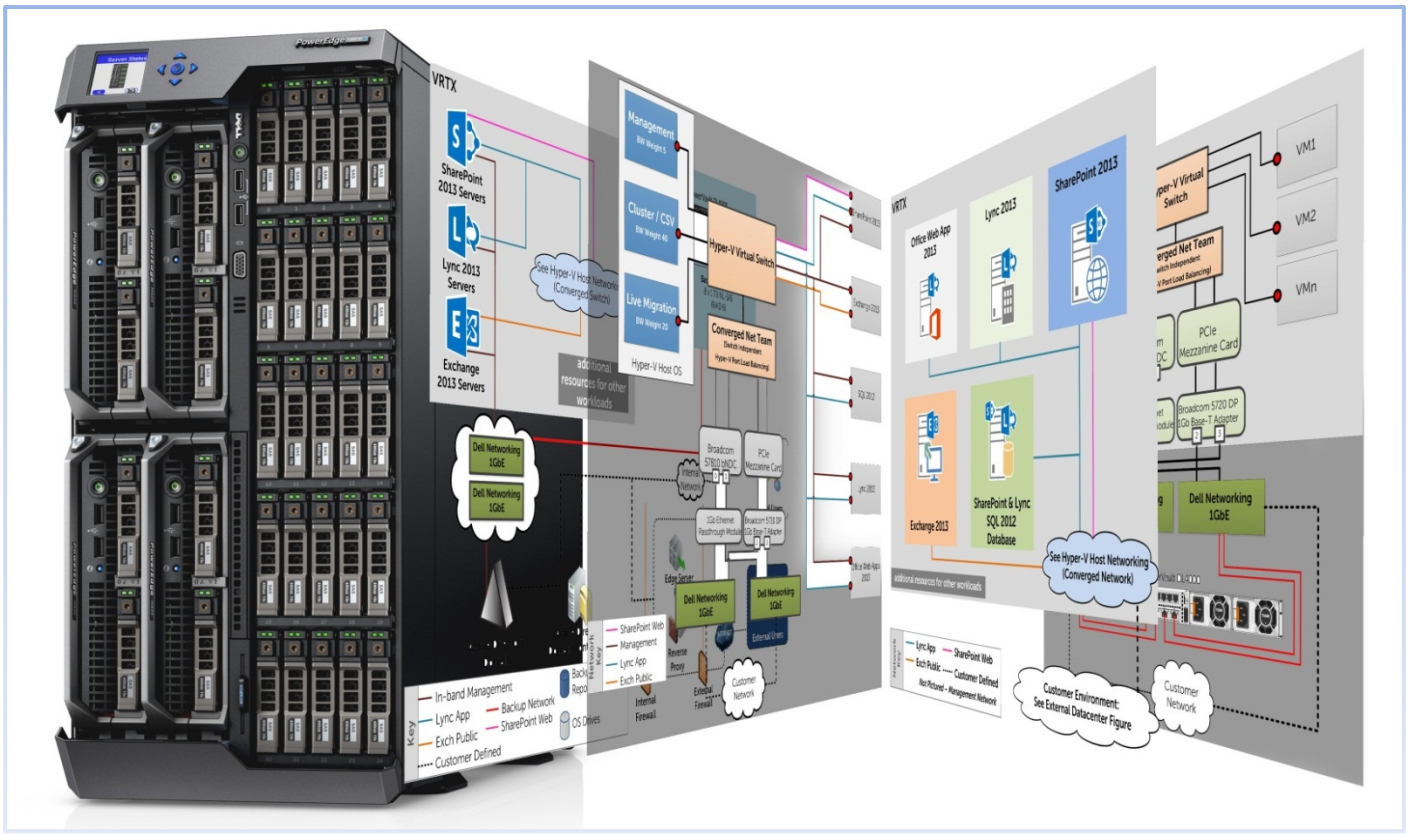
Microsoft Exchange, Lync and SharePoint Server 2013 on Dell PowerEdge VRTX with Microsoft Windows Server 2012 Hyper-V

A Dell Reference Architecture for 500 users



Dell Global Solutions Engineering
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Revision History

Date	Description
February 2014	Initial release
April 2014	Updates to include new VRTX components

Table of Contents

Acknowledgements

This Reference Architecture was produced by the following members of the Dell Global Solutions Engineering team:

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1 Executive Summary

Information technology (IT) infrastructure suffers from complexities due to disparate hardware, a proliferation of various system management tools and hardware sprawl. This leads to an inefficient infrastructure resulting in increased total cost of ownership (TCO) and system downtime for maintenance. Additionally, such an infrastructure is inflexible in handling performance demands that eventually affects end users.

The Dell™ PowerEdge™ VRTX shared infrastructure platform resolves these complexities and enables IT administrators to combine servers, storage and networking into an easy-to-deploy chassis. Potential errors are reduced with the use of unified and simplified systems management. More application uptime with high availability is ensured.

Engineers at Dell Global Solutions Engineering have proposed a novel platform for virtualized workloads consisting of PowerEdge VRTX with Microsoft® Hyper-V®. This reference architecture is pre-engineered, validated and ready to be leveraged for deploying workloads.

A Microsoft® Unified Communication and Collaboration (UC&C) solution enabled by Microsoft® Exchange, Lync® and SharePoint® Servers provides organizations with mission-critical productivity tools—such as email, instant messaging, document sharing and web conferencing—to accomplish daily tasks. It is important to configure, deploy and maintain the applications for daily functioning. Architectural changes and feature enhancements in Exchange Server 2013, Lync Server 2013 and SharePoint Server 2013 enable better integration between the three applications and further improve end-user productivity. These changes and enhancements include:

- Site Mailboxes on a SharePoint site providing a consolidated view of project emails and documents
- User presence and availability across Microsoft® Office client applications
- eDiscovery from a central SharePoint site to store, retain and analyze content across all three applications
- Unified Contact Store between Lync and Exchange client applications

Implementing the three applications together on a shared virtualized infrastructure results in greater consolidation and efficiency than implementing each application on dedicated hardware. The benefits of deploying the Microsoft UC&C solution on a single virtualized infrastructure and the application integration are:

- Simplify deployment, configuration, maintenance and administration of hardware infrastructure and applications
- Allow a single view of server, storage and networking for multiple applications
- Reduce hardware cost and administration time
- Optimize application uptime and ensure business continuity by complementing application native availability with hypervisor-level high availability
- Achieve greater IT efficiency by eliminating infrastructure silos designed for individual applications

The study in this technical guide describes the reference architecture for Microsoft UC&C solution leveraging the pre-engineered PowerEdge VRTX with Hyper-V reference architecture. This reference

architecture has been used as the underlying platform to build a virtualized Microsoft UC&C solution. Certain percentages of PowerEdge VRTX resources are reserved for the solution while the remaining resources can be leveraged for running additional applications that are at the administrator's discretion.

This guide describes the solution in a structured way:

- Section 2: Describes the key components used in the solution reference architecture. These components are engineered to make the solution complete and effective. Understanding the components is essential for comprehending the reference architecture.
- Section 3: Describes the design considerations for virtualizing Microsoft UC&C applications and describes resource consolidation and other benefits achieved with the integration of features in the 2013 suite of UC&C applications.
- Section 4: Describes the actual reference architecture leveraging Hyper-V on Dell PowerEdge VRTX and provides details on how each component of the architecture is implemented according to the considerations described in Section 3.
- Section 5: Describes the backup architecture for protecting the UC&C solution using the Dell™ PowerVault DL4000 backup appliance.
- Section 6: Describes the verification performed to ensure the infrastructure is optimally configured to provide a highly available UC&C solution.
- Section 7: Describes a summary of the overall solution and explains why Dell PowerEdge VRTX is the best shared infrastructure to deploy the Microsoft UC&C solution for up to 500 users in an organization.

1.1 Scope

This guide explores implementing Microsoft Exchange Server, Lync Server and SharePoint Server 2013 on Dell PowerEdge VRTX. This guide concentrates on infrastructure design principles, which include high availability, application best practices, hardware abstraction and resource consolidation, and application data protection. The application integration points in the 2013 suite of applications are described and the implications of these integration points and the infrastructure design principles are discussed. A sample implementation for up to 500 users is given using the design principles.Consolidating these workloads into one virtualized infrastructure reduces management complexity, simplifies hardware maintenance and provides the end users with highly available business critical services. Using a shared infrastructure and integrating different sets of features offered by the individual applications provides a way to extend the application capabilities toward a true collaboration environment in the organization.

In line with the target market for Dell PowerEdge VRTX, our assumption of the customer environment for the sample implementation is SMB offices as opposed to data centers. For such SMB offices, The IT infrastructure typically resides in an IT closet or a machine room. Instead of managing a variety of server, storage and networking products for essential operations, these customers can now have a consolidated infrastructure with smaller foot print, efficient resource allocation, and simplified management. Operating in an office environment, these customers also have different requirements from those operating in a data center. As a result, we used different architectural designs for the applications than we would typically use in a data-center environment while maintaining solution high-availability requirements. The main

consideration for the different designs is to reduce cost and maximize return of investment for the targeted SMB customers.

For more information on stand-alone reference architecture guidance for Exchange, Lync and SharePoint, visit dell.com/ucc.

1.2 Audience

This guide is intended for IT professionals and administrators interested in designing and deploying a Microsoft UC&C solution for up to 500 users on Dell PowerEdge VRTX with Hyper-V. While the guide provides an overview of the Dell PowerEdge VRTX and Exchange Server, the reader is expected to have sufficient understanding of Microsoft Hyper-V, Microsoft Exchange 2013, Microsoft Lync 2013, Microsoft SharePoint 2013 and Dell PowerVault DL4000.

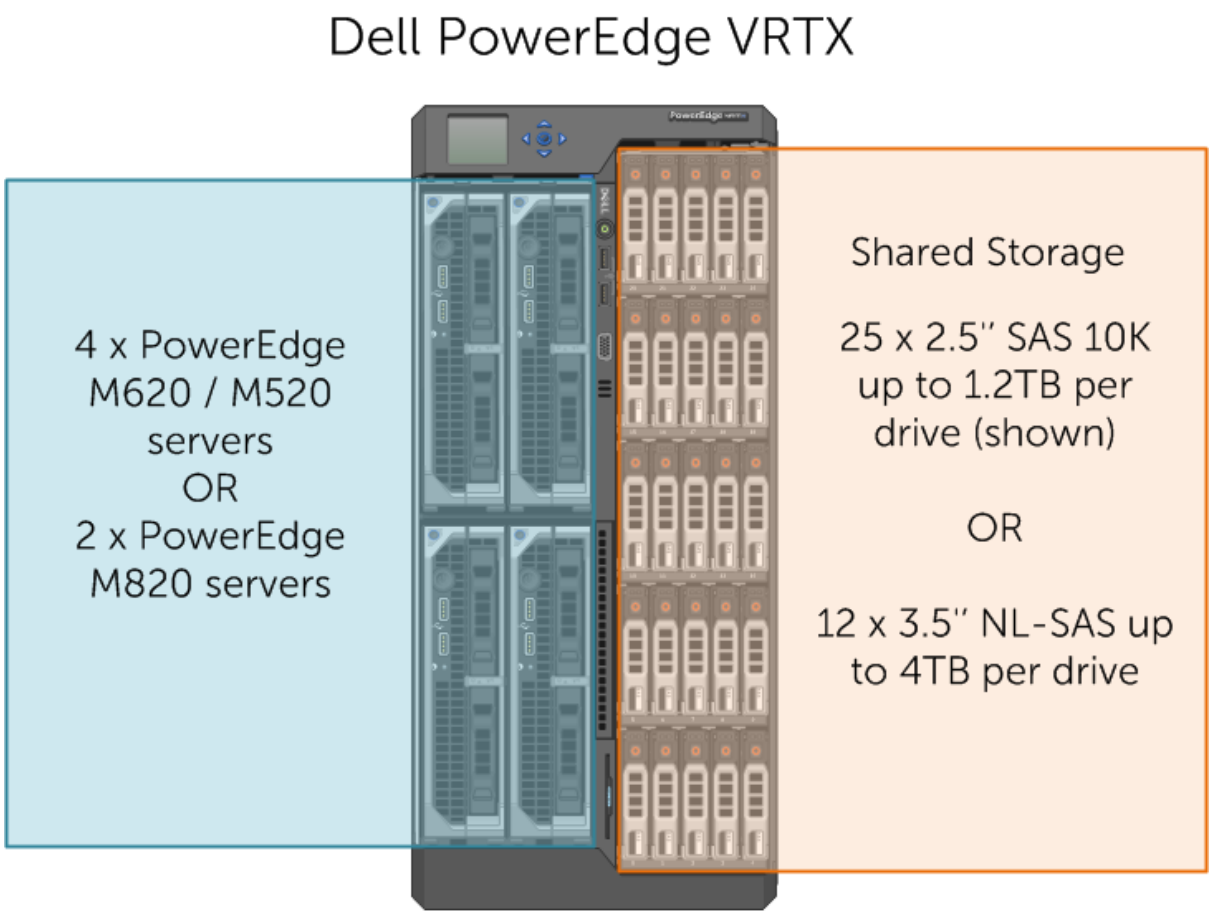
2 Solution Components

This reference architecture is based on Dell PowerEdge VRTX and incorporates Windows Server® 2012 with Hyper-V and Microsoft Exchange, Lync and SharePoint Server 2013.

2.1 Overview of Dell PowerEdge VRTX

Dell PowerEdge VRTX is an exemplary platform that combines server, storage and networking into a single all-encompassing chassis. The design of the new PowerEdge VRTX platform is inspired by the need to specifically address and resolve IT concerns in small and medium (SMB) businesses. Many of the IT pain points experienced in office environments are the same as those of data centers—e.g. having sufficient performance to process jobs or transactions quickly; having sufficient capacity to grow over time with minimal disruption; and ensuring that systems, applications and data are highly available. Office environments range across a full spectrum, from single, stand-alone offices to multiple distributed offices of large enterprises and organizations. With a wide array of customer-inspired features and capabilities, PowerEdge VRTX offers optimized dimensions, security, acoustics and power options to enable a very compelling value proposition. The simple, integrated and scalable shared storage in PowerEdge VRTX addresses the needs of virtualized workloads and projected storage capacity and performance.

Figure 1 Dell PowerEdge VRTX logical representation



PowerEdge VRTX is a converged infrastructure platform but much simpler than the Dell™ PowerEdge™ M1000e platform. PowerEdge VRTX uses I/O cards in the PCIe industry-standard format to provide shared storage of up to 48 TB in the 3.5-inch HDD bay chassis. The storage is shared among up to four server nodes and is managed through the PowerEdge VRTX Chassis Management Controller (CMC). Using CMC, virtual disks can be created and assigned to single or multiple server nodes (multiple if clustering-aware software is installed).The CMC web console can also be used to assign the PCIe slots to server nodes. Up to four PCIe slots can be assigned to a single server node. These mappings can be reassigned later, but the servers involved in the reassignment need to be power cycled.

Table 1 Overview of PowerEdge VRTX Infrastructure

Feature	**Description**
Server Compatibility	Dell™ PowerEdge™ M520/M620/M820 servers
Form Factor	Stand-alone tower or 5U rack enclosure
Number of Servers	Up to 4 PowerEdge M520/M620 servers OR Up to 2 PowerEdge M820 servers
I/O	8 PCIe slots (supporting Ethernet, FC, GPU)
Power Supplies	Up to 4 PSUs (PSU and AC redundant options)
Chassis Storage	Up to 12 3.5-inch NL-SAS, SAS HDDs/SSDs or Up to 25 2.5-inch NL-SAS, SAS HDDs/SSDs
Raid Controller	Shared PowerEdge™ Raid Controller (PERC 8; Entry Shared[1] PERC or Fault Tolerant PERC)
Management	1 or 2 Chassis Management Controllers
Network	1GbE pass-through module or 1GbE internal switch module (8 external ports) 10GbE internal switch module (8 external ports)

For more information on Dell PowerEdge VRTX, see the Remote Office Infrastructure Reference Architecture on Dell PowerEdge VRTX using Microsoft Hyper-V 2012.

2.2 Overview of Microsoft Hyper-V Reference Architecture with PowerEdge VRTX

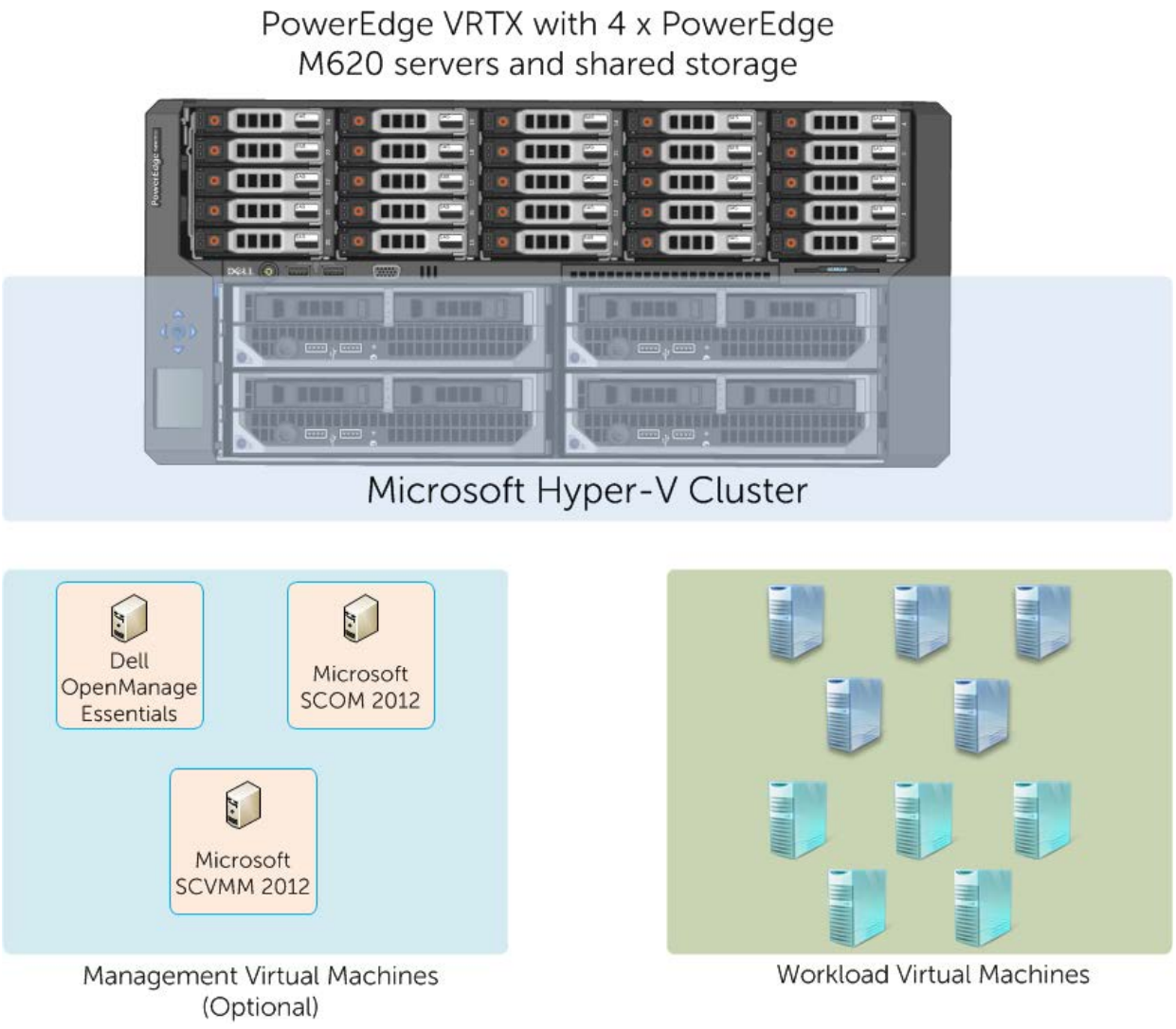
Windows Server 2012 Hyper-V increases operational efficiency by enabling server virtualization to make optimum use of server hardware. With Windows 2012, Microsoft has introduced a significant number of

[1] This reference architecture uses an Entry Shared PERC 8 controller.

improvements that allow customers to take advantage of newer server, storage and network hardware technologies.

