FUJITSU

# WHITE PAPER
# DISASTER RECOVERY WITH ETERNUS DX – THE DATA SAFE – AND VMWARE SRM

Disaster Recovery is a necessary component of data and business protection. This paper shows the way to protect data and business, where hardware is only one factor. The other factor is the proof that in a worst case scenario the protection works well. The challenge is to test that protection in near real-life situations but without impact on business production.

CONTENTS



Green IT

Green Policy Innovation

Green Product
This product cleared our company's original evaluation standard which followed global environmental measures.

# INTRODUCTION

## WHY IS HIGH AVAILABILITY SO IMPORTANT?

With the increasing use of IT to support daily business processes, the reliability and availability of the IT based systems, becomes more and more important. This includes the customer requirements to assure the operation of applications within defined time frames. With applications needed on a 24hr x 7 day basis, maintenance windows need to be considered. Such business critical applications where downtime can affect the business will require maximum availability and short restart times. In addition life-cycle management is required to protect against failures and the damage that may be caused to user data. This will require well planned backup, spare system redundancy, effective testing environments, as well as support agreements with the manufacturers of the hardware and software being use.

## BUSSINESS REQUIREMENTS

To be a successful company in today's market, some seal of quality or certification of the quality standards of the organization is required. A company which is certificated, to ISO 900x standards for example must prove that its business processes run well and how they can be improved or secured. Such requirements directly affect data center mangers, as they have to prove the relevant IT systems meet the required quality of IT support processes.

## PROTECTION FROM UNPREDICTABLE OCCURRENCES

Even with the best preparation, like well trained Backup/Restore data center managers, your IT is not automatically immune to external hazards. Even predictable activities such as power outages can lead to considerable problems. So how much more is this the case, with events that are harder to predict?

# HOW TO PROTECT DATA

## CHALLENGES IN PROTECTION

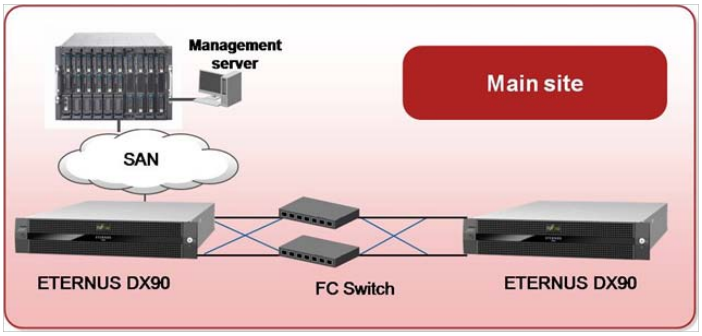
Server failures can often be quickly solved, thanks to the use of virtualization technology. A “worst case” situation, like a failure in the central data store will be highlighted due to the many applications that can be affected. But solving the resulting problems may require external (service) support and a full data restore. Such downtime and its impact may take several days to reconcile, while the hardware itself may have been quickly repaired.

For data needing high availability, consolidating data storage onto reliable, fast, scalable and easy-to-manage ETERNUS DX disk storage systems is a good initial step. The high-speed internal and external volume copy functions enable business continuity with fast restores for planned downtime, such as updates of operating systems and applications, as well as helping minimize the impact of unplanned downtime when an unexpected event occurs.

## DUPLICATE DATA – THE NEXT STEP IN PROTECTION

For improved business continuity, a higher level of availability can be achieved by storing data in two locations.

To better protect against such serious failures and to minimize necessary restore times and administrator effort, data duplication to a second storage system has become standard for many large customers. This is because the costs associated with the failure of a single storage system can be significantly more than the cost of an additional storage system and data duplication.

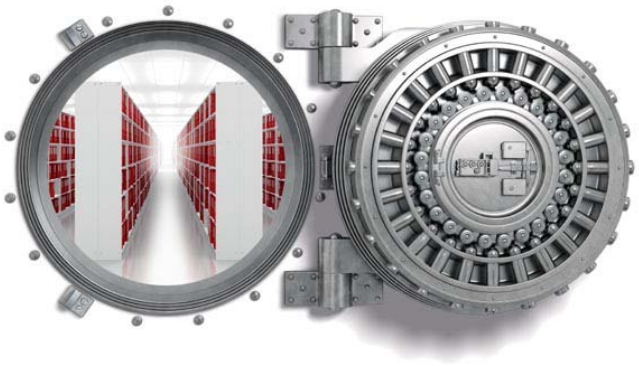



Use of ETERNUS DX, in this example ETERNUS DX90 with ETERNUS SF AdvancedCopy Manager, interconnected by Fibre Channel switches, will enable the data to be stored in two locations.

