Testing MicroStrategy with VMware vCenter™ Site Recovery Manager 5.1 and vSphere vMotion and High Availability
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Introduction

Businesses using the MicroStrategy® Business Intelligence Suite depend heavily on the continuous availability of their information and processes in deployed application environments. Importantly, business want to ensure that their MicroStrategy business intelligence (BI) applications remain available in the event there is a major service disruption. However, due to the complexity and distributed nature the MicroStrategy BI application platform, implementing and maintaining traditional disaster recovery solutions has proven to be complicated and costly.

For this reason, MicroStrategy has been working together with VMware® to develop a joint disaster recovery solution using that meets the challenge of providing continuous availability in a manner that is simplified and cost efficient. For this solution, the MicroStrategy Business Intelligence Suite is run in a VMware vSphere® virtual environment in order to enable a scalable, resilient virtualized multi-tiered application solution.

By running the Microsoft Strategy solution in a virtualization environment, MicroStrategy can deploy VMware® vCenter™ Site Recovery Manager™ to provide for disaster recovery. Site Recovery Manager provides for the reliable recovery of business critical applications within defined timeframes.

MicroStrategy decided to use VMware vSphere virtualization technology and VMware vCenter Site Recovery Manager because it provides the optimal environment for a disaster recovery solution. Besides Site Recovery Manager, MicroStrategy is also using VMware vSphere advanced features, including VMware vSphere® vMotion® and VMware vSphere® High Availability (HA), to ensure the best operational performance.

When a disaster occurs, businesses, at a minimum, initially want to renew operations in “survival” mode. They want to restore at least the business processes that are essential to keep the company running based on a predefined business impact analysis (BIA). Site Recovery Manager supports the recovery of critical business processes that are typically defined using two types of objectives:

- **Recovery Time Objective (RTO)** – The RTO defines the criticality of each business process such as Finance or Call Center Operations and its dependencies in the event of a disaster. The RTO quantifies how rapidly the organization needs to have these business processes up and running.

- **Recovery Point Objective (RPO)** – For each critical business process, the RPO quantifies the minimal amount of data to restore to ensure a successful recovery, and to “what point in time” the data needs to be restored, such as to the prior week or month.

This paper describes the testing that was performed using MicroStrategy with VMware vCenter Site Recovery Manager, and with VMware vSphere vMotion and VMware vSphere High Availability. The Site Recovery Manager testing used block-based SAN storage and host-based replication to provide an effective availability solution for critical MicroStrategy deployments.

This paper is written for experienced architects and engineers who are responsible for the VMware virtualization environment. It assumes that the reader has knowledge of the VMware and MicroStrategy products described in the paper.
MicroStrategy Business Intelligence Suite

MicroStrategy is a leading provider of enterprise software including the MicroStrategy Analytics Platform™ and their Business Intelligence Suite. The MicroStrategy Business Intelligence (BI) platform supports a full range of analytic functionality, from easy-to-use business dashboards to sophisticated statistical analysis and data mining. This BI platform provides the flexibility businesses need to start small, and it scales to large enterprise deployments.

The MicroStrategy Business Intelligence Suite consists of these modules:

- **Metadata Database Server.** The MicroStrategy Metadata Database Server is a metadata repository (storage space) for all of the underlying reporting components and logical objects that form a MicroStrategy application. One metadata repository can hold multiple MicroStrategy projects. MicroStrategy Intelligence Server communicates with the metadata repository through Open Database Connectivity (ODBC) communication. Microsoft SQL Server and Oracle Database, as well as other database platforms are supported as metadata repositories.

- **Data Warehouse.** The Data Warehouse is the foundation of the MicroStrategy platform. The Data Warehouse stores data from the MicroStrategy Business Intelligence Suite for later analysis. Typically, an extraction, transformation, and loading (ETL) process is used to place or load data into the Data Warehouse. The ETL process usually uses an online transaction processing (OLTP) system as its main source of original data.

- **MicroStrategy Intelligence Server.** This server is the heart of the MicroStrategy Business Intelligence Suite. The MicroStrategy Intelligence Server executes reports and documents that are stored in metadata against the data warehouse. It passes the results of those reports and documents on to the end-users.

- **MicroStrategy Web.** The MicroStrategy web allows end-users to perform interactive analysis through a web browser. MicroStrategy Web provides a full set of data browsing, drilling, and reporting development capabilities that enable “stream of consciousness” navigation. Boardroom-quality reports can be generated using a wide range of charting and formatting options. MicroStrategy Web can be run on ASP.NET and JavaServer Pages (JSP) web application servers.

- **MicroStrategy Mobile.** This web service provides an interface that enables end-users to consume MicroStrategy reports and documents using Apple® iOS (previously iPhone OS) and Android based mobile devices. Users access MicroStrategy content through the MicroStrategy Mobile application available using the device’s application store. MicroStrategy Mobile is supported to run on ASP.NET and JSP web application servers.

In addition, MicroStrategy is the leading provider of the enterprise-class MicroStrategy Mobile App Platform™, MicroStrategy Identity Platform™, and MicroStrategy Loyalty Platform™. This platform enables businesses to build, deploy, and maintain mobile apps across a range of solutions by embedding business intelligence, transactions, and multimedia into application solutions. Note that these MicroStrategy platforms were not included in the testing described in this paper.
The MicroStrategy cloud offering combines the MicroStrategy platforms with third party software, hardware, and services to enable rapid, cost-effective development of hosted business intelligence, mobile, and social applications. The cloud offering is hosted by MicroStrategy, rather than being hosted on-premise by the customer.

