Microsoft Exchange 2013 on VMware VSAN

October 31, 2017
Table of Contents

1. Executive Summary
   1.1. Business Case
   1.2. Solution Overview
   1.3. Key Results
2. Introduction
   2.1. Purpose
   2.2. Scope
   2.3. Audience
   2.4. Terminology
3. Technology Overview
   3.1. Overview
   3.2. VMware vSAN
   3.3. VMware vSphere
   3.4. VMware vSphere Data Protection
   3.5. VMware Site Recovery Manager
   3.6. VMware vSphere Replication
   3.7. Microsoft Exchange 2013
   3.8. Exchange 2013 Database Availability Groups
   3.9. VMware vSAN and vSphere High Availability
4. Solution Configuration
   4.1. Solution Configuration
   4.2. Architecture Diagram
   4.3. Hardware Resources
   4.4. Software Resources
   4.5. VMware ESXi Server Configuration
   4.6. Network Configuration
   4.7. vSAN Configuration
   4.8. Exchange DAG Configuration
5. Solution Validation
   5.1. Overview
   5.2. Test Overview
   5.3. Testing and Monitoring Tools
   5.4. Jetstress Workload Testing
6. Exchange Server Backup and Restore on VSAN
   6.1. Overview
   6.2. Installing vSphere Data Protection
   6.3. Prerequisites
1. Executive Summary

Since the inception of email, Microsoft Exchange has evolved from a basic email application to a corporate-wide communication standard for most enterprises.
1.1 Business Case

Since the inception of email, Microsoft Exchange has evolved from a basic email application to a corporate-wide communication standard for most enterprises. During this evolution, Microsoft Exchange has also migrated from stand-alone servers to shared infrastructure with the goal of reducing costs and increasing availability.

Microsoft Exchange Server 2013 brings new technologies and features that are superior to that of legacy versions of Exchange. The architectural enhancements and implementation options, such as cloud extensions, are inviting features that make both existing and potential Exchange customers want to deploy Exchange 2013. This version of Exchange further solidifies its dominance in data centers and remains the premier corporate communication platform.

Adding VMware® vSAN™ to the Exchange 2013 architecture aims at furthering the evolution by providing highly scalable, reliable, and high performance storage using cost-effective hardware, specifically directly attached disks in VMware ESXi™ hosts. vSAN embodies a new storage management paradigm that automates or eliminates many of the complex management workflows that exist in traditional storage systems today. vSAN enables IT administrators to easily deploy and administer Microsoft Exchange 2013 on VMware vSphere® while still maintaining high availability and reducing costs using a shared infrastructure hosted on ESXi.

1.2 Solution Overview

In this solution, we validate that vSAN can support a mixed mailbox size configuration under load and stress using a highly available cluster architecture. We cover best practices and optimal configurations for Exchange 2013 on vSAN.

1.3 Key Results

The following highlights validate that vSAN is an enterprise-class storage suitable for Microsoft Exchange:

- Predictable storage I/O performance for Exchange on vSAN.
- Simple design that eliminates maintenance complexity of traditional SAN nor additional Windows utility software to deploy storage for Microsoft Exchange.
- Disaster recovery and data protection planning demonstrating site resiliency and mailbox database recovery of Exchange Server.
- High availability for the Exchange virtual machines. vSphere HA can provide protection from ESXi host failures, guest operating system failures, and application failures with the support of third-party add-ons.
- Validated architectures that reduce implementation and operational risks:
- Use of Microsoft Exchange Jetstress Tool with the defined architecture to prove that vSAN can host a Microsoft Exchange load.
2. Introduction

This reference architecture validates the vSAN ability to support Microsoft Exchange 2013
2.1 Purpose

This reference architecture validates the vSAN ability to support Microsoft Exchange 2013 using a high IOPS mailbox configuration with Exchange Database Availability Groups (DAGs). The design leverages VMware vSphere clustering technology and Exchange DAG. The architecture is a resilient design with Exchange Server protected by vSphere Data Protection™ and vSphere Site Recovery Manager™.

