Symantec and VMware: Virtualizing Business Critical Applications with Confidence

WHITE PAPER
Challenges of Using Traditional High-Availability Solutions

Business-critical applications and the systems they run on must be highly available. A common way to increase application availability in a physical environment is to deploy a traditional high-availability clustering solution such as Microsoft Cluster Service (MSCS). Such solutions protect against the unplanned failure of a component by restarting an application or set of applications on other servers in the cluster. They can also be used in a planned outage to shift applications to redundant servers so that the original server can be maintained with minimal disruption.

The trade-off with increasing application availability through traditional high-availability clustering is the additional cost of redundant hardware, clustering software and support, and additional complexity. Management costs also increase because of the need to maintain multiple systems with identical configurations, applications and patch levels. Operationally, it is extremely difficult to deploy a limited number of spare servers to provide redundancy for a large set of applications. A typical compromise is to deploy small two-node clusters for only the most critical applications, leaving most applications unprotected.

Keeping Infrastructure Highly Available in VMware Environments

As customers move forward with VMware® virtualization solutions, they recognize an immediate set of benefits that go far beyond a simple reduction in physical servers. VMware offers proven and widely deployed business-continuity solutions in the form of VMware vSphere® vMotion®, vSphere High Availability (VMware HA) and vSphere Fault Tolerance (VMware FT).

Using the revolutionary technology in vMotion, IT administrators can move applications for server maintenance with zero downtime and no data loss. The operating-system isolation that VMware virtualization natively provides makes it simple for a small set of highly consolidated servers to provide very high uptime at reduced administrative cost.

VMware HA provides a simple, reliable way to increase the availability of virtual machines hosting critical applications. VMware HA is a virtualization-based distributed infrastructure service of VMware vSphere. It monitors the health of virtual machines and the VMware ESX® hosts on which they reside. If a fault is detected, the virtual machine is automatically restarted on another ESX host with adequate capacity to host it. VMware HA is included in all vSphere editions and can be enabled on a VMware cluster via a single check box. Because VMware HA uses storage and network connectivity already in place to support vMotion, enabling high availability is as simple as ensuring you have adequate server capacity to handle the failure of one or more ESX hosts.

VMware FT extends the capabilities of VMware HA to provide even higher levels of availability for mission-critical applications. It enables instantaneous transfer of services to a secondary image of VMware FT enabled virtual machines. Virtual machines can continue operations—even when a server failure occurs—with zero downtime and no user interruption.

High Availability Challenges in the Application Layer

VMware HA and VMware FT technology increase availability for a large percentage of VMware customers. More than 80 percent of VMware customers leverage one or both of these technologies to protect most or all of their virtual machines. However, a method to increase availability at the application layer is often desired—especially for business-critical Tier 1 and Tier 2 applications. Without protection at the application level, organizations are exposed to application failures inside the virtual machine. For this reason, many organizations have tried to deploy a traditional application-clustering solution into the virtual machine’s guest operating system.

Deploying a traditional application-clustering solution in the virtual machine addresses failures at the application layer, but—because such solutions are designed for physical environments—also creates significant issues with the day-to-day operation of a virtualized environment. These issues include the added complexity of maintaining multiple identical virtual machines to properly host failover, additional capacity needed to host spare servers and difficulty in mapping application location to a specific virtual machine within the VMware management solution. More important, the addition of in-guest clustering significantly impacts the ability to make use of advanced VMware features—such as vMotion, VMware HA, vSphere Distributed Resource Scheduler (VMware DRS) and vSphere Distributed Power Management (VMware DPM).
Extending Application High Availability in vSphere 4.1 and vSphere 5.0

With the release of vSphere 4.1, VMware introduced an API that enables third-party software vendors to deploy application-monitoring components inside a VMware guest OS that inform VMware HA when problems arise. With this API, application-clustering vendors can develop application monitoring and control solutions that fully complement the virtual machine high availability and management that vSphere provides.