For more information on MicroStrategy and the Business Intelligence Suite, see the “Resources” section near the end of this paper.

**VMware vCenter Site Recovery Manager**

VMware vCenter Site Recovery Manager is the market-leading product that ensures the simplest and most reliable disaster protection for all virtualized applications. Site Recovery Manager leverages cost-efficient vSphere Replication and supports broad set of high performance storage-replication products to replicate virtual machines from a Protected Site to a Recovery Site, and to provide for failback. Site Recovery Manager automates its recovery processes to provide for rapid recovery within predefined RPOs and RTOs.

Site Recovery Manager is an extension to VMware vCenter that simplifies and automates disaster recovery to ensure reliability and operational performance. When the MicroStrategy Business Intelligence Suite virtualization solution runs as a workload in a VMware environment, Site Recovery Manager can orchestrate disaster recovery and integrate failover with other virtualized enterprise applications.

Site Recovery Manager greatly simplifies testing and it saves significant time and resources by:

- Simplifying and automating disaster recovery workflows.
- Ensuring reliable recovery by enabling non-disruptive testing.
- Simplifying recovery by eliminating complex manual recovery steps and by centralizing the management of recovery plans.

Disaster recovery testing is used to validate business continuity plans for recovering from a disaster, and restoring partially or completely interrupted critical functions within predetermined timeframes (RTOs and RPOs). Previous, regular testing of recovery plans using Site Recovery Manager is critical to achieving a successful recovery at the time of an actual disaster.

With Site Recovery Manager, recovery plans can be tested non-disruptively as frequently as required. Unlike other solutions, Site Recovery Manager recovery plan testing minimizes the use of resources, even with extremely complex disaster recovery plans. It provides a simple interface for setting up recovery plans that are coordinated across all infrastructure layers, replacing traditional, error-prone runbooks.

Site Recovery Manager is a disaster recovery solution that allows businesses to plan, test, and execute a scheduled migration or emergency failover of vCenter inventory from one site to another. By using virtualization, Site Recovery Manager can be used to test virtual machines and network connections as “walled-off” virtual entities. This testing can be co-resident with production applications that might be running at the recovery site.
The typical architecture for Site Recovery Manager includes storage array replication between the Protected Site and the Recovery Site, as shown in the figure below.

**Figure 2. Typical architecture for vCenter Site Recovery Manager**

Site Recovery Manager is an optional component of VMware vCenter. Site Recovery Manager allows disaster recovery tasks to be executed from the same centralized interface that is used to manage other administrative virtual machine tasks, such as creation, migration, and deletion.

However, Site Recovery Manager is not a built-in component of VMware® vCenter™. It is a separate server process with its own database that can co-exist on the same server as vCenter, or Site Recover Manager and vCenter can reside on separate servers. Similarly, both the Site Recovery Manager and vCenter data repositories can be created in a single database, or in separate databases.

Site Recovery Manager relies on the components below:

- **Replication of virtual machines to a secondary site.** Site Recovery Manager requires an underlying replication product to copy virtual machine data to a secondary site. Replication can be provided either using built-in vSphere Replication or by a third party, storage-based replication product. vSphere Replication provides cost efficient and simple replication for smaller sites and Tier 2 applications. Storage-based replication is mostly used for business-critical environments.

- **Integration with a replication product.** Site Recovery Manager integrates with the underlying replication product through a storage vendor supplied Storage Replication Adapter (SRA) plug-in. The SRA plug-in enables Site Recovery Manager to determine which virtual machines are being replicated and to coordinate the execution of recovery plans with the replication layer.

- **Integration with vCenter Server.** Site Recovery Manager requires separate vCenter Server instances at both the Protected Site and Recovery Site. Site Recovery Manager instances are deployed at both sites, and these instances integrate directly with local vCenter Server instances.
Testing MicroStrategy with VMware vCenter™ SRM 5.1, and vSphere™ vMotion and HA

- **Set up of recovery plans.** Site Recovery Manager provides an intuitive interface to enable the creation of recovery plans for different failover scenarios. This interface allows users to map production resources to recovery resources. It identifies which virtual machines to protect and their relative boot sequences, as well as which lower priority virtual machines to suspended at the Recovery Site. Users can also include custom scripts and automatically reconfigure IP addresses for their virtual machines.

Besides providing for automated disaster recovery, Site Recovery Manager can be used in other scenarios, such as to provide for high availability and business continuity, where a “actual” disaster has not occurred. These scenarios include:

- **Planned or unplanned extended power outages.** While not considered an actual “disaster”, an extended power outage such as in a hospital environment could result in a patient care disaster. In this scenario, Site Recovery Manager can be utilized to quickly and effectively bring business critical services back online.

- **Datacenter evacuation, planned or unplanned.** Perhaps, as part of their disaster recovery plan, a site requires a planned failover to a secondary site. Using Site Recovery Manager, this failover to a secondary site can first be tested and executed/failed over in a very short period of time.

- **Datacenter migration.** By using Site Recovery Manager with host-based replication or array-based replication, a datacenter migration can be performed with minimal downtime.

