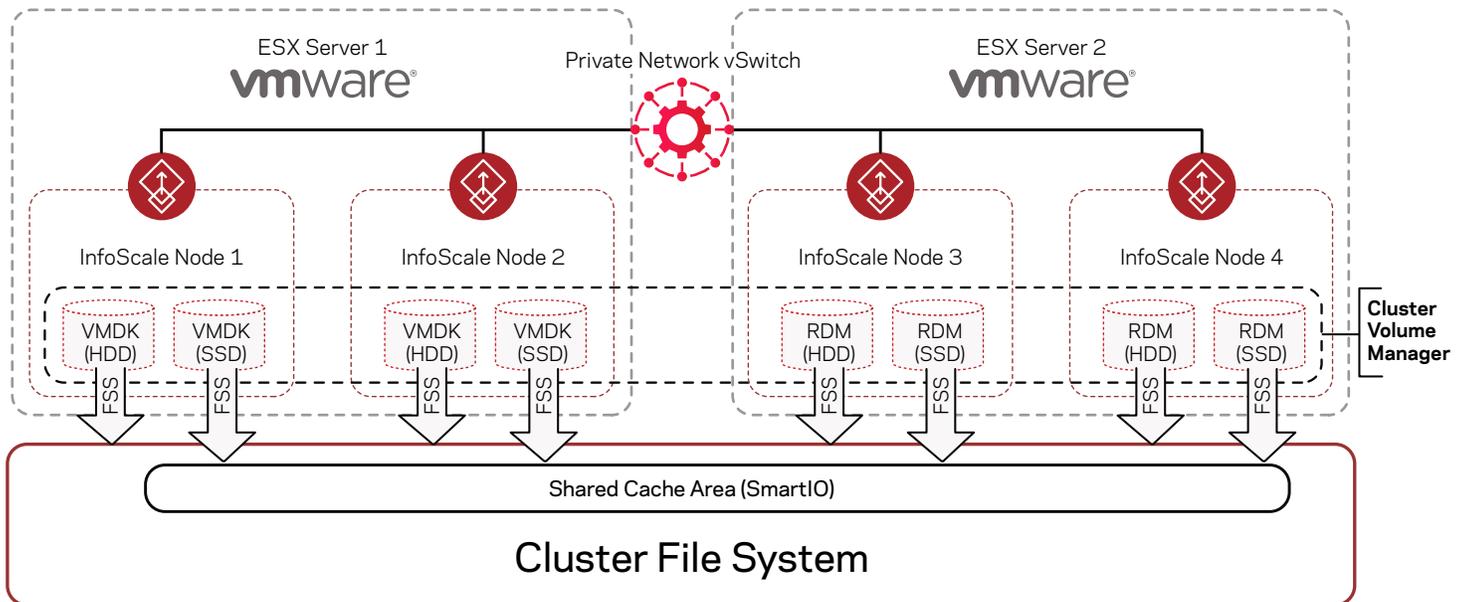

Figure 5. Cluster File System and VMware Example.

Figure 5 shows an example of a CFS configuration using a mix of VMDKs and RDMs. CFS provides a simple solution that meets this requirement, providing fault-tolerant shared storage with write-order fidelity, synchronous write persistence, and distributed locking needed for applications running in HA configurations.

CFS enables you to mount the same file system on multiple VMs concurrently and is an extension of the industry- standard Veritas File System (VxFS). CFS uses a distributed locking mechanism called Global Lock Manager (GLM) to ensure all nodes have a consistent view of the file system. GLM provides metadata and cache coherency across multiple nodes by coordinating access to file system metadata, such as inodes and free lists. CFS also provides advanced file lock management that makes failover highly reliable.