2.2 Scope

This reference architecture:

- Illustrates vSAN performance using Exchange Jetstress.
- Shows the benefits of minimal impact to the production environment for Exchange Server backup and restore in a consolidated vSAN environment.
- Includes a disaster recovery (DR) solution using VMware vSphere Replication™ and Site Recovery Manager.
- Demonstrates storage performance scalability and resiliency of Exchange 2013 DAG in a virtualized VMware environment backed by vSAN.
- Describes vSAN best practice guidelines for preparing the vSphere platform for running Exchange Server 2013. Guidance is included for CPU, memory, storage, and networking configuration leveraging the existing VMware best practices for Exchange 2013.

2.3 Audience

This reference architecture is intended for IT professionals and email administrators involved in planning, designing, or administering an Exchange 2013 environment with vSAN.

2.4 Terminology

This paper includes the following terminologies as shown in Table 1.

Table 1. Terminology

<table>
<thead>
<tr>
<th>TERM</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Database Copy</td>
<td>An active copy of a mailbox database within Exchange.</td>
</tr>
<tr>
<td>Client Access Server (CAS)</td>
<td>An Exchange Server role that provides authentication and proxy/redirection logic, supporting the client Internet protocols, transport, and unified messaging within an Exchange environment.</td>
</tr>
<tr>
<td>Database Availability Group</td>
<td>A DAG is a group of up to 16 Mailbox servers that hosts a set of databases and provides automatic database-level recovery from failures that affect individual servers or databases.</td>
</tr>
<tr>
<td>Exchange Control Panel (ECP)</td>
<td>Exchange web-based management console.</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>Failure to Tolerate (FTT)</td>
<td>Defines the number of host, disk, or network failures a virtual machine object can tolerate. For n failures tolerated, n+1 copies of the virtual machine objects are created and 2n+1 hosts with storage are required. Default value is 1. The maximum value is 3.</td>
</tr>
<tr>
<td>Lagged Database Copy</td>
<td>A passive mailbox database copy that has a log replay lag time greater than zero.</td>
</tr>
<tr>
<td>Mailbox Server</td>
<td>An Exchange server role that hosts both mailbox and public folder databases, and provides message storage.</td>
</tr>
<tr>
<td>Messaging Application</td>
<td>Messaging Application Programming Interface over HTTP is a new transport protocol implemented in Microsoft Exchange Server 2013 Service Pack 1 (SP1).</td>
</tr>
<tr>
<td>Programming Interface (MAPI)</td>
<td>Passively copies a mailbox database within Exchange.</td>
</tr>
<tr>
<td>SMB Share</td>
<td>Server Message Block Share, also known as a Windows share. A directory or directories that are shared from one computer to another computer or groups.</td>
</tr>
<tr>
<td>Storage Policy Based</td>
<td>The foundation of the Software Defined Storage Control Panel and enables vSphere administrators to overcome upfront storage provisioning challenges, such as capacity planning, differentiated service levels, and managing capacity headroom.</td>
</tr>
<tr>
<td>Management (SPBM)</td>
<td>----------------------------------------</td>
</tr>
</tbody>
</table>
3. Technology Overview

VMware vSAN is VMware’s software-defined storage solution
3.1 Overview

This section provides an overview of the technologies used in this solution:

- VMware vSAN
- VMware vSphere
- VMware vSphere Data Protection
- VMware Site Recovery Manager
- VMware vSphere Replication
- Microsoft Exchange 2013
- Exchange 2013 Database Availability Groups
- VMware vSAN and vSphere High Availability

This section provides an overview of the technologies used in this solution:

3.2 VMware vSAN

VMware vSAN is VMware's software-defined storage solution for hyper-converged infrastructure, a software-driven architecture that delivers tightly integrated compute, networking, and shared storage from a single virtualized x86 server. vSAN delivers high performance, highly resilient shared storage by clustering server-attached flash devices and hard disks (HDDs).