The joint solution includes two layers of protection. The first is the in-guest protection that the application high-availability vendor provides. This application-layer protection can include application-specific capabilities such as component-level monitoring, restarting of failed services and performance monitoring. The second layer is VMware HA, which can restart the virtual machine when the in-guest solution cannot resolve the issue.

The user can enable application monitoring using part of the VM Monitoring Status section of the VMware HA settings. Enabling application monitoring allows the application-monitoring solution to register with the VMware application-awareness API and communicate application status with VMware HA. Inside VMware vCenter™ Server, the user can determine which virtual machines are monitored at the application level and which ones are monitored only for basic virtual machine health.

Comprehensive High Availability with VMware HA and Symantec ApplicationHA Solution

VMware is pleased to work jointly with Symantec to provide Symantec ApplicationHA for VMware. This solution marries the best-in-class virtualization infrastructure from VMware with the industry-leading application high-availability package from Symantec. ApplicationHA leverages more than 12 years of development of Veritas Cluster Server to provide an application-monitoring package that runs inside a VMware guest operating system. It fully integrates with VMware HA to provide virtual-machine restart as needed to react to any application issue.

This combined solution

- Enhances the availability of Tier 1 virtualized applications on vSphere 4.x and 5.0 by providing a mechanism to detect and recover from application failures
- Improves the manageability of virtualized applications by providing visibility of the application’s status and application control (i.e., starting or stopping the application) through a single pane of glass—VMware vSphere Client, the user interface for vCenter Server
- Reduces operational complexity and TCO by eliminating the need for operating system–based clustering products
- Enables customers to enhance the availability of their applications without sacrificing the use of advanced VMware features such as vMotion, VMware DRS and VMware FT

Monitor, Detect and Recover from Application Failures

Symantec ApplicationHA leverages the VMware HA application-awareness API to provide comprehensive application availability in VMware environments. It comprises two main sets of components, as shown in Figure 1:

- The guest component, which is installed in each ApplicationHA-enabled virtual machine
- A vCenter Server plug-in that provides visibility and management of the applications
The guest component encompasses an application agent framework and various application agents. The application agent framework provides the infrastructure that the application agents use in their execution. The application agents are responsible for starting, stopping and monitoring a given application resource or instance.

By defining the resources that comprise an application, the application agents can monitor, start and stop the application instance and any related resources. For example, several resources might be required to support a Microsoft SQL Server database that is put under ApplicationHA control. These resources might include mount points to make the storage available, the Microsoft SQL Server instance, a Microsoft SQL Server agent to perform scheduled administrative tasks and a Microsoft SQL Server Online Analytical Processing (OLAP) service for multidimensional analysis. All of these individual resources would need to be monitored to ensure proper operation of the Microsoft SQL Server database application.

Additionally—in order to bring the Microsoft SQL Server application online or offline—these resources would require a specific order of operations. To support this, resources can be made dependent on one another, as depicted in Figure 2.

Figure 1. Symantec ApplicationHA Overview

Figure 2. Microsoft SQL Server 2008 Application Resource Dependency
Through the use of this dependency model, an administrator who starts or stops the application can be assured that the guest component handles the application resources in the correct sequence.

To ensure proper operation, ApplicationHA continually monitors the resources that comprise an application, at given intervals. If resource monitoring detects a failure, the guest component takes action:

1. The guest component tries to restart the application within the virtual machine. The number of attempts to restart an application is configurable by the user.

2. If the application does not restart successfully, the guest component communicates to VMware HA—through the VMware application-awareness API—to trigger a reboot of the virtual machine by VMware HA. The application is restarted as part of this reboot process.

The Symantec ApplicationHA vCenter Server plug-in displays the status of the application (offline, online, faulted or partial), as well as the status of the individual resources comprising the application. ApplicationHA state changes are also reflected under the vSphere Alarms tab, enabling administrators to configure notifications as desired.

