



Microsoft® Exchange, Lync and SharePoint Server 2013 on Dell™ Active System 800 with Microsoft Windows Server 2012 Hyper-V

A Dell Reference Architecture for 5,000 users

Dell Global Solutions Engineering
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Revision History

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1 Executive Summary

Traditional Information Technology (IT) infrastructures have been transformed with the use of virtualization technologies in the data center. Benefits of virtualization, such as consolidation and availability, have enabled creation of large clusters rich in hardware resources. These architectures improve the administrative management of underlying hardware resources and enable coexistence of multiple tiers of server applications on the same hardware.

A Microsoft Unified Communication and Collaboration (UC&C) solution enabled by Exchange, Lync, and SharePoint Servers provides organizations mission-critical productivity tools—such as email, instant messaging, document sharing, web conferencing—to accomplish daily tasks. Because these applications are critical for day-to-day business operations, it is important to configure, deploy, and maintain them properly. 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 with a unified communications and collaboration platform. 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 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, reducing 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

For successful implementation, it is critical to follow important design principles and best practices to ensure accurate resource sizing, ease of maintenance and maximization of uptime, as well as flexibility in a dynamic data center. Dell Active System 800 configured with Microsoft Windows Server 2012 with Hyper-V role (Active System 800m) with Microsoft Exchange Server 2013, Lync Server 2013, and SharePoint Server 2013 together provide a compelling solution that enables IT to achieve greater efficiency in a modern data center and empowers end users to accomplish their work more productively in a dynamic workplace.



Dell Active System 800m is a virtualized infrastructure solution that provides highly-available infrastructure resources. It is a pre-engineered, virtualized bundle that has already been extensively validated. Beginning with this bundle reduces deployment complexity and minimizes problems. When Exchange, Lync, and SharePoint are deployed together on Active System, hardware resources can be better utilized through consolidation of application roles and services, such as combining network load balancing, databases, and storage volumes, while improving administrative simplicity. Furthermore, by configuring the applications to allow hardware abstraction, these applications can easily be moved around within the virtual cluster provided by Active System. This ease in movement allows for transparent hardware maintenance and ensures minimal service-disruption for end users. In addition, Exchange, Lync, and SharePoint have application layer availability guidelines, which can be addressed through proper implementation as shown in this paper.

1.1 Scope

This paper explores implementing Microsoft Exchange Server, Lync Server, and SharePoint Server 2013 on Dell Active System 800m, which consists of best-in-class Dell Networking switches, Dell PowerEdge™ servers, and Dell EqualLogic™ storage and utilizes the latest of networking protocols to achieve converged networking. This paper concentrates on infrastructure design principles, which include high availability, application best practices, hardware abstraction, and resource consolidation. 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 5,000 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 towards a true collaboration environment in the organization.

For more information on standalone reference architecture guidance for Exchange, Lync, and SharePoint, visit <http://www.dell.com/ucc>.

1.2 Audience

This paper is intended for IT professionals and administrators interested in designing and deploying a custom-sized Microsoft Exchange, Lync, and SharePoint solution. The example implementation provides specifics for a custom-sized Exchange, Lync, and SharePoint solution consisting of up to 5,000 users on Dell Active System 800 with Microsoft® Hyper-V®. The reader is expected to have an understanding of Exchange Server 2013, Lync Server 2013, and SharePoint Server 2013, as well as Dell Active System 800m and to be proficient with Windows Server 2012 and Hyper-V. The audience for this paper is also expected to be familiar with converged infrastructure concepts such as Data Center Bridging (DCB).