**Recovery Testing Overview**

The functional testing scenario for disaster recovery was performed jointly by MicroStrategy and VMware using the MicroStrategy virtualization solution and related products running on VMware vSphere 5.1 with VMware vCenter Site Recovery Manager 5.1.

The goals of this functional testing are as follows:

- Verify that the MicroStrategy solution can fail over to the Recovery Site using Site Recovery Manager with array-based replication and vSphere Replication, without corrupting the asynchronous replication.

- Verify that all “test bubble”, “actual failover” and “failback” testing is performed without issue and MicroStrategy solution components fail over successfully.

The results of the functional testing prove that Site Recovery Manager provides a flexible, high-performance, high availability platform for disaster recovery that works well when the MicroStrategy solution runs in a VMware environment.

The functional testing scenario for the MicroStrategy solution is described below:

- Testing architecture
- Testing scenario
- Testing use cases
- Test workload generation
Testing MicroStrategy with VMware vCenter™ SRM 5.1, and vSphere™ vMotion and HA

- Test site installation
- Test site configuration
- Recovery plan execution
- Testing results and observations
- Recommendations

Each of these topics is described in the sections below.

**Testing Architecture**

The MicroStrategy solution architecture with Site Recovery Manager is described in the sections below.

**MicroStrategy Solution Architecture**

The solution architecture that was used to perform disaster recovery testing on MicroStrategy workloads with Site Recovery Manager is shown in the figure below. The MicroStrategy solution architecture used array-based replication and host-based replication across two sites.
Site Recovery Manager Architecture

Disaster recovery testing with Site Recovery Manager requires the virtual machines in the secondary site to start by using storage that provides a snapshot of the target logical unit numbers (LUNs). This practice ensures that the test is run against a storage infrastructure that is isolated from the production environment.
The testing architecture is described below:

1. The lab environments for the Protected Site and Recovery Site were built in two VMware datacenters in Palo Alto, California, with the sites located approximately 12 miles apart.
   - The Protected Site and the Recovery Site each run a VMware vCenter Server in a virtual machine. Each vCenter Server runs in a virtual machine in order to take advantage of vSphere advanced features including VMware vSphere vMotion and VMware vSphere High Availability.
   - The Protected Site and Recovery Site are configured using the NetApp® FAS 3020 storage platform.
2. Site Recovery Manager is installed on independent vCenter servers both at the Protected Site and Recovery Site in order to enable communication between these sites.
3. All virtual machines were configured using VMware Virtual Machine File System (VMFS) storage.
4. MicroStrategy application components were registered as machine services to start on boot.
5. For data replication, the storage platforms used at both the Protected Site and Recovery Site were configured using asynchronous replication mode to replicate all of the related LUNs from the primary storage to secondary storage on the NetApp storage platform. Both array-based and host-based replication was tested:
   - Asynchronous replication is supported with Site Recovery Manager, although it might result in minimal data loss during failover. (Contact the storage vendor for detailed information.)
   - Synchronous solution with Site Recovery Manager is supported, although it was not included in this testing. Synchronous replication is the preferred storage area network (SAN) replication strategy for business critical data because there is negligible risk of data loss in the event of failover.
6. Connectivity between MicroStrategy application components were specified with Domain Name System (DNS) names instead of IPs. DNS is set up with its routing capability enabled.

7. After the MicroStrategy server at the Protected Site fails over to the Recovery Site, the new IP address is automatically registered in DNS.

8. Once the MicroStrategy server is up and running, communication is established through a fully qualified domain name (FQDN).

9. MicroStrategy Web and Mobile were configured to automatically reconnect with the Intelligence Server once either service is restarted.

10. MicroStrategy related services (database, MicroStrategy Intelligence Server, web server hosting MicroStrategy Web and Mobile) were configured to start on machine boot.

For more information, see the “Resources” section near the end of this paper.

Array-based Replication

An array-based replication setup requires one or more storage arrays at the Protected Site to replicate data to peer arrays at the Recovery Site. Storage replication adapters (SRAs) are used to integrate Site Recovery Manager with a wide variety of vendor storage arrays. To use array-based replication with Site Recovery Manager, the replication needs to be configured first, and then Site Recovery Manager can be configured to use it.

Some of the properties of array-based replication include:

- Use the same storage solution, at least the same brand for other vendors. With EMC, use Recoverpoint for heterogeneous arrays.
- Replicate the data on the centralized storage solution (SAN).
- An unlimited number of virtual machines can be replicated depending on the capacity, distance between the locations, and available bandwidth.

Figure 4: Array-based replication
Host-based Replication

Site Recovery Manager supports host-based replication, which eliminates the need to maintain an identical storage array at the Recovery Site. It enables the use of low cost, direct-attached storage (DAS) for disaster recovery purposes, and it allows for more granular, virtual machine level replication.

vSphere Replication is a feature of Site Recovery Manager that enables disaster recovery to protect individual virtual machines, without requiring array-based replication. This host-based replication feature is licensed as part of the Site Recovery Manager product.

vSphere Replication enables these use cases:

- Allows per virtual machine replication for Site Recovery Manager.
- Can use Site Recovery Manager without requiring array-based replication.
- Enables virtual machine replication between heterogeneous arrays.

In addition, Site Recovery Manager can be deployed to protect virtual machines, regardless of which Hardware Compatibility List (HCL) supported storage is used at Protected Site or the Recovery Site.