vSAN delivers enterprise-class storage services for virtualized production environments along with predictable scalability and all-flash performance—all at a fraction of the price of traditional, purpose-built storage arrays. Just like vSphere, vSAN provides users the flexibility and control to choose from a wide range of hardware options and easily deploy and manage it for a variety of IT workloads and use cases. vSAN can be configured as all-flash or hybrid storage.

vSAN supports a hybrid disk architecture that leverages flash-based devices for performance and magnetic disks for capacity and persistent data storage. In addition, vSAN can use flash-based devices for both caching and persistent storage. It is a distributed object storage system that leverages the vSphere Storage Policy-Based Management feature to deliver centrally managed, application-centric storage services and capabilities. Administrators can specify storage attributes, such as capacity, performance, and availability, as a policy on a per virtual machine basis. The policies dynamically self-tune and load balance the system so that each virtual machine has the right level of resources.

3.3 VMware vSphere

VMware vSphere is the industry-leading virtualization platform for building cloud infrastructures. It enables users to run business-critical applications with confidence and respond quickly to business needs. vSphere accelerates the shift to cloud computing for existing data centers and underpins compatible public cloud offerings, forming the foundation for the industry's best hybrid cloud model.

3.4 VMware vSphere Data Protection

VMware vSphere Data Protection™ is a robust, simple to deploy, disk-based backup and recovery solution powered by EMC. vSphere Data Protection is fully integrated with the VMware vCenter™ and enables centralized and efficient management of backup jobs while storing backups in deduplicated destination storage locations.

VMware vSphere Data Protection 6.1 is a software-based solution that is designed to create image-level backups of virtual machines, virtual servers, databases. vSphere Data Protection can utilize application plugins to back up Microsoft SQL Server, Exchange Server, and SharePoint Server.

An Exchange-aware agent provides support for backing up Exchange databases. The lightweight agent installed inside the virtual machine deduplicates data, moving only unique changed blocks to
the vSphere Data Protection Advanced appliance. vSphere Data Protection achieves the highest levels of deduplication at the guest level. Guest-level backup and recovery provide application-consistent states that are crucial for reliable protection of the Exchange Server. The Exchange Server agent provides recovery of individual databases with options to restore to a recovery database to perform granular recovery of mailboxes and messages.

vSphere Data Protection supports both vSAN and traditional SAN storage. vSAN can provide a unified data store for you to back up virtual machines and user databases. The backup configuration is easy to implement through vCenter web client by the vSphere Data Protection plugin.

3.5 VMware Site Recovery Manager

VMware Site Recovery Manager 6.1 is an extension to VMware vCenter that provides disaster recovery, site migration, and non-disruptive testing capabilities to VMware customers. It is fully integrated with VMware vCenter Server and VMware vSphere Web Client.

Site Recovery Manager works in conjunction with various replication solutions including VMware vSphere Replication to automate the process of migrating, recovering, testing, reprotecting, and failing-back virtual machine workloads.

Site Recovery Manager servers coordinate the operations of the VMware vCenter Server at two sites. When virtual machines at the protected site are shutdown, copies of these virtual machines at the recovery site start up. By using the data replicated from the protected site, these virtual machines assume responsibility for providing the same services.

3.6 VMware vSphere Replication

VMware vSphere Replication is an extension to VMware vCenter Server that provides hypervisor-based virtual machine replication and recovery.

vSphere Replication is an alternative to a storage-based replication. With vSphere Replication, you can replicate servers to meet your load balancing needs. After you set up the replication infrastructure, you can choose the virtual machines to be replicated at a different recovery point objective (RPO). You can enable multi-point in time retention policy to store more than one instance of the replicated virtual machine. After recovery, the retained instances are available as snapshots of the recovered virtual machines.

3.7 Microsoft Exchange 2013

Exchange is the most widely used email system in the world. In established organizations, Exchange has been the communications engine for many versions, and it has met the requirements. With each new version of Exchange, enhancements to availability, performance, and scalability become compelling reasons to explore migration. Exchange 2013 continues the tradition with a new architecture, enhanced availability features, and further optimized storage I/O operations.

