IBM Reference Configuration for VMware on System x with SmartCloud Entry

- Understand components of the IBM Reference Configuration
- Learn about infrastructure and planning steps
- Follow preferred practices to create the solution

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IBM Reference Configuration for VMware on System x with SmartCloud Entry

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This edition applies to IBM Reference Configuration for VMware on System x with SmartCloud Entry.

Contents

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Preface

IBM® SmartCloud™ Entry provides a fully integrated software stack for transforming a virtualized environment to a cloud environment. The intuitive self-service portal allows users to get up and running quickly. Built-in workload metering and additional tools enable tight controls and planning.

The IBM Reference Configuration for VMware on IBM System x® with SmartCloud Entry provides an affordable, easy to deploy, private cloud architecture with configurations based on leading-edge technology from IBM, VMware, and Juniper Networks. The reference configuration is for midsized companies that need simpler and affordable IT solutions, without compromising on functionality. IBM and VMware, world leaders in enterprise-class IT solutions, are now bringing IT solutions tailored to the midmarket.

This IBM Redpaper™ publication provides setup, configuration, and deployment details for the reference configuration and is intended for IT professionals who are familiar with software and hardware setup and configuration.

The team who wrote this paper

This paper was produced by a team of specialists from around the world working at the International Technical Support Organization, Poughkeepsie Center.

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1

Overview

IBM SmartCloud Entry provides a fully integrated software stack for transforming a virtualized environment to a cloud environment. The IBM Reference Configuration for VMware on System x with SmartCloud Entry provides an affordable, easy-to-deploy private cloud architecture. Together, IBM and VMware, world leaders in enterprise-class IT solutions, are now providing IT solutions tailored to the midmarket.

The reference configuration offers the following highlights:

- Comprehensive and robust cloud solutions for small and medium-size businesses
- Leading-edge technology from IBM System x, VMware, and Juniper Networks
- Latest IBM SmartCloud Entry for System x software
- Designed to fit into and scale with IBM System x family of solutions
- Leading features and preferred practices drive the technology envelope
- Simple, easy to install cloud with potentially dramatic IT benefits

1.1 Target usage and market

The reference configuration on System x with IBM SmartCloud Entry combines leading technologies from VMware and Juniper Networks. It creates an affordable yet expandable cloud system that is easier to deploy in fast-moving data centers. IBM recently announced SmartCloud Entry for System x, a software cloud solution that crosses platforms on System x, BladeCenter, and IBM Power Systems™ servers.

Administering IT, in remote branch offices, retail stores, and at departmental office locations, can be a challenge due to the complexity of maintaining remote systems using a small administration staff. In these instances, this solution is ideal because of its capability, resilient design, and lower price point. All of these features are suited for remote and branch offices, retail stores, and departmental computing.

System x servers offer a balance of power and affordability and are the starting point in the design of a virtually ready-to-deploy cloud solution. The system architecture is sized to fit the needs of small and midmarket businesses. In keeping with these goals, the architecture supports various workloads:

- Collaborative
- Email and database
- Web infrastructure
- Web server
- IT infrastructure
- File server
- Decision support

Figure 1-1 shows how this solution can coexist with any existing infrastructure.

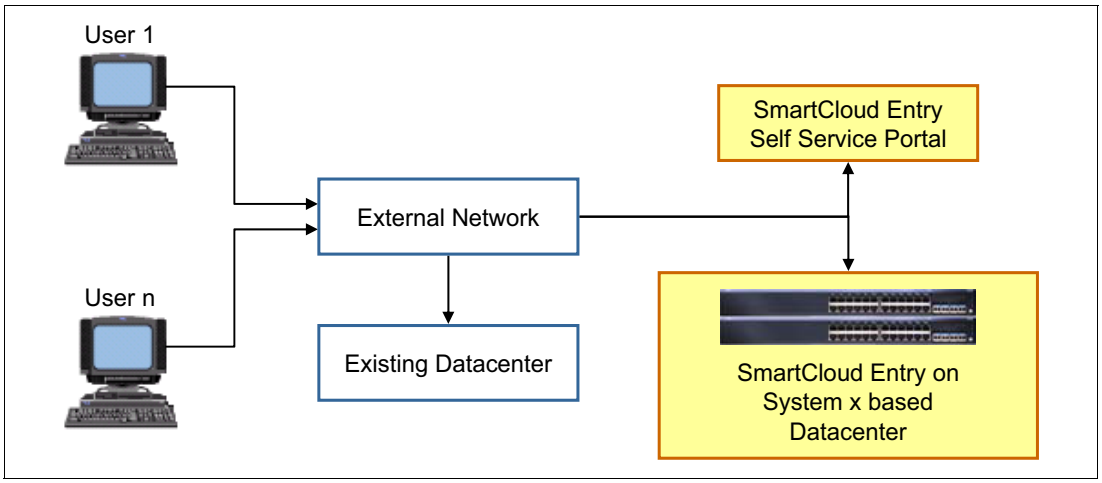

Figure 1-1 High-level view of IBM SmartCloud Entry for System x software cloud solution

1.2 Design goals and architecture

You can improve the efficiency and usage of your systems by following the current preferred practices that focus on virtualization and cloud technologies. The resulting solution can achieve many related goals, including affordability, a smaller footprint, and lower maintenance costs. This cloud platform conforms to these goals. It achieves them by following an optimized architecture and a comprehensive design that includes servers, storage, and networking.

The complete system has the following components:

- Compute and management servers

  Three IBM System x3650 M3 2U servers

- Storage:
  - One IBM System Storage® DS3524, 1 GbE IP-based Small Computer System Interface (iSCSI) Storage System with dual controllers
  - 24 x 300 GB serial-attached SCSI (SAS) drives in the DS3524

- Networking:
  - Two Juniper EX2200, 1 GbE Ethernet top of rack switches
  - Three 1 GbE dual-port onboard network interface cards (NICs) with software iSCSI
  - Three add-on Peripheral Component Interconnect Express (PCIe) quad-port NICs with HW iSCSI offload

You can use this hardware to create a cluster that runs VMware vSphere ESXi for the production VM environment. Management servers run on virtual machines in the VMware vSphere cluster. Figure 1-2 displays this configuration.

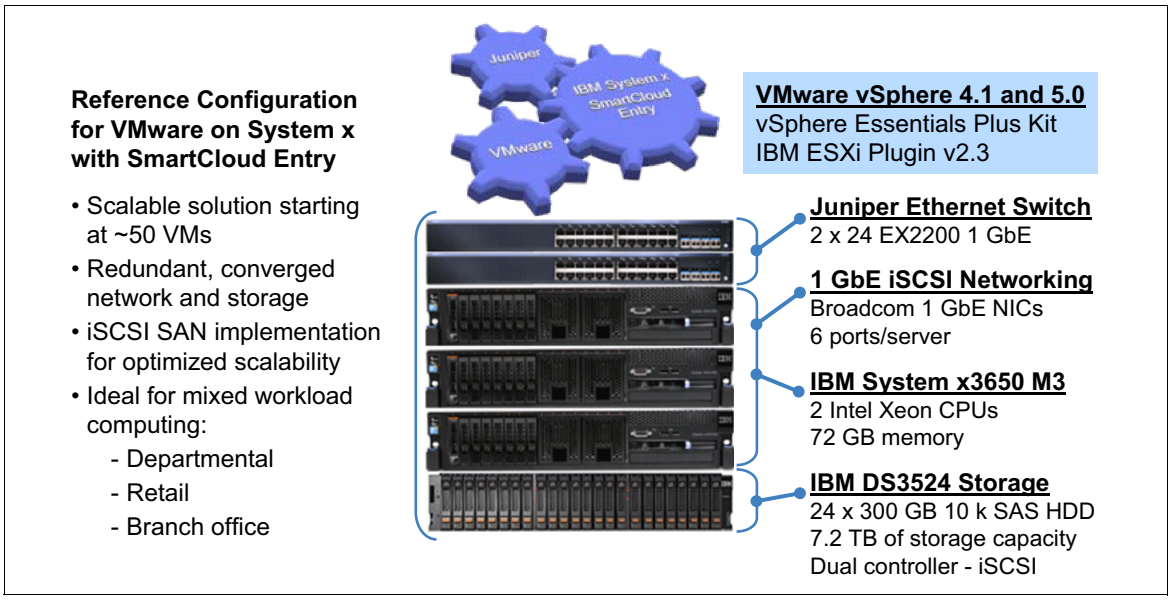

Figure 1-2 Hardware components of management and production clusters

1.3 Major components

In developing this cloud solution stack, the goals of providing a balance between price and performance optimized the choices of the server, networking, and storage elements. The result is an optimized cloud solution with high availability, scalable storage, and performance.