## ETERNUS DX – THE DATA SAFE

Fujitsu ETERNUS DX disk storage systems provide highly reliable and secure data safes, covering online backup to mission-critical applications, and can scale from entry-level to high-end environments. Developed by Fujitsu using its unique approach to quality engineering, ETERNUS DX disk storage systems offer a higher degree of data storage reliability. Plus in combination with proven software it provides the robustness needed in dynamic infrastructures.

The whole product family uses the same software stack and hardware functions across the entire range. This allows ease-of-use, provides greater efficiency for users and reduces administration costs.



With ETERNUS DX90, Fujitsu developed a disk storage system especially for the SMB market. Data mirroring is matched to the characteristics of the ETERNUS DX90 and takes into consideration the financial constraints on the SMB market. While other storage manufacturers offer data duplication products handed down from their large enterprise business – with corresponding pricing; Fujitsu has specifically developed the ETERNUS DX90, as a storage system with a unique price performance ratio for the SMB market.

ETERNUS DX400 series and ETERNUS DX8000 series disk storage systems continue the Fujitsu success story in the mid-range and enterprise segments. ETERNUS DX440 is the world’s fastest dual controller mid-range disk storage system (cf. SPC-1).
ETERNUS DX8000 series offers market leading online storage capacity, multi-dimensional scalability and the capability to maximize the pooling of storage resources. Any rapid increase in storage capacity is no problem, since controller power, cache and host interfaces can be easily increased.

Across the ETERNUS DX90/DX400/DX8000 range the protection from disaster, of business critical data, is provided by the server-less remote mirroring function Remote Copy. It ensures fast recovery if the primary site fails. By using Fibre Channel interfaces, Remote Copy provides synchronous and asynchronous remote site support between the primary and secondary storage devices. Remote Copy also supports asynchronous replication via iSCSI for ETERNUS DX400/DX8000, including encryption of the replication traffic over the iSCSI connection.

ETERNUS SF – Fujitsu's Storage Management Software – is the perfect fit for ETERNUS DX. ETERNUS SF AdvancedCopy Manager controls the variety of high-speed internal and external volume copy functions (such as Local Copy and Remote Copy) in collaboration with Fujitsu’s ETERNUS DX disk storage systems. This guarantees unmatched high availability and business continuity in 24 x 7 operation. (for more information on ETERNUS SF cf. appendix)

Even though this whitepaper focuses on the “Easy Business Continuity with VMware” solution and especially on ETERNUS DX90; the basic information in this whitepaper also applies to ETERNUS DX400 series and ETERNUS DX8000 series.

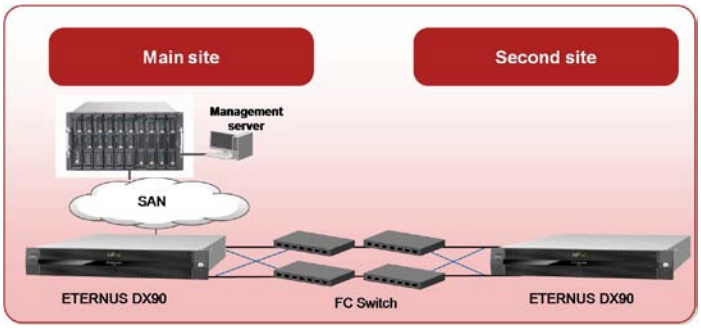
# THE WAY TO A TWO ZONE CONCEPT

## BENEFITS

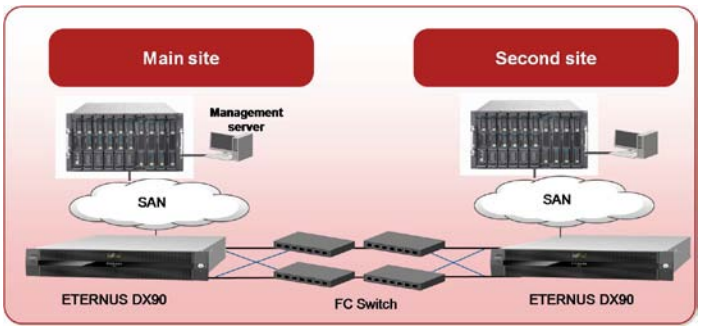
Once a second mirrored storage system has been added, new backup options become possible. Backup itself gets easier and restores are much faster. At this point customers have the choice to improve their backup SLAs (Service Level Agreements). Just this advantage can quickly compensate for the investment costs of the second storage system.