**Figure 3: Host-based replication**

Some of the differences between array-based replication and vSphere Replication (host-based replication) are described in the table below.

**Array-based replication versus Host-based replication comparison**

<table>
<thead>
<tr>
<th>Array-based replication</th>
<th>Host-based replication</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Replication is using storage layer.</td>
<td>• Replication is using vSphere/hypervisor layer.</td>
</tr>
<tr>
<td>• Data on the centralized storage solution only can be replicated.</td>
<td>• Replication of local or direct-attached storage is possible.</td>
</tr>
</tbody>
</table>
## Array-based replication

- Unlimited number of virtual machines can be replicated, depending on the capacity, distance between the locations, and available bandwidth.
- Replication is configured per LUN/VMFS or NFS volume.
- Can replicate virtual machine templates.

## Host-based replication

- A maximum of 500 virtual machines can be replicated.
- Replication can be configured per virtual machine.
- Cannot replicate virtual machine templates.

For more information about vSphere Replication, see the “Resources” section near the end of this paper.

### Storage Replication Adapter

With Site Recovery Manager, disaster recovery becomes an integrated part of managing the VMware virtual infrastructure. The Storage Replication Adapter (SRA) is a vendor-supplied plug-in that is installed on the Site Recovery Manager server to manage communication with the storage platform. The SRA for the NetApp storage platform used in this testing scenario is tightly integrated with vCenter, vSphere, and NetApp storage replication technologies, as described below.

For asynchronous testing, the NetApp SRA plugin was installed on the vCenter servers at the Protected Site and Recovery Site to facilitate the Site Recovery Manager testing workflow, and to create a clone of the replicated LUNs to synchronize data between the two sites. For this testing, the schedule for replicating changed or updated data from primary storage to secondary storage device was every 60 seconds.

### SAN Storage and Data Replication

For this testing, Site Recovery Manager was used with the NetApp FAS 3020 storage platform and NetApp® SnapMirror® 1.4.3 technology using the SRA for NetApp, as described below. Site Recovery Manager has been tested and deployed in a variety of storage area network (SAN) environments.

Site Recovery Manager works in conjunction with NetApp SnapMirror array-based replication technology through the NetApp Storage Replication Adapter(SRA). NetApp SnapMirror is easily configured using NetApp® ONTAPI® CLI or FilerView.

For a complete list of storage platforms that are compatible with VMware, see the “Resources” section near the end of this paper.
Testing Scenario

In this scenario, the testing goals are to verify that Site Recovery Manager can enable disaster recovery in deployments that run in a VMware environment. These goals include:

- Demonstrate that the MicroStrategy solution can run successfully with Site Recovery Manager to enable disaster recovery in deployments that run in VMware vSphere 5.1:
  - Confirm that the MicroStrategy server can fail over to the Recovery Site using Site Recovery Manager with asynchronous replication, and maintain application functionality without corrupting the in-use databases.
  - Site Recovery Manager also supports a synchronous solution, although it was not included in this approach.
  - Confirm that both the users and the MicroStrategy servers can regain connectivity once these applications are running at the Recovery Site.

The testing scenario was performed as described below:

- For Site Recovery Manager, as virtual machines at the Protected Site are shut down, virtual machines at the Recovery Site start up and use data replicated from the Protected Site to provide the same services.

In this scenario:

- The two datacenters are not synchronized in real time (asynchronous replication), although the lag time for replication is just a few seconds. Failover and recovery require only a few minutes.
- Site Recovery Manager controls the transfer of services by using a recovery plan that specifies the order in which virtual machines shut down and start up, compute resources are allocated, and network access is given.
- It enables fast and accurate recovery by maintaining duplicate copies automatically when data spanning multiple volumes and storage systems is replicated across long distances.

Site Recovery Manager enables the testing of recovery plans in a way that does not disrupt the ongoing operations at either site. For example, Site Recovery Manager can:

- Create a temporary copy of the replicated data to test the failover process and ensure that the secondary image is consistent and usable.
- Rely on independent vCenter servers both at the Protected Site and Recovery Site to facilitate the failover process.

For more information, see the “Resources” section near the end of this paper.
Testing Use Cases

The tests cases that were executed during this testing scenario include:

1. Use MicroStrategy Integrity Manager to run a set of reports and documents and compare the results against an established known-good baseline.

2. Connect to the following MicroStrategy components to verify correct execution of a set of reports:
   - MicroStrategy Intelligence Server
   - MicroStrategy Web
   - MicroStrategy Mobile

3. Use MicroStrategy Command Manager to trigger the execution of a set of email subscriptions and verify correct delivery.


5. Connect to MicroStrategy Web and verify correct operation of data input and write-back features.


Test Workload Generation

The testing of MicroStrategy with Site Recovery Manager was performed using MicroStrategy Integrity Manager in Baseline versus Project mode. The MicroStrategy Tutorial project was used for the workload. Integrity Manager was configured to compare SQL and grid results returned for reports, and execution results for documents.

<table>
<thead>
<tr>
<th>Project</th>
<th>Number of reports</th>
<th>Number of documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>MicroStrategy Tutorial</td>
<td>660</td>
<td>143</td>
</tr>
</tbody>
</table>

Test Site Installation

This section provides a high level overview of Site Recovery Manager installation and configuration. For detailed configuration information, see “Appendix A” later in this paper.