3.8 Exchange 2013 Database Availability Groups

A database availability group is a collection of Exchange servers that are clustered to provide redundant copies of mailbox databases. One of the characteristics of Exchange DAG is each mailbox database must have one active copy and one passive copy. DAGs provide a non-shared clustering solution of storage failover. DAGs use asynchronous log shipping technology to distribute and maintain passive copies of each database on Exchange DAG member servers. With the reduction in storage I/O and optimized storage patterns in Exchange 2013, the direct-attached storage has
become more attractive. Exchange DAG technology takes advantage of the quorum component of Windows Server Failover Cluster.

**Mailbox Database Copies**

A mailbox database adds mobility and disconnects databases from servers. Mailbox database copies support up to 16 copies of a single database.

The process of a switchover is activating a mailbox database copy is designating a specific passive copy as the new active copy of a mailbox database. A database switchover involves dismounting the current active database and mounting the database copy on the specified server as the new active mailbox database copy. The passive database copy that will become the active mailbox database must be healthy and current.

Refer to the Mailbox database copies topic for key characteristics of mailbox database.

![Figure 2. Exchange 2013 Database Availability Group](image)

A DAG with 4 members and 12 mailbox databases is shown with the active and passive database copies evenly distributed across the available DAG members. If one of the servers that hosts the active database copy experiences a problem, for example a hardware failure, one of the remaining DAG members is able to activate the copy of the database so clients are still able to connect to their mailbox data.

### 3.9 VMware vSAN and vSphere High Availability

By providing a higher level of availability that is possible for most applications without customization, vSphere HA has become the default HA solution for vSphere virtual machines. Regardless of operating system or application, vSphere HA can provide protection from ESXi host failures, guest operating system failures, and application failures with the support of third-party add-ons.

vSAN with vSphere HA provide an HA solution for virtual machine workloads. If the host that fails is not running any active virtual machines, there is no impact on the virtual machine workloads. If the host that fails is running active virtual machines, vSphere HA restarts those VMs on the remaining hosts in the cluster.

Exchange 2013 environments are built for high availability. CAS that is deployed can be load balanced. Mailbox servers are deployed in DAGs for mailbox database high availability. In the case of a hardware failure, the utilization of the remaining CAS rises because new connections are established and DAG protection is reduced (passive databases are activated). In a physical deployment, the administrator needs to address the outage quickly to restore availability levels and mitigate any further outages.
Within a vSphere infrastructure, any hardware failure results in virtual machines powered back on by vSphere HA, restoring availability levels quickly and keeping utilization balanced.

**VM Storage Policy and HA**

It is important to have an understanding of the VM storage policy mechanism and how it protects data. vSAN uses storage policies, applied on a per-VM basis, to automate provisioning and balancing of storage resources to ensure that each virtual machine gets the specified storage resources and services. vSAN leverages storage policies to ensure that data is never lost if a disk, host, network, or rack fails. As part of vSAN, VM storage policies define the requirements of a virtual machine’s storage running in the virtual machine from an availability, sizing, and performance perspective.

**Objects and Components**

A virtual machine deployed on a vSAN data store consists of a set of objects including VM home namespace, VMware virtual machine disk (VMDK), and VMs wap (when the virtual machine is powered on).

Each of these objects consists of a set of components, determined by the policies specified for the VM’s storage. For example, if the value of the Number of failures to tolerate parameter is set to 1 in the VM storage policy, the VMDK object is replicated, with each replica consisting of at least one component and each replica is striped. If the value of the Number of disks tripes per object parameter is greater than 1 in the VM storage policy, the object is striped across multiple disks and each stripe is an object component.

**Number of Failures to Tolerate**

The number of FTT policy setting is an availability capability that can be applied to all virtual machines or individual VMDKs. This policy plays an important role when planning and sizing storage capacity for vSAN. Based on the availability requirements of a virtual machine, the setting defined in a virtual machine storage policy can lead to the consumption of as many as four times the capacity of the virtual machine.

For n failures tolerated, n+1 copies of the object are created and 2n+1 hosts contributing storage are required. The default value for the Number of failures to tolerate parameter is 1. If a policy is not chosen when deploying a virtual machine, there is still one replica copy of the virtual machine’s data. The maximum value for the Number of failures to tolerate parameter is 3.