## IMPROVED PROTECTION

At this stage additional disaster protection is possible. Customers can protect themselves further by using a 2 cell concept for both storage systems. In this case the mirrored storage systems can be placed at separate locations. This will reduce the direct impact of physical disasters, like fire, on the data assets of the company.



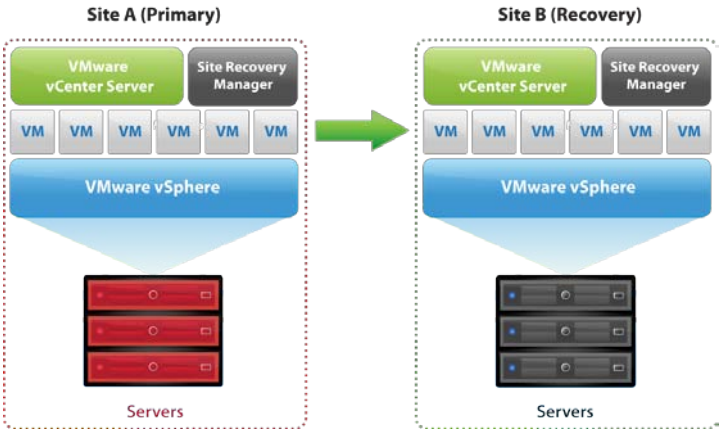

If applications have to be available 24 x 7, it is also somewhat obvious that the servers should also be configured redundantly.




## THE ADVANTAGE OF VIRTUALIZATION

One of the big advantages of virtualization is that data center managers are no longer forced to buy identical servers to prepare for such disaster recovery configurations. This is due to the effective separation of operating systems and applications from the hardware. Ideally they will have a certain number of systems operating at the second location. The number of servers required will simply depend on the number of business critical applications and their workloads.

Using the 2 cell concept with storage and servers, data center managers can drastically increase the availability of their services, by free movement of applications between data centers.



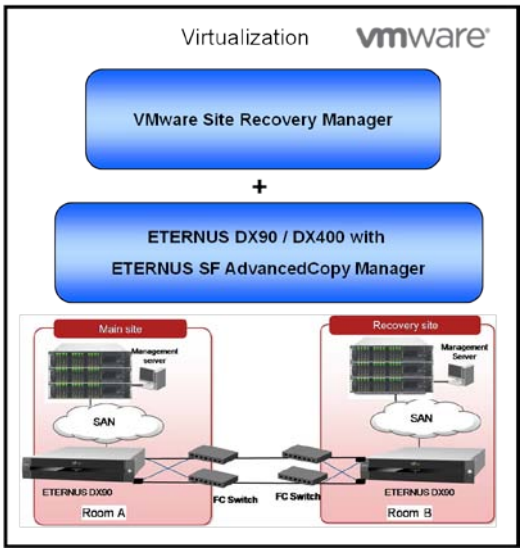
# EASY BUSINESS CONTINUITY WITH VMWARE

"EASY BUSINESS CONTINUITY WITH VMWARE"

Fujitsu's reliable and affordable "Easy Business Continuity for VMware" solution is easy to acquire, deploy and manage. Optional administration training and services also ensure best practice implementations.

The standard offering for two sites includes:

- Two PRIMERGY RX200/RX300 management servers
- Two ETERNUS DX90 or DX400 disk storage systems – the Data Safe
- Two ETERNUS SF AdvancedCopy Manager Remote Copy Licenses and Storage Replication Adapter
- VMware vSphere and VMware Site Recovery Manager (SRM)




THE SOLUTION IN DETAIL:

### PRIMERGY RX200 or RX300 servers

High-performance dual-socket rack servers, to suit your most demanding tasks

- High availability through hot-plug redundant power supplies and fans
- Reliable and continuous operation with Cool-safe™ system design
- Flexible I/O bandwidth and broad communications capability
- Maximum productivity with latest Intel technology and extensive memory options
- PRIMERGY ServerView Suite (as standard) for easy and common system and storage management