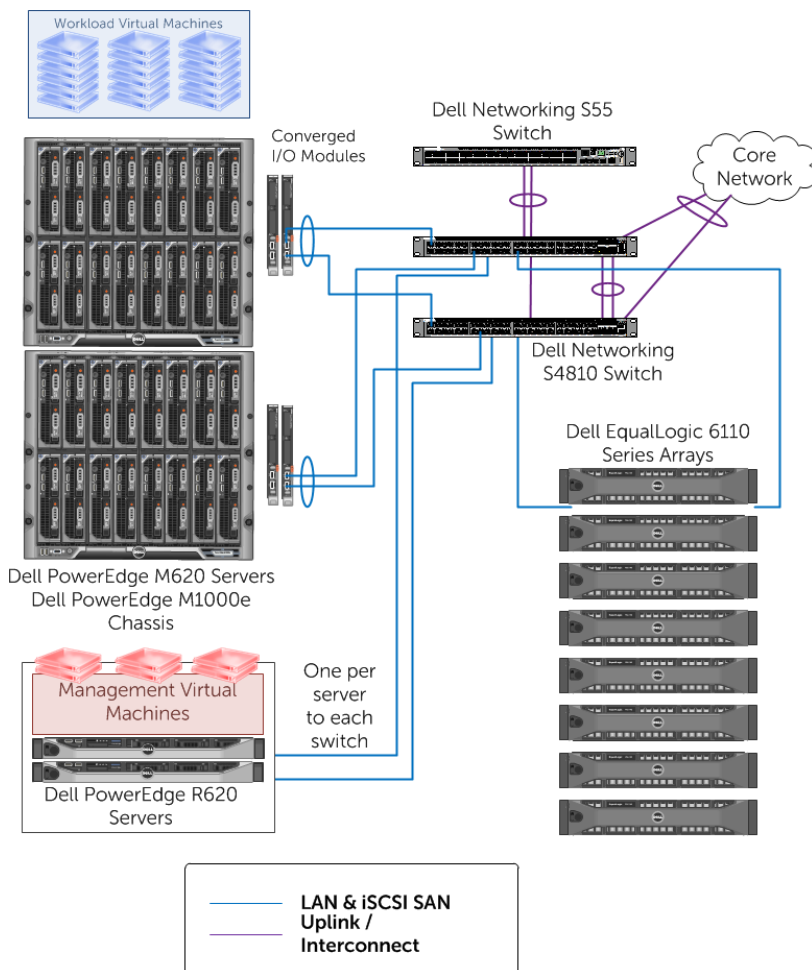
2 Solution Components

This reference implementation considers Dell Active System 800 configured with Microsoft Windows Server 2012 with Hyper-V role (Active System 800m). The following sections describe the components of Active System 800m pre-integrated infrastructure and the application components deployed in the sample reference implementation for 5,000 users.

2.1 Dell Active System 800m

Dell Active Infrastructure is a family of virtualized infrastructure solutions that combines servers, storage, networking, and infrastructure management into an integrated and optimized system that provides general-purpose virtualized resource pools. Active Infrastructure leverages Dell's converged networking and modular server architecture to help IT rapidly respond to dynamic business demands, maximize data center efficiency, and enhance IT service quality.

Figure 1. Active System 800m Architecture



As a member of the Dell Active Infrastructure family, the Active System 800 solution has been designed and validated by Dell Engineering. It is available to be racked, cabled, and delivered to a customer's site to speed deployment. Dell Services deploys and configures the solution so that it is ready to be integrated into the customer data center.

Dell Active System 800m intelligently combines Dell PowerEdge servers, Dell Networking switches, EqualLogic SAN, and Microsoft Hyper-V. It utilizes a networking technology called Data Center Bridging (DCB) that extends Ethernet to support the convergence of LAN and SAN traffic on a single physical pipe, while guaranteeing lossless transport of iSCSI traffic.

A summary of the components can be found in Table 1. For complete details of Active System 800m, see the [Reference Architecture for Active System 800 with Microsoft Hyper-V](#).

Table 1. Active System 800m Components

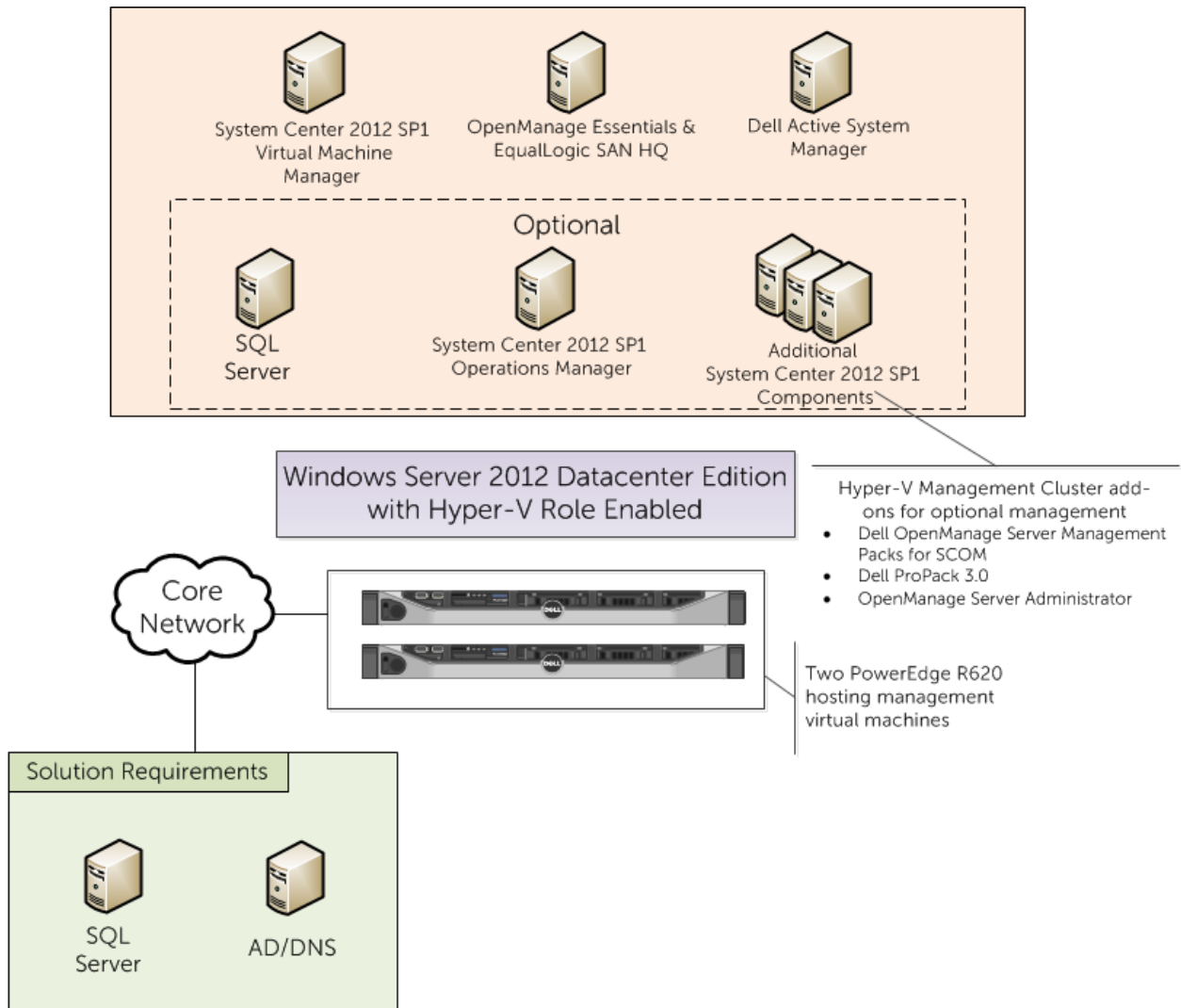
Component	Details
Hypervisor Server	Up to 2 x Dell PowerEdge M1000e chassis with up to 32 x Dell PowerEdge M620 Blade Servers and Microsoft Hyper-V
Converged Fabric Switch	2 x Dell Networking S4810
	2 x Dell PowerEdge M I/O Aggregator in each Dell PowerEdge M1000e chassis
Storage	Up to 8 x Dell EqualLogic PS6110 series arrays
Management Infrastructure	2 x Dell PowerEdge R620 servers with Microsoft Hyper-V hosting management VMs
	1 x Dell Networking S55 used as a 1Gb out-of-band management switch
Management Components Hosted in the Management Infrastructure	Dell Active System Manager (ASM)
	Microsoft System Center 2012 Virtual Machine Manager (SCVMM) SP1
	Dell OpenManage™ Essentials (OME) and Dell EqualLogic SAN HeadQuarters (HQ)
	Microsoft SQL Server
	System Center 2012 SP1 Operations Manager (Optional)
	Additional System Center 2012 SP1 Components (Optional; Dell OpenManage Server Management Packs for SCOM, Dell ProPack 3.0, and OpenManage Server Administrator)