The Microsoft UC&C solution design described in this guide leverages the Dell PowerEdge VRTX Reference Architecture Virtualization Solution using Microsoft Hyper-V 2012. The goal of this architecture is to provide an efficient small and medium business (SMB) infrastructure solution that reduces the management and support overheads while keeping in place the virtualized and shared infrastructure best practices that benefit enterprise-class UC&C applications. The PowerEdge VRTX reference architecture is also designed to provide comprehensive design information on the core infrastructure services that are based on Windows Server 2012.

Figure 2 PowerEdge VRTX Hyper-V Cluster Architecture



The key benefits of the PowerEdge VRTX reference architecture to Microsoft UC&C solution include:

- Efficient application management and best practices achieved through hardware abstraction at various levels of the infrastructure, such as storage, network and server.
- Centralized management of the application ecosystem.
- Complemented high availability for the application servers.
- Reduction in TCO.

This SMB office solution includes PowerEdge M620 servers running on the Dell PowerEdge VRTX chassis hosting virtualization solution based on Microsoft (Hyper-V) with Dell Networking 1GbE or 10GbE switches as a network backbone and the PowerEdge VRTX internal shared storage as a storage area network (SAN). Table 2 lists the compute resources used in the PowerEdge VRTX reference architecture.

Table 2 Compute Resources in PowerEdge VRTX

Resource	Description
Compute Nodes	Up to 4 x PowerEdge M620 or M520 servers OR Up to 2 x PowerEdge M820 servers
Processors	Up to 2 x Intel® E5-2600 or E5-2600v2 Family processors in each M620 server Up to 2 x Intel® E5-2400 Family processors in each M520 server Up to 4 x Intel® E5-4600v2 Family processors in each M820 server
Memory	Up to 768 GB (with 32-GB LR-DIMMS) in each M620 server Up to 384 GB in each M520 server Up to 1.5 TB in each M820 server

The following sections describe the features of the Hyper-V Reference Architecture with PowerEdge VRTX that benefits the UC&C deployment.

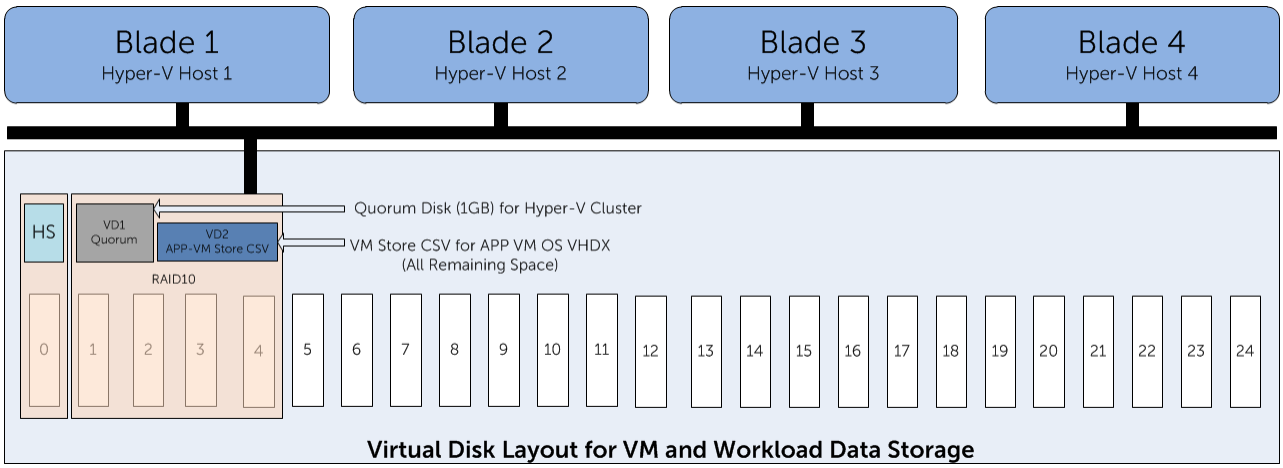
2.2.1 Overview of Storage Architecture and Configuration

The Hyper-V cluster in this reference architecture utilizes the storage virtual disk (VD) option. The reference architecture requires a minimum of two VDs for:

- The cluster Quorum configuration.
- The cluster shared volume (CSV) for workload VM VHDXs.

The PowerEdge VRTX chassis offers two options for disk configurations: 12 x 3.5-inch spindles and 25 x 2.5-inch spindles. The study described in this guide uses the latter option with 2.5-inch disks. In case of the PowerEdge VRTX chassis with 2.5-inch disks, disk 0 is used as the global hot spare (HS). The cluster Quorum VD and the VM Store CSV are created on the next four disks with RAID 10 along with the respective settings, as shown in Figure 3.

Figure 3 Virtual Disk Configuration on 2.5-inch PowerEdge VRTX Chassis



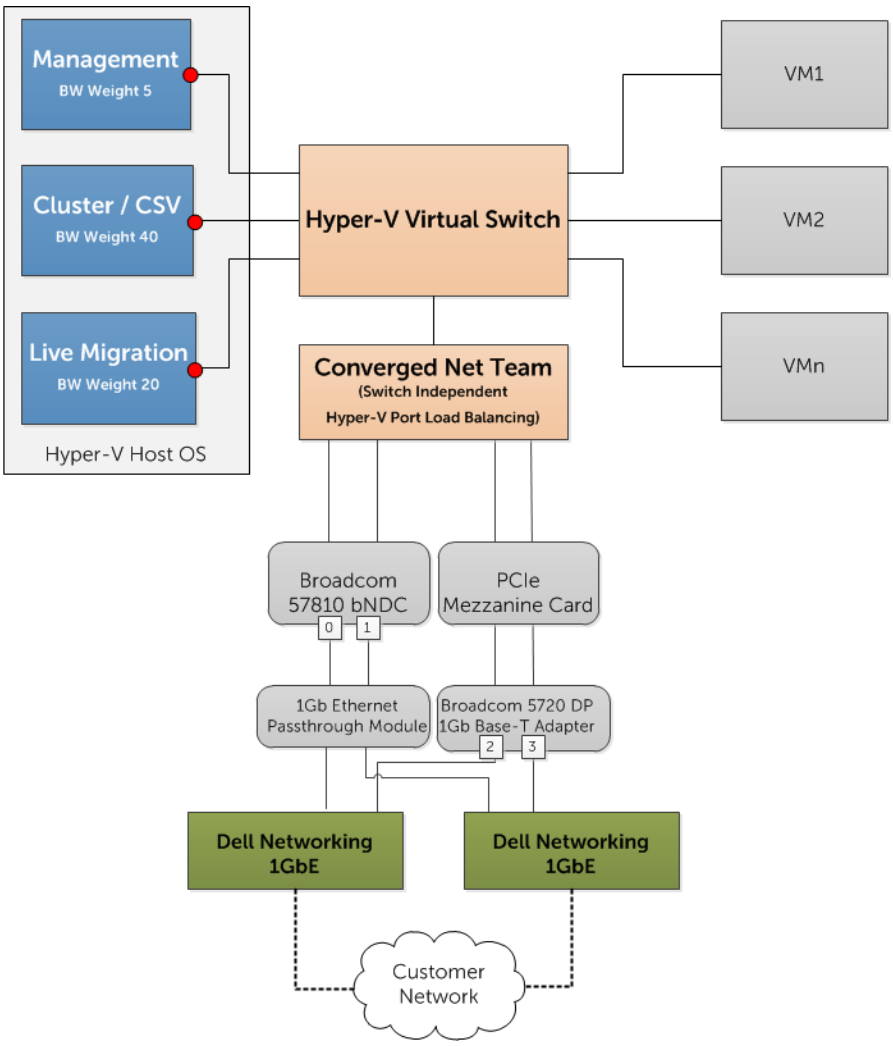
As shown in Figure 3, the rest of the 20 spindles are available for storing workload-related data like Exchange, SharePoint and Lync SQL databases and customer-defined workload/storage. However, in order to achieve appropriate isolation between the VM guest data store and application-specific data, the available physical disks must be grouped appropriately as VDs. Section 4.1 provides detailed storage architecture for this solution.

2.2.2 Overview of Network Architecture and Configuration

The Dell PowerEdge VRTX chassis offers two options for the network fabric: a pass-through module and an Ethernet switch module. To build high availability, the host ports are mapped to redundant Dell Networking 1GbE top-of-the-rack switches to support management, Live Migration and cluster interconnects traffic. The traffic types are logically separated using VLANs and QoS settings. The two switches are lagged together through an inter-switch-link (ISL), which provides a 20-Gb bandwidth between the two switches. The solution provides four 1-Gb uplinks from each switch to link into an existing core network infrastructure.

Each Dell PowerEdge M620 server is configured with a Broadcom BCM57810 blade network daughter card (NDC), providing two 1GbE ports (as the Network Fabric A bandwidth supports only a 1-Gb network). There is another PCIe Network Broadcom BCM 5720 Dual Port adapter configured to provide additional bandwidth and high availability for the Hyper-V cluster. All the four network ports (two ports from the network pass-through switch and two from the PCIe adapter) are connected to the redundant Dell Networking switches placed outside of the PowerEdge VRTX enclosure, as shown in Figure 4.

Figure 4 Logical Network Architecture for PowerEdge VRTX



On the Microsoft Hyper-V host a converged network design using Microsoft NIC teaming is used to provide network connectivity to the application VMs, as shown in Figure 4.

For more details on the configuration of this converged network design, please refer the Remote Office Infrastructure Reference Architecture on Dell PowerEdge VRTX using Microsoft Hyper-V 2012.

2.3 Overview of the Dell PowerVault DL4000

The Dell™ PowerVault™ DL4000 is designed to help safeguard the physical and virtual servers that power your business, whether they are in your home or branch office, server room, or private cloud. Powered by Dell™ AppAssure™ software, the PowerVault DL4000 is a fully configured 1U backup appliance that integrates 5.5 TB (expandable up to 35.5 TB) of storage capacity with snapshot, replication, deduplication and compression software to quickly recover applications and data.

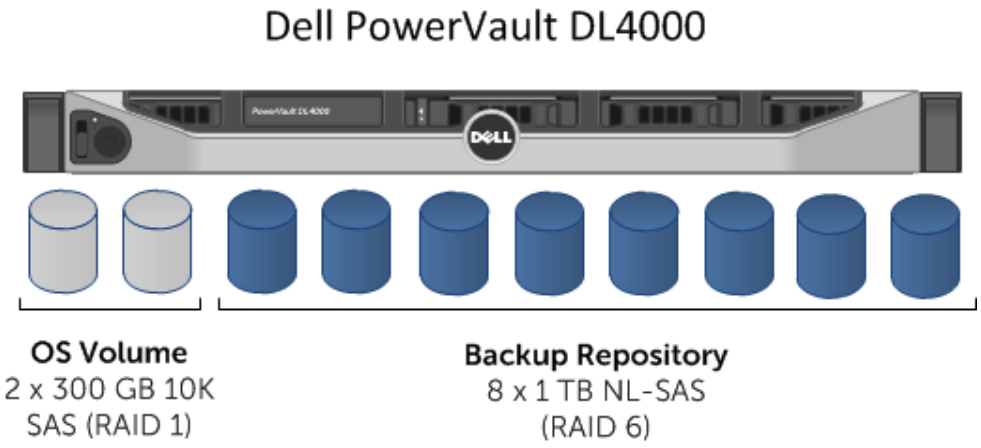
The Dell™ PowerVault™ DL4000 includes the following hardware and software:

- Dell PowerVault DL4000 1U system
- Dell PowerEdge RAID Controllers (PERC)
- Optional Dell PowerVault MD1200 storage enclosure
- Preinstalled operating system and Dell™ OpenManage™ system and storage management software
- Dell AppAssure 5 software

PowerVault DL4000 is available in Standard and High-Capacity editions that scale up to 80 TB in backup storage capacity with higher processing, memory and networking power. See the Dell PowerVault DL4000 Owner's Manual at dell.com/support/manuals for details about each configuration.

As shown in Figure 5, the appliance operating system resides on a RAID 1 (mirrored) virtual disk from the first two disks and the AppAssure backup repository resides on a RAID 6 auto-provisioned virtual disk separate from the rest of the higher capacity drives.

Figure 5 Dell PowerVault DL4000 Overview



As mentioned earlier, the PowerVault DL4000 appliance offers capacity expansion up to 80 TB with the PowerVault MD1200 storage enclosure attached to the DL4000 system externally.

For more information on PowerVault DL4000 expansion configurations, see the PowerVault DL4000 Appliance Deployment Guide.

2.3.1 AppAssure 5.0 Feature Overview

PowerVault DL4000 is preinstalled and configured to run AppAssure 5.0 backup and recovery software. AppAssure 5.0 sets a new standard for unified data protection by combining backup, replication and recovery in a single solution that is engineered to be the fastest and most reliable backup for protecting virtual machines (VMs) and physical machines.

AppAssure 5.0 combines backup and replication into one integrated and unified data protection product that also provides application awareness to ensure reliable application data recovery from your backups. AppAssure 5 is built on the new, patent-pending True Scale™ architecture, which delivers fast backup performance with aggressive, near-zero recovery time objectives (RTOs) and recovery point objectives (RPOs).

AppAssure 5 combines several unique, innovative and breakthrough technologies:

- **Live Recovery:** Instant recovery technology provides near-continuous access to data volumes on virtual or physical servers.
- **Recovery Assure:** Provides recoverability of applications (file systems, Microsoft Exchange/SQL) and backups in virtual and physical environments and features a comprehensive integrity-checking algorithm that identifies data corruption early and prevents corrupted data blocks from being maintained or transferred during the backup process.
- **Universal Recovery:** Provides unlimited machine restoration flexibility—physical-to-virtual (P2V), virtual-to-virtual (V2V), virtual-to-physical (V2P), physical-to-physical (P2P)—and carries out bare metal restores to dissimilar hardware.
- **True Global Deduplication:** Dramatically reduces physical disk capacity requirements via inline block-level compression and deduplication along with incremental block-level backups forever.

Dell offers additional software that can provide individual object-level granular recovery for Exchange and SharePoint. The Dell MailRetriever and Dell Recovery Manager for Exchange can be used for granular recovery of individual e-mails. Similarly the Dell DocRetriever and Dell Recovery Manager for SharePoint can be used for individual item recovery.

The DL4000 is licensed to have up to two local continuous VM exports using which you can export up to two machines to the Hyper-V server resident on the DL4000 for a very quick RTO. For instance if the exchange service is compromised due to software or hardware failure, and if its VM is configured to export continuously, it can be started on the Hyper-V server on the DL4000 in seconds.

2.4 Overview of Exchange, Lync and SharePoint 2013

Combining Microsoft Exchange, Lync and SharePoint 2013 collocates all essential productivity solutions within Dell PowerEdge VRTX. This simplifies management of the solution while leveraging the benefits of virtualization and shared infrastructure. With the 2013 suite of Microsoft UC&C enterprise applications, there are more application integration opportunities than with earlier versions. This reference architecture leverages these integration points to provide a better collaborative platform to the end users.

- Microsoft Exchange Server is a popular solution for enterprise email.
- Microsoft Lync Server is for real-time communication, such as instant messaging and presence, audio/video conferencing and web conferencing.
- Microsoft SharePoint Server provides a web-based engine and a platform for deploying a wide range of business services, including collaborative sites, content management systems, publishing intranets, business intelligence systems and web portals.

Further details on these workloads can be found in the following sections.

2.4.1 Microsoft Exchange Server 2013

Exchange Server 2013, the leading enterprise messaging system, comprises multiple Exchange server roles. In Exchange Server 2013, the number of server roles has been reduced to two: the Client Access server and the Mailbox server, instead of the five server roles that were present in Exchange 2010 and Exchange 2007. The server roles in an Exchange Server 2013 deployment are described below:

- **Mailbox Server Role**: This is the back-end server that hosts mailboxes, mailbox databases and public folders. The Mailbox server role also includes the transport service and Unified Messaging components. To achieve application high availability, multiple Mailbox server roles can be clustered using the Database Availability Group (DAG) functionality. The Mailbox server handles all activity for the active mailboxes on that server.
- **Client Access Sever (CAS) Role**: This server role supports messaging clients, such as Outlook, mobile cellular devices and Exchange Web Services. The Client Access server in Exchange Server 2013 functions as a front end, accepting all client requests, authenticating and routing/proxying the request to the Mailbox server that houses the currently active copy of the database hosting the user's mailbox. The Client Access server provides client authentication and manages client connections through redirection and proxy functionality. It also provides network security functionality, such as Secure Sockets Layer (SSL).

Microsoft recommends consolidating multiple server roles as application-level entities on a single physical or virtual server. A configuration consisting of multiple server roles—for example Mailbox and Client Access server roles that are collocated on a single server—is referred to as Exchange Multi-role server configuration and is used in the example implementation in this guide.

This guide concentrates primarily on the collocation of Mailbox and Client Access server roles. The Unified Messaging component and Exchange clients corresponding to mobile cellular devices are not verified as a part of this guide.

2.4.2 Microsoft Lync Server 2013

Lync Server 2013 software enables instant messaging and presence, audio and video conferencing, web conferencing, and telephony or enterprise voice. Lync Server 2013 has new features and functionality, such as an enhanced conferencing experience and richer presence information. It also has architectural or topology changes to support new capabilities. Below are the new and existing server roles of Lync Server 2013:

- **Standard Edition Server:** The Standard Edition server delivers the features of Lync Server 2013 using integrated databases on a single server. This configuration enables an organization to have Lync Server 2013 infrastructure at a low cost and in a form that can be deployed with a backup registrar to provide limited high availability features. This handles all Lync workloads, including client authentication, instant messaging, user presence updates, web conferencing, audio-video conferencing and Enterprise Voice, all running on one server. For a highly available solution, use Lync Server Enterprise Edition.