### ETERNUS DX90 or DX400 storage

Reliable disk storage systems – The Data Safe

- Flexible scalability and highest performance
- Integrates with multi-vendor Fibre Channel networks (ETERNUS DX90) or Fibre Channel and/or iSCSI networks (ETERNUS DX400)
- Online data movement with RAID Migration
- Reduces power consumption with Eco-mode for a greener Data Center

### ETERNUS SF AdvancedCopy Manager

High-speed internal and external volume copy

- Volume copy management within and between ETERNUS DX90 or ETERNUS DX400/DX8000 disk storage systems
- Integrates with applications for consistent backup
- Enables continuous 24 x 7 operation
- Integrates with VMware vCenter Site Recovery Manager (SRM) for automated disaster recovery and failover testing

# VMWARE SRM BENEFITS IN A DISASTER RECOVERY SCENARIO

## OPERATIONAL CHALLEGES

When disaster occurs administrators must switch IT operation from one location to the other. Such switching typically relies on the technical competence of the administrator to handle the many dependencies in the sequence. Further an emergency plan needs to be generated and tested to prove that the switchover will work reliably. But such action causes many issues particularly as there is a reluctance to touch the running systems. The result in many cases is theoretical plans which have never been tested in the real operational environment. Also to be taken into account is the experience of the administrators, who, under stress from the disaster, may make mistakes, and compound the problem.

## THE BENEFITS OF VMWARE SRM

SRM simplifies and automates the key elements of disaster recovery: setting up disaster recovery plans, testing of those plans, executing failover when a datacenter disaster occurs, and failing back to the primary datacenter.

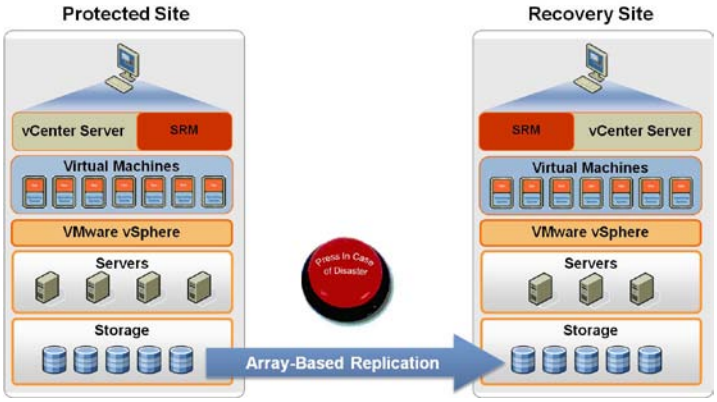
- Simplifies and automates disaster recovery workflows:
- Enables setup, testing, failover
- Turns manual recovery runbooks into automated recovery plans
- Provides central management of recovery plans from the VMware vSphere Client

From the vCenter central management station, all actions can be monitored and managed. This gives administrators end-to-end control of the process. They can calmly prepare the emergency plan, test it and improve it where necessary without any impact on the operational systems. All actions are logged and available for audit. Furthermore it becomes much easier to define recovery times in advance of any action. The complete set of processes needed following a disaster can be automated and tested, providing administrators with familiarity in use of all procedures.

## HOW IT WORKS IN AN EMERCENCY

Once VMware vSphere is deployed on the protected and recovery sites, disk array-based replication is established between the two sites. SRM is then used to create disaster recovery plans that designate failover instructions.

In the event of a disaster, administrators are notified, enabling them to decide whether to initiate a failover. Once they initiate a failover, SRM implements the disaster recovery plan following four basic steps:




First, on the Protected Site, SRM shuts down the virtual machines starting with those virtual machines designated as lowest priority. Failover does not require connectivity to the protected site, so if SRM cannot connect to the site, it simply notifies the administrator that it cannot power down the virtual machines and proceeds to the next step.

Then, at the recovery site, SRM prepares the datastore groups for failover.

Next, SRM suspends all virtual machines running on the recovery site designated as non-critical. This provides more resources for the virtual machines to be powered on at the recovery site.