2.1.1 Management Infrastructure

As shown in Table 1, the Active System 800m management infrastructure uses two Dell PowerEdge R620 servers with Microsoft Hyper-V. The management software required to deploy and manage the Active System 800m infrastructure is hosted as different VMs in the Hyper-V management cluster.



Figure 2. Active System 800m Management Architecture



As shown in Figure 2, Microsoft SCVMM, Dell ASM, and Dell OME are mandatory components of the management infrastructure. SCVMM requires a Microsoft SQL Server instance for the VMM Database. This SQL instance must be available in the customer data center infrastructure or it should be a part of the Active System management infrastructure. SCVMM is required to implement the application best practices described in the Key Design Considerations section.

2.2 Exchange, Lync, and SharePoint 2013

Combining Microsoft Exchange, Lync, and SharePoint 2013 locates all essential productivity solutions within Dell Active System. This simplifies management of the solution while leveraging the benefits of virtualization and pre-configured infrastructure. With the 2013 release of Microsoft UC&C suite of 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 2013 is for real time communication such as instant messaging and presence, audio/video conferencing, and web conferencing. Microsoft SharePoint 2013 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 all three of these workloads can be found in the following sections.

2.2.1 Exchange Server 2013

Exchange Server 2013 is the leading enterprise messaging system and is comprised of 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. This server role includes the Client Access protocols and is responsible for client processing. 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 Server (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 paper.

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

2.2.2 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 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:

- **Front End Server role:** This role handles Lync client authentication, Instant Messaging, Web Conferencing, and User Presence status. In Lync Server 2013, Front End Server has a local database which stores User data—the Central Management store (CMS) database—and a new High Availability and Disaster Recovery for Front End role. The A/V Conferencing role is now collocated with Front End server and cannot be deployed as separate role.
- **Persistent Chat Server role:** This is a new and separate role in Lync Server 2013 which provides features similar to group chat for users to participate in multiparty, topic-based chat.
- **Archiving and Monitoring Server Role:** This Lync server role monitors user statistics and Quality of Experience (QoE) within Lync, and archives conference content and instant messages for future audits. With Lync 2013, the Archiving and Monitoring role runs on the Front End servers.
- **SQL Database:** A Microsoft SQL Server provides databases for the Lync Front End, and Archiving and Monitoring roles. This server is used as backup storage for user and conference data, and is primary storage for other databases such as Response Groups, Persistent Chat Server, and Archiving and Monitoring data. Lync Server 2013 supports SQL mirroring for high availability of Lync databases.
- **Office Web Apps Server (OWS):** Lync Server 2013 now uses Office Web Apps Server for providing enhanced web conferencing, application sharing, document collaboration and PowerPoint presentations. This role enables users to use power presentations having custom fonts and animated slides in web conferencing.

This paper 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.