- **Front End Server:** In Lync Server Enterprise Edition, the Front End Server is the core server role, and runs many basic Lync Server functions. The Front End Server, along with the Back End Servers, are the only server roles required to be in any Lync Server Enterprise Edition deployment. The Front End Server role handles Lync client authentication, instant messaging, web conferencing, audio-video conferencing and user presence updates. It is the central component of a Lync Server topology. The Front End Server has a local database that stores user data and topology information. In Lync Server 2013, the Archiving and Monitoring role is combined with the Front End role. The Archiving and Monitoring component of the Front End role can be used to monitor user statistics and quality of experience (QoE) within the Lync environment, for archiving conference content and instant messages for future audits. This component also allows IT administrators to access call detail records and quality of experience (QoE) statistics for Lync communication. Organizations can also deploy separate Archiving and Monitoring roles, or use the new unified archiving features in Exchange Server 2013, as per their requirements.
- **Back End Server:** Microsoft® SQL Server® serves as the back end for Enterprise Edition servers and is also responsible for Archiving and Monitoring roles and Persistent Chat roles. SQL Server maintains a copy of the topology information, user contact lists, archiving/monitoring databases and logs, and other data. Lync Server 2013 supports SQL mirroring with primary and secondary copies. High availability for SQL databases can be provided via two SQL Servers servicing SQL mirrors.
- **Mediation Server:** This Lync role provides Enterprise Voice capabilities and handles the communication between Lync front ends and media gateways or session border controllers (SBCs). This role can be collocated with the front end. The Mediation Server facilitates traffic encryption/decryption and transcoding. Traffic encryption and decryption is made possible by the use of TLS (Transport Layer Security) instead of traditional TCP. This is more secure than transmitting clear traffic over the wire. Transcoding refers to the process of converting media streams between different audio codecs. Transcoding becomes necessary if the telephony codec used is not G.711, i.e. the codec used by Lync.
- **Director Server:** This is an optional role in Lync Server 2013. The Director role provides resiliency and redirection to users' requests to their home pools, which can be either a Standard Edition server or an Enterprise Edition Front End pool. A Director protects Front End servers from denial-of-service attacks and cannot be collocated with any other server role.
- **Persistent Chat Server:** This is a new and separate role in Lync Server 2013 that provides features similar to group chat in earlier versions of Lync. Persistent chat allows users to participate in multiparty and topic-based chat. Chats can be categorized by topic in a chat room and are not transient like unarchived instant message conversations or audio/video/web conferences.
- **Edge Server:** This role in Lync 2013 is responsible for handling all communications that are made available to external and federated users except anything related to HTTP/HTTPS. All other traffic, such as SIP or RTP, is routed to the external users using the Edge Server.

This guide uses the Lync Standard Edition Server and does not consider Mediation Server and Enterprise Voice roles. This functionality can be added by using Session Initiation Protocol (SIP) Trunks, PBXs or voice gateways to communicate with users on the telephony network (PSTN). Dell Global Infrastructure Consulting Services can assist with this functionality and its appropriate sizing.

2.4.3 Microsoft SharePoint Server 2013

For best practices, SharePoint Server 2013 is designed with a three-tier architecture, as follows:

- **Front End Servers:** SharePoint Server is installed on these servers to provide end-user access through a hardware or software network load balancer.
- **Application Servers:** SharePoint Server is installed on these servers; additional SharePoint application services, such as search indexing, are configured.
- **Database Servers:** A highly available Microsoft SQL Server is installed on these servers to provide storage for the SharePoint application. This design utilizes mirroring to provide high-availability; therefore, an additional SQL witness server is needed.

Unlike Exchange and Lync Server, SharePoint Server does not have roles that can be installed separately during deployment. Instead, for Front End servers and Application servers, the SharePoint server application itself is installed. The role of a SharePoint server changes depending on how it is configured to run SharePoint specific services. In a typical multi-tiered SharePoint farm, Front End servers are configured for client access and Application servers are configured differently to provide SharePoint application services, such as Search. The SharePoint database is a Microsoft SQL Server deployment that is connected to the Front End and Application Servers. The Front End access should have a network load-balanced path to the SharePoint users through either a hardware or software load balancer. The Application server has search services configured and runs the search crawl.

This guide focuses on the recommendations and reference implementation for the SharePoint collaboration workload only and collocates the Front End and Application server roles in the same virtual machine. There is no load balancer in this sample reference implementation.

3 Exchange, Lync and SharePoint on Dell PowerEdge VRTX

To design a robust solution, we considered design principles for each individual application and every layer of the infrastructure. The details of these design principles are presented below and are followed by their impact to Microsoft Exchange, Lync and SharePoint servers.

3.1 Key Design Considerations

While the Hyper-V reference architecture for PowerEdge VRTX is built on a number of key design principles, such as infrastructure high availability, virtualization and networking best practices. Additional principles must be considered for the deployment and configuration of Exchange, Lync and SharePoint Servers on Dell PowerEdge VRTX. These additional design principles drive every aspect of this combined application design on PowerEdge VRTX:

- High availability
- Application best practices and performance
- Hardware abstraction
- Resource consolidation
- Application data protection

Solution high availability is critical to ensure minimal business downtime. Installing the application correctly and ensuring that the application's performance remains above appropriate thresholds is necessary for the business to function properly.

One of the goals of this virtualized infrastructure is to abstract hardware requirements from the applications that run on that hardware. This hardware abstraction reduces administrative complexity, but it must be done while ensuring that the high availability and application performance principles are not compromised.

3.1.1 High Availability

High availability is a design principle that must be considered for solution availability. PowerEdge VRTX makes architecting such a solution easier. As mentioned in Section 1.1 under Scope, our sample implementation is office environment and our assumption is these customers have different requirements. The high availability in this document is concerned with two layers as presented below:

- Infrastructure availability is provided by PowerEdge VRTX to ensure that when a hardware component fails there is another server, network path, storage drive, etc. to provide the same resource.
- Hypervisor availability brings application VMs back up on other hosts upon host hardware failure.

If a compute node in the infrastructure fails, the hypervisor availability automatically moves VMs to other available physical hosts to reduce the time that an application is in a failed state. While infrastructure and hypervisor availability ensure that the application's services won't get impacted, the shared storage in the PowerEdge VRTX and the RAID implementation ensure that the application data is highly available.

This reference implementation considers PowerEdge VRTX as a shared infrastructure with high availability built at the infrastructure components, including high availability for the virtual machines provided by the hypervisor. However, there is no application-level high availability implemented. For example, there are no multiple Lync Front End VMs, SharePoint Front End VMs, SQL mirroring or Exchange Database Availability Group implemented as part of the design.

3.1.2 Application Best Practices and Performance

While maintaining high availability is critical, applications must still ensure a good end-user experience. Following application best practices helps prevent performance bottlenecks. By validating and verifying performance under load generation, application performance can be determined. Several high-level concepts are dictated by the following best practices and performance recommendations. These high-level concepts are listed below:

- Do not use dynamic memory for memory-intensive applications, as specified by best practices for that application role.
- Maintain the virtual CPU to physical core ratio at one-to-one.
- Allow no coexistence of critical application services on the same host.
- Use dedicated hard drive spindles for certain applications' critical data, as specified by best practices. The use of fixed VHDX instead of pass-through disk mapping is recommended for optimal performance and ease of management for the applications that require external storage for data.

3.1.3 Hardware Abstraction

Abstracting specific hardware from the application services reduces complexity and ensures that the application is load balanced across the entire cluster. Applications can be decoupled from their underlying hardware as long as best practices from the infrastructure and application layer are maintained.

Using a virtual cluster with VM failover and performance load balancing provides this abstraction. VM failover allows the application VMs to be moved around from server to server within the cluster for maintenance or in the event of server failures. However, certain application VMs cannot coexist among themselves or with other application VMs for performance reasons. Rules can be created so that certain VMs do not coexist on the same physical server with other VMs.

3.1.4 Resource Consolidation

While running a solution that combines Exchange, Lync and SharePoint servers on the same infrastructure, resources can be consolidated to reduce the overall hardware needed. Some examples of resource consolidation are:

- Shared SQL servers can be used by applications to reduce resource requirements and the application footprint.
- A single virtualized cluster allows VMs to reside on the same shared storage array, reducing hardware resource costs.

- Sharing storage for application data also reduces costs as long as application best practices and performance requirements are met.

Apart from sharing the underlying infrastructure, the application features in the 2013 suite of Microsoft UC&C applications can be integrated to achieve better collaboration across the organization. This can also result in consolidation within the solution and reduce the resource requirements. The following section describes the benefits of application coexistence and integration within the solution architecture.

3.1.5 Application Data Protection

While infrastructure high availability ensure that the application services are available, it is equally important to enable mechanisms to protect the data these applications store. Each of the enterprise applications has specific backup and recovery mechanism and also a set of design considerations.

3.1.5.1 Application Aware Data Protection

The UC&C suite of applications have the native backup and recovery methods that use Volume Shadow Copy Service (VSS). Lync and SharePoint Server data is stored in SQL Server and therefore these applications benefit from the VSS backup methods. These native methods support application-aware backup and recovery. Application awareness is an important aspect when planning for data protection. This functionality ensures that the in-place recovery of the application data is available to the application administrators. Also, in-place recovery features provide faster recovery for both virtual machines and application data. With in-place recovery, there is no need to perform an entire backup set restoration.

3.1.5.2 Dedicated Backup Network Connections

It is recommended as a general practice to separate the backup network from the application workload network to ensure the backup network traffic doesn't impact application performance. However, the in-band management network, where there is no workload traffic, on each of the application VMs has the lowest network traffic during normal operation and is best suited for sharing the management network bandwidth with a backup network.

3.1.5.3 Network Connection Teaming and Switch Redundancy

To provide sufficient bandwidth for backup and recovery operations and to enable fault-tolerance for network connections, it is recommended that the network connections on the backup appliance are teamed and connected through redundant network switches.

3.2 Benefits of Application Coexistence and Integration

As mentioned earlier, Dell PowerEdge VRTX provides a shared virtualized infrastructure for deploying applications such as Exchange, Lync and SharePoint. The PowerEdge VRTX provides the shared virtualized infrastructure suitable for implementing these enterprise applications. Apart from sharing the underlying physical infrastructure, the PowerEdge VRTX shared infrastructure complements the application deployment by providing benefits at the infrastructure level. The 2013 suite of these applications can be integrated to provide a better end-user experience.

3.2.1 Benefits at the Infrastructure level

The Hyper-V Reference Architecture used to implement the UC&C solution in this guide is built with virtualization best practices. It provides an infrastructure that enables the key tenets of virtualization, such as Live Migration and hypervisor high availability. By abstracting specific hardware details, such as the physical host and the storage location, the application virtual machines can move from one host to another in a failover scenario, simplifying maintenance and administration. Infrastructure lifecycle management, such as firmware updates or memory increases, can be done seamlessly by moving application VMs to other hosts in the PowerEdge VRTX infrastructure. Doing so allows the administrators to perform maintenance tasks without disrupting the application. Specifying and configuring applications correctly helps IT achieve these benefits from PowerEdge VRTX while adhering to application best practices and ensuring a high-quality end-user experience.

Typically, these applications are run in silos, preventing a consolidated view of how these applications are performing. By deploying applications on a single infrastructure, administrators can quickly debug software, view performance metrics and manage the hardware for the applications. This benefit is exemplified by the Chassis Management Controller (CMC) console, where an administrator can manage the compute, storage and networking fabric used by the applications. In a traditional deployment, the management of these infrastructure elements would be spread across multiple consoles, making it difficult for the administrators. In addition to the infrastructure-level benefits from application coexistence, Lync and SharePoint databases can be collocated to reduce resource requirements. The following section details the application level integration benefits in the UC&C applications.

3.2.2 Benefits at the Application Level

The 2013 suite of UC&C applications offer several integration points between the three applications therefore allowing an administrator to eliminate the need for deploying separate VMs for any common application functionality. For example, the Office Web Applications deployment can be shared across all the three applications. The following section lists the features that can be used for application integration to build a complete UC&C solution.

- **User Presence:** User presence information in Lync includes end-user availability status, location, out-of-office notes and a color-coded presence indicator. When SharePoint, Lync and Exchange are integrated through common directory services, the user presence information provided by Lync becomes available in client applications, such as Outlook and SharePoint web pages.
- **eDiscovery:** eDiscovery enables the process of finding, storing, analyzing and producing content in electronic formats as required by legal procedures. With the 2013 applications, eDiscovery can be performed across Lync, SharePoint, Exchange and file shares from a single location.
- **Site Mailboxes:** Site Mailboxes are available with the integration of SharePoint and Exchange 2013. This feature provides users with team email on a SharePoint site, allowing a single location for emails and documents. Site Mailboxes also provides links to SharePoint document libraries in Outlook 2013, enabling users to share files and email messages with other members of a team that are working on a joint project.
- **Exchange Storage for Lync Archival:** Instant messaging and web conferencing content can be archived in the users' mailboxes and, therefore, do not require a separate archival role and database to be configured in the Lync infrastructure.

- **Office Web Applications (WAC):** WAC provides users with an enhanced web conferencing experience when presenting Microsoft PowerPoint® content. This is a required role for Lync Server 2013 deployment. The features of WAC can be integrated with SharePoint and Exchange applications to provide an in-browser document viewing and editing experience for SharePoint users and Outlook Web Access for Exchange mailbox users.
- **Unified Messaging (UM):** UM enables users to use voice mail and other features, including Outlook Voice Access and Call Answering Rules. UM combines voice messaging and email messaging into one mailbox that can be accessed from many different devices. The UM component can be integrated with Lync to provide voice message capabilities from within the Lync IM interface.
- **Unified Contact Store:** Lync stores all the contact data in the user's Exchange 2013 mailbox. Lync employs Exchange Web Services instead of SIP requests to retrieve a user's contact list.
- **Search Integration:** This feature enables users with search capabilities to surface content from across the organization. Exchange, Lync and SharePoint 2013 benefit from FAST search engine integration. This component can be shared across SharePoint and Exchange applications. Lync users can benefit from SharePoint search capabilities through the Lync client to perform skill- and people-based searches.
- **High Resolution Photos in Exchange Store:** Users can upload a contact image up to 648x648 pixels to be stored in the user's mailbox. The image is available to multiple clients, including Lync 2013, Outlook 2013, Outlook 2013 Web App and Lync 2013 Web App.

Table 3 summarizes the application integration points described above and shows which applications benefit from each of the integration points.

Table 3 Integration Points in 2013 suite of UC&C applications

Component	Exchange	Lync	SharePoint
User Presence	X	X	X
eDiscovery	X	X	X
Site Mailboxes	X		X
Office Web Applications	X	X	X
Unified Messaging	X	X	
Unified Contact Store	X	X	
Search Integration	X	X	X
High Resolution Photos in Exchange Store	X	X	X

In this reference implementation, a subset of the above integration points and the impact of this application integration are considered while sizing the resource requirements for each application. Integration features such as Unified Messaging, Search Integration, High Resolution Photos in Exchange Store, eDiscovery and Site Mailboxes require a thorough investigation of the resource requirements. These integration features are not verified as a part of this reference implementation.

4 Solution Architecture

This section describes key configurations for the solution architecture. The solution architecture proposed in this guide for the three applications—Exchange, Lync and SharePoint 2013—incorporates application best practices while following the design principles detailed in the Exchange, Lync and SharePoint on Dell PowerEdge VRTX section of this guide.

Some common design goals for the three applications are:

- Providing infrastructure high availability for all the application VMs.
- Abstraction to decouple applications from the underlying hardware.
- Consolidation of resources to optimize the overall solution architecture and enable application integration.

The common design goals are implemented with the help of the Hyper-V reference architecture, virtualization design principles and hypervisor features. The reference implementation in this guide maps the design goals—both common and application-specific—to a set of specific hardware and software resources.

The design goals for each of the applications are:

- **Exchange:** Implementing a stand-alone Exchange reference solution for 500 mailboxes, each of 2 GB size and a message profile per user of 150 messages of 75 KB each sent and received per day.
- **SharePoint:** Implementation to support 500 concurrent users in a collaboration usage profile with an average farm response time of less than one second.
- **Lync:** A Lync Standard Edition Server deployment, with an Archiving and Monitoring role, for 500 users for providing audio-video, instant messaging and web conferencing capabilities.

Table 4 summarizes the physical host configuration used in this reference implementation.

Table 4 Physical Host Configuration

Compute Node	Processor	Memory	Internal Drives	Network Adapters
Dell PowerEdge M620	2 x Intel® Xeon® E5-2660v2 2.20 GHz	128-GB DDR3	2 x 300-GB 10K SAS	Broadcom 57810 Blade NDC

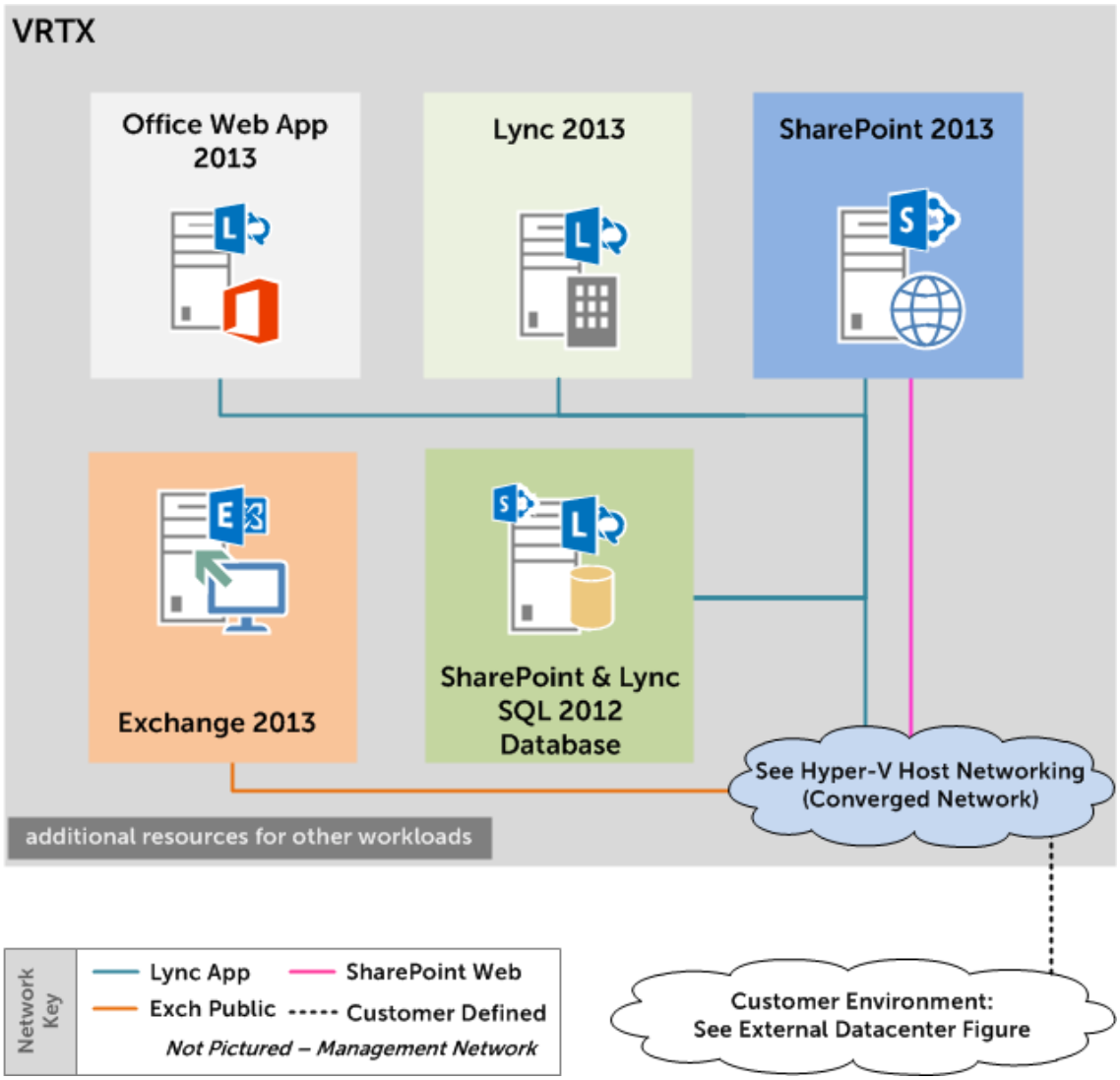
Table 5 summarizes the VM resource requirements for deploying the three applications on Dell PowerEdge VRTX infrastructure.