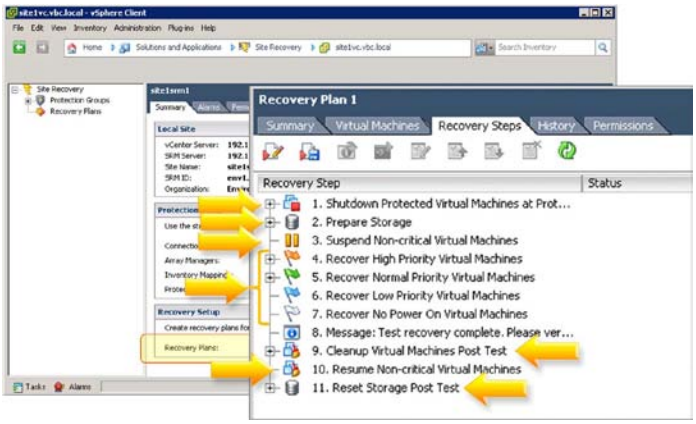
Finally, SRM restarts the virtual machines at the recovery site starting with the virtual machines designated as highest priority.

# PREPARING DISASTER RECOVERY PROTECTION

## RECOVERY PLAN PREPARATION

We begin with a discussion of SRM recovery plans.
Within SRM, a recovery plan is the list of steps for switching data center operation from the protected site to the recovery site. Recovery plans ensure that both tests and failovers execute in a repeatable and reliable manner. Recovery plans also provide a way to test the business continuity/disaster recovery plan in an isolated environment at the recovery site without impacting the protected virtual machines at the protected site.

Administrators create recovery plans at the recovery site. When creating a recovery plan, SRM automatically populates the plan with the basic steps needed to fail over the protected virtual machines to the recovery site.




## STEP BY STEP

The Recovery Steps tab shows the basic steps.

Step 1 shuts down the virtual machines at the protected site (if there is still connectivity to the protected site).
SRM shuts down the protected virtual machines at the protected site starting with the lowest priority virtual machines. Recovery does not require connectivity to the primary site, so if SRM cannot connect to it, a notification is sent and SRM moves on to the next step.
SRM does not perform Step 1 during recovery plan testing.

Step 2 prepares the datastore groups at the recovery site for failover of the protected virtual machines.
During this step, SRM:

- Promotes replicated volumes,
- Rescans the HBAs on the ESX Servers,
- Re-signatures VMFS datastores,
- And deregisters shadow virtual machines.

Step 3 SRM suspends any virtual machines at the recovery site designated as non-critical.
This provides more resources for the virtual machines to be powered on at the recovery site.
Step 4 SRM restarts virtual machines at the recovery site.
This is performed in the order, high priority machines first, then normal priority, then low priority.
Finally, SRM resumes the non-critical virtual machines that were suspended in Step 3.

During testing, SRM performs two additional tasks to remove all traces of the test.

- First SRM powers down the recovered virtual machines.
- Then SRM demotes replicated volumes, detaches devices, unregisters virtual machines, and re-registers placeholder, or shadow, virtual machines.

The toolbar on the Recovery Steps tab allows customization of the basic steps in any recovery plan. Specifically administrators can:

- Edit the basic properties of the recovery plan,
- Export the plan to a Word document, an Excel Workbook, a Web page, a CSV or XML file.


Administrators can also add custom steps that display messages or execute commands. When adding command steps, the same syntax is used as when adding Pre-Power On and Post Power On commands.

Once a custom step has been added the toolbar buttons can be used to edit it, move it up or down in the list, or remove it.

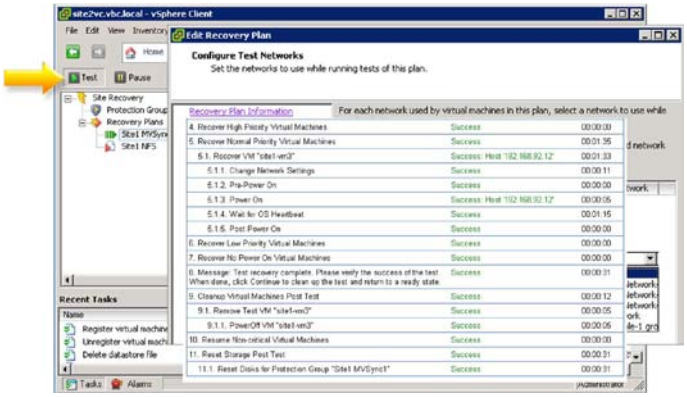
Administrators can also use the Move step up and Move step down buttons to arrange the order in which virtual machines are powered on within a step. For example, they can reorder high priority virtual machines to ensure that they powered on in a specific order.