The solution is made up of the following components, which are shown in Figure 1-2 on page 3:

- Servers: IBM System x3650 rack servers
- Software:
  - IBM SmartCloud Entry v2.3
  - VMware Essentials Plus 5.0:
    - vSphere ESXi 5.0
    - vCenter Server 5.0
- Storage: IBM System Storage DS3524 (iSCSI-based SAN)
- Network: Converged networking with these products:
  - Juniper EX2200 Top of Rack (ToR) switches
  - Broadcom iSCSI NICs
- Infrastructure: Rack, power, and cabling system

1.3.1 IBM System x3650 M4 and x3550 M3 rack servers

The IBM System x3650 M3 server, which is shown in Figure 1-3, is a highly available, high-performance platform that is ideal for virtualization and cloud.

Figure 1-3 IBM System x3650 M3 rack server

The 1U x 3550 M3 design provides the same virtualization capabilities as the 2U x3650 M3, but in a more compact design. If you do not need the additional internal storage or I/O expansion slots, you can substitute the x3550 M3 into the reference configuration. Both System x servers offer innovative, energy-smart engineering to help lower operational costs.

Two ways exist to reach the optimized performance that you need for a virtualized environment whenever speed and high availability are concerns. The first way to achieve higher performance is to use 18 dual inline memory modules (DIMMs) of registered 1333 MHz DDR3 error correction code (ECC) memory with Chipkill1 protection (optional). The second way to improve performance is to obtain a memory capacity of up to 288 GB or 48 GB DDR3 unregistered DIMMs (UDIMMs) through 12 DIMM slots.

Both the System x3550 M3 and System x3650 M3 support the use of IBM USB Memory Key for VMware ESXi 5.0 through an internal USB port. This key, installed in a USB socket contained inside each server, allows the server to run the embedded hypervisor.

1.3.2 IBM DS3524 Storage System

The IBM DS3524 Express Storage™ System, shown in Figure 1-4, represents a carefully thought-out and well-tailored fit that provides high availability, scalability, and performance. The DS3524 comes with optional EXP3524 24 x 6.35 cm (2.5 in.) hard disk drive (HDD)) and EXP2512 12 x 8.89 cm (3.5 in.) HDD expansion trays that take it beyond its base number of 24 HDDs, for a total of 192 drives. This configuration fills up the base unit with 24 2.5-inch 300 GB 10K rpm, hot-swap SAS hard disk drives for a total of 7.2 TB of raw unstructured storage.

Figure 1-4 IBM DS3524 Express Storage System

1.3.3 Networking element

The following devices are networking elements.

Juniper Networks EX2200 ToR switches for IBM System x

The configuration uses two Juniper Networks EX2200 ToR 1 GbE switches, with 24 fixed ports and four modular ports, each as shown in Figure 1-5.

Figure 1-5 Juniper EX2200 ToR switches for IBM System x

The EX2200 occupies a single rack unit and features complete Layer 2 and basic Layer 3 switching capabilities. It delivers a compact solution where space and power are at a premium. Each EX2200 switch supports four fixed front panel GbE uplink ports with optional pluggable optics. The switch allows for high-speed backbone or link aggregation connections between wiring closets and upstream aggregation switches.

Broadcom NetXtreme II 1000 Express Quad Port Ethernet Adapter

The Broadcom NetXtreme II 1000 Express Quad Port Ethernet Adapter, coupled with the two-port Broadcom card in the server, provides the six ports for each required server for this configuration. The quad-port card includes an iSCSI hardware offload engine within the adapter.

1.3.4 VMware Essentials Plus

VMware vSphere Essentials includes vCenter Server Essentials and ESXi for three hosts, vCenter agents, eight-way virtual symmetrical multiprocessor system (vSMP), and the update manager. vSphere Essentials can be used on up to three hosts and on servers with up to two processors with 192 GB total vRAM entitlement.

1.3.5 IBM SmartCloud Entry v2.3

IBM Starter Kit for SmartCloud on System x includes IBM SmartCloud Entry, an entry private cloud offering that is simple to deploy and easy to use. IBM SmartCloud Entry works with an existing systems infrastructure. IBM SmartCloud Entry allows managers to quickly deploy self-service provisioning of virtualized workloads with a simple interface. This interface provides oversight; at the same time, it increases IT efficiency and lowers administration costs. IBM SmartCloud Entry offers these features:

- Self-service portal for workload provisioning, that is, create/replicate assets, manage deployments, and monitor activity
- Virtualized image management with library for standardized images
- Administrative controls for secure operation of a persistent cloud
- Basic metering, or automated collection of resource usage metrics, authentication, and authorization

Another SmartCloud Entry feature is the simplification of virtualization management. This feature provides these components:

- Deployed virtual machines (VMs)
- VMware configuration considerations
- IBM System Storage DS® Storage Manager
- IBM System Storage DS3500 plug-in for VMware VCenter

Deploying virtual machines

Dramatically reduce time-to-value for new workloads, from months to a few days, by providing the following benefits:

- Deploy application images across compute and storage resources
- Improve responsiveness with user self-service
- Ensure security through VM isolation, project-level user access controls
- Simplify use because there is no need to know all the details of the infrastructure
- Protect your investment with full support of existing virtualized environments
- Optimize performance on IBM systems with dynamic scaling, expansive capacity, and continuous operation

For more details, use the link:

http://www.ibm.com/systems/bladecenter/solutions/cloud/starterkit/index.html

Prerequisite software components

IBM SmartCloud Entry has additional software prerequisites that vary depending on the type of cloud provider you use. IBM SmartCloud Entry depends on IBM Systems Director VMControl™ or VMware vSphere with vCenter for platform management and virtualization services. Ensure that you download and apply the latest fix packs for SmartCloud Entry.

Server and concurrent user maximums

Depending on your cloud manager, IBM SmartCloud Entry supports 30 concurrent users on the interface or application programming interfaces (APIs), and 450 maximum virtual servers (for VMware).

Configuration considerations for VMware

Consider these suggestions for VMware configurations:

- Use system pools for advanced placement: We suggest that you enable IBM SmartCloud Entry to allow vCenter to place the user workload on the best host machine. Configure by using a DRS-enabled cluster within vCenter and setting the appliance target to use the FIXcluster or a resource pool defined in the cluster. This configuration allows vCenter to manage the available host resources. Otherwise, the appliance target is an individual host machine or a resource pool on a host machine.
- To obtain the best performance, we suggest that the vCenter server and the IBM SmartCloud Entry server reside on the same network.

Self-service portal

The self-service portal, a key capability of SmartCloud Entry, enables you to perform administrative and user tasks in an intuitive and simple-to-use graphical interface, as shown in Figure 1-6. Use the appliance option to create templates for images that you want to deploy.

Figure 1-6 IBM SmartCloud Entry self-service portal

IBM DS Storage Manager

With IBM DS Storage Manager software, perform administrative tasks such as creating arrays and logical drives, assigning logical drives to host servers, setting up IBM FlashCopy® and Volume Copy, capturing logs for troubleshooting, and management tasks.