Table 5 Overview of VM Configuration

Application Role	Number of VMs	Total Virtual CPU	Total Memory (GB)	Networks
Exchange Multi-role Server	1	4	32	2 x Synthetic Network Adapters per VM
Lync Standard Edition with Archiving and Monitoring Role	1	4	32	2 x Synthetic Network Adapters per VM
Lync Office Web Application	1	2	8	2 x Synthetic Network Adapters per VM
SharePoint Web Front End	1	4	16	3 x Synthetic Network Adapters per VM
SQL For SharePoint and Lync Databases	1	4	32	2 x Synthetic Network Adapters per VM

Figure 6 provides a high-level logical view of the application architecture for the three applications. The SQL VM has two SQL instances deployed each for Lync and SharePoint application. Each VM in this solution runs Windows Server 2012 Data Center Edition and is configured with a fixed VHDX hard drive format as the operating system drive. The fixed VHDX format is recommended instead of pass-through disks for simplified management.

Figure 6 Application Architecture



The reference implementation in this guide relies on the hypervisor high availability features to provide the application VM failover. The application high availability features, such as Exchange Database Availability Group, and load balancing features, such as hardware load balancing or network load balancing, are not implemented. Please refer to Section 1.1 and Section 3.1.1 for our assumptions for the customer environment. In case of a Hyper-V host failure, using Hyper-V cluster high availability features, the VMs on that host will be restarted on another host. This results in service unavailability during the VM failover from the failed node to another.

4.1 Storage Architecture

In this reference implementation, 25 x 2.5-inch 1.2-TB 10K SAS drives are used for the internal shared storage provided by PowerEdge VRTX. These drives are used to create five virtual disks (VDs) for storing

application VM OS VHDX and the application data. Therefore, there are two components to storage in the application architecture presented in this guide. The first component is the Cluster Shared Volume (CSV) for APP-VM store, which is needed for Hyper-V high availability. By storing the VMs on this CSV, each PowerEdge M620 host can run the Exchange, Lync or SharePoint VMs. Four drives are used in a RAID 10 configuration to create two virtual disks (VD)—a 1-GB VD for Hyper-V Cluster Quorum and a second VD with remaining space for the APP-VM store CSV.

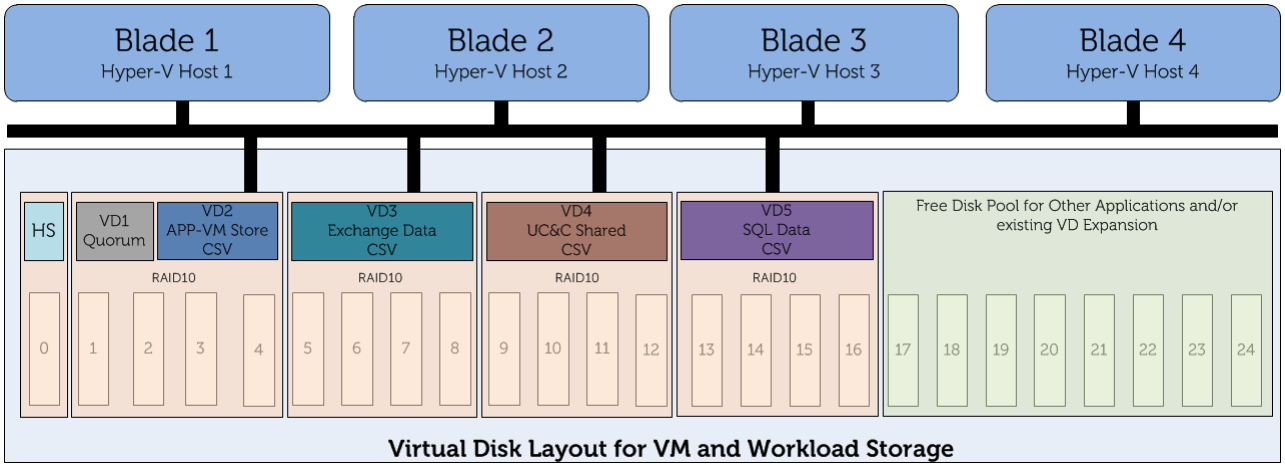
The second component contains the application storage. It is not recommended to combine the storage used for Exchange and SQL application data. Therefore, the data for these applications is stored across multiple virtual disks. Similarly, since a stand-alone Exchange multi-role server is implemented, it is a best practice to place the database files and its corresponding logs on different physical disks. Further details are shown in Table 6.

Table 6. Storage Configuration Overview

Configuration	Virtual Disk	Purpose
4 x 2.5-inch 1.2-TB 10K SAS drives in RAID 10	Virtual Disk 1	Hyper-V Cluster Quorum
	Virtual Disk 2 (APP-VM Store CSV)	VM VHDX store for infrastructure and application VMs
4 x 2.5-inch 1.2-TB 10K SAS drives in RAID 10	Virtual Disk 3 (Exchange Data CSV)	Storage for Exchange databases
4 x 2.5-inch 1.2-TB 10K SAS drives in RAID 10	Virtual Disk 4 (UC&C Shared CSV)	Storage for shared UC&C components, such as SharePoint Search index, Exchange Logs and Exchange recovery volume
4 x 2.5-inch 1.2-TB 10K SAS drives in RAID 10	Virtual Disk 4 (SQL Data CSV)	Storage for Lync and SharePoint SQL databases

Following the best practices for implementing application data storage in Windows Server 2012, CSV volumes are created on each storage array dedicated for application storage. As shown in Figure 7, a single CSV volume is used for VM operating system VHDX storage. Three CSV volumes are created for Exchange, SQL and UC&C shared data.

Figure 7 Storage Architecture Overview



This storage configuration ensures that there is no contention for I/O between the high I/O-intensive applications, such as Exchange and SQL. While ensuring the optimal performance from an I/O perspective, a free pool of eight drives ensures that this storage design enables future expansion of any of the CSV volumes and/or can support any future application data needs shown in Figure 7.

As mentioned earlier, to implement the application and hypervisor best practices, each application's data volumes are implemented as fixed VHDX files stored on the data CSV volumes, as described above.

Figure 8 VHDX Placement for Application Data Storage

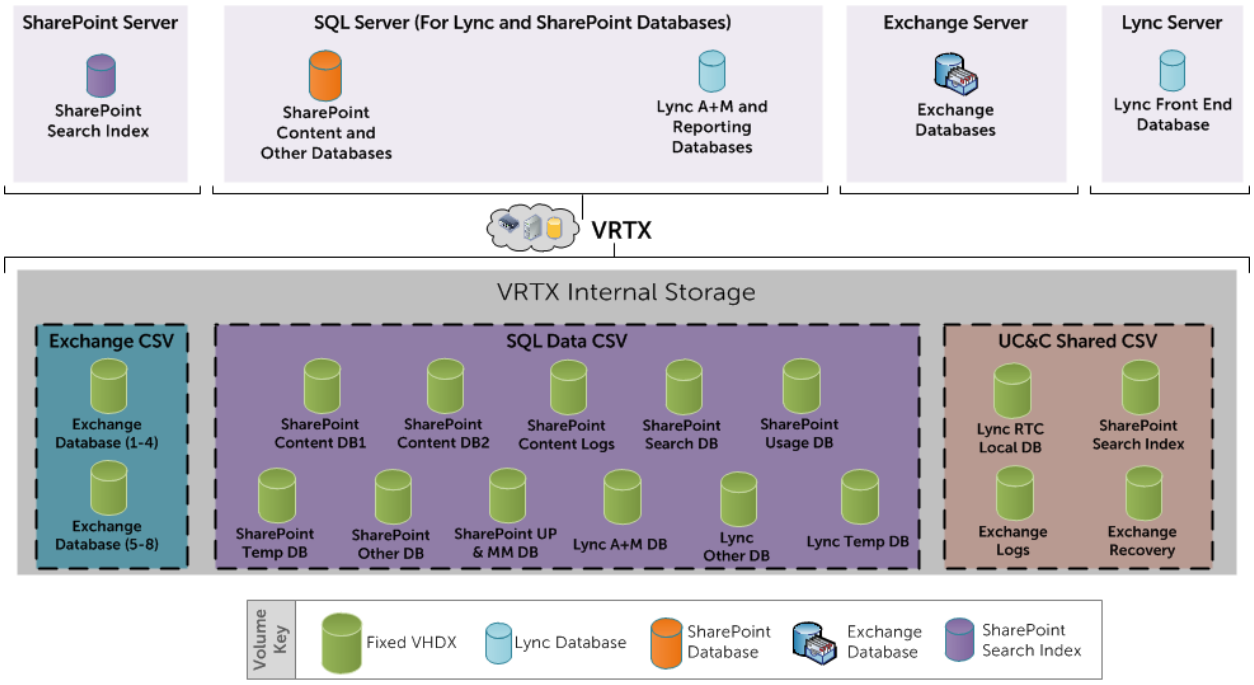


Figure 8 shows a high-level overview of how the application data CSV volumes created on the PowerEdge VRTX shared storage are used for storing the fixed VHDX files for various applications. For optimization and consolidation purposes, some of the databases can be stored on the same volume. In this reference implementation, fixed VHDX files are connected to the VMs as volumes. Table 7 provides a complete application data to VHDX mapping.

Table 7 Application Data to VHDX Mapping

Application	Application Data Purpose	VHDX Name	Connected To
Lync	Archiving and Monitoring Databases	Lync A+M DB	SQL Server
	Reporting Server Databases	Lync Other DB	
	Temp DB	Lync Temp DB	
	RTC Database	Lync RTC Local DB	Lync Front End Server
	RTCDYN Database		
	XDS Database		
	CPSDYN		
	LIS		
	RGSCONFIG		
	RGSDYN		
	RTCAB		
	RTCSHARED		
	RTCXDS		
	XDS		
	LYSS		
SharePoint	WSS_Content_DB1	SharePoint Content DB1	SQL Server
	WSS_Content_DB2	SharePoint Content DB2	
	Search Services Analytics Reporting Store DB	SharePoint Search DB	
	Search Crawl Store DB		
	Search Application DB		
	Search Link Store DB		

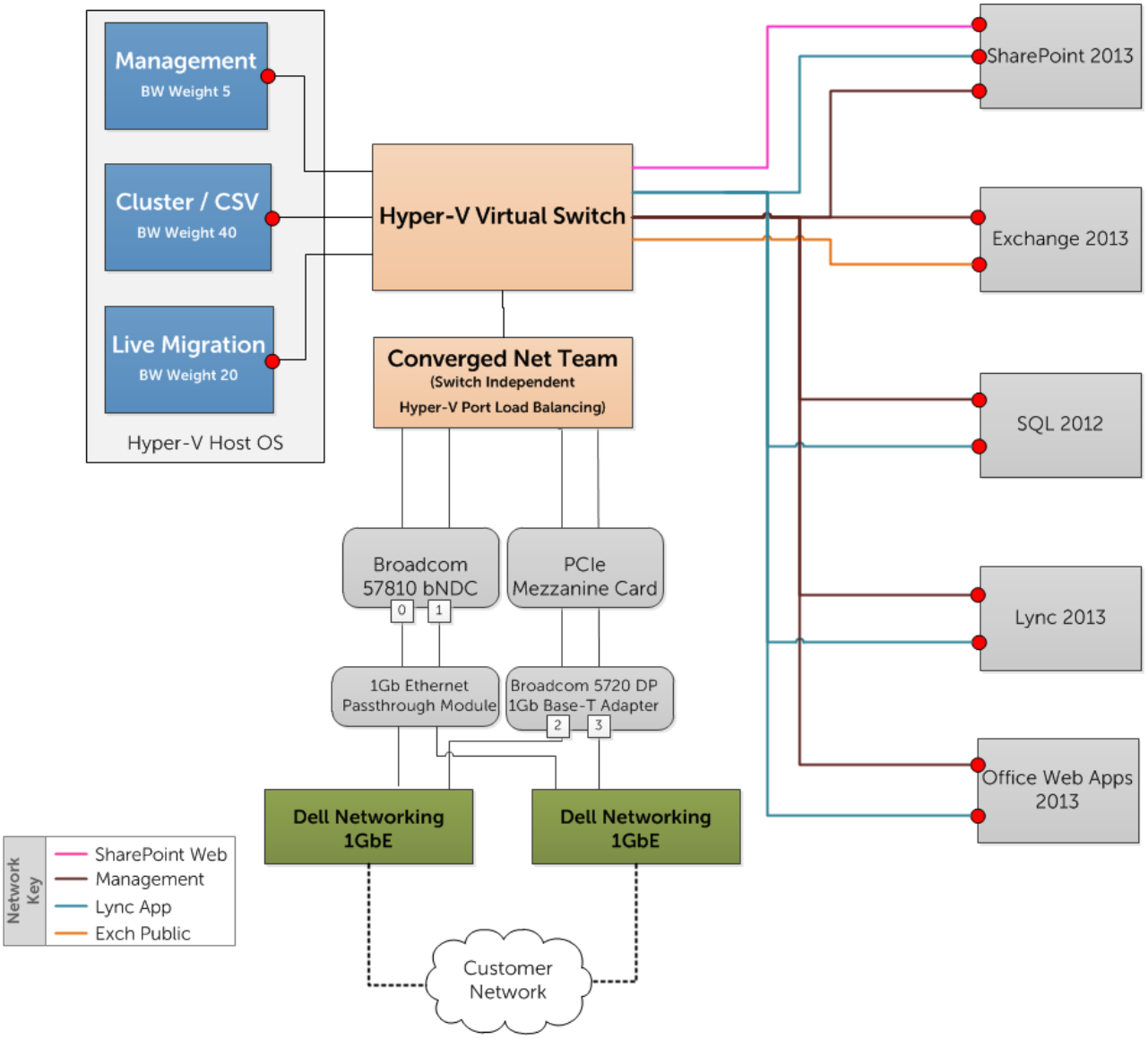
	SharePoint Configuration DB	SharePoint Other DB	
	SharePoint Admin Content DB		
	WSS Usage Application DB	SharePoint Usage DB	
	Temp DB	SharePoint DB	
	WSS Content Logs 1 and 2	SharePoint Content Logs	
	User Profile Database	SharePoint UP & MM Database	
	User Profile Synchronization Database		
	Social Tagging Database		
	Managed Meta Data Term Store		
	Search Index	SharePoint Search Index	SharePoint Front End Server
Exchange	Exchange Mailbox Databases 1 – 4	Exchange Database (1-4)	Exchange Server
	Exchange Mailbox Databases 5 - 8	Exchange Database (5 -8)	
	Exchange Logs	Exchange Logs	
	Exchange Recovery	Exchange Recovery	

4.2 Network Architecture

According to the application best practices and infrastructure design principles, each application network is deployed as a separate workload VLAN that is defined in the data center core network. The Dell PowerEdge M620 server in the PowerEdge VRTX infrastructure provides two 10GbE ports (NDC) labeled as Broadcom 57810 in Figure 9. Although the blade NDC are 10GbE network connections, the effective connection speed depends on the pass-through module in the PowerEdge VRTX chassis and the type of top-of-rack (ToR) switch used in the architecture.

To provide network high availability, the reference implementation in this guide used four Broadcom 5720 DP PCIe NICs within the PowerEdge VRTX chassis. These additional NICs are then mapped to the servers. This configuration provides a total of four network connections within the host operating system for network connectivity. As shown in Figure 9, a native network team is created using the four network connections and a converged virtual network switch is implemented for VM connectivity. All of the workload VLANs are created as virtual network adapters on the converged virtual switch across these four network connections.

Figure 9 Network Architecture for Workloads



The logical view of the application architecture shown in Figure 6 includes the application VLANs needed for the inter-application traffic. This includes the Exchange MAPI network for client connectivity, Lync App network and the SharePoint public network for client connectivity. The application VMs connect to these networks using the virtual network adapters connected to the converged virtual switch shown in Figure 9.

5 Protecting UC&C Applications with Dell PowerVault DL4000

As explained in the above sections, one of the design goals of this reference architecture is to provide uninterrupted Microsoft UC&C application services to the end user.

High availability of the physical hosts (PowerEdge M620 servers) within PowerEdge VRTX is achieved via Hyper-V cluster service configured to provide seamless application VM migrations across different physical hosts within the PowerEdge VRTX. The physical disk-level redundancy is gained by configuring RAID volumes across the physical hosts' internal hard disks, as well as across the PowerEdge VRTX shared storage, both of which are described in prior sections.

Additionally, in this reference implementation PowerVault DL4000 running AppAssure data protection software is deployed to protect the application data. AppAssure protects UC&C application VMs from corruptions at OS, application or data volume level.

5.1 AppAssure Application Aware Backup and Restore

Installing and configuring AppAssure agent on each of the three application VMs enables complete recoverability of the whole VM, which restores host operating system, system state, installed applications, application configurations and application data.

One of the prime features of AppAssure is application-aware backup and recovery of Exchange 2013 and SQL 2012. Application aware agents check the Exchange and SQL metadata to identify database and logs locations and tie those volumes together as a single Protection Group so that AppAssure can snap them simultaneously. The AppAssure agents installed on SharePoint 2013, Lync 2013 and WAC UC&C application VMs treat them as a generic VM-level backup without needing any specific application-level configurations.

In the event of operating system or application corruption, in-place rollback restores can be performed to bring the application VM back to a previous point-in-time state. Similarly for application-data-only corruption, a single volume or multiple volumes containing application data can be restored. An application-aware AppAssure agent for Exchange 2013 and SQL 2012 allows seamless in-place recovery without requiring manual shutdown of respective services.

In addition to UC&C application VMs running on PowerEdge VRTX, it is recommended to backup AD/DC/DNS servers to enable complete environmental recovery of this solution.

5.2 Backup Configuration Recommendations

Post AppAssure Agent installation on the application VMs, auto backup policy is defaulted to take snapshots at 60-minute intervals. However, depending on the application workload performance needs along with the RPOs of your business, the snapshot frequency can be adjusted for each protected application VM.

If the business requires retaining backup snapshots for longer periods of time, the retention periods can be changed. Global deduplication and continuous incremental block-level backup help to reduce overall disk space requirements for backup retentions. If needed, AppAssure backup repository expansion to PowerVault MD1200 storage shall be considered for additional backup storage space.

AppAssure can be configured to perform mountability checks on Exchange and SQL databases after every snapshot. This corruption detection feature alerts administrators of potential failures and ensures that all data on the Exchange and SQL servers will be recovered successfully in the event of a failure.