2.2.3 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, enabling end-user access.
- **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. Instead, for Front End Servers and Application Servers, the SharePoint Server application itself is installed. Front End Servers are then 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 implementation in this paper uses a virtual hardware load balancer appliance. The Application server has search services configured and runs the search crawl.

This paper focuses on the recommendations and reference implementation for the SharePoint collaboration workload only.



3 Benefits of Application Co-existence and Integration

As mentioned earlier, Active System 800m provides a shared virtualized infrastructure for deploying applications such as Exchange, Lync, and SharePoint. Active System provides several benefits when running Exchange, Lync, and SharePoint Server on the same virtualized infrastructure, including increased hardware flexibility, ease of infrastructure maintenance, and simplifying administrative tasks. The integration enhancement in the most recent release of these applications further improves the collaboration experience for the end users.

3.1 Benefits at the infrastructure level

Active System is built with virtualization best practices and provides an infrastructure that enables the key tenets of virtualization, such as live migration, hypervisor high availability, and redundancy to minimize single points of failure in the infrastructure. By abstracting specific hardware details, such as the physical host and the storage location, the application virtual machines (VMs) 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 Active System. Doing so allows the administrators to perform maintenance tasks without disrupting the application. Specifying and configuring applications correctly helps IT achieve these benefits from Active System while adhering to application best practices and ensuring a high-quality end-user experience.

Typically, these applications are run in silos, preventing a complete view of how these applications are performing. By deploying on a single infrastructure, administrators can quickly debug, view performance, and manage the hardware for these applications. This benefit is exemplified by EqualLogic SAN HQ, where EqualLogic performance and utilization can quickly provide an overview of the space, throughput, and RAID used for the storage volumes of all these applications. In a traditional deployment, these storage volumes would be spread across multiple servers or storage arrays, making it difficult to adequately gauge storage performance and space.

3.2 Benefits at the application level

In addition to the infrastructure level benefits from application co-existence, Lync and SharePoint databases can be collocated to reduce resource requirements. Also, utilizing the same virtual load balancer appliance provides synergy between all 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 integration of SharePoint and Exchange 2013. This feature provides users 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 contents can be archived in the user's mailboxes and, therefore, don't require a separate archival role and database to be configured in the Lync Infrastructure.
- **Office Web Applications (OWS):** OWS provides users with enhanced web conferencing experience when presenting PowerPoint content. This is a required role for Lync Server 2013 deployment. The features of OWA 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 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 clients including Lync 2013, Outlook 2013, Outlook 2013 Web App and Lync 2013 Web App.

Table 2 summarizes the application integration points described above and shows which applications benefit from each of the integration points.



Table 2. Application Integration Points

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.



4 Exchange, Lync, and SharePoint on Active System 800m

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.

4.1 Key Design Considerations

While Active System follows 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 Active Infrastructure. These additional design principles drive every aspect of this combined application design on Dell Active System:

- High Availability
- Application Best Practices and Performance
- Hardware Abstraction
- Resource Consolidation

Deploying high availability of the solution is critical as a principle to ensure minimal business downtime. High availability must be considered at each layer of the solution, including the infrastructure, VM and application. Installing the application correctly and ensuring that application's performance remains above appropriate thresholds, even during degraded scenarios, 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. Finally, consolidating VMs, storage arrays, network load balancing, and databases while maintaining application best practices reduces resource cost and administrative time.

4.1.1 High Availability

High availability is a feature that must be considered at every layer, and Dell Active System makes architecting such a solution easier. This document is concerned with three layers of High Availability that are presented below.

- Infrastructure availability is provided by Active System to ensure that when a hardware resource fails, there is another server, network path, storage drive, storage array, etc. that provides the same resource.
- Hypervisor availability brings application VMs back up on other hosts upon hardware failure.
- Application-level availability entails utilizing pools of application servers to provide a highly available service.

If infrastructure fails, infrastructure availability provided by Active System ensures there is an additional hardware resource, and the application level availability will keep the application service up for end users. However, because fewer VMs are running the application, these services will be running in a degraded state. Hypervisor availability automatically moves VMs to other available physical hosts to reduce the time



that an application is in a degraded state. While these two levels of availability relate to the end-user access to the application service, the application data also needs to sustain a storage failure. This solution deploys multiple copies or leverages mirroring to ensure application data availability in the event of a storage array failure. This ensures that user data will persist in the event of a hard drive or storage array failure.

4.1.2 Application Best Practices and Performance

While maintaining high availability is critical, applications must still perform well to ensure a good end-user experience. Following application best practices helps prevent performance bottlenecks, and 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:

- Dynamic memory for memory-intensive applications should not be used, as specified by best practices for that application role.
- Virtual CPU to physical core ratio must be maintained at one-to-one.
- No co-existence of critical application services on the same host.
- Dedicated hard drive spindles for certain application's 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.

4.1.3 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 co-exist amongst themselves or with other application VMs for performance reasons. Rules can be created so that certain VMs do not co-exist on the same physical server with other VMs.

4.1.4 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:

- A virtual hardware load balancer appliance is easily shared across all three applications, reducing the number of VMs and their technical requirements.
- 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 cost.



- Sharing storage arrays 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 can be integrated to achieve better collaboration across the organization.