The IBM DS Storage Manager offers these features:

- Intuitive and powerful management:
  - Robust functionality with easy-to-understand graphical user interface (GUI) and wizards
  - Unparalleled configuration flexibility that enables superior utilization
  - Tunable attributes to meet any server or application need
- Protected and available data:
  - Online configuration, reconfiguration, expansion, and maintenance
  - Automated I/O path failover, drive rebuild, and cache destage
  - Integrated disk encryption, Redundant Array of Independent Disks 6 (RAID 6), and proactive drive monitoring
- Fully integrated advanced functionality (premium features)

  Partitioning, FlashCopy, and Volume Copy

IBM DS3500 System Storage Plug-In for VMware vCenter

The System Storage 3500 Plug-In for VMware vCenter provides VMware administrators with powerful capabilities that are designed to increase their productivity and simplify their jobs. The plug-in is designed to monitor and manage System Storage DS3500 storage arrays used in conjunction with VMware virtualization software. The plug-in also allows administrators to monitor and provision the storage subsystems that they employ. The ultimate goal is to ensure the performance and availability of the virtual infrastructure that they manage.

The plug-in enables administrators to monitor and manage their storage subsystem from a single point and to perform a common set of storage provisioning tasks without switching between multiple user interfaces. The vCenter plug-in helps VMware administrators in many ways:

- Quickly provisioning additional storage for virtual machines
- Enabling an end-to-end view for VMware to storage from a virtual machine, host, storage subsystem, or volume perspective
- Describing current conditions in easy-to-understand terms
- Responding better to service level agreement (SLA) and quality of service (QoS) issues
- Employing RAID protection
- Ensuring availability of sufficient disk space
- Troubleshooting and conducting root cause analysis for virtual machines and their storage
- Setting up the remote mirror for VMware Site Recovery Manager
- Taking a FlashCopy of a data store for validation or before changing the environment

2

Infrastructure and planning

This cloud solution is designed as a versatile platform that can fit into several environments, such as retail, departmental computing, or branch offices. In each scenario, the solution can coexist with installed equipment or the solution can be part of the data center. Planning well for the installation can help to ensure early success and create a pathway for future growth and scaling with this product.

2.1 Rack, power, and cabling

Optimized infrastructure equipment is critical to drive improved IT efficiency and availability for data centers of today and tomorrow. The IBM rack and power infrastructure offerings are custom designed for IBM System x servers. You can realize the following benefits with this infrastructure:

- Improved data center efficiency
- Increased power efficiency
- Increased space efficiency
- Lowered cost through better data center utilization
- Improved IT availability
- Improved uptime
- Action before downtime affects business
- Matched utilization, power resources, and capacity planning

In addition, IT availability and efficiency are primary drivers to data center spending:

- Servers for each rack show a 50% increase since 2000.
- Energy consumption shows an increase of 20% due to more memory and improved utilization from virtualization.
- Power densities are higher at the server and rack levels.

Today, in the online environment, even minutes of downtime can significantly affect the operations of an organization, client satisfaction, and financial results, making high availability an essential feature. Data center technology fundamentals require a solid foundation of rack and power infrastructure that delivers the ability to securely manage and control power resources, servers, and appliances in the data center and across the network. This solid foundation is imperative to maintain the highest levels of IT availability and drive operational efficiencies.

IBM has over 40 new products, refreshing the offerings across the entire rack and power options portfolio. Figure 2-1 on page 11 shows several of the new products:

- Three new racks that are 1,200 mm (47.24 in.) deep. This new lineup includes a new 47U tall rack and new 42U versions that include a *dynamic* rack that is ship loadable.
- A lineup of optional uninterruptible power supplies that includes new rack-mounted and tower units, supporting voltages and configurations not previously available. These uninterruptible power supplies include new 1,500, 2,200, 3,000, and 6,000 volt ampere (VA) units.
- A new line of 0U strip power distribution units (PDUs) designed for tool-less installation in the new racks. These PDUs have 24 outlets for the server-dense rack installation of today.
- IBM also offers new Local and Global Console Managers that support unique cabling options, *conversion options*, to enable chaining up to 1,024 managed devices that can be managed from a single console.

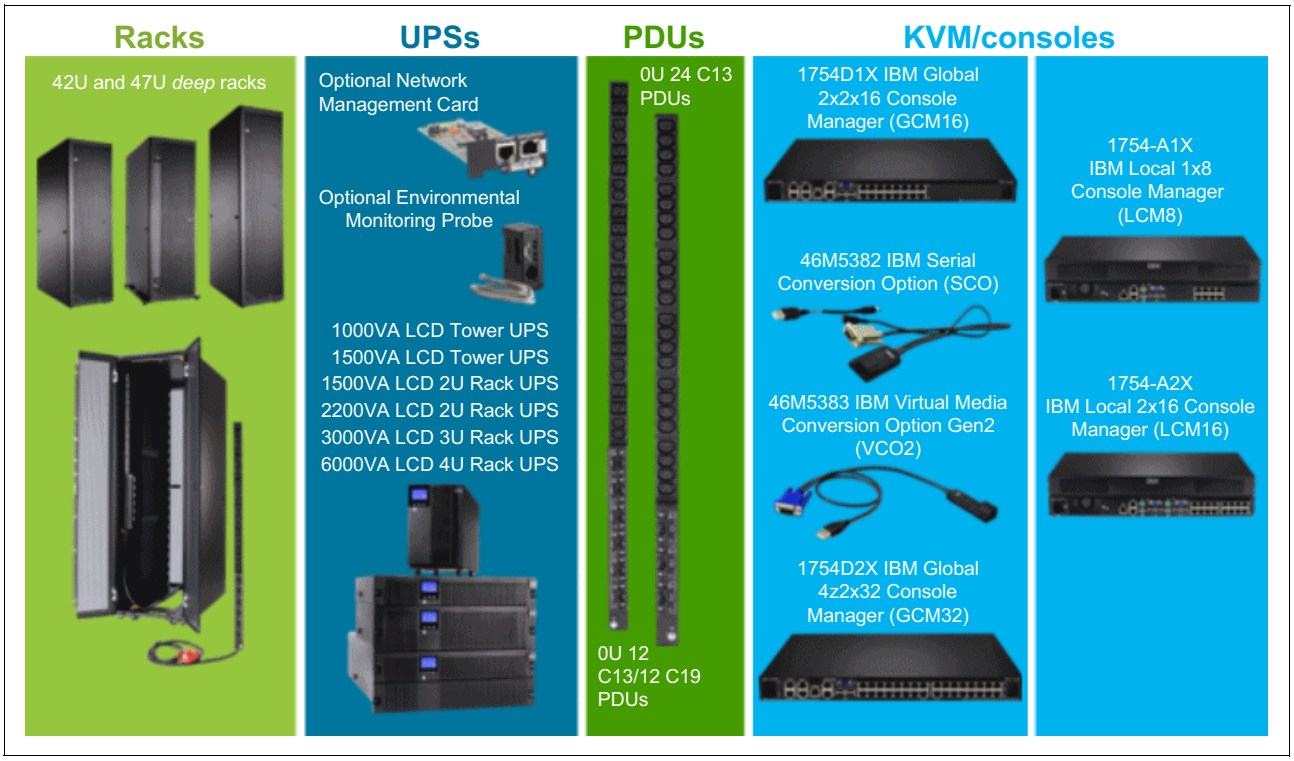

Figure 2-1 New System x rack and power offerings

You can use these additional components to complement the solution with consoles, KVM switches, rack enclosures, and additional elements for a more efficient data center.

2.2 Components

These infrastructure components reflect preferred practices and the preferred elements for the reliable operation of the solution. You can also deploy the solution within existing racks and connect it to existing infrastructure, if you follow the overall guidelines and principles described here.

Components include rack and power elements, compute and management cluster components, storage and network elements, and software components.

Table 2-1 describes the rack and power elements.

Table 2-1 Rack and power elements

Part number	Description	Quantity
93072PX	IBM S2 25U Static Standard Rack Cabinet	1
Alternative		
93072RX	NetBAY S2 25U Standard Rack Cabinet	1

Table 2-2 on page 12 shows the compute and management cluster components.