Following Exchange and SQL server settings can be enabled depending on your organization specific needs.

Exchange Settings:

- Automatic mountability check
- Nightly checksum check
- Nightly log truncation

SQL Settings:

- Nightly attachability check
- Nightly log truncation

To conduct SQL attachability checks, you will need a SQL CAL (Client Access License) on the DL4000.

If you are protecting your AD/DC/DNS server in addition to all application VMs using PowerVault DL4000, set "Maximum Concurrent Transfers" to at least one more than the number of hosts being backed up.

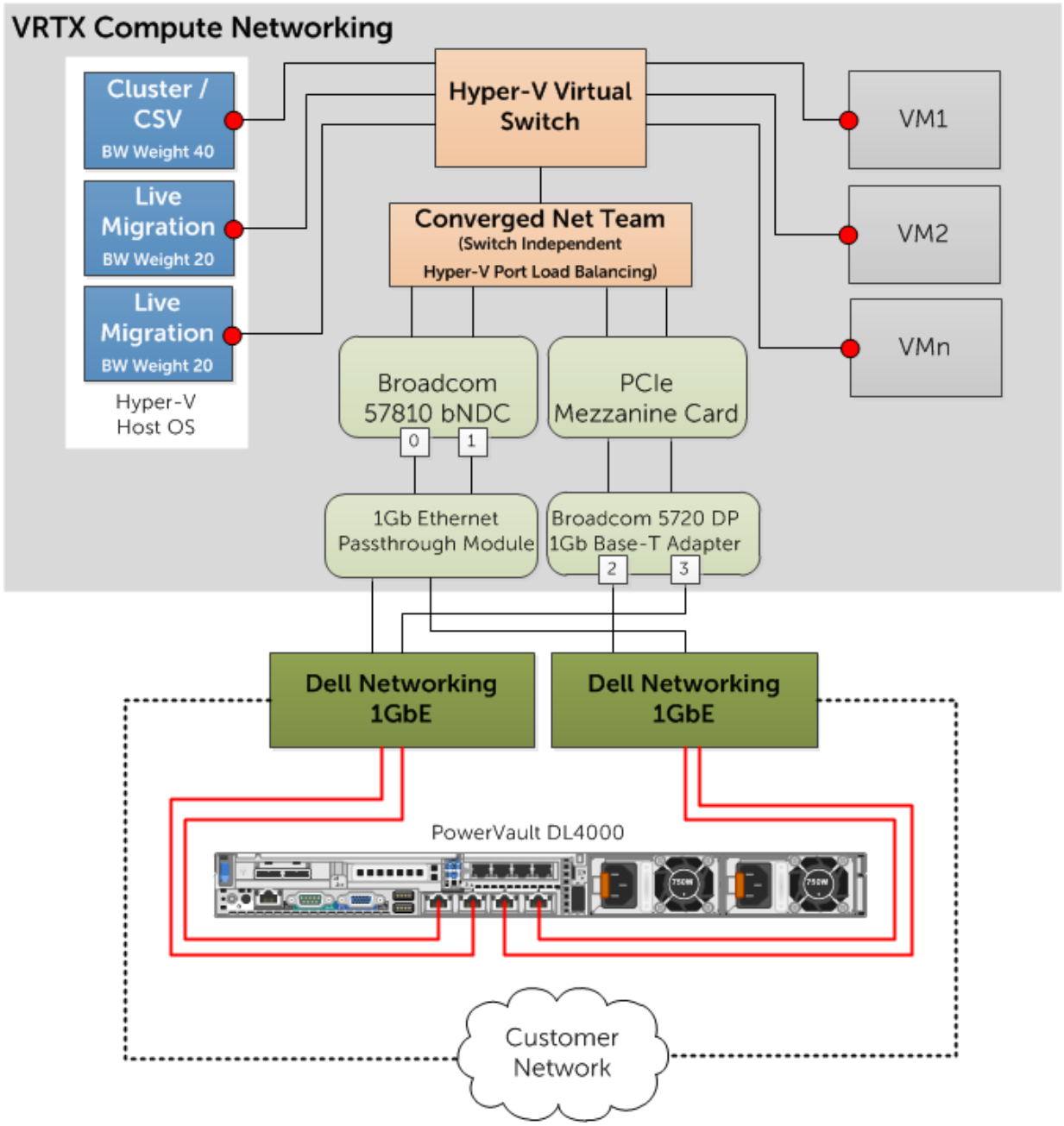
5.3 Backup Architecture with PowerVault DL4000

In this reference implementation, PowerVault DL4000 is architected to be a part of the overall solution architecture. Apart from application-aware backup and in-place recovery mechanisms, the design goals for application data protection include network isolation or separation of backup network, network teaming, and switch redundancy for failover and optimal backup performance of the appliance.

The PowerVault DL4000 has four 1GbE Broadcom ports, which are recommended to be teamed together using Broadcom Advanced Configuration Suite. This provides a much bigger network pipe for backup load, in addition to network interface redundancy. Additionally, the use of two Dell Networking switches provides redundancy for the backup network by connecting two of the PowerVault DL4000 LOM ports to each switch, as shown Figure 10.

Additional 4 x 1 GbE Intel add-on NIC ports on PowerVault DL4000 can be teamed together to handle replication or stand-by application traffic.

Figure 10 Backup Network Architecture with PowerVault DL4000

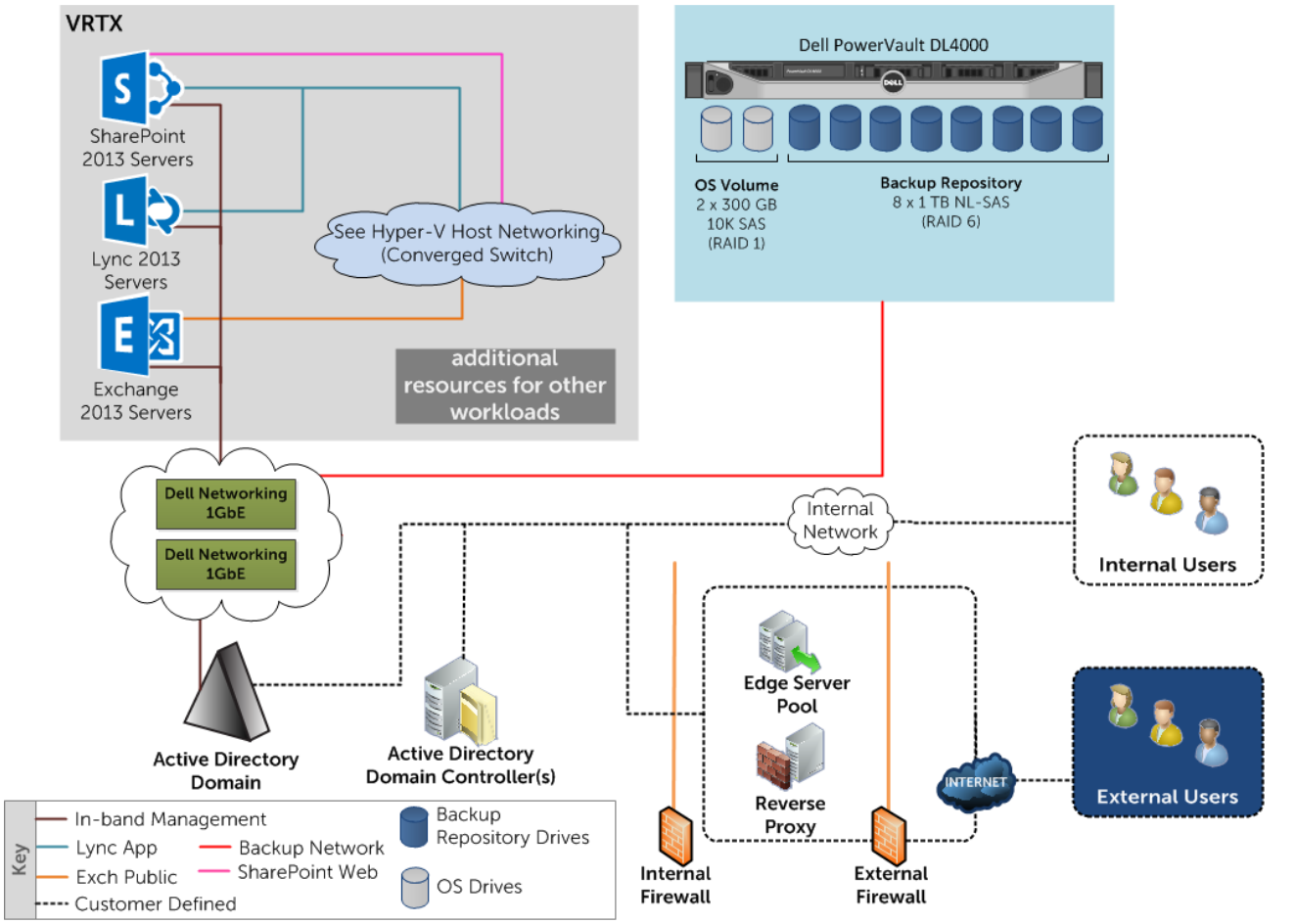


AppAssure has inbuilt data deduplication/compression, and its continuous incremental synthetic backup mechanism generates less backup traffic.

As shown in Figure 11, the PowerVault DL4000 network integrates with the external data center network while providing data protection services to the applications running on PowerEdge VRTX shared infrastructure. The PowerVault DL4000 connects on the Dell Networking switches and registers itself as a part of the PowerEdge VRTX application VM domain. The internal network routing policies are used to

route traffic between the PowerVault DL4000 backup appliance and the VM management network for the backup and recovery mechanism.

Figure 11 External Data Center Architecture



Implementation details of the domain controller, firewalls, edge servers and data center networking are outside the scope of this PowerEdge VRTX-based solution. Dell Services can help design a specific solution for each individual customer's environment.

6 Solution Specification

This section provides a complete list of components used as a part of the solution architecture.

Table 8 Solution Specification

Component	Details	
Virtualization Infrastructure	1 x Dell PowerEdge VRTX architecture 4 x Dell PowerEdge M620 servers 25 x 2.5-inch SAS HDDs Shared PowerEdge Raid Controller PERC 8 1GbE pass-through module	
Virtualization Hosts	4 x Dell PowerEdge M620 Servers	
	Processor	2 x Intel Xeon E5-2660v2 Family
	Memory	128 GB; 16 x 8GB DDR3 DIMMs
	HDD	2 x 300GB 10K SAS in RAID 1 for OS volume
	Network	Broadcom 57810 dual port NDC Broadcom 5720 dual port Add-on in PowerEdge VRTX assigned to M620
	OS	Windows Server 2012 Data Center Edition
Backup Appliance	1 x PowerVault DL4000 Standard Edition 2 x 300GB 10K SAS Drives in RAID 1 configuration for OS and Backup Application 8 x 1.2 TB NL-SAS Drives in RAID 10 configuration Backup Repository	
Networking	2 x Dell Networking 7048 for Local Area Networking (LAN)	
Exchange Multi-role Server	1 x Hyper-V Virtual Machines	
	Processor	4 x Virtual Processors
	Memory	32 GB
	Network	2 x Synthetic Network Adapters
	OS	Windows Server 2012 Data Center Edition
	Application	Exchange Server 2013 Standard Edition
Lync Standard Edition with Archiving and Monitoring Role	1 x Hyper-V Virtual Machines	
	Processor	4 x Virtual Processors
	Memory	32 GB
	Network	2 x Synthetic Network Adapters

Component	Details	
	OS	Windows Server 2012 Data Center Edition
	Application	Lync Server 2013 Standard Edition
Lync Office Web Application	1 x Hyper-V Virtual Machines	
	Processor	2 x Virtual Processors
	Memory	8 GB
	Network	2 x Synthetic Network Adapters
	OS	Windows Server 2012 Data Center Edition
	Application	Lync Server 2013 Standard Edition
SharePoint Web Front End	1 x Hyper-V Virtual Machines	
	Processor	4 x Virtual Processors
	Memory	16 GB
	Network	2 x Synthetic Network Adapters
	OS	Windows Server 2012 Data Center Edition
	Application	SharePoint Server 2013 Standard Edition
SQL For SharePoint and Lync Databases	1 x Hyper-V Virtual Machines	
	Processor	4 x Virtual Processors
	Memory	32 GB
	Network	2 x Synthetic Network Adapters
	OS	Windows Server 2012 Data Center Edition
	Application	SQL Server 2012 SP1 Enterprise Edition

7 Verification

Dell PowerEdge VRTX provides compute infrastructure that is shared and appropriate for running the UC&C applications. This reference architecture considered the right size for each application without compromising the infrastructure and application best practices described in Key Design Considerations. However, a solution architecture design must be verified to ensure that the design goals are met. As a part of the verification process, the infrastructure and applications need to be optimized to meet the expected performance and service levels. Verification involved infrastructure and performance verification of the overall architecture. Finally, this section is concluded by describing the backup and recovery verifications performed for the UC&C applications using the Dell PowerVault DL4000 backup appliance.

7.1 Infrastructure Verification

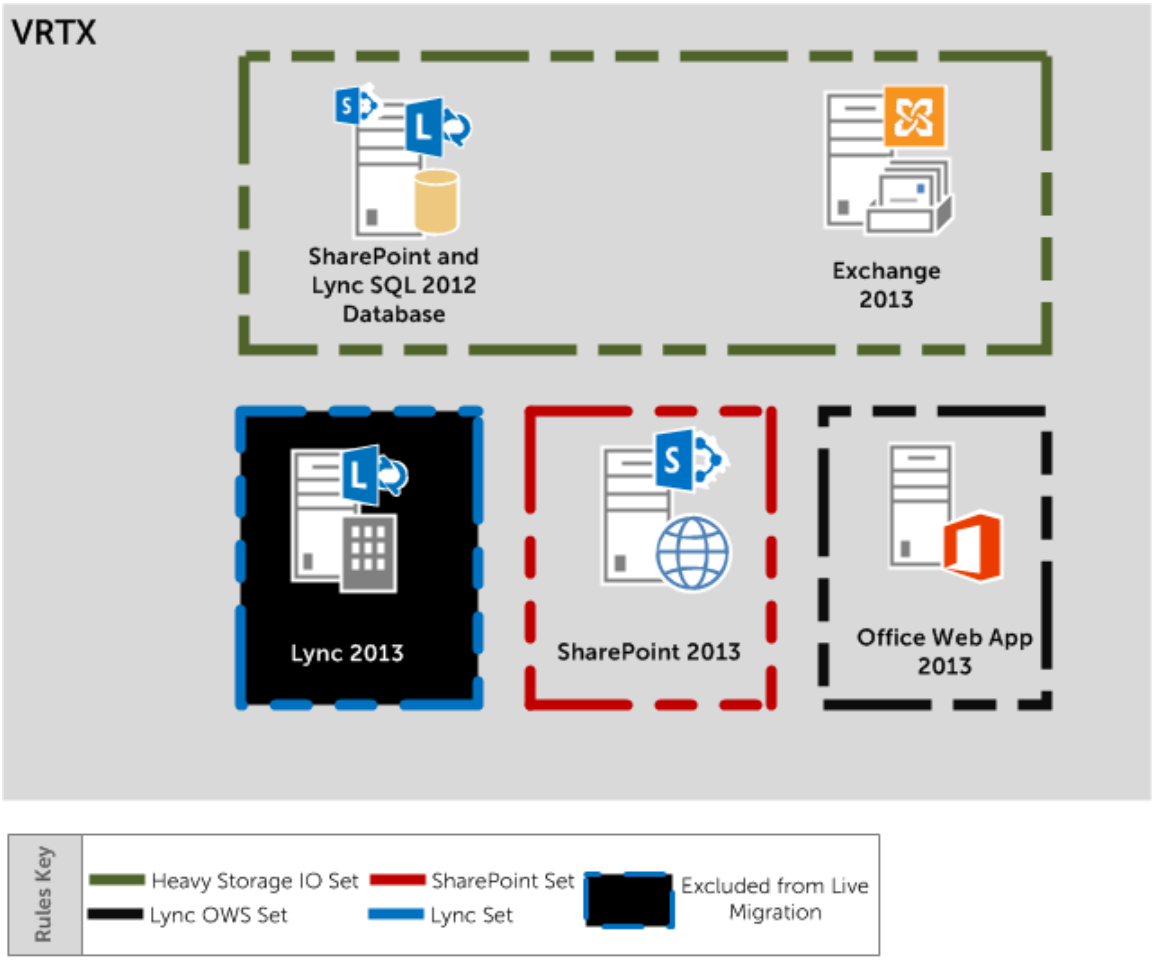
For the purpose of infrastructure verification, the failover capability of the virtualized infrastructure is verified. This includes both hypervisor host failure for unplanned downtime and the Live Migration of VMs from one host to another for planned downtime. The following sections detail the methodology followed in performing the verifications and record the observations from these verifications.

7.1.1 Application Recovery Verification

The Hyper-V failover clustering enables application recovery in case of hardware failure. By using failover features built into the Hyper-V cluster implementation along with SCVMM Dynamic Optimization (DO), the applications can be restored to their healthy state almost instantaneously. These features can be configured independently of the guest operating system and application running in the VM.

SCVMM DO enables automated resource load balancing and helps IT administrators offload the task of moving workloads within the cluster as the application's resource demand changes. One of the significant benefits of Live Migration is to enable the administrators to proactively prepare the environment for maintenance tasks by live migrating virtual machines to other available hosts. In the absence of DO, an IT administrator will need to know where to move specific VMs so that he does not violate the application best practices. By combining SCVMM DO with an availability set configuration, an administrator need not worry about specific VM placements in the cluster. Instead, he can migrate the VMs and let DO ensure that application best practices are not compromised. As a part of this solution, four availability sets are defined.

Figure 12 Availability Set Configuration



As shown in Figure 12, four availability sets are created within SCVMM. The "Heavy Storage IO Set" ensures that the VMs running SQL and Exchange applications are never placed on the same physical host. Based on this configuration, a minimum of two hosts are needed to run all three applications. Also, as shown in Figure 12 and based on Microsoft recommendations, Lync Server VM is excluded from SCVMM DO.

In the absence of SCVMM to manage the hypervisor cluster, the availability sets shown in Figure 12 can be implemented as Anti-Affinity Class names within the cluster and the same can be configured using PowerShell.