5 Solution Architecture

This section describes key configurations to accomplish the solution architecture. The solution architecture proposed in this paper for the three applications—Exchange, Lync, and SharePoint 2013—incorporates application best-practices while following the design principles detailed in section 4.1.

Some common design goals for the three applications are:

- Providing infrastructure high availability for all the application VMs while leveraging the application high availability features.
- 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 Active System infrastructure design principles and the hypervisor features. The reference implementation in this paper 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 reference solution for 5,000 mailboxes each of 2GB size and a message profile per user of 100 messages of 75KB each sent and received per day.
- **SharePoint:** Implementation to support 5,000 concurrent users in a collaboration usage profile with an average farm response time of less than one second.
- **Lync:** A deployment for 5,000 users for providing audio/video, instant messaging, and web conferencing capabilities.

Table 3 summarizes the VM resource requirements for deploying the three applications on Active System infrastructure.



Table 3. Virtual Machine Configuration

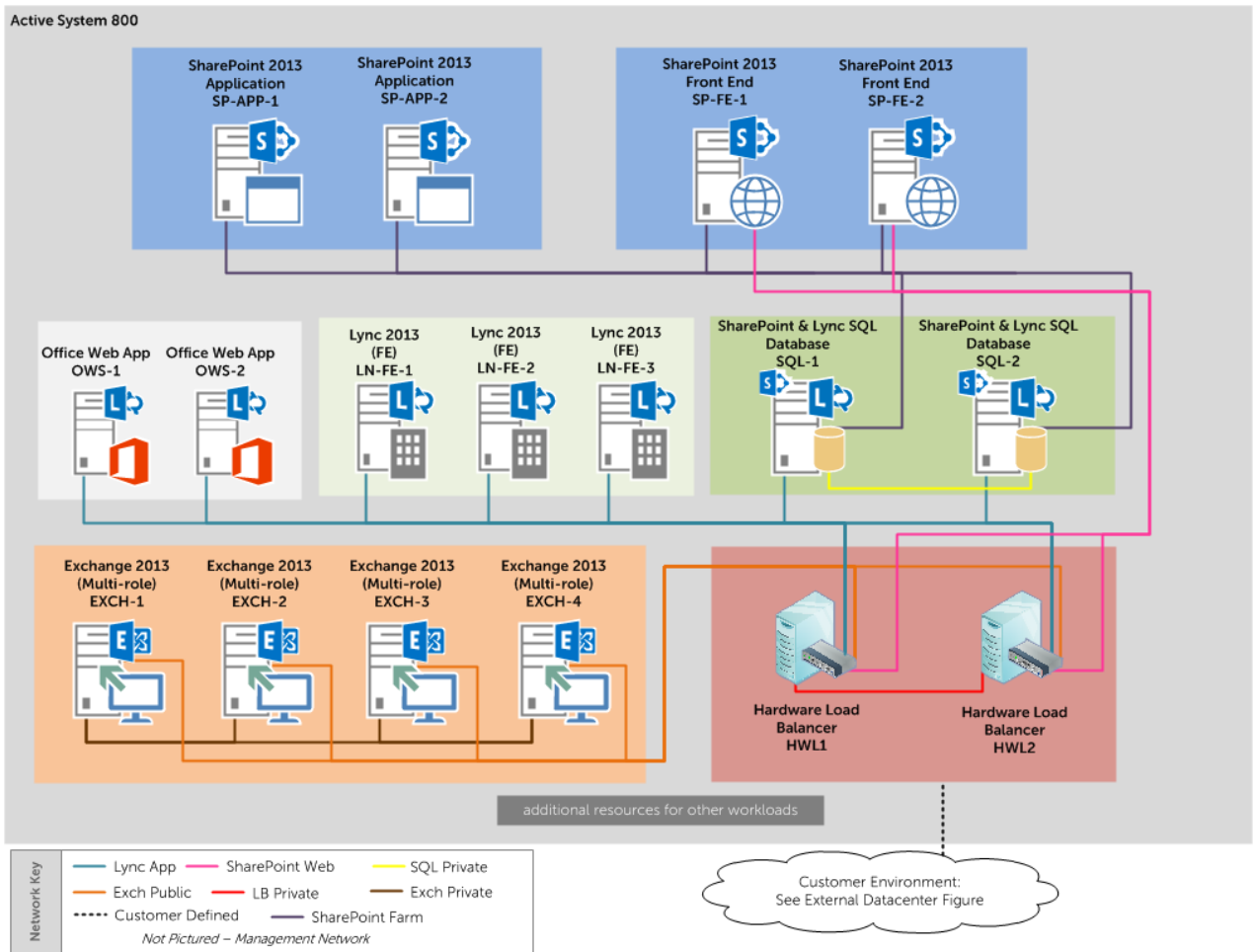
Application Role	Number of VMs	Total Virtual CPU	Total Memory (GB)	Networks
Exchange Multi-role Servers	4	24 (6 per VM)	288 (72GB per VM)	3 x Synthetic Network Adapters per VM
Lync Front End	3	12 (4 per VM)	48 (16GB per VM)	2 x Synthetic Network Adapter per VM
Lync Office Web Application	2	8 (4 per VM)	16 (8GB per VM)	2 x Synthetic Network Adapter per VM
SharePoint Web Front End	2	8 (4 per VM)	32 (16GB per VM)	3 x Synthetic Network Adapters per VM
SharePoint Application Server	2	8 (4 per VM)	16 (8GB per VM)	2 x Synthetic Network Adapters per VM
SQL For SharePoint and Lync Databases	2	12 (6 per VM)	128 (64GB per VM)	4 x Synthetic Network Adapters per VM
Virtual Load Balancer Appliances	2	4 (2 per VM)	8 (4GB per VM)	4 x Synthetic Network Adapters per VM