In this solution, we enable Distributed Resource Scheduler (DRS) and set Anti-Affinity rules to separate the Exchange VMs and keep them on separate ESXi hosts. We use the FTT policy as the default value of 1 and use the FTT value of 0 in some test cases.
4. Solution Configuration

This section introduces the component configuration for the solution.
4.1 Solution Configuration

This section introduces the component configuration for the solution including:

- Architecture diagram
- Hardware resources
- Software resources
- VMware ESXi Server configuration
- Network configuration
- vSAN configuration
- Exchange DAG configuration

4.2 Architecture Diagram

The key designs for the vSAN Cluster solution are:

- A 4-node vSAN Cluster for the Exchange single site architecture.
- A 4-node Exchange DAG with active and passive mailbox database copies with both Mailbox Server and CAS roles.
- A medium size Exchange deployment: 2,500 mailboxes at 2GB each. The number of mailboxes per configuration is determined based on the Exchange sizing calculator and the environment.

![Solution Architecture for Virtual SAN Cluster](image)

4.3 Hardware Resources

vSAN Production Cluster

For production workloads, the solution uses four standard rack mount servers. The local solid state drives (SSDs) and hard disk drives (HDDs) are used in conjunction with vSAN technology to provide a scalable and enterprise-class storage solution. Each ESXi host has two disk groups each consisting of one SSD and six HDDs. The disk groups are combined to form a vSAN datastore. This next-generation storage platform combines powerful and flexible hardware with advanced efficiency, management, and software-defined storage. The cluster is connected to a 10GbE switch with two connections per server and one 1GbE connection for both ILO and ESXi management.

4.4 Software Resources
Table 2 shows the software resources used in this solution.

Table 2 Software Resources

<table>
<thead>
<tr>
<th>PURPOSE</th>
<th>QUANTITY</th>
<th>VERSION</th>
<th>SOFTWARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange virtual machines Load virtual machines Domain controller VMware vCenter server</td>
<td>10</td>
<td>2012 R2 x 64 SP1</td>
<td>Windows Server 2012 Enterprise Edition</td>
</tr>
<tr>
<td>ESXi and vSAN Cluster</td>
<td>4</td>
<td>6.0 U1</td>
<td>VMware ESXi</td>
</tr>
<tr>
<td>Management server</td>
<td>1</td>
<td>6.1</td>
<td>VMware vCenter</td>
</tr>
<tr>
<td>Email software</td>
<td>ISO</td>
<td>CU9</td>
<td>Exchange 2013 Enterprise</td>
</tr>
<tr>
<td>vSphere Replication</td>
<td>1</td>
<td>6.1</td>
<td>vSphere Site Replication Manager</td>
</tr>
<tr>
<td>vSphere Data Protection</td>
<td>1</td>
<td>6.1</td>
<td>vSphere Data Protection</td>
</tr>
</tbody>
</table>

4.5 VMware ESXi Server Configuration

Each vSAN ESXi Server in the vSAN Cluster had the following configuration as shown in Figure 4.

![Figure 4. Virtual SAN Cluster Node](image)

Each vSAN oESXi Server in the vSAN Cluster had the following configuration as shown in Table 3.

Table 3. ESXi Host Configuration
<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESXi host CPU</td>
<td>2 sockets 20 cores E5-2690 3Ghz v2 x 2</td>
</tr>
<tr>
<td>ESXi host RAM</td>
<td>256GB</td>
</tr>
<tr>
<td>ESXi version</td>
<td>6.0 U1</td>
</tr>
<tr>
<td>Network adapter</td>
<td>2 x 10Gb SFI/SFP+ Network Connection</td>
</tr>
<tr>
<td>Storage adapter</td>
<td>2 x 12Gb SAS</td>
</tr>
<tr>
<td>Disks</td>
<td>12 x 900GB HDD 2 x 400GB SSD</td>
</tr>
</tbody>
</table>

**Storage Controller Mode**

The storage controller used in the reference architecture supports both pass-through and RAID modes. We used the pass-through mode in the testing. The pass-through mode is the preferred mode for vSAN and it gives vSAN complete control of the local SSDs and HDDs attached to the storage controller.

