

# Virtualizing Microsoft Exchange Server 2010 with NetApp and VMware

Deploying Microsoft Exchange Server 2010 in a virtualized environment that leverages VMware virtualization and NetApp unified storage technologies can yield significant operational IT benefits in terms of increased data protection and availability, reduced storage requirements, and significant cost savings when compared to operating a traditional Microsoft Exchange environment. This paper describes these benefits in detail and outlines recommended best practices and key steps to achieve a successful implementation.

## EXECUTIVE SUMMARY

**Trends in Exchange 2010 and Virtualization** – The use of virtualization technology is spreading widely throughout companies in all vertical sectors. The ability to reduce hardware costs, lower energy costs, and improve overall operations in areas including R&D, database use, and Microsoft Exchange can yield significant benefits. As companies plan their upgrades, they must also account for the changes in their operations, including disaster recovery and impact on the data center.

**Typical Benefits in Adopting a Virtualized Environment for Exchange 2010 with NetApp and VMware** – These include significantly greater efficiency such as more efficient use of processors and server platforms, greater flexibility, easier management, and improved availability. These benefits are extended with NetApp, which provides much faster storage provisioning, significantly greater storage efficiency, and improved disaster recovery capabilities.

**Best Practices** – Using a series of best practices will help ensure that you adopt a virtualized Exchange environment with a high degree of success, fewer adoption problems, and a reduced chance of data loss. These best practices include using a highly reliable

storage configuration, efficient data protection tools, effective redundancy, and deduplication to reduce storage requirements.

**Steps for Successful Implementation** – You must ensure that your network has sufficient capacity to support the requirements of a virtualized Exchange environment. To accomplish this, you must conduct an inventory of your server and infrastructure hardware, and ensure that your existing infrastructure is configured properly, has the required bandwidth available, and has sufficient redundancy. You must also develop an upgrade list of items that will need to be replaced to support the environment you need. Finally, you must plan your migration in stages so that you can make sure that your virtualized Exchange environment is working as intended, and so that changes can be made while it's still feasible to do so.

For most companies, the process of moving to a virtualized Exchange environment is like most other migrations, except that NetApp has significantly improved the ease of the transition and the likelihood of success. While you still need to make sure your hardware and infrastructure will meet your requirements, the impact on your data center and IT staff is significantly reduced.

## **INTRODUCTION - TRENDS IN EXCHANGE 2010 AND VIRTUALIZATION**

Virtualization technology is taking hold in a wide range of companies. The companies using virtualization are leveraging the technology in development and testing, database applications, collaboration systems, proprietary tools, and of course with Microsoft Exchange, along with other mission-critical applications. More and more companies are planning to upgrade to Exchange Server 2010 in the near future, and to use Exchange in a virtualized environment to gain improved disaster recovery, lower operating costs, and improved consolidation.

NetApp, which provides a wide variety of storage management and infrastructure, along with a number of unique high-availability solutions, can play a major role in helping companies address these challenges and manage their migrations to a virtualized Exchange 2010 infrastructure.

## **THE ROLE OF NETAPP STORAGE IN VMWARE VIRTUALIZED SERVER ENVIRONMENTS**

NetApp unified storage provides a stable, high-performance environment that reduces the cost of a VMware implementation while also reducing management cost and complexity, dramatically simplifying provisioning, and providing advanced backup and recovery. Because NetApp unified storage natively supports Fibre Channel, iSCSI, FCoE, NFS, and CIFS protocols, organizations have the flexibility to meet all their current and future storage needs from the same scalable storage array and the choice of the best solution that suits both their current and future needs.

NetApp and VMware work together to provide integrated products and solutions that provide high availability, ease of administration, and freedom from the requirements of specific server hardware.

NetApp complements VMware efficiency with deduplication capabilities. Since virtual machine data contains essentially identical information, NetApp deduplication can be used to dramatically reduce the primary storage capacity required for a virtual environment. NetApp storage systems significantly improve storage efficiency, and provide high performance and availability for Microsoft applications.

## **BENEFITS OF MOVING EXCHANGE 2010 TO A VIRTUALIZED ENVIRONMENT WITH NETAPP AND VMWARE**

NetApp solutions are designed specifically to work in close harmony with Microsoft applications solutions, including Exchange 2010, as well as with other Microsoft enterprise technologies such as SQL Server and SharePoint Server. Running Microsoft Exchange 2010 in a VMware virtualized environment with NetApp enables better availability, flexibility, and more efficient use of infrastructure without an impact to performance. By using a virtualized environment, IT organizations can make much more effective use of their server installations, and in some cases can limit the number of servers being used for Exchange by using virtual machines in place of the physical servers that would otherwise be used to support Exchange.