1. Install Site Recovery Manager server at the Protected Site and Recovery Site. In this test scenario, Site Recovery Manager was installed on a separate virtual machine.

2. Install the Site Recovery Manager plug-in to vCenter:
   - When array-based replication is used, install the SRAs on the Site Recovery Manager server at each site, as described below.
- When host-based replication is used, configure the replication at host level, as described below.

The hardware and software configuration for array-based replication and host-based replication is described in the sections below.

Array-based Replication
Configuring the solution architecture for array-based replication includes these steps:
1. Configure storage arrays at the primary and secondary sites.
2. Create LUNs on the Protected Site storage and expose them to Protected Site VMware® ESX® host server.
3. Configure storage replication between primary and secondary site storage arrays.
4. Install vCenter Server 5.1 on two Windows virtual machines. These virtual machines serve as the Protected Site and Recovery Site vCenter Server instances.
5. Install and configure Site Recovery Manager on the Protected Site and Recovery Site vCenter Server instances. See the “Test Site Configuration” section for detailed information.

Site Recovery Manager can be installed as a separate standalone virtual machine or use the same database server to support the vCenter database instance and the Site Recovery Manager database instance.

After installation, the Site Recovery Manager plug-in is available and can be accessed via the vSphere or VMware Infrastructure (VI) Client.

For more information on installation and configuration, see the “Resources” section near the end of this paper.

Host Based Replication
Configuring the solution architecture for host-based replication includes these steps:
1. Configure host-based replication between Protected Site and Recovery Site.
2. Configure vCenter Server 5.1. These virtual machines serve as Protected Site and Recovery Site vCenter Server instances.
3. Install MicroStrategy virtual machines on the Protected Site.

For this testing, Site Recovery Manager enables the VMware environment at the Protected Site and Recovery Site to communicate. See the “Test Site Configuration” section for detailed information.

For more about Site Recovery Manager installation and configuration, see the “Resources” section near the end of this paper.
Test Site Configuration

For this solution architecture, the Protected Site and the Recovery Site are configured as described in the sections below.

Protected Site

Configuring the Protected Site includes these steps:

1. Configure the connection between the Site Recovery Manager servers at the Protected Site and Recovery Site.

2. Install the SRAs for NetApp FAS 3020 1.4.3 and configure ArrayManager using Site Recovery Manager.

3. Configure the array-based or the hosted-based replication.

4. Configure the inventory preferences that provide the mappings between compute resources and virtual machine folders. Configure the networks on the Protected Site and their counterparts on the Recovery Site.
   - To configure the mappings, go to the Site Recovery Manager, Administration Guide refer to “configure inventory preferences”) at: https://pubs.vmware.com/srm-51/topic/com.vmware.ICbase/PDF/srm-admin-5-1.pdf

5. Create a Protection Group named MicroStrategy-Protection for the virtual machines at the Protected Site.

   Site Recovery Manager can be used to add virtual machines that share common resources to Protection Groups at the Protected Site. Protection Groups can be configured into recovery plans for restoration at the Recovery Site.

Recovery Site

Configuring the Recovery Site includes these steps:

1. Create a recovery plan named MicroStrategy-Recovery.

2. In the recovery plan, enable the option to suspend non-critical virtual machines that are running at the Recovery Site in the event of a disaster to maximize the available computing resources.

   Typically, the hardware resources at the Recovery Site are used to host non-critical virtual machines during normal operations such as Test and Dev instances.

3. Prioritize the start order of the virtual machines as required. Create a customization specification for the virtual machines to enable them to start up on the Recovery Site using a different subnet than the Protected Site.

   Do not create a custom specification and configure the virtual machines to start up in a private test “bubble” network using the same networking parameters as the Protected Site.
4. On as-needed basis, create a post power-on command to execute the script on the virtual machines after failover.

Recovery Plan Execution

Execute the recovery plan using Site Recovery Manager includes these steps:

1. Break the NetApp SnapMirror relationships between the Protected Site and Recovery Site.
2. Map the LUNs to the existing NetApp snapshots.
3. Trigger the disaster recovery ESX hosts to rescan and detect the storage.
4. Suspend any non-critical virtual machines at the Recovery site such as Test or Dev instances, in order to maximize the available computing resources.
5. Reconfigure the virtual machines as defined for the network at the Recovery Site.
6. Power on the virtual machines in the order that was defined in the recovery plan.
7. After boot up, the MicroStrategy server automatically receives the new IP address that was customized during the initial configuration steps.

   - For more information, go to the Site Recovery Manager Administration Guide (refer to “IP address mapping”) at: https://pubs.vmware.com/srm-51/topic/com.vmware.ICbase/PDF/srm-admin-5-1.pdf

Testing Results and Observations

The testing results demonstrate that Site Recovery Manager provides a flexible, high performance, high availability platform for disaster recovery. It is fully compatible with MicroStrategy solutions that run in a VMware virtualization environment. As a result of this testing, MicroStrategy supports using Site Recovery Manager with the MicroStrategy Business Intelligence Suite.

The testing exercised the MicroStrategy server using a test workload with forced failover. During the failover process, the server was not responsive until it was fully up and running at the Recovery Site. After failover, the MicroStrategy software was tested on the virtual machine at the Recovery Site.