**Storage Controller Pass-Through Mode**

Storage controller HBAs and RAID adapters can support a mode of operation commonly known as pass-through mode, where the VMware vSphere Hypervisor is given direct access to the underlying drives. For storage controller HBAs, this is also known as initiator target mode; for RAID controllers that support pass-through, this is known as JBOD mode. Regardless of the nomenclature, the result gives vSAN complete control of the local SSDs and HDDs attached to the storage controller.

**Storage Controller RAID 0 Mode**

For storage controller RAID adapters that do not support the pass-through mode, vSAN fully supports RAID 0 mode. RAID 0 mode is implemented by creating a single-drive RAID 0 set by the storage controller software, using all SSDs and HDDs within the vSAN Cluster. The single-drive RAID 0 sets are then presented to vSAN. For vSAN to differentiate between the SSD and HDD RAID 0 sets, the single-drive SSD RAID 0 sets must be tagged within the vSphere esxcli. See vSphere 5.5 Update 1 documentation and VMware Knowledge Base Article 2013188 for more information.

Each vSAN ESXi Server in the vSAN Cluster had the following configuration as shown in Figure 4.

**4.6 Network Configuration**

A VMware vSphere Distributed Switch™ acted as a single virtual switch across all associated hosts in the data cluster. This setup allows virtual machines to maintain a consistent network configuration as they migrate across multiple hosts. The vSphere Distributed Switch used two 10GbE adapters per host.

You can define properties of security, traffic shaping, and NIC teaming in a port group. Table 4 shows the settings used with this design.

**Table 4. Port Group Properties—vSphere Distributed Switch**
### Property Setting Value

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>SETTING</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>Port Binding</td>
<td>Static</td>
</tr>
<tr>
<td>Policies: Security</td>
<td>Promiscuous mode</td>
<td>Reject</td>
</tr>
<tr>
<td></td>
<td>MAC address changes</td>
<td>Reject</td>
</tr>
<tr>
<td></td>
<td>Forged transmits</td>
<td>Reject</td>
</tr>
<tr>
<td>Policies: Traffic Shaping</td>
<td>Status</td>
<td>Disabled</td>
</tr>
<tr>
<td>Policies: Teaming and Failover</td>
<td>Load balancing</td>
<td>Route based on originating virtual port</td>
</tr>
<tr>
<td></td>
<td>Failover detection</td>
<td>Link status only</td>
</tr>
<tr>
<td></td>
<td>Notify switches</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Failback</td>
<td>Yes</td>
</tr>
<tr>
<td>Policies: Resource Allocation</td>
<td>Network Resource Pool</td>
<td>None</td>
</tr>
<tr>
<td>Policies: Monitoring</td>
<td>NetFlow status</td>
<td>Disabled</td>
</tr>
<tr>
<td>Policies: Miscellaneous</td>
<td>Block all ports</td>
<td>No</td>
</tr>
<tr>
<td>Policies: Advanced</td>
<td>Allow override of port policies</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Configure reset at disconnect</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### 4.7 vSAN Configuration

**vSAN Storage Policy**

vSAN can set availability, capacity, and performance policies per virtual machine. Table 5 shows the designed and implemented storage policies.
Table 5. vSAN Storage Setting for Exchange Server

<table>
<thead>
<tr>
<th>STORAGE CAPABILITY</th>
<th>SETTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of failures to tolerate</td>
<td>1</td>
</tr>
<tr>
<td>Number of disk stripes per object</td>
<td>1</td>
</tr>
<tr>
<td>Flash read cache reservation</td>
<td>0%</td>
</tr>
<tr>
<td>Object space reservation</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Number of FTT**—The FTT policy defines how many concurrent host, network, or disk failures can occur in the cluster and still ensure the availability of the object. The configuration contains FTT+1 copies of the object and a witness copy to ensure that the object’s data is available even when the number of tolerated failures occurs. FTT settings applied to the virtual machines on the vSAN datastore determines the usable capacity of datastore.