Flexible Storage Sharing

FSS is a feature of CFS that enables network sharing of local storage, cluster-wide. The local storage can be in the form of Direct Attached Storage (DAS) or internal disk drives. In a VMware environment, VMDKs can be presented to an individual VM and shared with the rest of the nodes in an InfoScale cluster. Network shared storage uses a network interconnect between the nodes of a cluster.
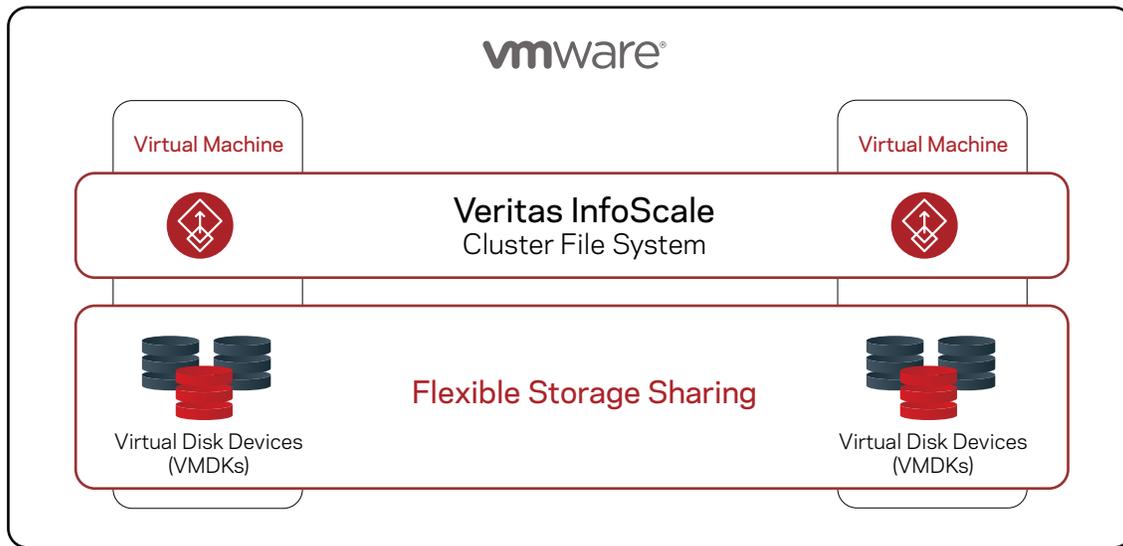
Figure 6. Flexible Storage Sharing.

FSS allows network shared storage to co-exist with physically shared storage, and logical volumes can be created using both types of storage, creating a shared storage namespace. Logical volumes using network shared storage provide data redundancy, high availability, and disaster recovery capabilities, without requiring physically shared storage, transparently to file systems and applications.

With FSS, you can build a cluster-wide high performance and resilient software-defined storage infrastructure with mirrored or erasure-coded volumes.

FSS in the Cloud

In public cloud environments where the options for shared disk devices are limited, FSS is the perfect solution for providing a clustered file system for mission-critical applications in the cloud. With FSS, public cloud storage devices are easily configured and shared between nodes and they make use of the same tools and interfaces as an on-premises, bare-metal installation.

I/O Fencing

An essential requirement for protecting data in a cluster environment is to guarantee that there is always a single consistent view of cluster membership. In other words, when one or more nodes in the cluster stop sending heartbeats, the InfoScale software must determine which nodes can continue to participate in the cluster membership and re-integrate returning nodes' resources to the cluster when they become healthy again.

InfoScale I/O fencing has been designed to solve a common problem with any clustered storage solution, known as the "split-brain condition", which occurs when there is a communication disruption between cluster nodes. InfoScale I/O fencing ensures that there is no data corruption in a split-brain condition, where cluster nodes cannot distinguish between system failure and an interconnect failure. A split-brain condition can also occur where a node within the cluster is so busy that it appears to be hung and pauses communication with the other cluster nodes. To mitigate and resolve the split-brain condition, InfoScale's I/O fencing system guarantees the data integrity of the application's data stored on the InfoScale CFS by determining which nodes in the cluster should remain in the event of communication disruption. When a disruption occurs, the node which has failed is ejected from the cluster. The ejected node is also prevented from accessing the data disks.

InfoScale I/O fencing can be configured to work on-premises, on various hypervisors, or in public cloud platforms.

SmartTier

Tiering data by storing different types of data on different types of storage can help improve performance and reduce costs. SmartTier enables businesses to reduce storage costs by dynamically ensuring frequently-accessed-data is stored on faster storage devices than infrequently-accessed-data. SmartTier matches data storage with data usage requirements. After data matching, the data can then be relocated based upon data usage and other requirements determined by the storage or database administrator (DBA).

SmartTier uses storage classes to designate which disks are included in different storage tiers.

Efficiency and Agility

InfoScale helps businesses become more productive by providing features that reduce the complexity of data movement between data centers and platforms, including the public cloud. As well, InfoScale facilitates and orchestrates high availability operations for between like and dissimilar architectures.

VVR and GCO

Veritas Volume Replicator (VVR) provides organizations with an extremely flexible storage hardware independent alternative to traditional array-based replication solutions. It is also a robust mechanism for moving data into public cloud environments. VVR delivers the flexibility of block-based continuous replication as well as file-based periodic replication with Veritas File Replicator (VFR).

VVR also manages and maintains write-order fidelity, meaning that writes to the primary volume are tracked in the order they're received and are applied to the secondary volume in the same order. This is an important feature that ensures data consistency and protects against data corruption by ensuring that the data on the secondary volume is consistent with the data on the primary volume. Write-order fidelity guarantees that the application is working with the same data at both sites. Native storage replication solutions do not typically maintain write-order fidelity. VVR maintains write-order

fidelity by logging write operations on the primary volume in the order in which they are received and applying them on the secondary volume in the same order.