After the testing of Site Recovery Manager was completed, it was observed that:

- All of the virtual machines were cleanly powered on at the Recovery Site.
- The server responded to its name properly at the new IP address location.
- When the MicroStrategy server was fully online, users were able to connect to the server at the new location without issue.
- All of the testing on MicroStrategy software passed without issue.
- There were no errors to indicate any significant data loss or data contamination.
The testing included running workloads in an asynchronous configuration only. In this scenario, the potential for data loss was minimal, and it could be anticipated. However, data loss can be minimized within the NetApp array by reducing the synchronization window schedule and/or by using other types of complementary data protection technologies.

When avoiding data loss is considered a significant issue, the recovery plan might require a synchronous solution.

Using the MicroStrategy virtualization solution with Site Recovery Manager provides these advantages:

- Gets you back in business rapidly and allows customers to avoid loss by expediting failover and recovery in alignment with predefined RTOs and RPOs.
- Ensures that business critical applications are protected using built-in disaster recovery features that are highly and continually available, redundant, and fully recoverable.
- Accelerates disaster recovery by minimizing its inherent risks and removing the causes for downtime, such as by eliminating manual recovery steps.
- Delivers advanced capabilities for disaster recovery management, non-disruptive testing, and automated failover, especially with long distance replication.
- Enables automated failover across geographically-dispersed locations.
- Requires minimal administration and minimal additional hardware.
- Enables customers to expand protection to other important systems and applications.

**Recommendations**

Based on the testing results, the recommendations for achieving the best performance in implementing the MicroStrategy solution using Site Recovery Manager are described below.

For more information about using Site Recovery Manager, see the “Resources” section near the end of this paper.

1. Install the Site Recovery Manager database close to the Site Recovery Manager server to reduce the effect of round trips on recovery time performance. Use the same database server to support the vCenter database instance and the Site Recovery Manager database instance.

2. Enable faster testing and actual recovery by grouping virtual machines under fewer Protection Groups. Ensure that the virtual machines have no constraints preventing them from being added to similar Protection Groups.

3. Enable VMware vSphere® Distributed Resource Scheduler™ (DRS) at the Recovery Site. Migrations might occur as DRS tries to load balance the cluster during recovery.

4. Enable VMware vSphere® Distributed Power Management™ (DPM) on Recovery Site clusters when the Recovery Site hosts are in a Standby state. This ensures that adequate physical resources are available at the Recovery Site. More hosts lead to increased concurrency for recovering virtual machines and enabling shorter recovery times.
If DPM is not enabled and the hosts are in a standby state, bring the hosts out of standby mode manually. Drag and drop shadow virtual machines on them.

5. Chart the dependencies between virtual machines. Define recovery priorities and assign virtual machines to appropriate Protection Groups to reduce overall failover times. Ensure that only a certain number of required virtual machines are assigned a high priority. High priority Protection Groups power up virtual machines sequentially. In contrast, medium and low Protection Groups power up virtual machines in parallel.

6. As an alternative to placing virtual machines in a high priority group, separate all of the virtual machines to be recovered into two logical groups:
   - Group1 with level 1 virtual machines – Place Group1 virtual machines in the normal priority group.
   - Group2 with level 2 virtual machines (dependent upon virtual machines in Group1) – Place Group2 virtual machines in the low priority group within the same plan.

This maintains dependency across both of these logical groups and reduces the recovery time by introducing more concurrency for these Protection Groups. Maintain dependency between priority groups. There is no dependency across virtual machines within a single priority group.

7. It is strongly recommended that VMware Tools be installed in all protected virtual machines in order to accurately acquire their heartbeats and network change notifications.

8. Specify a non-replicated datastore for swap files to speed up replication between the two sites and remote calls to vCenter Server, and to avoid wasting network bandwidth. During recovery, delete swap files for all virtual machines in order to speed up the recovery.

9. Make sure any internal script or call-out prompt does not block recovery indefinitely.

10. VMware recommends a minimum of two ESX hosts at the Recovery Site. Although this is not a requirement, having two ESX hosts ensures availability for VMware services, such as for VMware vSphere vMotion and High Availability, and it improves the recovery time.

11. Site Recovery Manager relies on the capabilities of the storage platform for failover. Recovery time can vary depending on the SAN vendor, replication type, and other factors. It can take from 5 to 10 minutes to make the changes to the back-end storage. Follow VMware best practices for Site Recovery Manager, along with the SAN vendor’s best practices, to ensure an optimal recovery time.

vSphere vMotion and High Availability Testing

This testing scenario demonstrates that the VMware advanced features, including VMware vSphere vMotion and High Availability, can increase IT agility and improve the operational performance of the MicroStrategy solution. vSphere vMotion and High Availability are fully compatible with MicroStrategy deployments that run in a virtual environment. As a result of this testing, MicroStrategy supports using vMotion and High Availability with MicroStrategy solutions that run in a virtualization environment.
**vMotion**

VMware vSphere vMotion keeps your IT environment up and running, providing the flexibility and availability needed to meet the increasing demands of the business, with no end user impact. vMotion enables the live migration of running virtual machines from one physical server to another with zero downtime, continuous service availability, and complete transaction integrity. This capability makes hardware maintenance possible at any time and vMotion does not require clustering or redundant servers. In addition, vMotion can move online workloads from one ESX Server host machine to another in order to maintain service levels and performance goals.