Table 2-2 Compute and management cluster components

Part number	Description	Quantity
Servers		
794572U	x3650 M3, Xeon 6C X5675 95W 3.06GHz/1333MHz/12MB, 1x4GB, O/Bay HS 2.5in SAS/SATA, 675W p/s, Rack	3
CPU and memory		
81Y6544	Intel Xeon 6C Processor Model X5675 95W 3.06GHz/1333MHz/12MB	3
49Y1397	8GB (1x8GB, 2Rx4, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP RDIMM	18
49Y1407	4GB (1x4GB, 2Rx8, 1.35V) PC3L-10600 CL9 ECC DDR3 1333MHz LP RDIMM	18
41Y8300	IBM USB Memory Key for VMware ESXi 5.0	3

Table 2-3 describes the storage elements.

Table 2-3 Storage elements

Part number	Description	Quantity
Storage system	**Additional 300 GB drives**	
1746A4D	IBM System Storage DS3524 Express Dual Controller Storage System	1
49Y1836	300GB 2.5in 10K 6Gb SAS HDD	24
68Y8433	1Gb iSCSI 4 Port Daughter Card	2

Table 2-4 describes the network elements.

Table 2-4 Network elements

Part number	Description	Quantity
Top-of-rack switch		
6630010	Juniper 24 Port 1Gb EX2200 Ethernet Switch for IBM System x	2
In server	**NIC PCIe adapters**	
49Y4220	NetXtreme II 1000 Express Quad Port Ethernet adapter	3

Table 2-5 on page 13 describes the planning actions of the software components.

Table 2-5 Software components planning actions

Part number	Description	Quantity
Cloud	**IBM SmartCloud Entry (one year)**	
00D4658	IBM Starter Kit for Cloud x86 Ed V2, Per Managed Srvr w/1 Yr S&S	3
Alternative	**IBM SmartCloud Entry (three year)**	
00D4659	IBM Starter Kit for Cloud x86 Ed V2, Per Managed Srvr w/3 Yr S&S	3
Hypervisor-OS	**VMware Essentials Plus (one year)**	
4817SF9	VMware vSph5 Ess Plus Bundle for 3 hosts Lic and 1 Year Subs	1
Alternative	**VMware Essentials Plus (three year)**	
4817TF9	VMware vSph5 Ess Plus Bundle for 3 hosts Lic and 3 Year Subs	1

A key element of the installation steps is to ensure that power to the system is provided reliably, thus minimizing the possibility of inadvertent power loss. This section describes choices and preferred practices that can prevent power-related issues and problems.

2.2.1 Rack and power distribution

You need to install the PDUs and their cabling before placing any of the systems or storage in the rack. Provide enough PDUs to allow redundant power supplies to be fed from separate electrical circuits. As you cable the PDUs, consider the following suggestions:

- Ensure that sufficient separate electrical circuits and receptacles are available to support the necessary PDUs.
- Minimize the chance that a single electrical circuit failure might disable a device by ensuring PDUs feeding redundant power supplies are supplied from separate electrical circuits.
- Plan for one electrical cord from separate PDUs for devices that have redundant power supplies.
- Power each EX2200 Ethernet switch from a separate PDU.
- Locate Ethernet switches to allow the easiest cable runs possible.
- Locate storage in lower portions of rack for added stability.

2.2.2 Network

The network topology and architecture play an important role in streamlining flow. You need to carefully plan the following steps:

- Network naming conventions
- Network cabling plan and port assignment
- IP addresses, subnets, and virtual local area networks (VLANs)

2.2.3 Storage

Implementing the storage usage model can be part of a standard. The approach used in this configuration balances performance and redundancy; however, you can choose the configuration that best fits your specific environments.

2.2.4 Virtualization

Defining a virtualization strategy is key to maximizing the benefits of a centralized administration of tasks and resources. This strategy helps with scalability issues and overall hardware resource allocation, including power management. You must consider the following areas:

- VMware vSphere cluster and management servers
- vSphere to application development (AD) domain integration
- VM naming conventions
- VM network connectivity

3

Designing the solution

In this section, we describe the two major subsystems, networking and storage, in detail. Networking and storage, along with the servers, create the foundation for the solution. The networking section describes the virtual local area network (VLAN) configuration and topology. The storage section includes suggested structure for performance and redundancy.

3.1 Networking

Each server offers six 1 Gb Ethernet ports to the hypervisor, vSphere ESXi. Two ports are LAN ports on motherboard (LoM) and four ports are on additional network interface cards (NICs). Each server has additional ports for integrated management modules (IMMs), which are not used by the hypervisor or virtual machines (VMs), as shown in Figure 3-1.

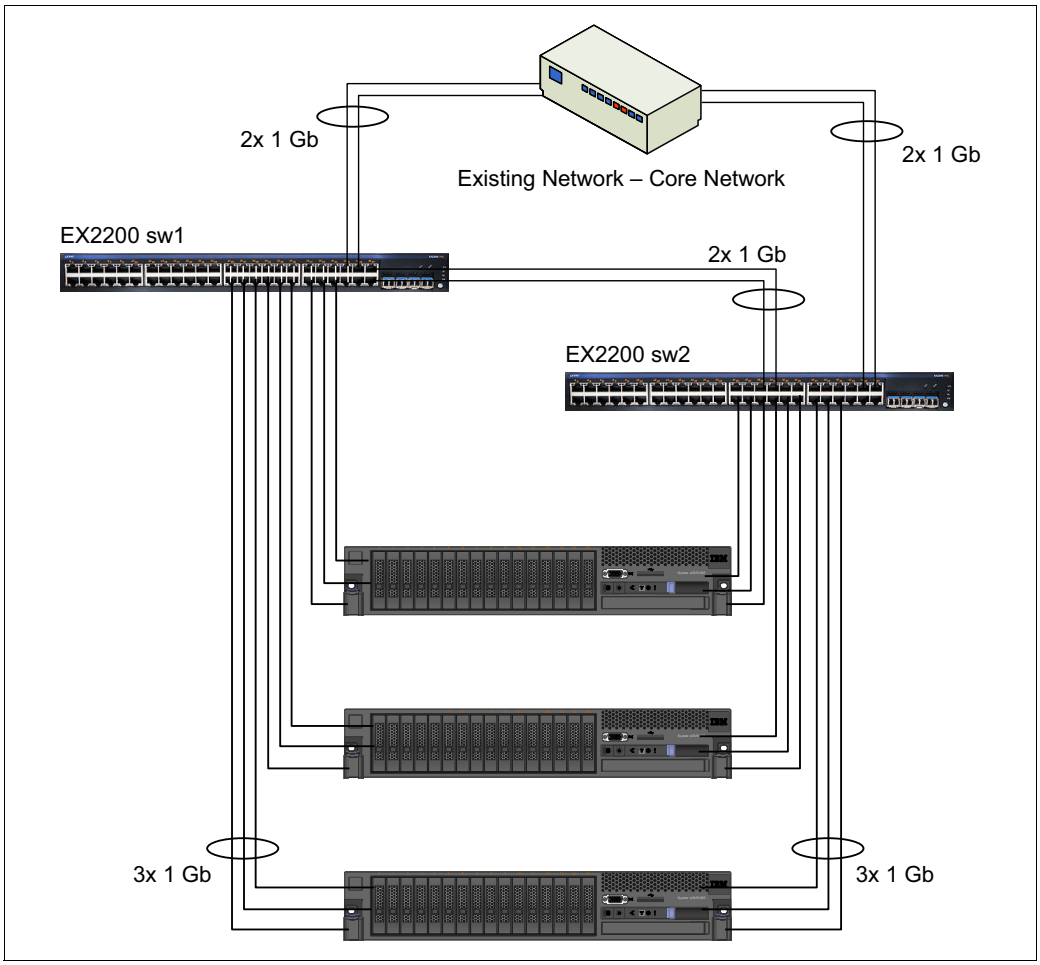

Figure 3-1 Network topology

3.1.1 Ethernet switching

Network traffic is organized in eight networks that are placed in separate VLANs. Several Ethernet ports are used for more than one network, as outlined in Table 3-1.