InfoScale facilitates high availability between geographically dispersed sites by integrating VVR replication with the Global Cluster Option (GCO). GCO extends high availability from local cluster failover to inter-cluster failover between different data centers or public clouds.
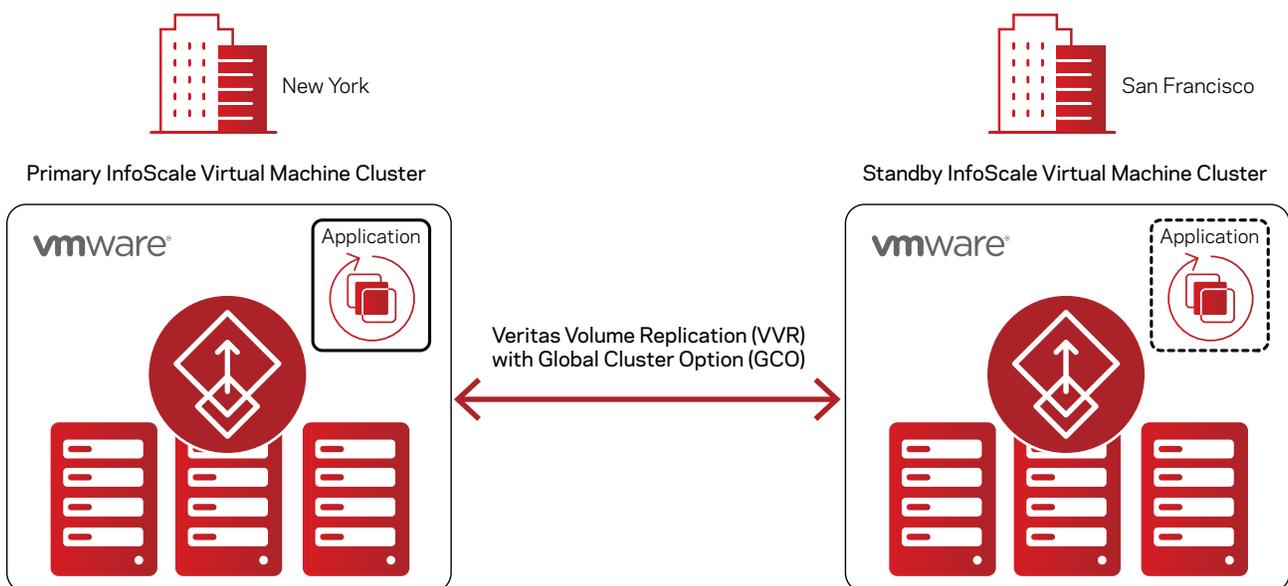

New York
Primary InfoScale Virtual Machine Cluster

San Francisco
Standby InfoScale Virtual Machine Cluster

Application

Veritas Volume Replication (VVR)
with Global Cluster Option (GCO)

Application

Figure 7. VVR and GCO.

Veritas InfoScale Operations Manager

Veritas InfoScale Operations Manager (VIOM) is a platform and vendor agnostic centralized management console for InfoScale and third-party infrastructures. Veritas InfoScale Operations Manager is used for monitoring, visualization, and management of system and storage resources on-premises or in the cloud. VIOM is also a reporting engine and can generate multiple reports, including a risk analysis report that can summarize issues that may arise within an environment that could reduce high availability and disaster recovery readiness.

A typical VIOM deployment consists of 2 main components: a management server and managed hosts. Depending on the usage scenario, VIOM may also discover virtualization environments, SAN/NAS infrastructure as well as SAN fabrics.

Managed hosts can be added into VIOM, either using agents or as agentless hosts in the situation where there is no InfoScale software installed on the target hosts. VIOM manages agentless hosts using SSH or WMI. The level of visibility within VIOM for agentless hosts is the infrastructure only; there is no application visibility for agentless hosts.

VIOM also features the ability to migrate storage volume between hosts (physical, virtual, and cloud instances) through a wizard based interface to minimize downtime and user error. Migrations can be scheduled for less busy periods to minimize interruption to the business.

Public Cloud

InfoScale helps make applications running in VMs highly available and resilient to disruption regardless of whether they're running on- premises or in a public cloud platform like Amazon Web Service, Microsoft Azure, or Google Cloud Platform. InfoScale protects mission-critical applications from unforeseen failure events at the application layer down to the infrastructure layer with tight integration into these public cloud platforms, all while presenting a similar look- and-feel, thus reducing complexity.