**Figure 3. VMware vSphere vMotion**

![VMware vSphere vMotion Diagram](image)

**Testing Results**

vMotion was successfully tested with different components of the MicroStrategy Business Intelligence platform, including Intelligence Server, Mobile, and Web. Once the vMotion testing completed, it was verified to confirm that all MicroStrategy components successfully executed reports in regards to the MicroStrategy components. In addition, MicroStrategy Command Manager was tested to trigger the execution of a set of email subscriptions and verify correct delivery.

**High Availability**

VMware vSphere High Availability can be enabled with many applications running in virtual machines require, independent of its operating system or underlying hardware configuration, and the application running on it. High Availability provides uniform, cost effective failover protection from hardware and operating system failures in a virtualized IT environment by:

- Monitoring virtual machines to detect operating system and hardware failures.
- Restarting virtual machines on other physical servers in the resource pool, without manual intervention, when a server failure is detected.
- Protecting applications from operating system failures by automatically restarting virtual machines when an operating system failure is detected.
Testing Results

This failover testing was performed using the MicroStrategy Intelligence Server and Mobile server with High Availability and these tests were completed successfully. High Availability failover was performed after an ESX host failure was detected. The MicroStrategy virtual machine was restarted on a different ESX host in the cluster, without human intervention.

All of the services on the virtual machine were started automatically and no failures were observed. After High Availability was triggered, the MicroStrategy virtual machine rebooted on the other host in the cluster in minutes. All application services started automatically without issues.
Conclusion

VMware vCenter Site Recovery Manager provides for effective and automated disaster recovery in a MicroStrategy solution that run in a virtualization environment. For this testing, a multi-tier MicroStrategy application was deployed on VMware virtual infrastructure.

By using Site Recovery Manager for disaster recovery, the MicroStrategy deployment gained these advantages:

- Accelerates recovery for the virtual environment through automation. The recovery of MicroStrategy virtual machines into a different subnet on the secondary site is fully automated.
- Ensures reliable recovery by enabling non-disruptive testing. Recovery plan testing can be conducted as many times as required to satisfy auditing requirements.
- Simplifies recovery by eliminating complex manual recovery steps and centralizing recovery plan management.
- Provides for the successful testing of the failback scenario both with array-based and host-based replication.

When the MicroStrategy solution runs in the VMware vSphere virtual environment, the solution provides for IT agility, including disaster recovery capabilities. This paper described each of the functional testing scenarios that were performed using MicroStrategy with Site Recovery Manager. In addition to disaster recovery, the MicroStrategy solution was tested with VMware vSphere vMotion and High Availability to ensure that is delivers the best operational performance.

For each scenario, all of the tests were performed without issue. The testing results for each scenario demonstrate that the MicroStrategy components provided the functionality needed to work successfully in a virtualization environment that is powered by VMware.

In a disaster, Site Recovery Manager can be used to support disaster recovery for business critical applications running in a VMware environment. For this testing, Site Recovery Manager enables the rapid recovery of resources within defined RTO and RPO timeframes using an asynchronous solution. The testing demonstrates that Site Recovery Manager works well with MicroStrategy software solutions.

Note that Site Recovery Manager also supports a synchronous solution, although it was not included in this testing. Synchronous replication is the preferred SAN replication strategy for business critical data because there is negligible risk of data loss in the event of failover.
Appendix A: Test System Configuration

Appendix A describes the configuration of the solution architecture for MicroStrategy testing with VMware, as described in this paper. This includes the hardware and host configuration, installed software, and virtual machine configuration, as shown in the tables below.

Hardware and Host Configuration

Table 1 describes the configuration of the physical hardware including VMware ESX® host servers and storage.

Table 1. Hardware configuration for solution architecture

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers</td>
<td>• <strong>Protected site</strong>: 2 HP® Proliant blade servers, 480c G1 servers</td>
</tr>
<tr>
<td></td>
<td>Each server is equipped with:</td>
</tr>
<tr>
<td></td>
<td>• 3 GHz dual quad-core Intel Xeon (R) E5450</td>
</tr>
<tr>
<td></td>
<td>• 48 GB RAM</td>
</tr>
<tr>
<td></td>
<td>• <strong>Recovery site</strong>: 1 Hewlett-Packard Proliant blade server, 480c G1 server</td>
</tr>
<tr>
<td></td>
<td>Each server is equipped with:</td>
</tr>
<tr>
<td></td>
<td>• 2.3 GHz dual quad-core Xeon (R) E5410</td>
</tr>
<tr>
<td></td>
<td>• 32 GB RAM</td>
</tr>
<tr>
<td>Storage platform (Protected Site and Recovery Site)</td>
<td>• 1 NetApp FAS 3020 with SnapMirror 1.4.3, 300 GB LUN (each site)</td>
</tr>
</tbody>
</table>

Installed Software

Table 2 lists the vendor software installed for this solution.

Table 2. Software for solution architecture

<table>
<thead>
<tr>
<th>Software Provider</th>
<th>Software Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware</td>
<td>• VMware vSphere 5.1, vCenter Server 5.1, ESX 5.1, Site Recovery Manager 5.1</td>
</tr>
<tr>
<td>Microsoft</td>
<td>• Microsoft® SQL Server™ 2008 R2, Enterprise Edition</td>
</tr>
<tr>
<td>Oracle</td>
<td>• Oracle® Database 11g R2</td>
</tr>
<tr>
<td>MicroStrategy</td>
<td>• MicroStrategy 9.3.0</td>
</tr>
</tbody>
</table>
Virtual Machine Configuration

Table 3 describes the configuration of virtual machines running on ESX host servers that were used to implement this solution.