By using NetApp as the storage infrastructure, the virtualized environment benefits from the advanced storage management, provisioning, backup, and data recovery features of NetApp as well as significantly greater storage efficiency. NetApp affords the ability to add storage as needed by running under a hypervisor for added efficiency, and to quickly provision additional Exchange servers including the HUB, CAS, and Mailbox server roles.

VMware provides the capability to virtualize Exchange, resulting in more efficient use of server resources combined with all the other benefits of server virtualization including better availability, lower cost, and increased flexibility.

There are a number of benefits that can be realized by using Exchange in a VMware virtualized environment with NetApp storage technology:

- More efficient use of processors and server hardware. Dedicated non-virtualized servers tend to have very low utilization rates, frequently below 15% for some roles. By migrating the Exchange environment to a virtualized server, significantly higher server utilization rates can be expected.
- Reduced server hardware requirements. By letting one server support several virtual machines, the number of physical servers required to support Exchange can be reduced.
- Increased flexibility without over-provisioning. For initial Exchange 2010 deployment, tighten the hardware

requirements as suggested by calculations using the Microsoft Exchange sizer for Exchange servers and storage, without the over-provisioning that is typical in many Exchange environments. Then, as needs change, the provisioning can be adjusted so that the servers and storage are the right size to meet the needs of the business without buying more hardware than you need at any one time.

- Reduced costs and increased efficiency. The use of thin provisioning and deduplication technologies can be used to provide a highly efficient Exchange 2010 environment that meets the needs of the business with less hardware and software than otherwise needed. Multiple instances of additional database copies in a Database Availability Group (DAG) configuration on Exchange Mailbox servers can be set up as needed for data protection requirements. However, by using technologies such as NetApp deduplication, data storage resources can be kept to a minimum, thereby reducing the data center footprint and associated costs.
- Provision storage to meet changing e-mail needs quickly and reliably. With NetApp systems, storage resources can be provisioned rapidly to adapt the Exchange storage infrastructure quickly and easily as storage requirements change. The NetApp Provisioning and Cloning Module (formerly the RCU)—an interface for NetApp FlexClone and part of the Virtual Storage Console, which can be accessed directly from VMware vCenter Server—provides rapid storage provisioning, cloning, and deployment services.
- Increase Exchange data availability. NetApp provides high-availability storage for Microsoft servers without the need for clustering at the VM level. In combination with VMware HA and DRS, virtual machines can be moved to different physical hosts in the ESX Cluster as needed while still maintaining access to the shared datastore and RDM LUNs. NetApp's advanced backup and recovery solutions are built in to the integrated system, reducing or eliminating the need for tape-based backup. NetApp snapshot technology makes backups faster and less intrusive, makes recovery easier to accomplish, and requires less storage. In VMware environments, snapshots are managed efficiently with NetApp SnapManager for Virtual Infrastructure (SMVI) and SnapManager for Microsoft Exchange (SME) for virtual machine backup, and an application-consistent backup of the Microsoft Exchange messaging data to provide a highly

availability data protection solution.

- TCO can be decreased by as much as 54% through reduced downtime, lower operational costs, lower licensing costs, and greater reliability.<sup>1</sup>

## DATA STORAGE CONSIDERATIONS FOR EXCHANGE 2010

Exchange 2010 uses a fundamentally different approach to high availability than earlier versions of Exchange. While transactional IO requirements have been reduced from legacy versions of Exchange, new non-transactional database maintenance IO is significant and must be considered when sizing the Exchange storage.

Notably, earlier versions of replication have been eliminated and replaced with a DAG. The DAG can support from two to 16 mailbox servers, and each server can hold one or more active or passive copies of a database.

The DAG Active Manager, new with Exchange 2010, controls the active or passive status of individual mailboxes, and in the event of the failure of a mailbox, it can promote a passive mailbox to active status. This failover mechanism ensures that e-mail isn't interrupted by a hardware or software failure on the part of Exchange. However, the underlying infrastructure must also support this redundancy by minimizing hardware failures.