Table 3-1 Network VLANs

Network	Name	Description
VLAN 11	iSCSI-1	iSCSI storage network 1 that is used for iSCSI storage traffic
VLAN 12	iSCSI-2	iSCSI storage network 2 that is used for iSCSI storage traffic
VLAN 31	VM31	Production VM communication network 1, used as communication network for production VMs
VLAN 32	VM32	Production VM communication network 2, used as communication network for production VMs
VLAN 33	VM33	Production VM communication network 3, used as communication network for production VMs
VLAN 40	LM	Live migration, private network for ESXi hosts, used for vMotion
VLAN 50	MGMT	Management network, which is the network that is used for managing ESXi hosts, DS3500, and Active Directory connections
VLAN 51	IMM-MGMT	Management network, which is the network that is used for managing IMMs on servers

There are three production VM networks here, though, in some cases, only one network can be used for this purpose. By creating multiple networks, you can isolate workload (VMs) for security purposes.

Two IP-based Small Computer System Interface (iSCSI) networks, which are shown in Table 3-1, enable multipath design by using redundant gigabit Ethernet ports on servers and storage controllers. This design helps to achieve high availability and more bandwidth. Figure 3-2 on page 18 illustrates this configuration.

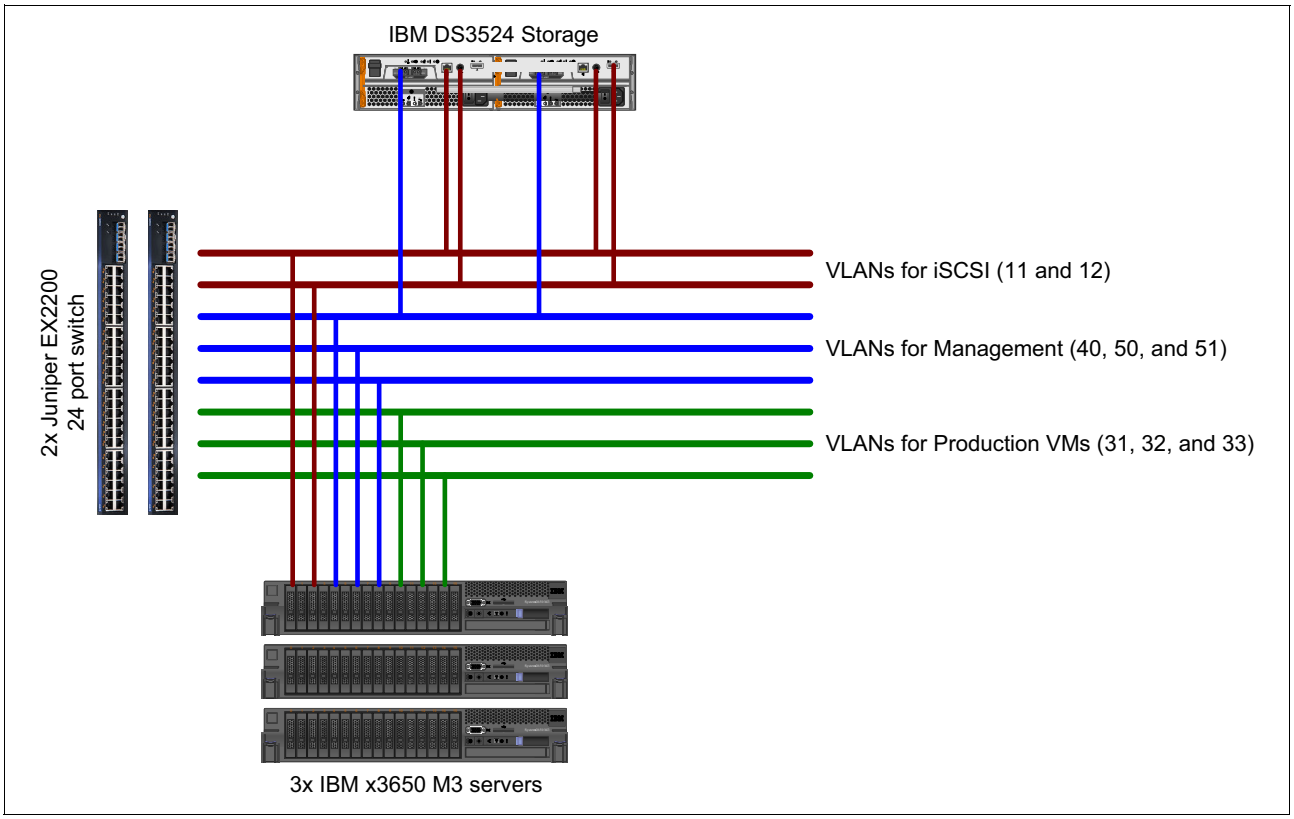

Figure 3-2 VLAN assignment

Table 3-2 describes the VLAN assignments.

Table 3-2 VLAN assignments

Server port	VLAN	Purpose
LAN1	MGMT (50) and live migration (40)	Management and live migration to Switch 1
LAN2	MGMT (50) and live migration (40)	Management and live migration to Switch 2
Card 1 port 1	iSCSI-1 (11)	iSCSI storage to Switch 1, no VLAN tagging
Card 1 port 2	iSCSI-2 (12)	iSCSI storage to Switch 2, no VLAN tagging
Card 1 port 3	VM31, VM32, VM33	Production VM traffic to Switch 1
Card 1 port 4	VM31, VM32, VM33	Production VM traffic to Switch 2

This configuration uses two Juniper Networks EX2200 switches. The switches have 24 fixed ports, 10/100/1000Base-T (gigabit Ethernet) ports with RJ45 connectors, and four uplink slots for optional gigabit small form factor pluggables (SFPs). Figure 3-3 on page 19 shows this configuration.

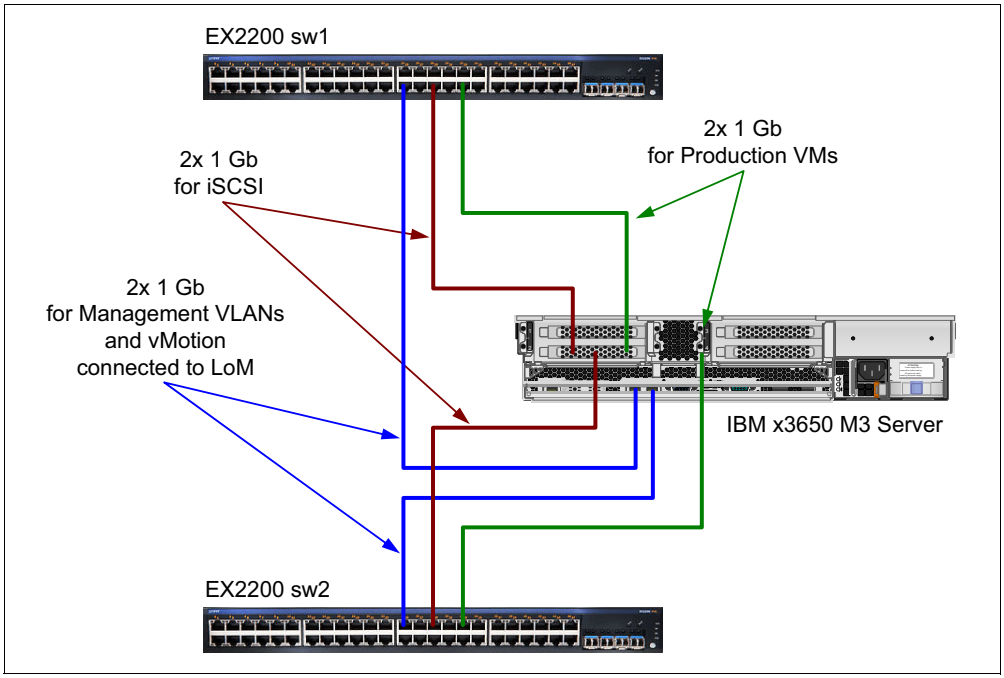

Figure 3-3 Switch connectivity

Table 3-3 outlines the suggested VLAN mapping for EX2200 switches.