Figure 3 provides a high level logical view of the application architecture for the three applications. The SQL VMs have two SQL instances deployed on each VM. These instances serve as the SQL mirror pairs for Lync and SharePoint applications. Each VM in this solution runs Windows Server 2012 Data Center Edition and is configured with a fixed VHDX hard drive format as OS drive. The fixed VHDX format is recommended instead of pass-through disks for simplified management. Utilizing a hardware load balancer virtual appliance reduces complexity of the network design.

This paper presents suggestions for the virtual load balancer configuration, but the reader must refer to the respective vendor's load balancer virtual appliance manual for appropriate configuration.



Figure 3 Application Architecture



5.1 Storage Architecture

There are two components to storage in the application architecture presented in this paper. The first component is the Cluster Shared Volume (CSV) for VM store, which is needed for Hyper-V high availability. By storing the VMs on shared iSCSI EqualLogic storage, each PowerEdge M620 virtual host can run the Exchange, Lync, or SharePoint VMs. A single EqualLogic PS6110X array is used for this store configured as RAID 10, as recommended by Active System.

The second component contains the application storage. It consists of two EqualLogic PS6110E arrays for Exchange and two EqualLogic PS6110X arrays for Lync and SharePoint, configured to provide array redundancy. The arrays for Exchange are separated from the arrays for Lync and SharePoint to minimize disk contention. Also, the PS6110E arrays used for Exchange application storage provide higher disk capacity while delivering the required IOPS to ensure optimal application performance. Further details are shown in Table 4.