In addition to DAGs, with Exchange 2010, Microsoft also introduces the concept of lag database copies. A lagged mailbox database is a mailbox database copy configured with a replay lag time value greater than 0. The system cannot use both lag databases and backup copies of the database, as lag copies and backups are essentially the same thing (you would choose one or the other, not both).

## BEST PRACTICES

Microsoft recommends multiple healthy database copies and redundant active and passive mailboxes, and NetApp recommends storage configurations that reduce the chance of data loss to nearly zero. With proper hardware redundancy, configuration of the storage infrastructure, and backup strategies, the chance of actual data loss is greatly diminished. There are, however, a number of best practices that should be employed to ensure that this level of assurance is achieved:

1. "Total Cost Comparison: IT Decision-Maker Perspectives on EMC®, HP® and Network Appliance™ Storage Solutions in Enterprise VMware Environments, February 2009

- Use a highly reliable storage configuration. NetApp recommends RAID-DP to reduce the chances of data loss due to disk failure and therefore the number of copies of the mailbox databases that would otherwise be required. Other forms of RAID cannot survive a double disk failure. Microsoft recommends maintaining three copies of each database; however, by using RAID-DP, similar Service Level Agreements can be achieved with only two copies. In a disaster recovery configuration, Microsoft recommends five copies of each database; however, by using RAID-DP, only three copies are needed. RAID-DP is a Double Parity RAID 6 implementation that prevents data loss when two drives fail.
- Use efficient and reliable data protection tools. For example, NetApp's SnapManager for Exchange allows the creation of Snapshot copies of the Exchange databases that are more space-efficient than a VSS clone or third-party backup tools where the entire dataset must be copied. With the NetApp solution, only the changed blocks need be copied, and these are typically only a small fraction of the dataset size. NetApp SnapManager for Exchange also eliminates the need for lag database copies in Exchange 2010 environments, further reducing the storage resources required. NetApp snapshot technology also provides the ability to restore from any point in time rather than the two-week limit imposed by Microsoft's lag copy approach. Either will allow for "point-in-time" restores, but Snapshots use much less space and are more flexible (see Figure 1).
- Make sure that the active and passive copies of the redundant mailbox databases are identical in capacity and performance, and use the passive database copies for backups.
- Balance your Exchange servers across multiple physical servers to minimize the impact of a server failure. Also ensure active and passive copies of the same database are not on the same physical server.
- NetApp recommends configurations such as one CAS (client access server) role – the server where all clients connect which then communicates with the mailbox server housing the active copy of your database – one hub, and two mailbox servers per host server as an appropriate mix.
- Use SATA disks paired with intelligent caching modules to reduce costs while improving storage performance. The SATA disk design has relatively low performance when compared with SAS or Fibre Channel disks, but that can be effectively overcome with caching modules such as NetApp Flash Cache and the use of appropriate infrastructure. Exchange 2010 includes many performance optimizations in the Extensible Storage Engine (ESE) database that enable the use of SATA disks. Some organizations find that a Flash Cache module in the controller can reduce physical disks, lower latency, and/or increase the number of users that can be supported in the environment.
- Use thin provisioning which allocates, but does not consume, disk space until it's actually needed. This eliminates the common problem of over-provisioning a LUN (Logical Unit Number), and allows the pool of free space to be shared.
- Use deduplication to reduce storage requirements. In e-mail databases, a significant amount of information is identical, and deduplication can reduce storage requirements by approximately 20-30%. In virtualized environments, deduplication can also recover space that would be used by identical operating system and application components in each of the virtual environments (see Figure 2, next page).
- When configuring the virtual environments, avoid allocating more virtual CPUs than you will actually need or be able to use. First, make sure Exchange can take advantage of the vCPUs that you're allocating, starting with a conservative number and increasing the number as needed. In addition, make sure that the number of vCPUs is less than or equal