Table 3-3 Suggested VLAN mapping for EX2200 switches

Ports	VLANs and purpose
0 - 3	MGMT and LM - management and live migration (vMotion), VLAN tagged, connected to LAN1/LAN2 on the server
4 - 7	iSCSI-1 (Switch 1) or iSCSI-2 (Switch 2) - storage iSCSI traffic, untagged
8 - 11	VM31, VM32, VM33 - Production VM traffic
12 - 13	Available
14 - 15	IMM-MGMT - IMM network management connection on the servers, two ports on each switch
16 - 17	iSCSI-1 or iSCSI-2 - storage iSCSI traffic for DS3500, untagged
18 - 19	MGMT - management for DS3500 and optional local management workstation
20 - 21	All VLANs - Trunk link aggregation (LAG) to other switch
22 - 23	All VLANs - Trunk LAG to existing corporate network

Figure 3-4 illustrates the networking configuration in vSphere ESXi virtual Ethernet switches and ports.

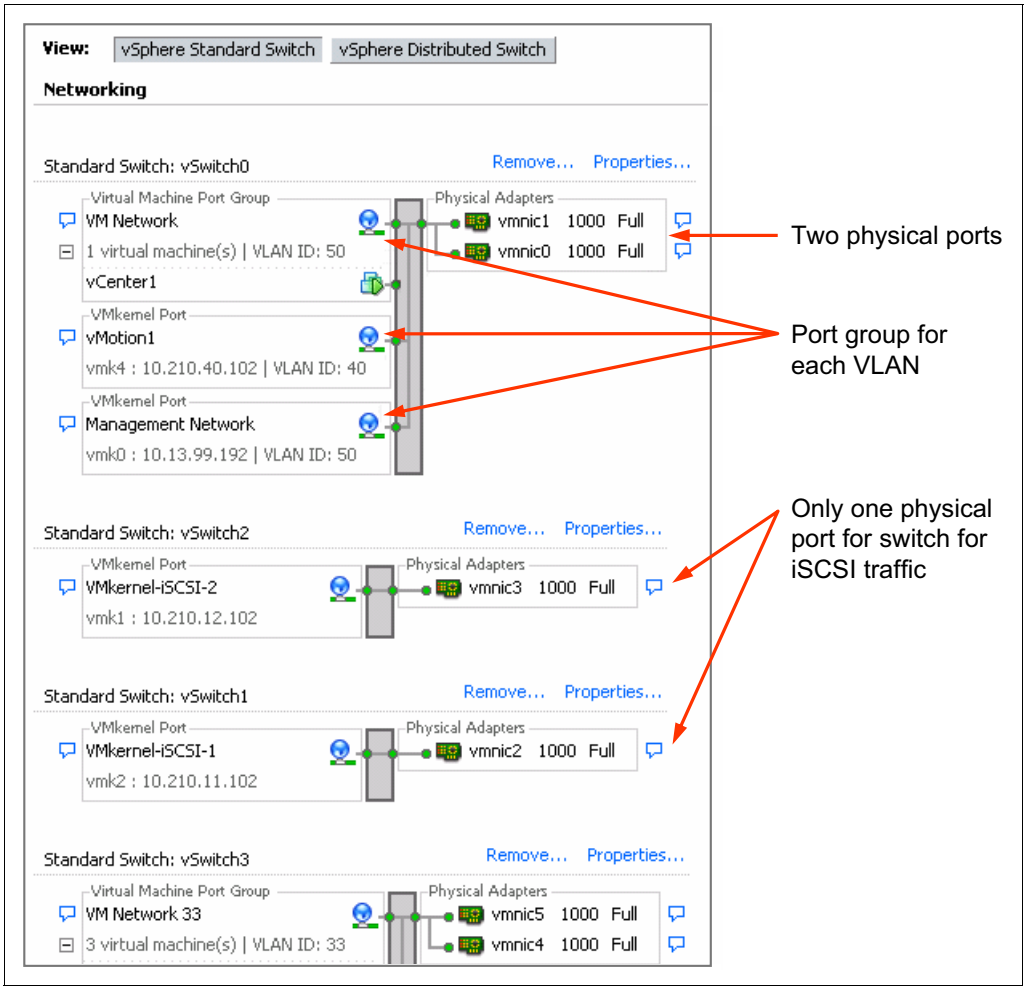

Figure 3-4 Network configuration in vSphere ESXi virtual Ethernet switches and ports

Link aggregation (LAG) or bonding is not used between servers and EX2200 switches. A LAG link has two ends. If all LAG member links on one end are terminated on the server, all member links on the other end need to be terminated on one physical or logical switch. EX2200 switches work independently; therefore, they cannot work as one logical switch (virtual chassis).

If two physical ports on the host are connected to the same virtual switch in ESXi (IBM Versatile Storage Server (VSS)), load balancing is configured for each virtual port identification. Management VLANs (LoM port) and production VM VLANs, use this configuration, as shown in Figure 3-4.

Use *Auto Negotiate* for links between server NICs and the EX2200 switch. You do not need to fix speed or duplex on modern gigabit Ethernet NICs.

Preventing network bridge loops: Server Time Protocol

A loop might occur in the network when two switches are connected to the existing network. Rapid Spanning Tree Protocol (RSTP) is enabled by default on EX2200 loop prevention protocol. To optimize data paths in the network, configure RSTP to keep a link between the two EX2200 switches in a forwarding state, and link between the first EX2200 and corporate

network in a forwarding state. Then, link between the second EX2200 switch and corporate network in a blocked state. Create this linkage by configuring bridge priorities and port cost on EX2200 switches. Alternatively, you can configure EX2200 to use Multiple Spanning Tree Protocol (MSTP) for loop prevention. The choice between RSTP and MSTP depends on which protocol that you use in the existing network.

3.1.2 IP routing

EX2200 is configured as a managed level 2 (L2) switch. EX2200 also has level 3 (L3) capabilities, but those levels are not used in this setup. We assume that you are using existing corporate network equipment to route traffic between VLANs and to the Internet.

3.1.3 Prioritizing network traffic (class of service)

Consider configuring quality of service settings (QoS) (class of service) for ports that are used for more than one VLAN. Live migration (vMotion) traffic might have lower priority than management traffic for ESXi hypervisors or integrated management modules (IMMs). Configure class of service on EX2200 switches to correctly prioritize traffic.

To configure class of service on an EX2200 switch, consider these methods:

- Classify inbound traffic in forwarding classes based on VLANs.
- Configure schedulers by specifying a transmit rate for forwarding classes, and applying sets of these schedulers on egress ports.

For detailed information about the Juniper class of service, see this link:

http://www.juniper.net/techpubs/en_US/junos/information-products/pathway-pages/cos/index.html

You can configure networking on ESXi hosts to limit the amount of traffic for every port group. For example, host vMotion outgoing traffic can be limited to reserve bandwidth on shared ports for ESXi management traffic. Another example is to limit outgoing traffic for port groups for VM production traffic. ESXi implements hard limits for the traffic; if traffic reaches the configured limit, it is not used even if unused bandwidth exists on the port.

3.1.4 Managing EX2200

An EX2200 switch has a console port on the back for out-of-band management that uses the command-line interface (CLI). For more information, see Juniper Networks *EX2200 Switch Quick Start* paper for instructions about initial configuration:

http://www.juniper.net/techpubs/en_US/release-independent/junos/information-products/pathway-pages/ex-series/ex2200/ex2200.html

You can manage the EX2200 switch by using the following methods:

- Out-of-band management port on the back of the device
- In-band management that applies an L3-interface to one of the VLANs, for example, management VLAN

In the sample configuration shown in Appendix B, “Sample Juniper Networks EX2200 Ethernet Switch configuration” on page 35, out-of-band management is used to configure the IP address on the Management Ethernet, *me*.

3.2 Storage area network (iSCSI network)

EX2200 switches provide function for storage area networks (SANs), connecting hosts with storage. This configuration is a converged network design because the same infrastructure is used for SAN traffic and data traffic.

Converged networks provide significant savings:

- Infrastructure cost: Fewer devices to purchase
- Operational cost: Fewer devices to manage, and less energy for power and cooling

The network is designed to avoid the adverse effects other types of traffic might have on SAN traffic:

- EX2200 switches are non-blocking with wire-rate forwarding speed. After the frame is in the switch, it is forwarded to the destination port independently of other types of traffic.
- SAN traffic uses dedicated ports on EX2200, servers, and DS3524, so that it does not compete for bandwidth on the same physical port with other types of traffic.