In addition to providing visibility of an application’s state, the Symantec ApplicationHA vCenter Server plug-in allows for the management of the application and ApplicationHA features. This includes the ability to start and stop the application, to enable or disable ApplicationHA functionality, and to disable the communication to VMware vCenter Server so that a user can troubleshoot a problem application without triggering a restart of the virtual machine.

**Automate Recovery from Virtual-Machine Image Corruption**

ApplicationHA is integrated with Symantec Backup Exec to provide virtual-machine image restoration as a possible remediation mechanism in the event of a corrupt virtual machine.

When an application on the virtual machine faults, ApplicationHA first tries to bring it online by restarting the application and its dependent components. If the fault still remains, ApplicationHA triggers a virtual-machine restart through its integration with VMware HA. ApplicationHA and VMware HA settings control the number of attempts to bring the application online and the number of virtual-machine restarts. If both of the preceding remediation procedures do not rectify the fault, ApplicationHA notifies Backup Exec to restore the last known good copy of the virtual machine.

On receiving the notification, Backup Exec automatically sets up a restore job for the virtual machine. By default, users are prompted for consent before Backup Exec restores the virtual machine, as shown in Figure 3. The virtual-machine files—such as configuration, snapshot and log files—are preserved before the virtual machine is restored. These files can be used for diagnostics and data recovery.
Enable End-to-End Disaster Recovery of Applications

VMware vCenter Site Recovery Manager™ (SRM) is a disaster-recovery solution for virtual machines. SRM supports array-based and host-based replication of the virtual machines configured at the primary or protected site to a recovery site. It also helps to manage synchronization of data between the protected and the recovery site.

In case of a disaster, migration of the virtual machines from the protected site to the recovery site is defined by a recovery plan that specifies the recovery tasks to be performed. By integrating seamlessly with VMware Infrastructure™ and vCenter server, VMware SRM helps to automate and accelerate the recovery process. For more details on VMware SRM, refer to the VMware product documentation.

Symantec ApplicationHA is integrated with VMware SRM to enable end-to-end recovery in a disaster scenario—by ensuring application recovery and continued application monitoring (see Figure 4).

In a local application-monitoring configuration, Symantec ApplicationHA communicates with VMware HA and conveys the application health status in the form of an application heartbeat. VMware HA can automatically reset or restart a virtual machine if it does not receive the application heartbeat within a specified interval. However, this configuration does not provide monitoring capability if an outage affects the entire local site.

If a disaster strikes, Symantec ApplicationHA initiates the application-monitoring capability after the virtual machines at the protected site are failed over and started at the recovery site. The ApplicationHA guest components ensure application recovery, resume application monitoring and also augment the VMware SRM audit trail with records of application recovery to provide an end-to-end disaster-recovery audit trail.

Figure 4. Typical ApplicationHA Configuration with VMware Site Recovery Manager
Install and Configure Easily

Symantec ApplicationHA provides users with a simplified wizard-based installation and configuration process. The installation wizard, shown in Figure 5, lets you install and register the VMware vCenter Server plug-in, and install the guest components into a virtual machine directly from within the vSphere Client. The guest components can be a mix of supported Windows or Linux operating systems, and the installation process can be tracked directly from within vSphere Client.

![Symantec ApplicationHA Installation Wizard](image)

Figure 5. Symantec ApplicationHA Installation Wizard
Using a view in the installation wizard—similar to the VMware Datacenter tree view in vCenter Server—an administrator can select a group of virtual machines as a target for installation. This view provides several levels of granularity of selection, including that of a VMware Datacenter, VMware HA cluster or an individual virtual machine. For example, an administrator who wants to provide ApplicationHA to all virtual machines in a Microsoft SQL Server cluster can select those virtual machines, as shown in Figure 6.

Symantec ApplicationHA also provides a simple wizard-driven process to assist in configuring and monitoring an application. You can use this wizard to configure off-the-shelf applications—such as Microsoft SQL Server or Microsoft Exchange—using default parameters common to those applications.