Figure 8. Public Cloud.

In addition to protecting your application and enhancing performance in a single cloud provider, Veritas InfoScale provides the option of protecting your application and data between public clouds and on- premises data centers. This protection is made possible by InfoScale's ubiquitous OS and platform support, enabling you to move data seamlessly and reliably while ensuring that all InfoScale functionality is on-hand when you need it.

In case of a failure within on-premises resources or a public cloud, InfoScale enables you to maintain seamless support for failing over to another public cloud (or on-premises/nearline datacenter).

Veritas Resiliency Platform (VRP) Integration

Veritas Resiliency Platform is a software-defined disaster recovery and resiliency orchestration solution for physical and virtual systems that enables automated resiliency and disaster recovery for data centers, hybrid and multi-cloud environments. While InfoScale is ideally suited for managing high availability and performance for mission-critical applications that need to be 'always-on', Resiliency Platform is well suited for applications with less demanding RPO and RTO requirements and it can work in parallel with InfoScale.
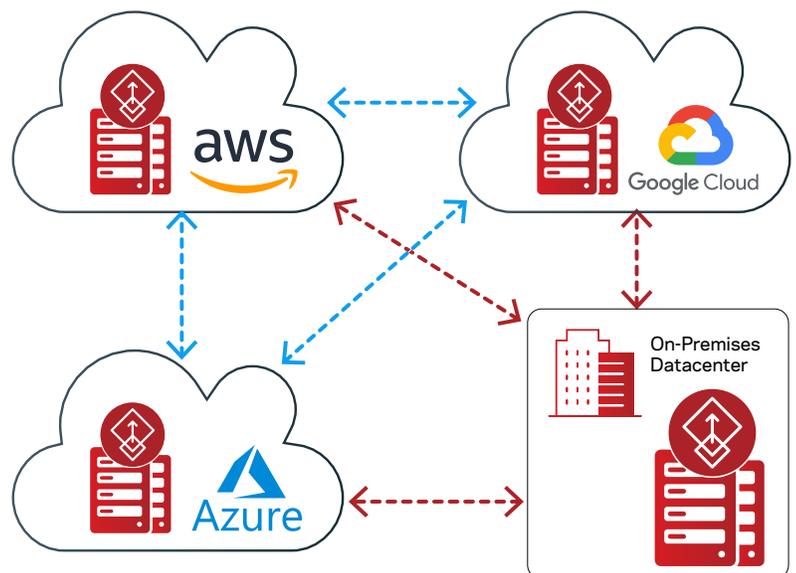
Resiliency Platform provides system-level replication management with either it's native data mover, storage level replication, or NetBackup replication. It compliments InfoScale by integrating directly with InfoScale clusters to provide a single interface for orchestration and visibility for all your applications and VMs.

By integrating InfoScale clusters that protect mission-critical applications with Resiliency Platform, you can provide a broad continuum of availability for the full suite of business applications within your organization. This unique solution enables you to manage availability and resiliency for any type of application, with nearly any RPO and RTO requirement, as a single unified solution. Resiliency Platform acts as a single centralized interface when integrated with InfoScale and NetBackup that provides control and visibility for the overall availability and resiliency solution.

Summary

It is a complex task to manage and build an IT environment that is resilient, highly available, and performant. InfoScale helps reduce complexity by providing a solution to simplify the management, orchestration, and automation required to build an enterprise high availability solution for VMware environments. InfoScale increase efficiency, performance, and agility for VMware environments and provides several key benefits:

- Maximizing server, storage and network resource utilization
- Automated non-disruptive failover testing to ensure that your environment is fully protected in the event of an outage
- Intelligent application monitoring that acts instantly in the event of a fault to ensure data integrity and minimal disruption
- vCenter integration for centralized management

With the ability to provide best-in-class performance, high availability and architectural flexibility, InfoScale is a proven software-defined solution that helps you ensure maximum application performance and uptime for VMware environments– on-premises or in the cloud.

Table of Figures

About Veritas

Veritas Technologies is a global leader in data protection and availability. Over 80,000 customers—including 87 percent of the Fortune Global 500—rely on us to abstract IT complexity and simplify data management. The Veritas Enterprise Data Services Platform automates the protection and orchestrates the recovery of data everywhere it lives, ensures 24/7 availability of business-critical applications, and provides enterprises with the insights they need to comply with evolving data regulations. With a reputation for reliability at scale and a deployment model to fit any need, Veritas Enterprise Data Services Platform supports more than 800 different data sources, over 100 different operating systems, more than 1,400 storage targets, and more than 60 different cloud platforms. Learn more at www.veritas.com. Follow us on Twitter at @veritastechllc.

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