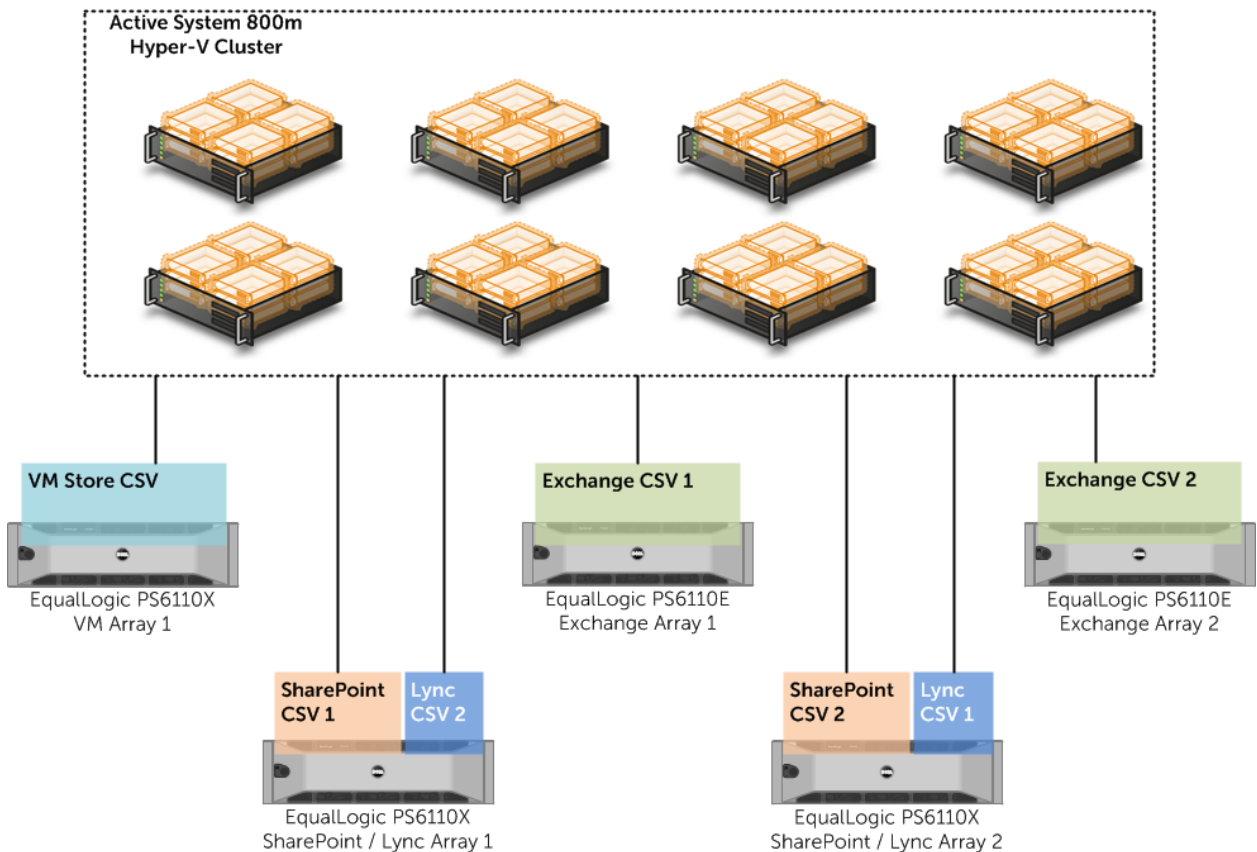


Table 4. Storage Configuration Overview

Storage Array	Purpose
VM Storage Array	Clustered Shared Volume shared with Active Infrastructure 1 x Dell EqualLogic PS6110X; 900 GB 10K hard drives
Exchange Storage Array	2 x Dell EqualLogic PS6110E; 2 TB NL-SAS hard drives for Exchange Mailboxes
SharePoint and Lync Storage Array	2 x Dell EqualLogic PS6110X; 900 GB 10k hard drives for Lync and SharePoint Storage

The storage arrays used for each application are deployed as different storage pools to build storage isolation at the array level. 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 4, a single CSV volume is used for VM storage. Two CSV volumes are created for Exchange, one on each Exchange Storage array, and two CSV volumes are created on each storage array used for SharePoint and Lync.

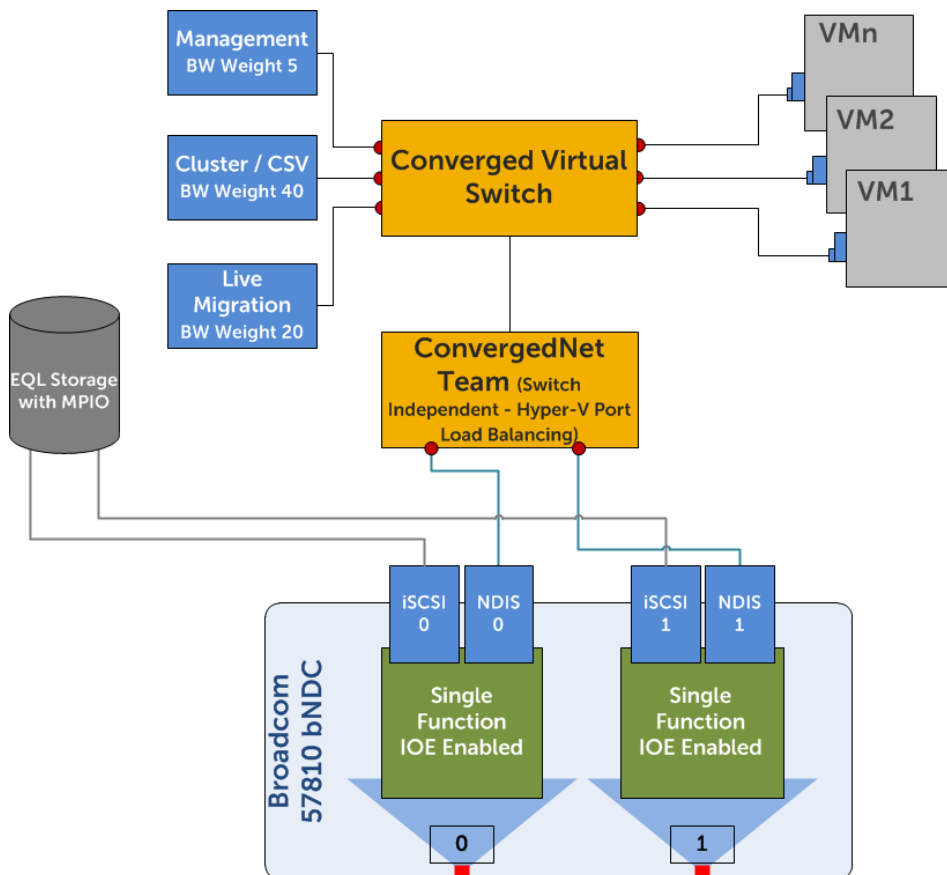
Figure 4. Storage Architecture Overview



5.2 Network Architecture

Active System 800m enables rapid deployment of the application networks. According to Active Infrastructure principles, each application network is deployed as a separate workload VLAN that is defined in the data center core network. Active System provides two 10 Gigabit Ethernet ports labeled as Broadcom 57810 in Figure 5. All of the Workload VLANs are created as virtual network adapters on a single converged virtual switch across these two network connections.

Figure 5. Active System 800m Network Architecture



The logical view of the application architecture shown in Figure 3 includes the application VLANs needed for the inter-application traffic. This includes the SQL private network that is used for SQL Mirror pair communication, Exchange replication traffic VLAN, virtual load balancer private communication network, and the application VLANs. The application VMs connect to these networks using the virtual network adapters connected to the converged virtual switch shown in Figure 5.