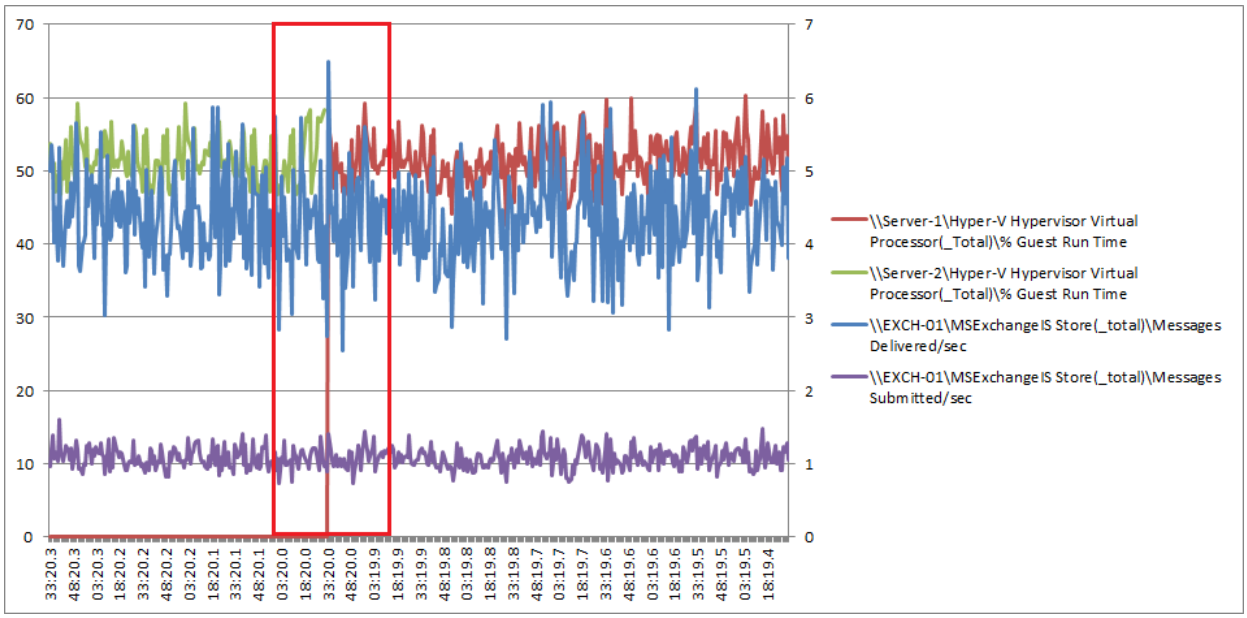
With the SCVMM availability set configuration, the VM host failure may be simulated by powering down two of the four physical hosts in a PowerEdge VRTX infrastructure. It is observed that the SQL and Exchange VMs are placed on different physical servers in the cluster to ensure the best practices for VM placement are followed.

The Dynamic Optimization feature ensures that no two anti-affined VMs are hosted on the same physical server. To verify the anti-affinity rules in DO, two anti-affined VMs—Exchange and SQL—are started on the same physical host. During a scheduled optimization, these VMs are moved to separate physical servers.

7.1.1.1 Exchange VM Live Migration

As a part of planned maintenance activity, an administrator can use features such as Live Migration to move the VMs between multiple physical hosts in the Hyper-V cluster. Live Migration causes no perceivable downtime for the application end users.

Figure 13 Exchange VM Live Migration During Load Verification

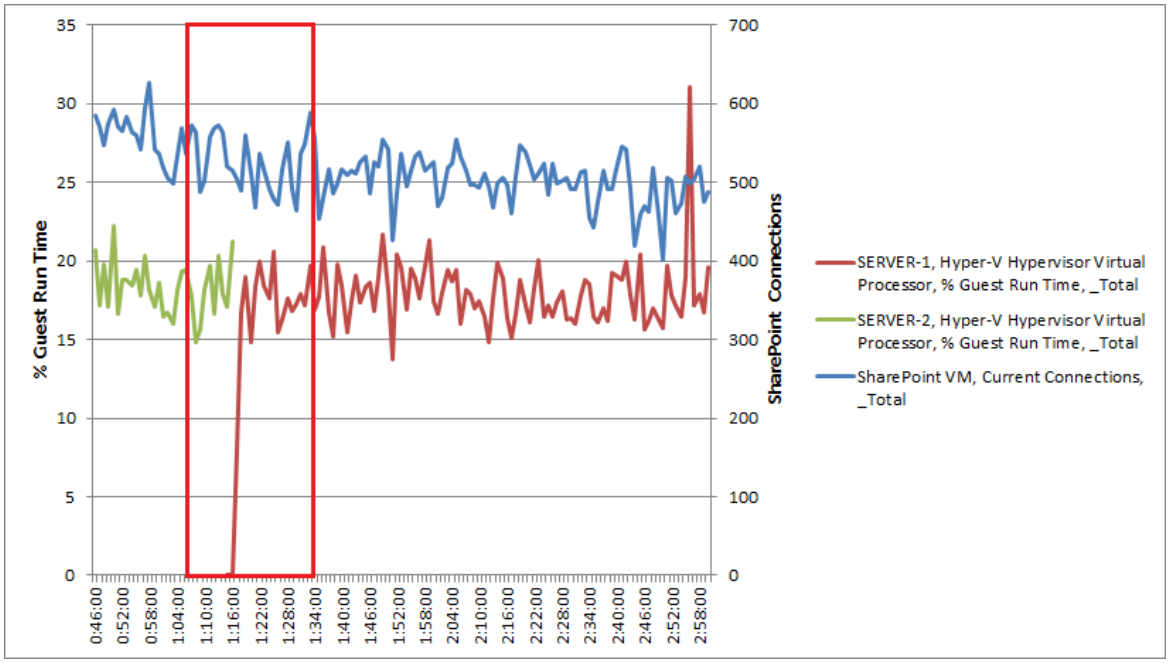


As shown in Figure 13, there is no interruption in the message flow while the Live Migration is in progress. The drop in processor utilization on Server-2 and the increase on Server-1 represent the transition of the Exchange VM from one physical host to another host.

7.1.1.2 SharePoint VM Live Migration

Similar to the way Exchange VM Live Migration is performed, SharePoint Front End VM and the SQL VM are live migrated—one at a time—while the SharePoint application is under peak verified user load.

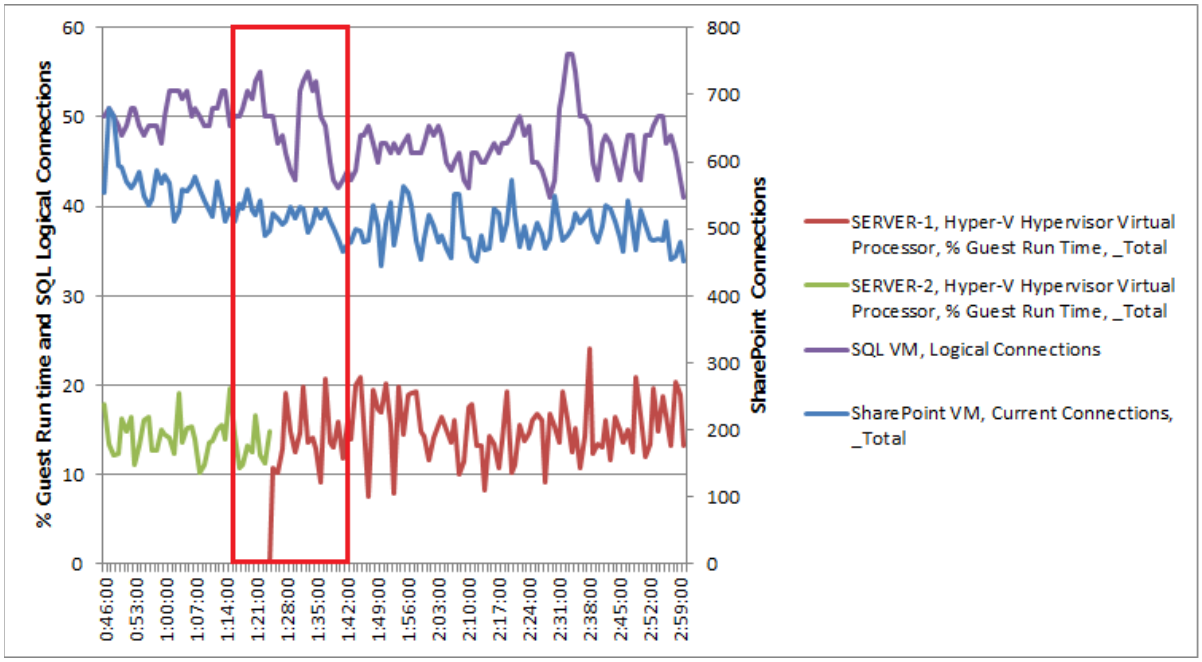
Figure 14 SharePoint VM End User Connections During Live Migration



As shown in Figure 14, there is no interruption in the connectivity to SharePoint application services while the VM is migrated to different physical host. As highlighted in the red rectangle, the transition of SharePoint Front End VM from one physical host to another is shown by a drop in the % Guest Run Time on Server-2 and an increase in the same metric on Server-1, while the end-user connections to the SharePoint VM remain the same.

A similar observation is made when the SQL VM running the instance for SharePoint content databases is live migrated from Server-2 to Server-1. Figure 15 shows connections to both the SQL database instance and the SharePoint end-user connections remain uninterrupted while the SQL VM moves from one physical server to another.

Figure 15 SQL and SharePoint Connections During Live Migration



It is evident from Figure 15 that the SQL VM live migration has no impact on the SharePoint application services. It is observed that the SQL VM with the resource allocation, as described in Table 5, takes approximately four minutes to migrate from one physical host to another during peak verified user load with no perceived impact to any of the application services.

For brevity, a portion of the data from load tests has been omitted from the charts shown in Figure 13, 14 and 15. Also, for demonstration purposes, only one VM per physical host is powered on during the Live Migration verification.

Apart from the Live Migration verification, the infrastructure failover capability is also verified. This includes failing the top-of-rack (TOR) switch to ensure that the application services are not interrupted. Through the network redundancy built into the solution architecture, it is observed that there is no application service interruption while one of the TOR switches becomes unavailable.

7.2 Load Generation Verification

For any solution architecture, after the deployment, it is essential to ensure that it performs as per the service and performance-level assumptions made during the design. The performance verification is used to understand whether the VM infrastructure is optimized and properly sized for running the desired workload. The load generation tools for the applications play a major role in performance verification. As a part of this reference implementation of UC&C applications for 500 users, load generation tools—such as Exchange 2013 Load Generator, Lync 2013 Stress and Performance Tool and Dell in-house developed SharePoint Load Generator—are used. The following sections describe the user profiles verified and the observations from these load generation runs.

7.2.1 Exchange Verification

The performance verification is broadly divided into two categories: verification of the storage subsystem performance and the end-to-end application performance verification. Microsoft recommends using standard performance verification tools JetStress and Load Generator to ensure that the theoretical sizing of the application components meets the performance requirements. Microsoft Exchange JetStress is used for verifying storage performance and the Microsoft Exchange 2013 Load Generator tool is used for verifying end-to-end Exchange application performance. Performance tools are configured such that they are isolated from the cluster of hosts running Exchange server roles; however, they interacted externally with the cluster.

7.2.1.1 Storage Verification Using JetStress

The verification storage subsystem performance is intended to ensure that the storage sized theoretically, for the Exchange databases, meets the performance expectations for the given number of mailbox users and the mailbox profile. Running the test with JetStress measures how well a storage system can perform and whether the storage subsystem meets the sizing requirements for a given Exchange mailbox profile. The JetStress Disk Subsystem Throughput test is performed in order to identify how well the storage performs at peak load while staying in the latency threshold established by Microsoft Exchange.

As mentioned earlier, this reference implementation uses the internal storage in the PowerEdge VRTX shared infrastructure for Exchange mailbox databases. As shown in Figure 7, four 1.2-TB 10K SAS drives in a RAID 10 configuration are used for the Exchange mailbox databases. Two 910-GB fixed VHDX files are used for storing Exchange databases 1 to 4 and 5 to 8, respectively. The JetStress test is run and the test results are collected from within the VM.

Table 9 Mailbox Profile for JetStress Test

Number of Mailboxes	Mailbox Size (GB)	Target IOPS	Storage	RAID Type	Number of Exchange Databases	VHDX Size	I/O Profile	Achieved IOPS
500	2 GB	~70	4 x 1.2-TB 10K SAS Drives	RAID 10	8 (4 DB per Fixed VHDX)	910 GB	150 messages a day	~370

The JetStress Mailbox Profile test verifies whether the storage system meets or exceeds the planned Exchange mailbox profile. The configuration shown in Table 9 is used to run the mailbox profile test with a planned target of 70 IOPS. The target IOPs is calculated based on the IO profile of 150 messages/day. Per Microsoft guidelines a profile of 150 message a day has an estimated IOPs per mailbox of 0.101 IOPs. It is recommended to add a 20% overhead to this value. Thus, the estimated per mailbox IOPs equates to 0.121, which for our target of 500 mailboxes comes out to 60 IOPs. We add an additional 10-15%

overhead on top of this and targeted 70 IOPs[2]. The achieved target is 370 IOPS. The results indicate that the storage is able to exceed the target transactional IOPS, staying well within the latency requirements.

7.2.1.2 End-to-End Performance Verification of Exchange

When verifying server and storage for Exchange Server 2013, a best practice is to simulate the worst case scenario under anticipated peak load. Based on a number of data sets, peak load is generally twice the average workload throughout the remainder of the work day. In order to determine whether the PowerEdge VRTX shared infrastructure can handle both normal as well as peak loads, the test plan consists of running Load Generator tests with only peak loads. To simulate peak load, the simulation day is set to four hours and test duration is set to eight hours. The Exchange Load Generator workload is configured to simulate Outlook 2007 Online with an Outlook-150 profile. This profile simulates sending and receiving 300 messages per mailbox per day during peak load verification. A single Load Generator instance is used to simulate the Exchange load. The performance results pertaining to the middle four hours of an eight-hour test are considered in the analysis. The processor and memory utilization has been measured from the Hyper-V hypervisor performance counters on the virtualization host where the Exchange VM is running. It is observed that the CPU utilization is approximately 50%, which is well below the set threshold of 70%. Memory utilization is observed at 60% during the peak load testing.

7.2.2 Lync Verification

The primary tool used for sizing the Lync Server is the Lync Server Stress and Performance Tool. This tool can simulate the following end-user features:

- **Instant messaging:** Communication between Lync clients using instant messages.
- **Presence:** Updates to the user status (Available, Busy, Away, etc.).
- **Audio, application sharing and IM conferencing:** Conversations involving multiple parties using audio, instant messaging, white boarding, polls and application sharing tools such as Microsoft PowerPoint or Excel.
- **Address book retrieval:** One of the servers running the Lync Server in the deployment runs the ABS service. Lync clients download address books from the ABS to complete user look-ups.
- **Distribution List Expansion (DLX):** Lync uses DLX to retrieve distribution list memberships that would consist of other Lync users.
- **Response groups:** Enables administrators to create and configure one or more small groups for the purpose of routing and queuing incoming calls.

Other user scenarios that can be verified using the Lync Stress and Performance Tool include Multiview, enhanced 9-1-1 and PSTN simulation.

[2] Sizing Exchange 2013 deployments

Although the Lync 2013 Stress and Performance tool is capable of simulating all the Lync user scenarios, this reference architecture considers and implements only instant messaging (IM), audio, video and web conferencing, data collaboration and application sharing.

Table 10 provides a high-level summary of the Lync user scenarios verified as a part of this reference implementation.

The Stress and Performance Tool is set up on multiple VMs to generate the load on the Lync server. For more detailed information on the Lync Stress and Performance Tool and its functionalities, see TechNet documentation for the Lync Server 2013 Stress and Performance Tool.

Table 10 Lync User Scenarios Verified

User Scenario	Load Level	User Range
Audio Conferencing – Large	Enabled	0 – 0
Audio Conferencing – AdHoc	Enabled	1 – 7
Audio Conferencing	High	8 – 18
Application Sharing – Large	Enabled	19 – 19
Application Sharing Ad-Hoc	Enabled	20 – 21
Application Sharing Sharer	High	22 – 24
Application Sharing Viewer	High	25 – 28
Data Collaboration – Large	Enabled	29 – 29
Data Collaboration – Ad Hoc	Enabled	30 – 32
Data Collaboration Conferencing	High	33 – 37
Instant Messaging – Large Conference	Enabled	38 – 38
Instant Messaging – Conferencing	Enabled	39 – 50
Instant Messaging – Peer-to-Peer	High	50 – 499

The overall utilization on the Lync VM is observed to be approximately 20% while the memory utilization is approximately 21%.

7.2.3 SharePoint Verification

As a part of performance verification for SharePoint 2013, an in-house developed load generation tool is used to verify the SharePoint collaboration profile for 500 concurrent users.

Table 11 SharePoint Collaboration Profile Test Mix

Action	Number of actions/hour/user
Read Site Home Page	6
Read Survey	2
Read Lists	2
Read Document Library	1
Read Wiki Page	1
Read Picture Library	1
Create Wiki Page	1
Upload Document	1
Search Site	3
Respond to Survey	1
Edit Wiki Page	1
Total tests/hour/connected user	20

Table 11 describes the test mix used in SharePoint performance verification. The SharePoint load generation tool is used to simulate 500 concurrent SharePoint users performing the activities described in Table 11. The intent of this performance verification is to understand the capacity and optimize the resource allocation of the SharePoint implementation.

The data set used to build the content database includes several different types of files, such as Microsoft Office documents, Adobe® PDF documents and different image formats. Table 12 shows a distribution of file content sizes used in this performance verification.

Two SharePoint content databases are created to store a single site collection per database. The aggregated content database size is approximately 500 GB. A full content crawl is performed once at the beginning of the load tests. There are no subsequent crawls after the load test or during the load test duration.

Table 12 Dataset used for SharePoint Load Generation

Average File size	Number of files
1 KB to 10 KB	224122
10 KB to 100 KB	47235
100 KB to 1 MB	138262
1 MB to 16 MB	31517
16 MB to 128 MB	617
Greater than 128 MB	12

It is observed that the resource allocation for the SharePoint and SQL virtual machines is appropriate to support a collaboration workload of 500 concurrent users.

Table 13 SharePoint Farm Performance

Maximum concurrent[3] user load validated	Requests per second[4] at Max concurrent user load	Avg. response time at the maximum validated user load
500	15	0.095 seconds

As shown in Table 13, the average response time at the peak verified concurrent user load is below one second. The processor utilization of SharePoint and SQL VMs during the peak user load verification is approximately 16% and 18%, respectively. This is well within the desired threshold limits of 60%. Although this utilization seems low, considering the additional utilization from search crawl, user profile synchronization and other SharePoint timer jobs that were not running during the load tests, the resource allocation for the SharePoint VM seems appropriate.

7.3 Data Protection Verification

Using the PowerVault DL4000 AppAssure appliance, all UC&C applications are protected against operating system, application or data volume level corruptions. To conduct backup and restore verifications of these applications, the Load Generator tools are leveraged to generate application data. The tools create application data for the sole purpose of load/stress testing; hence the application data has high potential of duplicate blocks. So the objective is not to measure the speed of backup/restore or claim deduplication ratios; rather it is to verify the backup and recovery of the application and its data sets.

7.3.1 Backup Verification

As part of the backup verification, the AppAssure core console is used to push install the AppAssure agent on each of the application VMs. On SharePoint 2013, Lync 2013 and WAC VMs, the agent treats them as a generic VM-level backup and does not need any specific application-level configurations. On Exchange 2013 and SQL 2012, the application-aware agent auto detects the application configurations. It then creates the Protection Groups, tying application database and log volumes together.

It is noted that the agent creates the first snapshot automatically soon after deployment, not needing any application interventions to perform backup. AppAssure performs a full backup for the first snapshot and then performs continuous incremental backups. Dell recommends to install the agent and take the first backup when you expect less application activity, possibly after business hours.