The only exception is the placement of SAN traffic on trunk interfaces between switches to provide an optional feature of iSCSI access to DS3524 from the core network. For this feature to work, iSCSI VLANs must be enabled on all three trunk ports, the switch-to-switch links, and the two uplink trunks from switches to the core network. Configure the class of service on EX2200 switches to correctly prioritize traffic on trunk ports if you want to use this feature.

Storage network traffic in EX2200 switches is isolated from other types of traffic by using two VLANs, iSCSI-1 (VLAN-ID 11) and iSCSI-2 (VLAN-ID 12). For iSCSI traffic servers, use two of the six ports for storage traffic. DS3524 controllers use a total of four ports dedicated for storage traffic. All access ports for VLAN iSCSI-1 are on Switch 1, and all access ports for VLAN iSCSI-2 are on Switch 2. This configuration effectively avoids the need for iSCSI traffic to go over trunk links.

Both storage VLANs are available at the same time for servers and DS3524, making multipathing possible. Multipathing allows high availability (HA) and increased bandwidth, which is doubled in this case, by using independent network ports and switches. If a failure occurs on one port or the entire switch, the server can continue to send and receive SAN traffic over the storage VLAN by using another path.

Multipathing is configured both on the ESXi hosts and the DS3524 controller. The server can transfer data to and from storage at a speed of 2 Gbps (4 Gbps full duplex). The DS3524 can use both controllers to send and receive data to servers, with a total available bandwidth of 4 Gbps or 8 Gbps, full duplex.

3.2.1 Jumbo frames

You can also configure server NICs and DS3524 controllers to allow jumbo frames with sizes up to 9,000 bytes. Jumbo frames are not enabled by default, but they are supported as a feature on all elements of this configuration, that is, servers, storage, and switches. Therefore, you need to configure all devices on the Ethernet frame data path and server switch storage for support of jumbo frames. To configure jumbo frame support, set the appropriate maximum transmission units (MTUs) to 9,000 (typically) on server and storage NICs. Set to 9,216 MTUs on EX2200 switches.

Follow these steps to set 9,216 MTUs on the ESXi 2200 switches:

1. In the ESXi configuration, under Networking, select switch **Properties**. For the vSwitch and the port group, set **MTU**; repeat for all iSCSI interfaces.
2. On the EX2200 switch, under physical port, that is, ge-0/0/; or LAG interface, that is, ae0; set MTU to **9216**. This configuration is sufficient for L2 operations on the switch.
3. On the DS3524, under Configure iSCSI Host Ports, select **Advanced Host Port Settings**, and set MTU to **9000** for all controller interfaces.

The Broadcom iSCSI Adapter (iSCSI HW offload) does not support jumbo frames. In this case, use the vSphere iSCSI Software Adapter.

3.3 Storage system

The IBM System Storage DS3500 Express Storage and the IBM System Storage EXP3500 Express expansion units deliver affordable, entry-level configurations for small and medium-sized businesses in compact 2U, 48.26 cm (19 in.) rack mount enclosures. These configurations have the flexibility to scale in capacity, performance, host interfaces, and advanced functions as your business grows or requirements change.

The IBM DS3524 Storage System offers the following key features:

- Six Gbps serial-attached SCSI (SAS) system delivers midrange performance and scalability at entry-level prices
- Built-in management expertise in intuitive and powerful storage management software
- Support for 6.35 cm (2.5 in.) and 8.89 cm (3.5 in.) hard disk drives (HDDs), scalable to a total of 192 HDDs
- Data security with full disk encryption is provided and supports high-performance solid-state drives (SSDs)
- Drive and expansion enclosure intermix that cost-effectively meets client requirements
- Four interface options:
  - Four or eight 6 Gbps SAS ports
  - Eight 8 Gbps Fibre Channel ports and four 6 Gbps SAS ports
  - Eight 1 Gbps iSCSI ports and four 6 Gbps SAS ports
  - Four 10 Gbps iSCSI ports and four 6 Gbps SAS ports

The DS3524 that is used in this reference configuration has the following hardware specifications:

- Dual-active, hot-swappable controllers
- One GB cache for each controller, with a 2 GB upgrade available

  Mirrored, battery-backed, and destaged to flash
- Eight 1 Gbps iSCSI ports and four 6 Gbps SAS ports
- 24 x 300 GB 10K rpm SAS HDDs, for a total of 7.2 TB of raw storage
- Two 6 Gbps SAS drive expansion ports
- Redundant power and cooling
- IBM Storage Manager running on a management console

3.4 IBM System Storage DS3500

The IBM System Storage DS3500 provides RAID controllers, plus tools for expanding storage and for configuration.

3.4.1 RAID controller

Redundant Array of Independent Disk (RAID) controllers support RAID levels 0, 1, 3, 5, 6, and 10. Each controller has 1 GB, which is upgradeable to 2 GB of user data cache with battery backup.

In dual controller configurations, the controller on the left is A, and on the right is B, when viewed from the rear of the subsystem. Dual controller configurations offer redundant access to disk storage. If the controller or I/O path fails, the other controller continues to provide access to disk drives.

All DS3500 RAID controllers have built-in connectors for the following ports:

- Two 6 Gbps SAS host server attachment ports
- Drive-side 6 Gbps SAS expansion port
- Ethernet management port
- Serial management port

3.4.2 Expansion for more storage

The DS3524 Storage System represents a carefully thought-out and well-tailored fit, providing scalability and performance. Perform the following steps to scale with more storage:

- Select larger (600 GB or larger) drives
- Use one or more expansion trays to increase scalability up to 192 drives: IBM System Storage EXP3512 Express Storage Expansion Unit (EXP3512), a 8.89 cm (3.5 in.) HDD; or IBM System Storage EXP3524 Express Storage Expansion Unit (EXP3524), a 6.35 cm (2.5 in.) HDD.

3.4.3 Configuration

The following RAID settings are used in this reference configuration:

- Array0: 3x300 GB HDD in RAID 5, which provides 558 GB
- Array1: 10x300 GB HDD in RAID 5, which provides 2,513 GB
- Array2: 10x300 GB HDD in RAID 10, which provides 1,396 GB

The following configurations support 45 VMs:

- 55 GB/VM on Array1/RAID 5
- 31 GB/VM on Array2/RAID 10

These numbers maximize allocations, leaving no space for future growth. You must balance the choice of additional reliability, availability, and data security, versus additional raw storage according to the needs of your business. The RAID configuration that is described balances performance, data security, and reliability.

vSphere Version 4.1 and earlier do not see logical unit number (LUN) sizes of 2 TB and larger. If you need a data store that is larger than 2 TB, use this workaround:

- On the DS3524, create a disk array of the size and characteristics (RAID type and number of drives) that you want.
- On the disk array, create logical drives that are smaller than 2 TB and assign LUNs to them.
- On the ESXi host, create a data store by selecting one LUN and building virtual machine file systems (VMFS) on it.
- Increase the size of the data store by adding more LUNs; they appear in the list of extents.

A

Configuration steps

This appendix describes the configuration process. First, install the equipment in the rack, connect to the cables, and power on.

This configuration process includes the following steps:

Configuring EX2200 switch

Use the following steps to configure the EX200 switch. The commands in parentheses are examples.