# TESTING PLANS AND IMPROVING QUALITY

## ENSURING QUALITY WITHOUT IMPACT ON THE PRODUCTIVE SYSTEM

Testing a recovery plan simulates failover of the virtual machines in the recovery plan. Testing enables confirmation, that the recovery plan is set up correctly and that the protected virtual machines start up in the correct order and take into account the various application service dependencies in the environment.

Testing takes place in an isolated environment to ensure that each test does not interrupt production activity. The SRA halts replication temporarily during testing.




Once the test is complete the environment is reset. This process involves removing any evidence of test activity on the virtual machines and DRS clusters and resetting of the virtual disks.

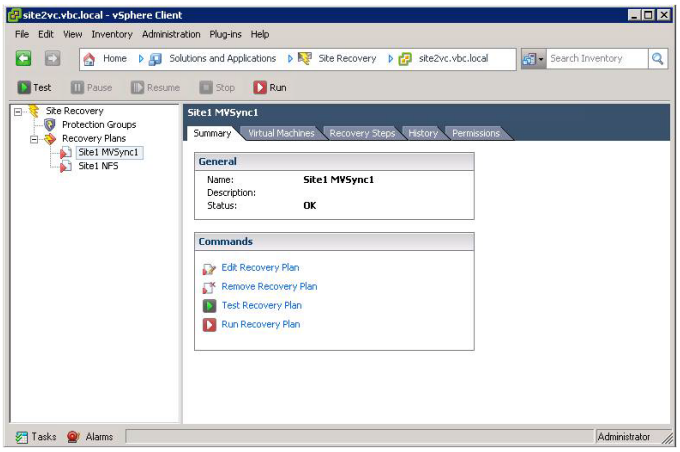
As part of the recovery plan creation process, a network needs to be selected to test powering on each virtual machine. The default selection, Auto, automatically creates a new isolated, internal network for each test. VMware recommends using Auto for testing recovery plans that include only one host server. If the recovery plan includes multiple hosts, we recommend pre-configuring and allocating networks specifically for testing.

SRM creates a detailed test report allowing the data center manager to easily demonstrate the level of failover preparedness to business users, auditors, and compliance officers.

# EMERGENCY FAILOVER

## FAILOVER PROCESS

A failover is simply the process of running a recovery plan. In the event of a disaster, the SRM administrator determines whether failover is required. If the answer is yes, the administrator selects a recovery plan, clicks the Run button, and monitors the recovery progress on the Recovery Steps tab.




After validating that the application services have been recovered, the administrator can report the success and business users can again access their services, which are now hosted at the recovery site.

Initiating a failover permanently alters the virtual machines and infrastructure of both the protected and recovery sites. For this reason, VMware recommends strictly limiting which users have permission to initiate failover.

Failover initiation is designed as a manual process to avoid split-brain scenarios. However, if required, the SRM API provides the ability to initiate failovers externally.

# SCENARIOS

## DISASTER RECOVERY PROTECTION OPPORTUNITIES

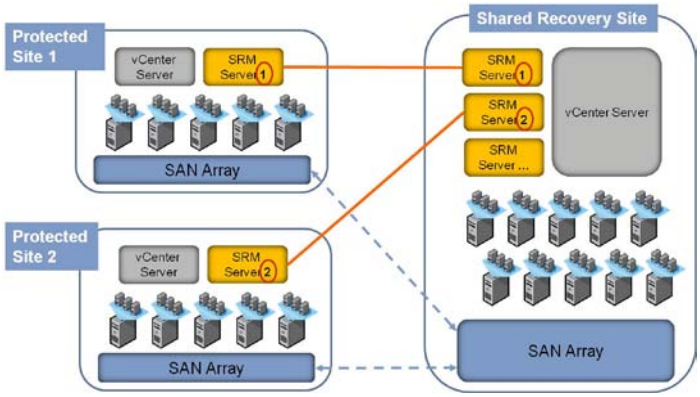
VMware SRM enables a variety of protection scenarios.

- Failover to a passive DR site:
  - The most common traditional scenario
  - Very expensive architecture

- Failover to an active DR site:
  - Leverages recovery infrastructure for testing, development, and training
  - Reduces sunk cost of recovery site

- Local failover:
  - A less common scenario
  - Protects against large localized data center failures

SRM also supports recovery site sharing allowing the protection of multiple sites with a single recovery site. This configuration is useful for environments with several remote field offices. It also makes it possible for service providers to offer recovery services to multiple customers.