**Object space reservation**—By default, a virtual machine created on vSAN is thin-provisioned. It does not consume any capacity until data is written. You can change this setting between 0 to 100 percent of the virtual disk size.

**Number of disk stripes per object**—This policy defines how many physical disks across each copy of a storage object are striped. The default value(recommended) of one was sufficient for our tested workloads.

**Flash read cache reservation**—Flash capacity reserved as read cache for the virtual machine object. Specified as a percentage of the logical size of the vmdk object. It is set to 0 percent by default and vSAN dynamically allocates read cache to storage objects on demand.

4.8 Exchange DAG Configuration

**Prerequisites**

See Installing Microsoft Exchange Server 2013 Prerequisites on Windows Server 2012 for the prerequisites.

**WSFC Setup**

The Exchange DAG setup installs and configures the necessary components for Windows Failover Cluster. Additional networking for the DAG replication and a Windows share on separate Windows Virtual Machine.

**WSFC Quorum Modes and Voting Configuration**

Exchange 2013 DAG takes advantage of Windows Server Failover Cluster (WSFC) technology. WSFC uses a quorum-based approach to monitoring overall cluster health and provides maximum node-level fault tolerance.
5. Solution Validation

The solution designed and deployed Microsoft Exchange 2013
5.1 Overview

The solution designed and deployed Microsoft Exchange 2013 on a vSAN Cluster focusing on ease of use, performance, and most importantly resiliency. In this section, we presented the test methodology, processes, and results. For business continuity and disaster recovery, we designed and demonstrated Site Recovery Manager and vSphere Data Protection with both vSAN and Microsoft Exchange 2013.

5.2 Test Overview

The solution tests include:

- Application workload testing to stress the application and observe vSAN performance by using the Jetstress tool.
- Backup and recovery testing using vSphere Data Protection.
- Business continuity and disaster recovery testing using Site Recovery Manager.
- Resiliency testing to ensure that vSphere HA and DRS work well with the Microsoft Exchange 2013 and vSAN solution, and impact on the performance is limited.

5.3 Testing and Monitoring Tools

We used the following testing and monitoring tools in the solution:

- vSAN Observer
  The VMware vSAN Observer is designed to capture performance statistics and bandwidth for a VMware vSAN Cluster. It provides an in-depth snapshot of IOPS and latencies at different layers of vSAN, read cache hits and misses ratio, outstanding I/Os, congestion, and so on. This information is provided at different layers in the vSAN stack to help troubleshoot storage performance. For more information about the VMware vSAN Observer, see the Monitoring VMware vSAN with vSAN Observer documentation.

- Jetstress
  Exchange log read and write average latency and database read average latency must be acceptable and pass for 5,000 mailboxes. For more information about the Jetstress tool, refer to the Jetstress 2013 Field Guide and the Microsoft Exchange Server Jetstress 2013 Tool.

5.4 Jetstress Workload Testing

Overview

We ran Jetstress for Exchange using database layout of 2,500 mailboxes each at 2GB with 0.17 IOPS per mailbox, which is equivalent to 250 mail messages at 75kb a day.

Test Scenario and Process

Perform the following steps to do the Jetstress workload testing:

Start vSAN Observer:

- We started the vSAN Observer by using the command line on the vCenter appliance: vsan.observer vcenterIP/ExchangeDC/computers/Exchange/--force --run-webserver -g /tmp/ --max-runtime 3. This ran vSAN Observer for three hours and generated a file/tmp directory of the vCenter appliance, and ran the webserver for real-time monitoring.
• Start Jetstress with 12 databases and 2 copies. See Table 6 for Jetstress configuration setting for each mailbox server (four servers in total).