FIGURE 1

**NetApp's SnapMirror™ Facilitates Disaster Recovery**

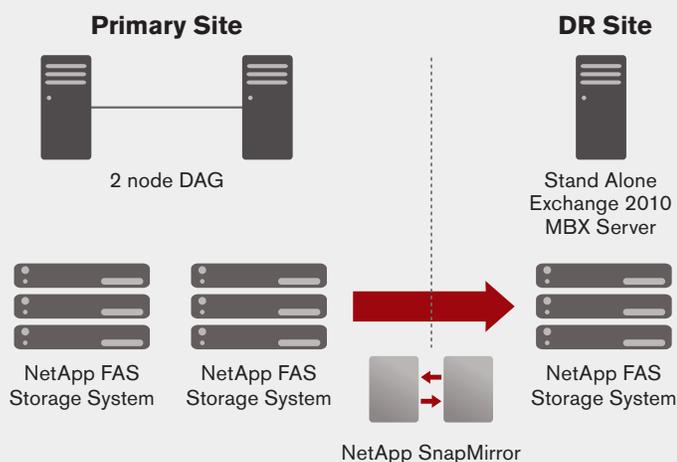
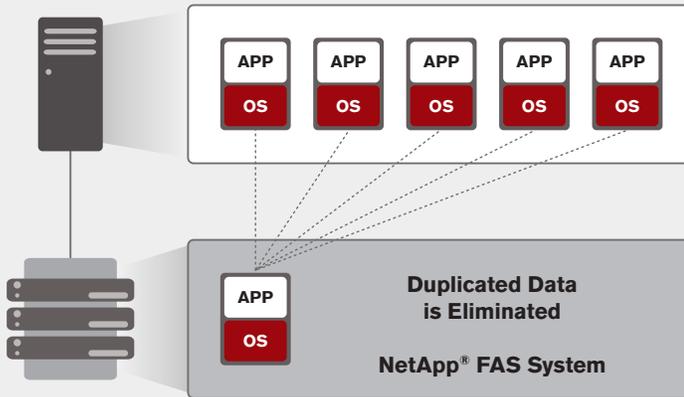


FIGURE 2

**Many Virtual Machine Images Are 100% Identical**



Savings extend to all copies of data—including backup, DR, test clones, and archival copies.

to the number of physical CPU cores in the server. Going over the number of physical CPU cores is possible, but performance will suffer.

- Set the memory allocation to the size you actually need so that you don't waste memory, and then enable VMware Distributed Resource Scheduling to make sure workloads are balanced in the ESX cluster. This ensures that critical workloads get the memory they require without over-committing memory.
- Plan on allocating at least four NICs per ESX host. This allows two for use by Exchange and added NICs for logging traffic, VMotion, or console access management. Use virtualized NICs provided by VMware to optimize the performance of network assets in a virtualized environment. VMware provides VMXNET3 for this purpose.
- Use 802.1Q tagging to support VLANs where you're using virtual switch tagging, virtual guest tagging, or external switch tagging. Make sure your physical network infrastructure supports 802.1Q tags and is properly configured so that the tags are recognized appropriately.
- Source and target ESX hosts in a HA/DRS cluster must be connected to the same gigabit (or 10-gigabit) network and the same shared storage. VMotion should have a dedicated network segment or VLAN.

- VMware recommends VMs that communicate with each other should reside on the same host machine to minimize network traffic.
- Source and destination hosts the ESX HA/DRS cluster must have the same or compatible CPU models for VMotion to work properly, and the destination must have sufficient resources. If migration is necessary, then VMware recommends that VMs with smaller memory sizes are better candidates than those with large memory sizes.
- VMware recommends utilizing shared storage for VMs to allow implementation of VMotion, HA, and DRS.
- Set up storage multipathing using a minimum of four paths from an ESX server to the storage array. Depending on the HBA or NIC being used as a path to storage will require at least two HBAs.

**AVOIDING PROBLEMS AND PITFALLS**

Any move to a virtualized environment is a complex process that requires careful planning to ensure a successful implementation. Proper planning must include consideration for the appropriate use of memory, CPU, and disk utilization, as well as for limitations in the VM software.

When you thin provision, you have to monitor so that you have forewarning when consumption is growing faster than planned. The point of thin provisioning is to give more LUN capacity than exists in the volume. When you run out of space, the volume will remove older snapshots, auto grow in size, or go offline depending on the configuration. It's prudent to take the following steps as well:

- Be cognizant of limitations in VMware of memory and disk size limits, and limits on the number of LUNs that can be addressed. Avoid approaching those limits.
- Do not allocate more vCPUs than you need, and don't exceed the number of cores on the ESX server. Start with fewer vCPUs and confirm proper operation before increasing the number.
- Avoid over-commitment of memory. Steady-state usage should be below the amount of physical memory on the server.

- Avoid memory reservations that limit VMotion by setting the reservation to no larger than the configured size of the VM.
- Follow Microsoft guidelines for memory and swap or page file configuration sizes of Exchange VMs.
- Avoid having heavily used VMs access the same LUN concurrently.
- VMs must not use actual physical devices such as floppy disks or CD-ROM drives.