Table 3. Virtual machines in solution architecture

<table>
<thead>
<tr>
<th>Virtual Machine</th>
<th>Hardware Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MicroStrategy Web/Mobile software</strong></td>
<td>• Software configuration</td>
</tr>
<tr>
<td></td>
<td>• Red Hat® Enterprise Linux® 6.3</td>
</tr>
<tr>
<td></td>
<td>• MicroStrategy 9.3.0</td>
</tr>
<tr>
<td></td>
<td>• Oracle® Java Development Kit (JDK) 1.6.0 R35</td>
</tr>
<tr>
<td></td>
<td>• Apache Tomcat 7.0.30</td>
</tr>
<tr>
<td></td>
<td>• Hardware configuration:</td>
</tr>
<tr>
<td></td>
<td>• 1 vCPU</td>
</tr>
<tr>
<td></td>
<td>• 4 GB memory</td>
</tr>
<tr>
<td></td>
<td>• 1 Ethernet card</td>
</tr>
<tr>
<td></td>
<td>• 40 GB x 1 storage</td>
</tr>
<tr>
<td></td>
<td>• 25GB VMDK only</td>
</tr>
<tr>
<td><strong>MicroStrategy Intelligence server</strong></td>
<td>• Software configuration</td>
</tr>
<tr>
<td></td>
<td>• Red Hat Enterprise Linux 6.3</td>
</tr>
<tr>
<td></td>
<td>• MicroStrategy 9.3.0</td>
</tr>
<tr>
<td></td>
<td>• Hardware configuration:</td>
</tr>
<tr>
<td></td>
<td>• 2 vCPUs</td>
</tr>
<tr>
<td></td>
<td>• 4 GB memory</td>
</tr>
<tr>
<td></td>
<td>• 1 Ethernet card</td>
</tr>
<tr>
<td></td>
<td>• 24 GB x 1 storage</td>
</tr>
<tr>
<td></td>
<td>• 25 GB VMDK only</td>
</tr>
<tr>
<td>Virtual Machine (Microsoft SQL Server)</td>
<td>Database server (Oracle Database)</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td><strong>Software configuration:</strong></td>
<td><strong>Software configuration:</strong></td>
</tr>
</tbody>
</table>
| • Microsoft SQL Server 2008 R2, Enterprise Edition | • Red Hat Enterprise Linux 6.3  
| **Hardware configuration:**           | • Oracle Database 11g R2          |
| • 2 vCPUs                            | • 2 vCPUs                         |
| • 4 GB memory                        | • 4 GB memory                     |
| • 1 Ethernet card                    | • 1 Ethernet card                 |
| • 40 GB x 1 storage                  | • 40 GB x 1 storage               |
| • 40 GB VMDK only                    | • 25 GB VMDK only                 |
|                                      |                                   |
Resources

For more information about VMware and MicroStrategy products and the storage platform that is discussed in this paper, view the links and references lists in the sections below.

**VMware vCenter Site Recovery Manager**

- vCenter Site Recovery Manager:
  http://www.vmware.com/products/site-recovery-manager/

- VMware vCenter Site Recovery Manager Documentation:
  http://www.vmware.com/support/pubs/srm_pubs.html

- What’s New in VMware vCenter Site Recovery Manager 5.0:

- vSphere Replication FAQ (2005776):

- Site Recovery Manager Installation and Configuration:

- Site Recovery Manager Administration Guide:

**VMware References**

**VMware vSphere**

- VMware vSphere Documentation:

- What’s New in VMware vSphere 5.1 – Performance:

- Performance Best Practices for VMware vSphere 5.1:

- Featured VMware Documentation Sets:
  http://www.vmware.com/support/pubs/

- VMware Licensing Help Center:
  http://www.vmware.com/support/licensing/

**VMware Community and TV**

- VMware Community, VMware Technology Network (VMTN):
  https://communities.vmware.com/community/vmtn

- VMware Best Practices (see VIOPS links):
  https://communities.vmware.com/community/vmtn/bestpractices
Testing MicroStrategy with VMware vCenter™ SRM 5.1, and vSphere™ vMotion and HA

- VMware Community, VMware Knowledge Base: http://communities.vmware.com/community/vmtn/resources/knowledgebase
- VMware TV: http://www.youtube.com/user/vmwaretv
- VMworld TV: http://www.youtube.com/user/VMworldTV
- VMware KBTV (external): http://www.youtube.com/user/VMwareKB

**MicroStrategy**
- The New MicroStrategy Analytics Platform Is Truly a “Game Changer”: http://www.microstrategy.com/blog/october-2013/the-new-microstrategy-analytics-platform-is-truly-a-game-changer"

**Storage Platforms**
- VMware vCenter Site Recovery Manager Storage Partner Compatibility Matrix:
  - SRAs for SRM 5.x: http://www.vmware.com/support/srm/srm-storage-partners.html
  - Setting up VMware vCenter Site Recovery Manager with Partner Storage Arrays (1014610): http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=1014610
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