This diagram shows the basic setup configuration for shared recovery. For each protected site, SRM must be installed once at the protected site and again at the recovery site. Each SRM Server installation at the shared recovery site must have a dedicate host. It is not possible to install multiple instances of the SRM Server on a single host.

Installation at each site follows the same procedure as a typical SRM installation, with one exception: during installation the SRM Server instance must be identified with a unique extension ID.
After each pair of SRM servers is installed, and the connection configured, the administrator connects the pair of SRM Server extensions with the same name.

The Shared Recovery Site feature can be used to address a hosted DR scenario as well as ROBO protection. In the case of ROBO protection, the enterprise could have multiple sites sharing a common DR site. This would decrease the overall cost of such solutions in enterprises with multiple data centers.

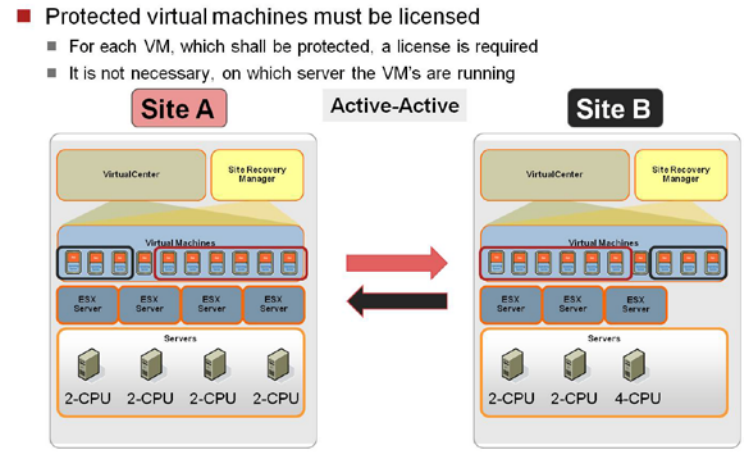
# LICENSING AND STARTING KIT

## DISASTER RECOVERY NEW LICENSING AND OPPORTUNITIES

VMware vCenter Site Recovery Manager is licensed per-virtual machine, to be protected. However it is not necessary to advise on which VM or on which server at the recovery site it will used. As a base condition, the servers on the recovery site running ESX, must be normally ESX licensed. However, customers have to clarify which VMs on the protected site will be protected on the recovery site. This determines how many SRM licenses are needed. If VMs in an active-active configuration on the recovery site will be protected on the protected site, that number of VMs must also be added to the total. Customers therefore only license the protected VMs. Licenses are available in 25 license packs. The VMs, which are listed in the recovery groups, must be counted for the license calculation.

Customers must take care, that there are sufficient resources on the recovery site to take over the load of protected site VMs following an emergency.

This new license model, which was available from 1st of September 2010, will provide customer with greater freedom. Moved VMs do not have to be fixed on specific servers. They will be load-balanced and distributed over the entire ESX farm. The result is a better balance and better protected recovery site and creates environments better prepared for cloud computing.



Example: 6 VM's from Site A and 3 VM's on Site B shall be protected,– you need 9 SRM licenses – existing ESX hosts resources and CPU-licenses are mandatory

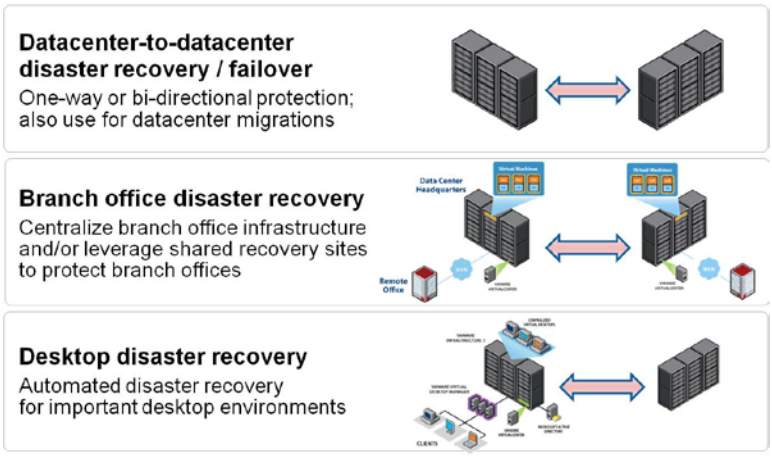
In the above example the customer would order a 25 license pack, use 9 licenses and have 16 spare for further growth.