Figure 6 External Data Center Architecture

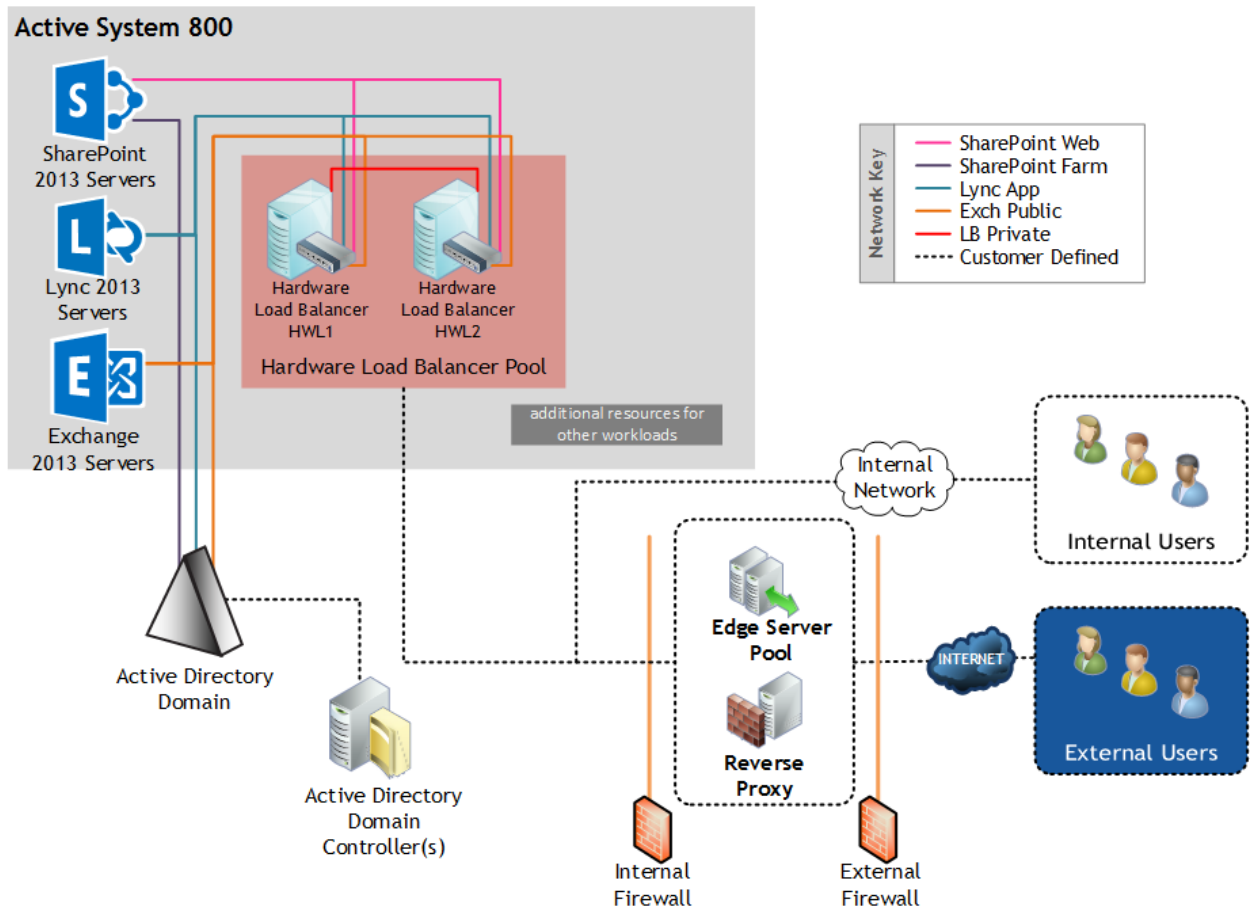


Figure 6 shows the hardware load balancers and how they connect to the external customer data center.

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

5.3 Solution Summary

The design requirements emphasize the use of the latest hardware and software features provided in Active System 800m architecture. Application-level high availability is implemented to complement Active System design for infrastructure availability. For example, a two-copy, four node Exchange DAG is implemented to ensure continuous availability of mailboxes; a common load balancer is implemented to balance the load across application services such as SharePoint Web Front End, Lync Front End, Office Web Apps Services and Exchange multi-role servers; and redundant SharePoint application servers are implemented to enable high availability of search and other SharePoint services.



The storage architecture and application storage configuration ensure that the application data is highly available. The EqualLogic Storage deployed for the VM and application data is highly available and provides desired performance and capacity for the application needs. Separating storage used for the applications into separate storage pools helps ensure that application level storage IO performance requirements are met.

The converged virtual switch used for the VM network access enables Quality-Of-Service (QoS) for different classes of traffic and, therefore, ensures that the demands for network bandwidth are met. The converged network fabric built on Dell Networking switches uses Data Center Bridging (DCB) protocols to prioritize the iSCSI storage traffic to the EqualLogic storage arrays used by the application data.

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 co-exist on the same hypervisor host.



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:
[Reference Architecture for Active System 800 with Microsoft Server 2012 Hyper-V](#)
4. Referenced or recommended Microsoft publications:
[Overview of farm virtualization and architectures for SharePoint 2013](#)
[Best practice configurations for the SharePoint 2013 virtual machines and Hyper-V environment](#)
[Virtualizing Exchange 2013](#)
[Running Lync Servers on Virtual Servers](#)
[Configuring Dynamic Optimization in VMM](#)
[Configure Availability Sets in VMM](#)