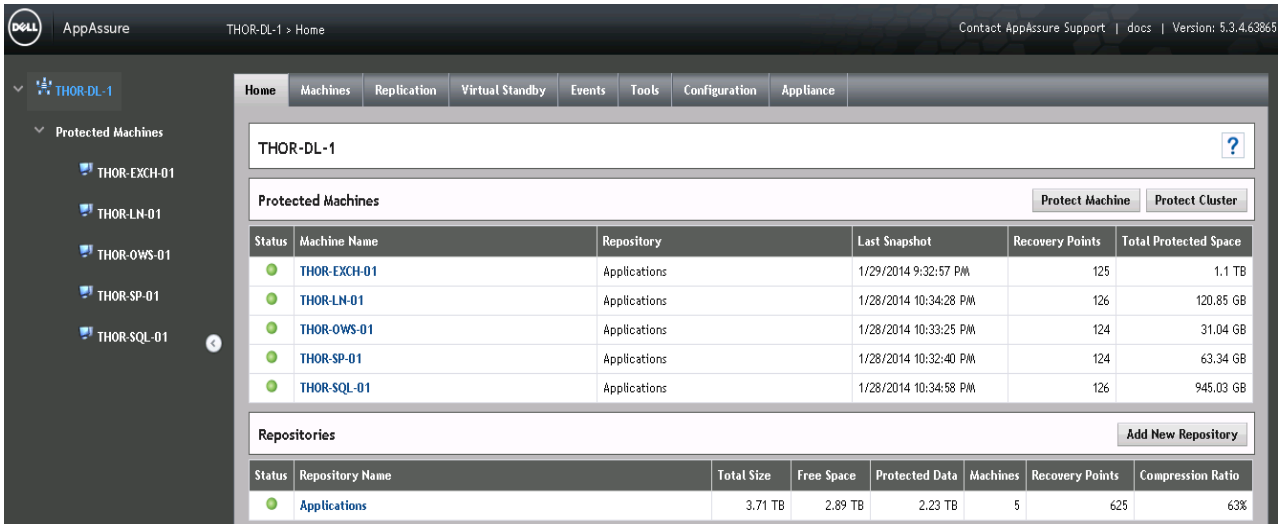
Figure 16 shows all UC&C Application VM hosts are protected by PowerVault DL4000 after successful agent installation followed by full backups. For each protected host it shows last snapshot time, total number of Recovery Points and Total Protected Disk/Volume Space.

[3] Concurrency refers to the number of simultaneous requests to the farm servers

[4] This number indicates the average. requests per second generated during the load test duration.

The Repository section shows achieved Compression Ratio across all the protected host backups.

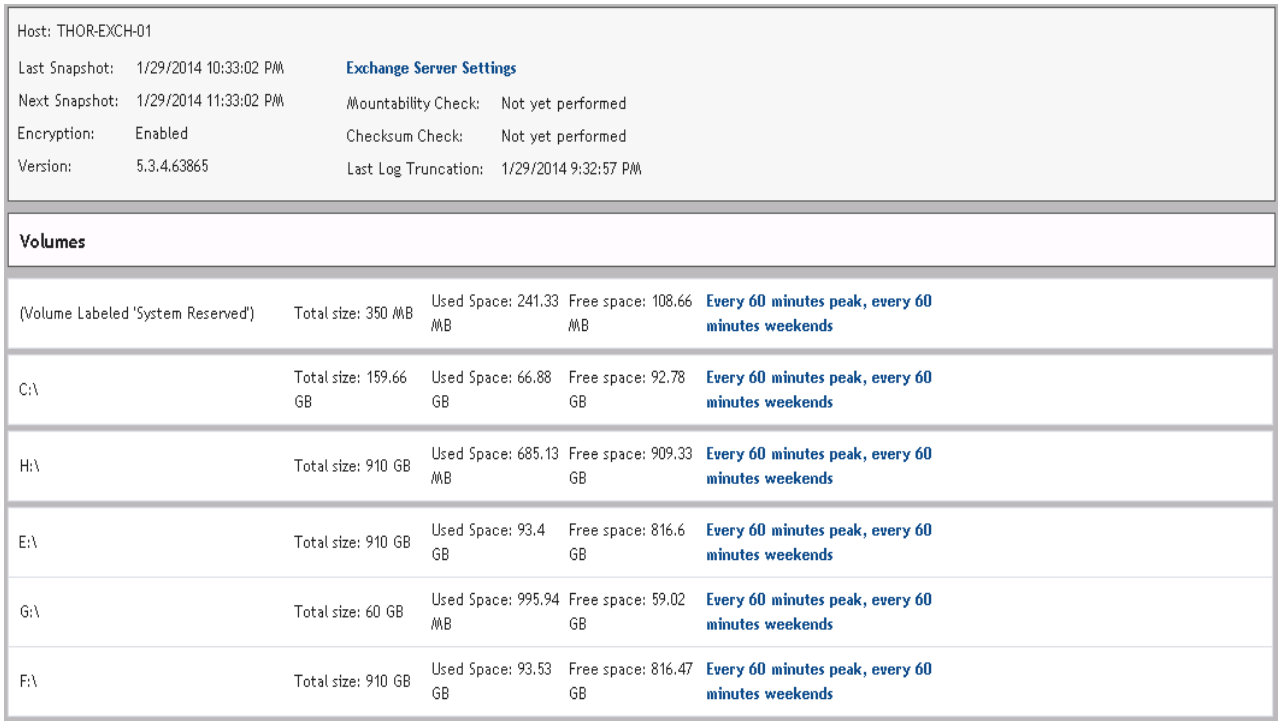
Figure 16 AppAssure Protecting UC&C Applications



The remaining sections covers backup configuration and restore verification for Exchange application. All other UC&C applications backup configurations are shown in AppAssure Backup Configurations section.

As shown in Figure 17 and Figure 18, the application-aware agent auto detects Exchange installation and configures the Protection Group of Exchange database and logs volumes along with operating system drive and system state. It also configures the Exchange server default snapshot policy interval to 60 minutes which can be changed per RPO (Recovery Point Objective) requirements. Additionally Exchange application-specific settings—such as the mountability check, checksum check and log truncation Exchange application—can be enabled via 'Exchange Server Settings' option.

Figure 17 Exchange Protection Group Settings



Host: THOR-EXCH-01

Last Snapshot: 1/29/2014 10:33:02 PM
Next Snapshot: 1/29/2014 11:33:02 PM
Encryption: Enabled
Version: 5.3.4.63865

Exchange Server Settings

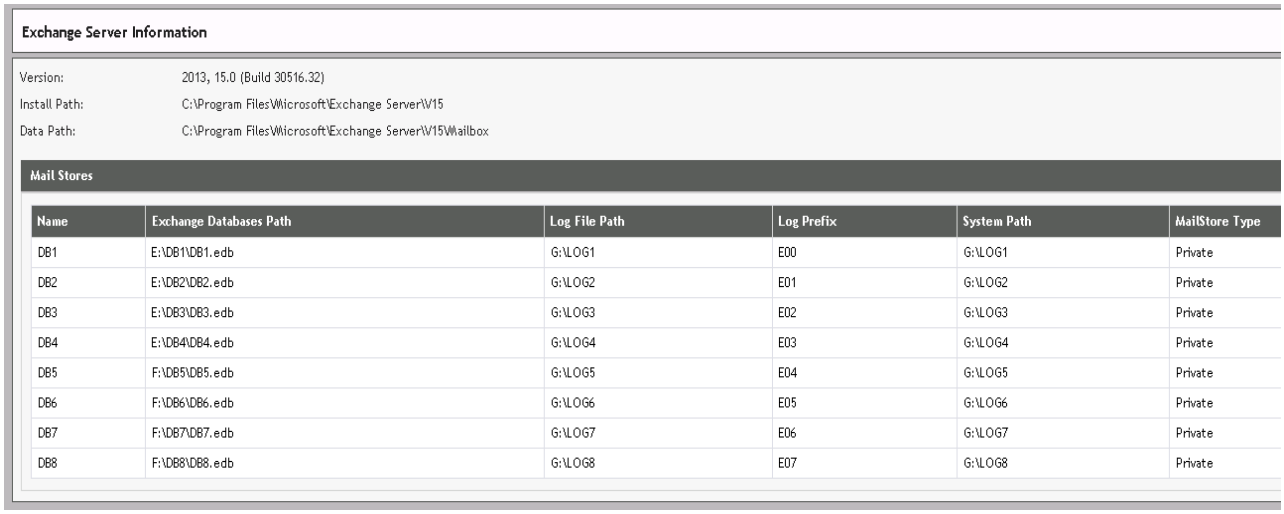
Mountability Check: Not yet performed
Checksum Check: Not yet performed
Last Log Truncation: 1/29/2014 9:32:57 PM

Volumes

(Volume Labeled 'System Reserved')	Total size: 350 MB	Used Space: 241.33 MB	Free space: 108.66 MB	Every 60 minutes peak, every 60 minutes weekends
C:\	Total size: 159.66 GB	Used Space: 66.88 GB	Free space: 92.78 GB	Every 60 minutes peak, every 60 minutes weekends
H:\	Total size: 910 GB	Used Space: 685.13 MB	Free space: 909.33 GB	Every 60 minutes peak, every 60 minutes weekends
E:\	Total size: 910 GB	Used Space: 93.4 GB	Free space: 816.6 GB	Every 60 minutes peak, every 60 minutes weekends
G:\	Total size: 60 GB	Used Space: 995.94 MB	Free space: 59.02 GB	Every 60 minutes peak, every 60 minutes weekends
F:\	Total size: 910 GB	Used Space: 93.53 GB	Free space: 816.47 GB	Every 60 minutes peak, every 60 minutes weekends

Figure 18 shows each of the Exchange databases and corresponding logs location matching the Table 7 Application Data to VHDX mapping for Exchange.

Figure 18 Exchange Database and Log Locations



Exchange Server Information

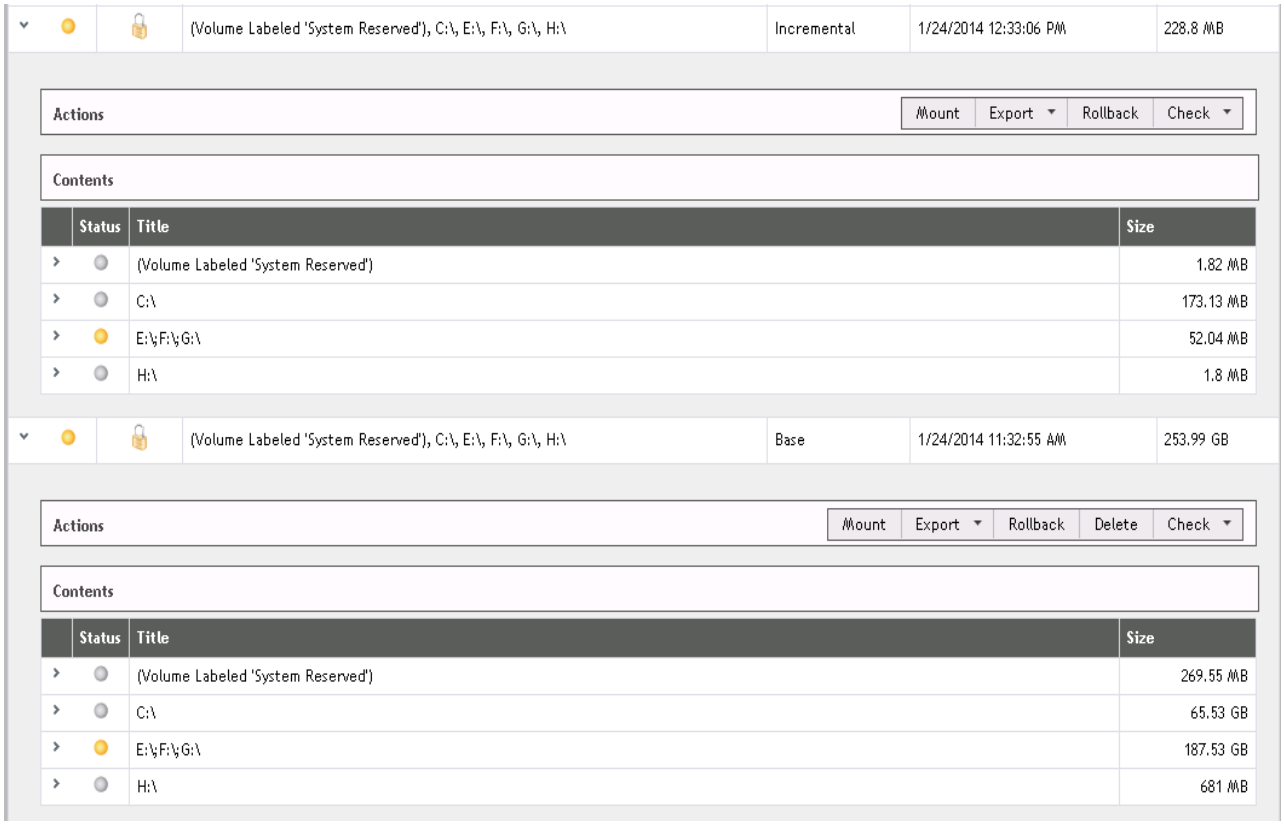
Version: 2013, 15.0 (Build 30516.32)
Install Path: C:\Program Files\Microsoft\Exchange Server\V15
Data Path: C:\Program Files\Microsoft\Exchange Server\V15\Mailbox

Mail Stores

Name	Exchange Databases Path	Log File Path	Log Prefix	System Path	MailStore Type
DB1	E:\DB1\DB1.edb	G:\LOG1	E00	G:\LOG1	Private
DB2	E:\DB2\DB2.edb	G:\LOG2	E01	G:\LOG2	Private
DB3	E:\DB3\DB3.edb	G:\LOG3	E02	G:\LOG3	Private
DB4	E:\DB4\DB4.edb	G:\LOG4	E03	G:\LOG4	Private
DB5	F:\DB5\DB5.edb	G:\LOG5	E04	G:\LOG5	Private
DB6	F:\DB6\DB6.edb	G:\LOG6	E05	G:\LOG6	Private
DB7	F:\DB7\DB7.edb	G:\LOG7	E06	G:\LOG7	Private
DB8	F:\DB8\DB8.edb	G:\LOG8	E07	G:\LOG8	Private

Figure 19 shows Base (full) and Incremental backups of the Exchange Protection Set per default 60 minutes backup interval/frequency.

Figure 19 Exchange Protection Set Full and Incremental Backups



7.3.2 Restore Verification

The following restore tests are performed to verify in-place recoveries of all three UC&C applications. For Exchange 2013 this test confirmed that an application-aware AppAssure agent allows seamless in-place recovery without requiring service shutdown:

- To restore a protected application host VM to previous point-in-time, the test performed rollback of a specific Recovery Point and all volumes of its Protection Group.
- To restore a single data or system volume of a protected application host VM, the test performed rollback of a specific Recovery Point and selected a single volume from the Protection Group.

In this reference architecture Exchange is configured to host four databases on to a single volume. To perform a single database recovery, perform an out-of-place restore of the whole volume containing all four databases on to the Recovery Volume and then manually conduct recovery of a single Exchange database from Recovery Volume to its original volume. AppAssure also supports “Mount” and “Export” of a Recovery Point.

As shown in Figure 20 and Figure 21, rollback of multiple Exchange volumes are performed for an in-place restore verification.

Figure 20 Exchange rollback from an incremental backup

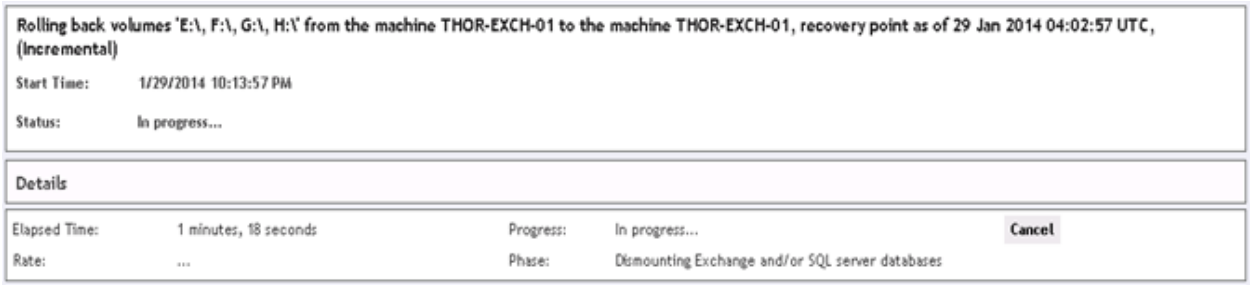


Figure 21 Successful Exchange Rollback

Refer to the Additional Resources section for more details around the PowerVault DL4000 deployment and operations guidelines and other collateral.

8 Solution Summary

The Dell PowerEdge VRTX shared infrastructure platform resolves the complexities involved in managing infrastructure for application deployments and enables IT administrators to combine servers, storage and networking into an easy-to-deploy chassis. Potential errors are reduced with the use of unified and simplified systems management. A Microsoft UC&C solution provides organizations with mission-critical productivity tools—such as email, instant messaging, document sharing and web conferencing—to accomplish daily tasks. It is important to configure, deploy and maintain the applications for daily functioning and better end-user experience.

The design goals, as described in Section 3, will add to the solution requirements to supply a list of resources used to meet all of the requirements. The recommended solution architecture described in Section 4 takes into account the best practices laid out by Dell and Microsoft. The design points emphasize the use of the latest hardware and software features presented in PowerEdge VRTX to enable application consolidation, hardware abstraction and infrastructure high availability. The infrastructure high availability features ensure that the application services are continuously available and deliver optimal performance.

The shared storage architecture described in this reference architecture is simple to configure and manage using the Chassis Management Controller (CMC) interfaces. By creating multiple virtual disks for VM and application data needs, data isolation and optimal performance are achieved.

The converged virtual switch used for the VM network access enables high quality-of-service (QoS) for different classes of traffic and ensures that the demands for network bandwidth are met. Hence, the bandwidth requirements for VM Live Migration and cluster traffic are given priority, when needed, to enable seamless movement of VMs during optimization and/or planned downtime of the hypervisor hosts.

Fully abstracting the application VMs from their physical hosts requires dynamic VM placement. VMs must be load balanced across servers depending upon their workload type and their relationship to other VMs. To achieve server load balancing, the cluster is configured with SCVMM Dynamic Optimization (DO) to automatically live migrate VMs to less utilized hosts. SCVMM availability sets are used to ensure that the VMs with similar application roles or high resource requirements do not coexist on the same hypervisor host.

The Dell PowerVault DL4000 data protection appliance provides the mechanisms for protecting the UC&C application data. The features such as application-aware backups, in-place recovery and the ease of deployment and configuration make PowerVault DL4000 the right choice for protecting UC&C application data.

The observations during the verification tests are inline with the design goals. The infrastructure verification demonstrated that the application services are available even when an application VM live migrates from one host to another. The infrastructure failure simulations showed that the capacity of the applications does not degrade even when only 50% of the compute resources are available within the Dell PowerEdge VRTX chassis. The load generation verifications indicate that the application infrastructure is capable of supporting more than 500 users. It is also observed that the Dell PowerVault DL4000 backup appliance can seamlessly deploy application aware agents that detects application instances and auto

protects the application data. It also enables easy recoveries by restoring a point-in-time snapshot of a VM or conducting a LiveRecovery of an application's data volumes.