# CONCLUSIONS

## THE MAIN BENEFITS OF ETERNUS DX WITH VMWARE SRM

It can be concluded that this approach provides the following benefits:

- Seamlessly integration that provides a simple to use implementation of Disaster Recovery using virtualized VMware environments
- Failover process simplification by automation of the workflow, including control of the ETERNUS Remote Copy functions
- A cost-effective Disaster Recovery solution that will suit both small- and medium-sized businesses
- A VMware certified solution (http://www.vmware.com/pdf/srm_storage_partners.pdf)
- Disaster Recovery plans can be tested without actually disrupting normal operations. This also proactively ensures that recovery times and recovery points can be achieved.
- Automation of the multiple steps required to test and execute an entire recovery plan.
- Detailed event logs and operational reports that record and audit recovery tests and operation
- Enables refining of recovery plans, by operations teams, to best match current run book processes.
- Auditable records of the planned steps, test procedures, and execution steps taken during actual disaster recovery operations
- Enables end-to end design, testing and execution of VM recovery all via a single point of control



# APPENDIX

## ETERNUS SF – STORAGE MANAGEMENT SOFTWARE

ETERNUS SF is the perfect fit for ETERNUS DX disk storage systems. ETERNUS SF Storage Management Software reduces total cost of ownership, simplifies the monitoring and management of ETERNUS DX disk storage systems and helps to achieve business continuity. To meet individual requirements, following ETERNUS SF products are optional available:

- ETERNUS SF Storage Cruiser (for advanced management, stable operation of all ETERNUS storage systems and Fibre Channel SAN management)
- ETERNUS SF AdvancedCopy Manager (to leverage high-speed internal and external volume copy functions of ETERNUS DX)
- ETERNUS SF Express (to simplify setup and administration of ETERNUS DX60/DX80/DX90)

With ETERNUS SF, storage resources in complex IT environments are optimized.


Like ETERNUS DX90, ETERNUS SF Express is especially developed for the SMB market to simplify storage system management and maintenance. The software helps to monitor multiple ETERNUS DX60/DX80/DX90 disk storage systems with one centralized console. In addition to that, ETERNUS SF Express manages Advanced Copy functions within the storage system for snapshots and clones with a simple management console. In business continuity scenarios, the management software supports remote replication between two ETERNUS DX90 disk storage systems. ETERNUS SF Express is only available for ETERNUS DX60/DX80/DX90.


For more functionality – like VMware SRM integration – ETERNUS SF AdvancedCopy Manager is the right choice. ETERNUS SF AdvancedCopy Manager is available for the whole ETERNUS DX family. Also ETERNUS SF AdvancedCopy Manager controls the Advanced Copy functions of ETERNUS DX and enables the integration into backup environments with almost zero effect on business applications. High-speed backup is not compromised by the volume of data, allowing application data and system volumes to be backed up with almost no operational halts.

## USEFUL LINKS

PRIMERGY Server
PRIMERGY RX200: http://ts.fujitsu.com/products/standard_servers/rack/primergy_rx200s6.html
PRIMERGY RX300: http://ts.fujitsu.com/products/standard_servers/rack/primergy_rx300s6.html

ETERNUS DX disk storage systems
www.fujitsu.com/eternus
ETERNUS DX90: http://www.fujitsu.com/eternus/products/diskstorage/dx-entry/
ETERNUS DX400 series: http://www.fujitsu.com/eternus/products/diskstorage/dx400/
ETERNUS DX8000 series: http://www.fujitsu.com/eternus/products/diskstorage/dx8000/
ETERNUS SF: http://www.fujitsu.com/eternus/products/eternus-sf/
ETERNUS SF AdvancedCopy Manager: http://www.fujitsu.com/eternus/products/eternus-sf/advance/

VMware
VMware vSphere: http://ts.fujitsu.com/products/standard_servers/server_solutions/vmware.html
VMware Site Recovery Manager: http://www.vmware.com/products/site-recovery-manager/

Storage Benchmark
Press Release: http://ts.fujitsu.com/ps2/press/read/news_details.aspx?id=4187
SPC website: http://www.storageperformance.org/home/
SPC-1 Benchmark results: http://www.storageperformance.org/results/benchmark_results_spc1#a00089

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