### KEY STEPS FOR SUCCESSFUL IMPLEMENTATION

Moving to Exchange 2010 is, in itself, a significant effort for your IT staff. Moving Exchange 2010 to a virtualized environment can be even more challenging. But that certainly doesn't mean it's not worthwhile. Like all migrations, moving to a virtualized environment with Exchange requires planning and careful design before deployment begins. To be successful on the first try, you must establish your environment, make sure your environment will support your goals, and then plan how you're going to move from the old to the new system. Here are some of the critical steps required in your deployment planning:

- Before you do anything else, perform a complete inventory of the hardware environment where you plan to host the virtualized Exchange 2010 environment. This includes identifying the physical servers (blade or otherwise), the number of available CPU cores, the available memory and memory expansion room, NICs and HBAs, backup facilities, power, and cooling.
- The next step is to take a complete inventory of your networking infrastructure, including the number of gigabit and 10-gigabit ports currently available for use, switch and wiring redundancy, firmware revision levels, and current traffic loads over time. Test your infrastructure to ensure it can handle anticipated loads, plus at least another 30% to allow for traffic growth over time.
- Ensure that there is sufficient network redundancy to allow for dedicated networks for VMotion activity as well as for iSCSI storage traffic if used. Storage traffic should use 10-gigabit pathways where possible, and NICs used for storage traffic should be redundant as should the network infrastructure. Management traffic can share the production

data network, but storage and VMotion traffic should not.

- Confirm network configuration settings on each piece of network infrastructure to ensure support for 802.1Q is enabled, and that latency is kept to a minimum.
- Ensure that your networked storage has sufficient expansion capability to support growth over time, and to support appropriate levels of performance. Assume that your performance needs will grow over time.
- Create an upgrade list for the additional servers, memory and / or processors that you're going to need, or create a list for new servers and related infrastructure if your current servers are nearing replacement (meaning about two to three years old). While you're at it, make sure your existing servers will work with VMware if you're planning to use them.
- Create a migration plan for moving your existing Exchange environment to the new one. Refer to Microsoft's migration documentation and Microsoft's Exchange mailbox server calculator, while recognizing that your specific infrastructure needs to meet the specific business requirements of your business. Your migration plan should start with one limited test environment before you migrate the whole system.
- Plan your migration in stages, and test at every stage. An ideal migration should start with a non-essential group of mailboxes so that a loss of e-mail for a short time won't bring a major impact to the organization. Once you're satisfied that the first group of mailboxes is fully functional (including all backup and recovery functions), move to the next group.
- Once your Exchange 2010 virtualized environment is up and running, keep the previous version of Exchange on hand until you're completely convinced that everything is working properly. This includes making sure that your backup and recovery plan is working, and has been tested.
- Create a full backup of your old Exchange environment and preserve it.
- Start planning your next round of hardware upgrades just in case you have more growth than anticipated.

Note that the bottom line in a successful migration is careful

planning followed by a step-by-step approach. Each step should be tested completely before the next step is begun. In addition, it's critical that every step be documented in detail and as-built.

## SUMMARY

A successful move to a virtualized environment for Microsoft Exchange 2010 requires careful planning and support. To be successful and to have your Exchange environment working in a way that enhances your operations requires that you have Exchange running as efficiently and as reliably as possible. This means that you need to optimize your storage, infrastructure, and server environments, while also making sure that you have effective management so that you can operate the virtualized Exchange using your existing staff and your existing data center.

Accomplishing a move to a virtualized Exchange environment is much more likely to be successful if you use a proven storage and operational management platform such as NetApp's offering. This will allow you to streamline your backups, improve your disaster recovery efforts, and minimize the hardware and storage growth necessary to succeed in the migration. By using

VMware and NetApp as your virtualization solution, you will help ensure your success and efficient operation in an environment that meets your organization's needs.

## CONCLUSION

A move to Microsoft Exchange 2010 can bring significant efficiencies to your organization, but such a migration works best if you also migrate your Exchange environment to a virtualized platform at the same time. Because Exchange 2010 is designed to work in a virtualized environment, you can gain improved operations, a smaller IT footprint, and easier management. By using Exchange in a NetApp and VMware virtualized environment, you can cut your costs, improve reliability, simplify operations, and reduce TCO.

**Your Next Step:** To learn more about using Exchange 2010 in a NetApp and VMware virtualized environment, visit <http://communities.netapp.com/docs/DOC-7535>