Table 6. Jetstress Configuration Setting

<table>
<thead>
<tr>
<th>JETSTRESS OPTION</th>
<th>PARAMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test category</td>
<td>Test an Exchange mailbox profile</td>
</tr>
<tr>
<td>Number of mailboxes</td>
<td>1,250 (per server)</td>
</tr>
<tr>
<td>IOPS/Mailbox</td>
<td>0.17</td>
</tr>
<tr>
<td>Mailbox size</td>
<td>2GB</td>
</tr>
<tr>
<td>Suppress tuning and use thread count</td>
<td>3</td>
</tr>
<tr>
<td>Test type</td>
<td>Performance</td>
</tr>
<tr>
<td>Multi host test</td>
<td>Selected</td>
</tr>
<tr>
<td>Run background database maintenance</td>
<td>Selected</td>
</tr>
<tr>
<td>Test duration</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

Test Result
The vSAN solution completed the Jetstress tests with 100 percent pass.

All 4 servers running a total of 12 mailbox databases with a total of 5,000 mailboxes at 2GB each passed the Exchange Jetstress test. The average database read and write times were well below the 20ms threshold. Also, the average reads and writes to the log files were below the 10ms threshold. We conducted the test with Exchange Jetstress set in the maintenance mode. Using the maintenance mode added additional stresses to the underlying storage hosting Exchange.

Table 7. Jetstress 2013 Metrics

<table>
<thead>
<tr>
<th>PERFORMANCE COUNTERS</th>
<th>SERVER1</th>
<th>SERVER2</th>
<th>SERVER3</th>
<th>SERVER4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieved Exchange transactional IOPS (I/O database reads/sec + I/O database writes/sec)</td>
<td>290</td>
<td>294</td>
<td>268</td>
<td>269</td>
</tr>
<tr>
<td>Target transactional IOPS</td>
<td>212</td>
<td>212</td>
<td>212</td>
<td>212</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>I/O database reads/sec</td>
<td>197</td>
<td>199</td>
<td>182</td>
<td>182</td>
</tr>
<tr>
<td>I/O database writes/sec</td>
<td>93</td>
<td>95</td>
<td>86</td>
<td>87</td>
</tr>
<tr>
<td>Total IOPS (I/O database reads/sec + I/O database writes/sec + BDM reads/sec + I/O log replication reads/sec + I/O log writes/sec)</td>
<td>359</td>
<td>364</td>
<td>336</td>
<td>336</td>
</tr>
<tr>
<td>I/O database reads average latency (ms) (Target &lt;20ms)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>I/O log write average latency (ms) (Target &lt;10ms)</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
</tr>
</tbody>
</table>
6. Exchange Server Backup and Restore on VSAN

vSphere Data Protection provides additional layer of Exchange mailbox data recovery through vCenter client and Exchange Server integration.
6.1 Overview

vSphere Data Protection provides additional layer of Exchange mailbox data recovery through vCenter client and Exchange Server integration. vSphere Data Protection is DAG-aware and supports both vSAN and traditional SAN storage. vSAN can provide a unified data store for you to back up virtual machines and user databases. The backup configuration is easy to implement through vCenter web client by the vSphere Data Protection plugin.

With the integration of an Exchange-aware agent in the guest operating system, vSphere Data Protection can be used for both the Client Access and Mailbox Exchange Server roles. Entire CAS virtual machines can be restored quickly in the case of operating system corruption or failure due to a bad patch. Mailbox server virtual machines can also be protected with supported Exchange Mailbox Database backup and restore.

6.2 Installing vSphere Data Protection

**Installing vSphere Data Protection for Exchange Server Client**

To support guest-level backups, you must install vSphere Data Protection for Exchange Server Client on each Exchange Server for backup and restore support.

**Prerequisites**

Before using vSphere Data Protection, you must install and configure the appliance in the VDP Installation and Configuration chapter of the vSphere Data Protection Administration Guide and you must have administrative rights to the Exchange Server and the SMB share for the DAG vSphere Data Protection Client.

6.3 Prerequisites

Before using vSphere Data Protection, you must install and configure the appliance in the VDP Installation and Configuration chapter of the vSphere Data Protection Administration Guide and you must have administrative rights to the Exchange Server and the SMB share for the DAG vSphere Data Protection Client.