Administrators can also protect non-off-the-shelf or custom applications. The configuration process for custom applications is also wizard-based, making it easy for users to deploy both packaged and custom applications. By selecting different services, processes and resources that need to be monitored, an administrator can provide enhanced availability to a practically limitless set of applications.
Perform Centralized Management and Administration Through VMware vCenter

Symantec ApplicationHA is managed via VMware vCenter Server through its provided plug-in. Using an already familiar interface, administrators can view the status of an application and its associated resources.

Additionally, administrators can perform operations specific to Symantec ApplicationHA, such as:

• Start or stop an application
• Enable or disable the communication between VMware HA and Symantec ApplicationHA
• Configure or unconfigure Symantec ApplicationHA

The ApplicationHA dashboard can be used to view all applications that are under ApplicationHA control. The consolidated GUI of ApplicationHA lets you administer configured applications on virtual machines in a VMware vCenter administered datacenter, as shown in Figure 7.

The dashboard is fully integrated with the VMware vSphere Client GUI, appearing in its ApplicationHA tab. On the dashboard, you can view the aggregate health of the configured applications within a datacenter. You can also drill down to a VMware cluster and view the aggregate health of configured applications in that cluster. You can further drill down to an individual application, on an individual virtual machine, and view or change the state of the application.

You can start or stop the application. You can enable or disable the heartbeat mechanism for the application. You can also take the application offline for maintenance (without raising a high-availability alert), or bring the application back online after maintenance.

User access control is enabled through a role-based mechanism provided by VMware vCenter. Three types of privileges can be assigned to the vCenter Server user roles in order to provide the appropriate level of access:

• **Guest** – Has visibility into the status of the application
• **Operator** – Has visibility into the status of the application and can start or stop the application
• **Administrator** – Has visibility into the status of the application, can start or stop the application, and can configure ApplicationHA
Follow Best Practices for ApplicationHA Deployment

As with any solution, the key to a successful ApplicationHA deployment is to follow best practices. The following list highlights common ApplicationHA best practices:

- Configure the VMware HA clusters in vCenter Server before installing ApplicationHA. This will simplify the installation process, because ApplicationHA leverages the VMware HA cluster configuration details to help simplify deployments.
- Install the ApplicationHA agent inside all virtual machines configured in a VMware HA cluster. Enable “VM and Application Monitoring” for all virtual machines in a VMware HA cluster. Monitoring all applications in the cluster ensures the highest availability levels.
- When running vCenter Server inside a virtual machine, install the ApplicationHA client components inside the virtual machine and use ApplicationHA to monitor the database and vCenter Server services.
- Before configuring application monitoring, ensure that the applications are fully installed, configured and running. ApplicationHA discovery can detect installed applications and automatically set up application monitoring.
- Use Veritas Operations Manager (VOM) for managing applications across physical and virtual environments from a single pane of glass to visualize and protect multitier applications—or for enabling users who do not have access to vCenter Server but need to visualize and control applications in VMware virtual machines.

Application and Platform Support

Symantec ApplicationHA provides application availability in Windows and Linux VMware guests on vSphere 4.x and 5.0. It provides extensive support to common off-the-shelf Tier 1 applications such as Microsoft Exchange, Microsoft SQL Server, IIS, Oracle WebLogic Server, Oracle Database and SAP—and the ability to monitor and manage custom applications. Refer to the Symantec ApplicationHA documentation at https://sort.symantec.com for the latest information about the supported applications and platforms.

Conclusion

The VMware application-awareness API provides a foundation that third-party vendors can build upon in order to provide application awareness within a virtualized environment. Symantec ApplicationHA uses this API to develop a robust solution that increases levels of availability for critical applications—avoiding many of the issues that implementing a traditional clustering solution in a virtualized environment can cause. VMware administrators will also appreciate having the VMware vSphere interface that they are familiar with to visualize and administer the solution.

Overall, this solution represents another leap forward in providing support for the most critical applications within a VMware virtualized environment.