A Additional Resources

1. **Support.dell.com** is focused on meeting customer requirements with proven services.
2. **DellTechCenter.com** is an IT Community where you can connect with Dell Customers and Dell employees for the purpose of sharing knowledge, best practices and information about Dell products and installations.
3. Referenced or recommended Dell publications:
    a. Dell PowerEdge VRTX
    b. Microsoft Windows Server 2012 Hyper-V Reference Architecture for Dell PowerEdge VRTX
    c. PowerVault DL4000 Product Manual
    d. Dell AppAssure Documentation
    e. Dell AppAssure Product Demos
4. Referenced or recommended Microsoft publications:
    a. Overview of farm virtualization and architectures for SharePoint 2013
    b. Best practice configurations for the SharePoint 2013 virtual machines and Hyper-V environment
    c. Virtualizing Exchange 2013
    d. Running Lync Servers on Virtual Servers
    e. Configuring Dynamic Optimization in VMM
    f. Configure Availability Sets in VMM

B AppAssure Backup Configurations

This section shows AppAssure backup configurations for SharePoint, Lync, WAC and SQL application VMs.

Figure 22 SharePoint FE VM Protection Group

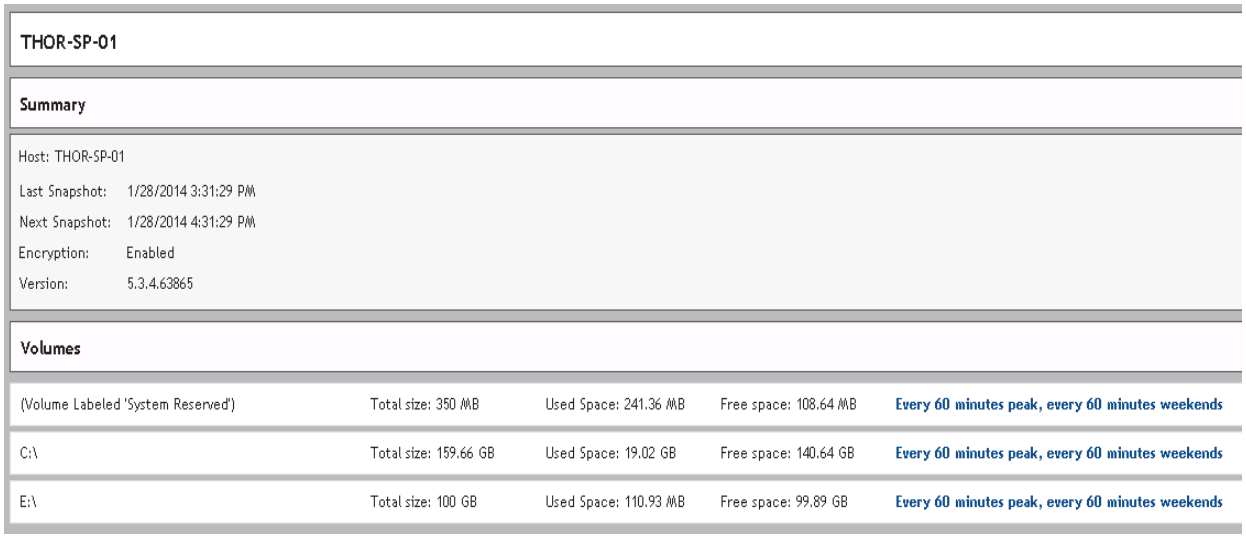


Figure 23 Lync FE VM Protection Group along with Local SQL databases

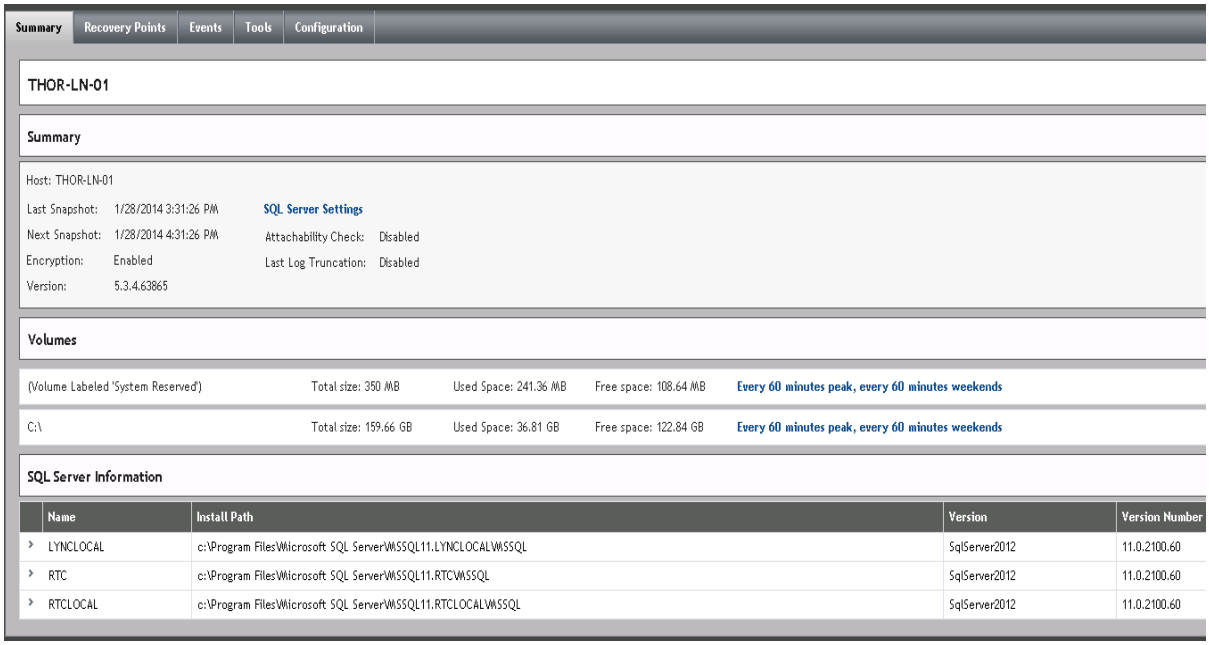
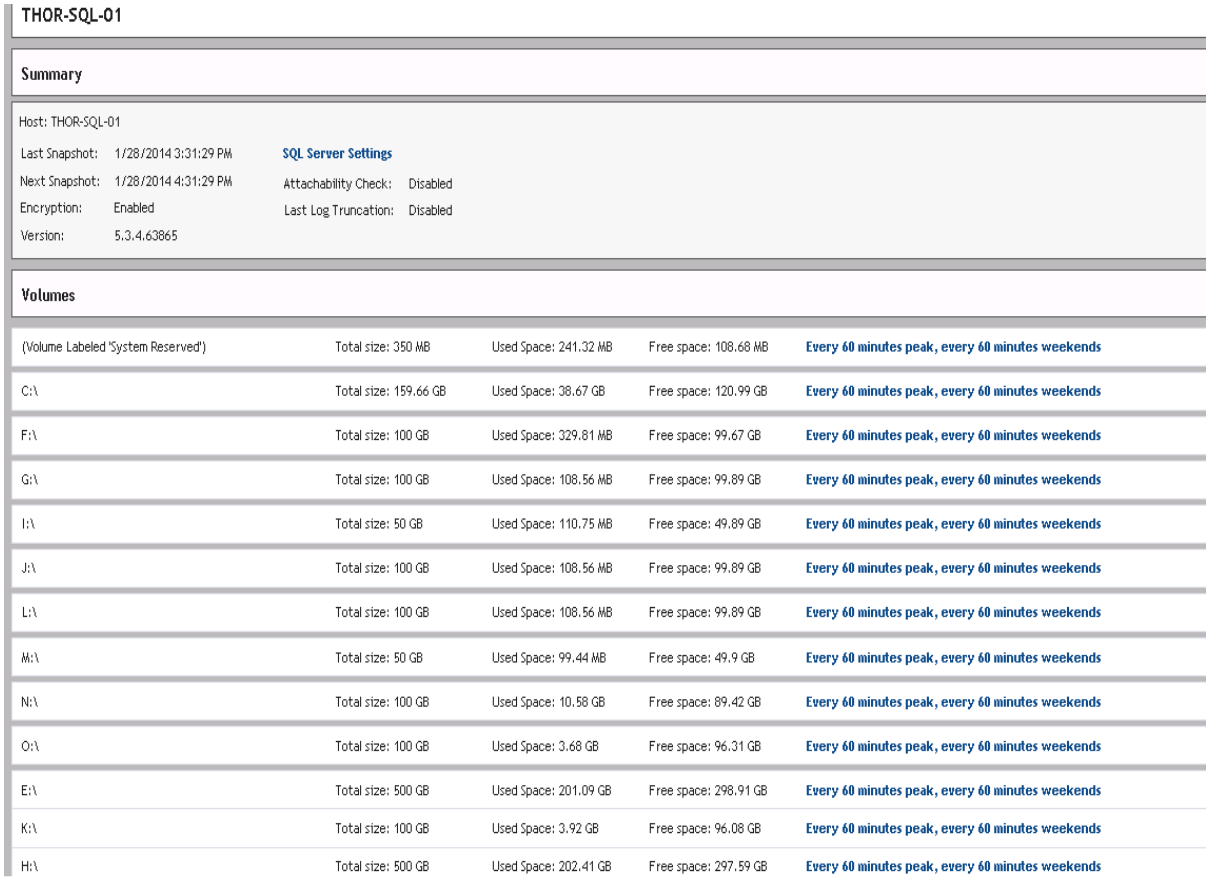


Figure 24 SQL VM Protection Group with all Lync and SharePoint databases



THOR-SQL-01

Summary

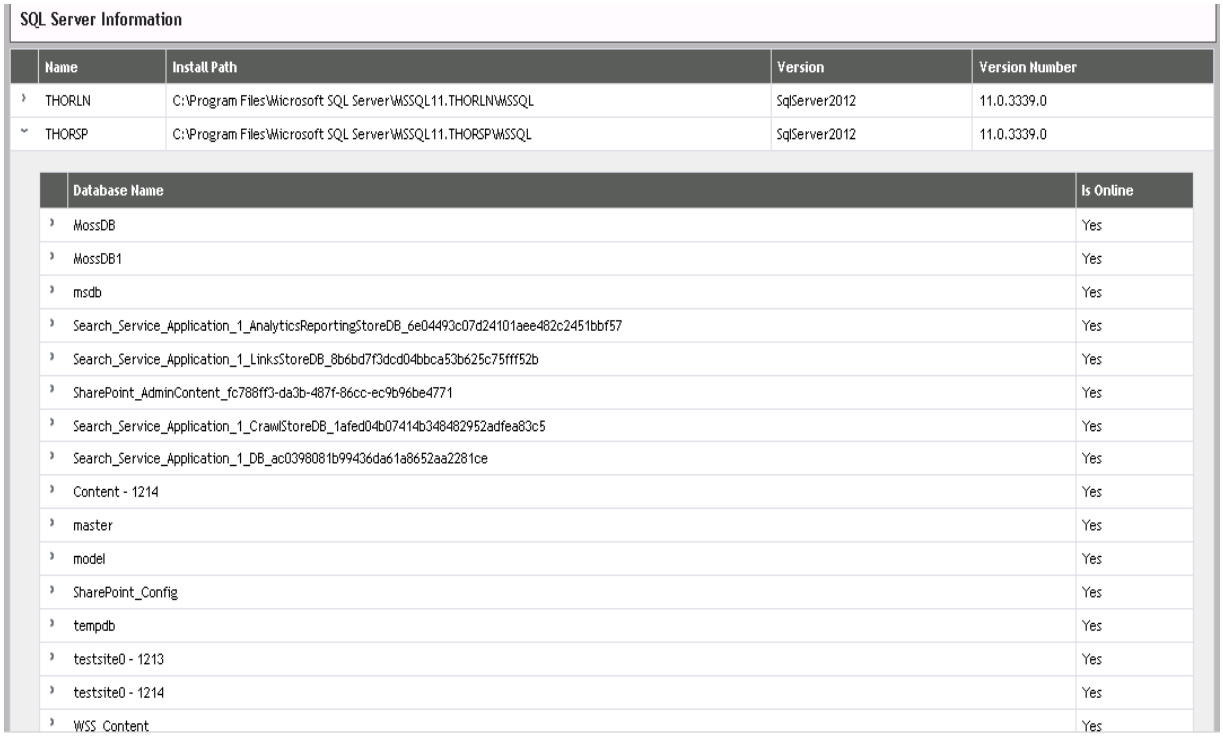
Host: THOR-SQL-01

Last Snapshot:	1/28/2014 3:31:29 PM	SQL Server Settings	
Next Snapshot:	1/28/2014 4:31:29 PM	Attachability Check:	Disabled
Encryption:	Enabled	Last Log Truncation:	Disabled
Version:	5.3.4.63865		

Volumes

(Volume Labeled 'System Reserved')	Total size: 350 MB	Used Space: 241.32 MB	Free space: 108.68 MB	Every 60 minutes peak, every 60 minutes weekends
C:\	Total size: 159.66 GB	Used Space: 38.67 GB	Free space: 120.99 GB	Every 60 minutes peak, every 60 minutes weekends
F:\	Total size: 100 GB	Used Space: 329.81 MB	Free space: 99.67 GB	Every 60 minutes peak, every 60 minutes weekends
G:\	Total size: 100 GB	Used Space: 108.56 MB	Free space: 99.89 GB	Every 60 minutes peak, every 60 minutes weekends
I:\	Total size: 50 GB	Used Space: 110.75 MB	Free space: 49.89 GB	Every 60 minutes peak, every 60 minutes weekends
J:\	Total size: 100 GB	Used Space: 108.56 MB	Free space: 99.89 GB	Every 60 minutes peak, every 60 minutes weekends
L:\	Total size: 100 GB	Used Space: 108.56 MB	Free space: 99.89 GB	Every 60 minutes peak, every 60 minutes weekends
M:\	Total size: 50 GB	Used Space: 99.44 MB	Free space: 49.9 GB	Every 60 minutes peak, every 60 minutes weekends
N:\	Total size: 100 GB	Used Space: 10.58 GB	Free space: 89.42 GB	Every 60 minutes peak, every 60 minutes weekends
O:\	Total size: 100 GB	Used Space: 3.68 GB	Free space: 96.31 GB	Every 60 minutes peak, every 60 minutes weekends
E:\	Total size: 500 GB	Used Space: 201.09 GB	Free space: 298.91 GB	Every 60 minutes peak, every 60 minutes weekends
K:\	Total size: 100 GB	Used Space: 3.92 GB	Free space: 96.08 GB	Every 60 minutes peak, every 60 minutes weekends
H:\	Total size: 500 GB	Used Space: 202.41 GB	Free space: 297.59 GB	Every 60 minutes peak, every 60 minutes weekends

Figure 25 SQL SharePoint Database Configuration

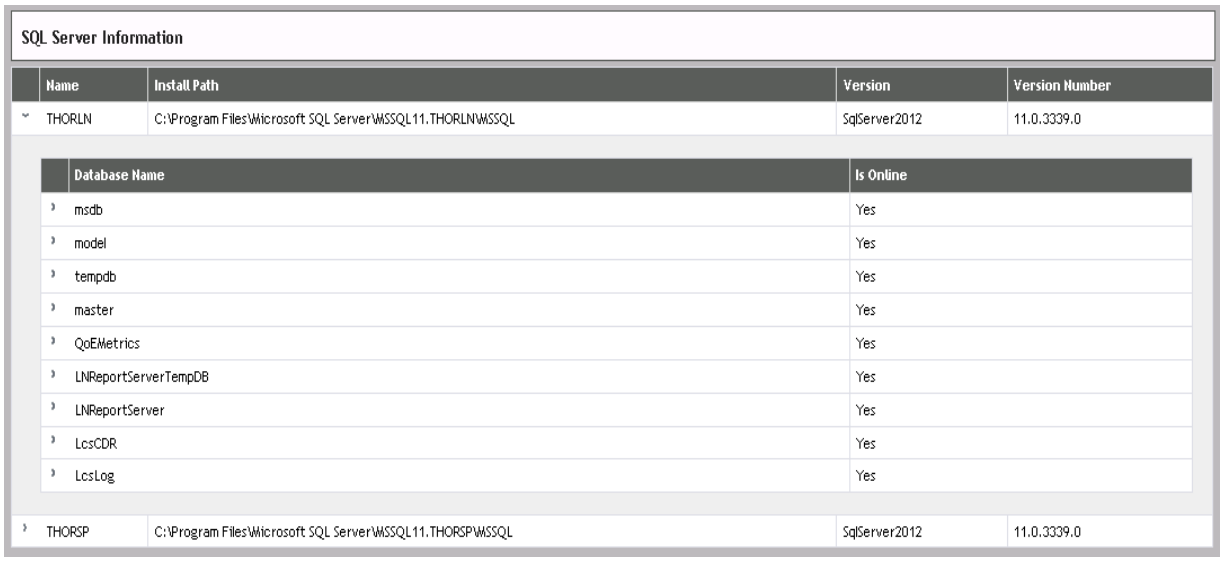


SQL Server Information

	Name	Install Path	Version	Version Number
›	THORLN	C:\Program Files\Microsoft SQL Server\MSSQL11.THORLN\MSSQL	SqlServer2012	11.0.3339.0
ˇ	THORSP	C:\Program Files\Microsoft SQL Server\MSSQL11.THORSP\MSSQL	SqlServer2012	11.0.3339.0

	Database Name	Is Online
›	MossDB	Yes
›	MossDB1	Yes
›	msdb	Yes
›	Search_Service_Application_1_AnalyticsReportingStoreDB_6e04493c07d24101aee482c2451bbf57	Yes
›	Search_Service_Application_1_LinksStoreDB_8b6bd7f3dcd04bbca53b625c75fff52b	Yes
›	SharePoint_AdminContent_fc788ff3-da3b-487f-86cc-ec9b96be4771	Yes
›	Search_Service_Application_1_CrawlStoreDB_1afed04b07414b348482952adfea83c5	Yes
›	Search_Service_Application_1_DB_ac0398081b99436da61a8652aa2281ce	Yes
›	Content - 1214	Yes
›	master	Yes
›	model	Yes
›	SharePoint_Config	Yes
›	tempdb	Yes
›	testsite0 - 1213	Yes
›	testsite0 - 1214	Yes
›	WSS_Content	Yes

Figure 26 SQL Lync Database Configuration



SQL Server Information

	Name	Install Path	Version	Version Number
ˇ	THORLN	C:\Program Files\Microsoft SQL Server\MSSQL11.THORLN\MSSQL	SqlServer2012	11.0.3339.0

	Database Name	Is Online
›	msdb	Yes
›	model	Yes
›	tempdb	Yes
›	master	Yes
›	QoEMetrics	Yes
›	LNReportServerTempDB	Yes
›	LNReportServer	Yes
›	LcsCDR	Yes
›	LcsLog	Yes

›	THORSP	C:\Program Files\Microsoft SQL Server\MSSQL11.THORSP\MSSQL	SqlServer2012	11.0.3339.0

Figure 27 WAC VM Protection Group