1. Use a console cable to connect EX2200 to a computer with terminal emulator software.
2. Follow the instructions for creating the initial configuration by using command-line interface (CLI) command **`ezsetup`** on the shell prompt.
3. Enter CLI mode by issuing command **`cli`** on the shell prompt.
4. Change the configuration by using CLI commands in configuration mode (**`config`**):
   a. Create the virtual local area networks (VLANs) (**`set vlan MGMT vlan-id 50`**) and interfaces to VLANs (**`set vlan MGMT interface ge-0/0/0`**).
   b. Set the maximum number of Link Aggregation Group (LAG) interfaces for each switch (**`set chassis aggregated-devices Ethernet device-count`**).
   c. Create LAG interfaces (**`set interfaces ae1 unit 0 family Ethernet switching`**).
   d. Remove Ethernet switching from LAG member interfaces (**`delete interfaces ge-0/0/20 unit 0`**).
   e. Add the interface as a LAG member (**`set interfaces ge-0/0/20 ether-options 802.3ad ae0`**).
   f. Set the trunk mode on the interface (**`set interfaces ge-0/0/11 unit 0 family ethernet-switching port-mode trunk`**). This step is mandatory for an interface that transports two or more VLANs.
   g. Change the maximum transmission unit (MTU) on the interface (**`set interfaces ge-0/0/4 mtu 9216`**).
   h. Change the bridge priority on the switch for Rapid Spanning Tree Protocol (RSTP) (**`set protocols rstp bridge-priority 44k`**).
   i. Commit the configuration changes (**`commit`**).

Configuring DS3524 System Storage network access

Follow these steps to configure the DS3523 System Storage network access:

1. Install the System Storage DS3524 in the rack. Power on the DS3524. Connect the DS3524 controllers to the network: management ports and host (iSCSI) ports.
2. Download the latest DS3524 management software: IBM System Storage DS Storage Manager from the IBM website (Fix Central) for your management workstation platform (Microsoft Windows, Linux, or MacOS).
3. Install IBM Tivoli® Storage Manager on your management workstation. This software runs on a computer that is not part of the cluster.
4. Determine the IP addresses of the Ethernet management ports on the DS3524. For more details, reference section 10.7, “Set Ethernet management ports”, in *IBM System Storage DS3500 Introduction and Implementation Guide*, SG24-7914. Change IP addresses of the DS3524 controllers to match your IP address plan.
5. Connect the Storage Manager software to DS3524 controllers over the IP network by specifying IP addresses of both controllers.

6. Click the **Setup** tab (initial setup tasks) and configure:
   - Storage subsystem password
   - iSCSI host ports
   - Manage iSCSI settings (authentication, identification, and discovery)

Configuring DS3524 System Storage storage subsystem

Plan carefully before you complete these steps. For example, reference technical documentation, such as section 3.3, “Planning your storage structure”, in *IBM System Storage DS3500 Introduction and Implementation Guide*, SG24-7914.

1. Use Storage Manager to connect to the DS3524.
2. Click the **Setup** tab (initial setup tasks) and choose **Configure Storage Subsystem**.
3. Choose *automatic* configuration or *manual* (advanced). Follow these steps for manual configuration:
   a. Configure the hot spare drive. Dedicate at least one drive for each shelf.
   b. Create arrays by using available drives; choose the Redundant Array of Independent Disks (RAID) level that you want.
   c. Create logical drives by using a space on the existing arrays. Choose the size, name, segment size, controller ownership, and caching options.

Configuring server hardware

Follow these steps to configure the server hardware:

1. Verify the processor and the memory configuration for the systems.
2. Confirm that a four-port network interface card (NIC) card is installed.
3. Confirm that two ports from the onboard NIC connect to the assigned communications network ports on each EX2200 switch. These ports are used for connecting to virtual LANs (VLANs) for management and live migration (vMotion).
4. Confirm that two ports on the add-on NIC card are connected to the assigned network port on each EX2200 switch for iSCSI storage traffic.
5. Confirm that two ports on the add-on NIC card are connected to the assigned network port on each EX2200 switch for production VM traffic.

Installing vSphere ESXi hypervisor on server

Follow these steps to install the vSphere ESXi hypervisor on the server:

1. Use a CD-ROM to install ESXi 5.0 on the server. The destination media is a USB key.
2. Verify in unified Extensible Firmware Interface (uEFI) on the server that the default boot device is the USB key.
3. Configure the management network on the server by using the following steps:
   - Use the onboard NIC.
   - Set the correct VLAN ID (50 in our example).

- Set the IP address and netmask.
- Set the default gateway.
- Set the host name, domain, and domain name servers (DNS).

4. Connect to the server by using the vSphere client from the computer that is running Microsoft Windows OS. This step enables you to verify the correct installation and basic configuration of ESXi.

Configuring networking on vSphere ESXi hypervisor

Follow these steps to configure networking on the vSphere ESXi hypervisor:

1. Use the vSphere client to connect to the ESXi host.
2. Add another onboard NIC port to the first virtual switch for management. Set both ports to **Active**, and under **NIC Teaming**, set the load balance to **Route based on the originating virtual port ID**.
3. Add port group for **Live Migration** (vMotion) on the first virtual switch, and assign the correct VLAN and IP address.
4. Create a new virtual switch for iSCSI traffic with one physical uplink port from the four-port NIC to switch 1 (VLAN11). Assign the correct IP addresses for the iSCSI interfaces. Do not apply any VLAN tags here.
5. Create a new virtual switch for iSCSI traffic with one physical link port from the four-port NIC to switch 2 (VLAN12). Assign the correct IP addresses for the iSCSI interfaces. Do not apply any VLAN tags here.
6. Create an additional virtual switch for production VM traffic with two uplink ports from the four-port NIC. Connect one uplink port to switch 1, and another to switch 2. Set both ports to **Active**, and load balancing is based on the virtual port ID.
7. Create port groups on the virtual switch for production VM traffic with the correct VLANs for connecting virtual machines (VMs).

Configuring storage adapter on vSphere ESXi hypervisor

Configure the ESXi storage adapters. Repeat this process on all servers:

1. Use the vSphere client to connect to the ESXi host.
2. Select the iSCSI software adapter and verify that the Status is **Enabled**.
3. Under Network Configuration, verify the appropriate VMKernel Port Bindings between the port groups and the VMKernel adapters. Add pairs as needed.
4. Identify the host iSCSI qualified name (IQN). The storage adapter is going to use this iSCSI ID to communicate with the DS3524.
5. On the DS3524, define the host by using this ID. For this definition, reference “Configuring IBM DS3524 System Storage host to LUN mapping”.
6. In vSphere Client**,** under Dynamic Discovery, add the iSCSI server location IP address of the iSCSI interface on DS3524.
7. Rescan the storage adapter. All the LUNs on DS3524 that are available to this host must be shown in the list (Devices).

Configuring IBM DS3524 System Storage host to LUN mapping

Configure the IBM DS3524 System Storage host to LUN mapping:

1. Use Storage Manager to connect to the DS3524.
2. Under the Mappings tab, define Hosts and their interfaces by using the iSCSI qualified names (IQNs).
3. Under the Mappings tab, define Host Groups and assign the hosts to the groups.
4. Under the Mappings tab, define Mappings between Hosts or Host Groups and LUNs.

Configuring storage on vSphere ESXi hypervisor

The assumption is that the DS3524 is already provisioned. Repeat this process on all servers. Formatting the logical unit number (LUN) must be completed only one time, not from each server. Follow these steps:

1. Use the vSphere client to connect to the ESXi host.
2. Add the DS3524 Logical Drive as the data store on ESXi host:
   a. Click **Configuration** → **Storage**.
   b. Click **Add Storage**.
   c. Click **Disk/LUN**.
   d. Choose **one LUN**.
   e. Choose the virtual machine file system (VMFS) version (Version VMFS-3 for compatibility with ESXi 4.1) that you want.
   f. Decide on the partitions, block size, and complete formatting. Formatting must be done only one time on the first server in the cluster.

Repeat these steps for all logical drives created on the DS3524.

Installing and configuring vCenter server

Follow these steps to install and configure the vCenter server:

1. Use the vSphere client to connect to the ESXi host.
2. Create VM for vCenter server.
3. Install Microsoft Windows Server 2008 R2 in VM for vCenter server.
4. Power on the newly created VM and connect to it by using VM Console.
5. Configure networking for this VM by connecting the VM to the management network, and by assigning a static IP address.
6. Add VM to the Active Directory.
7. Use the network connection to copy the vCenter software installation package to the VM virtual hard disk drive (HDD).
8. Install VMware vCenter on VM, then restart VM.

9. After this point, configure this setup by connecting the vSphere client to the vCenter VM, instead of connecting it to the individual ESXi hosts. Use the VM credentials to log in to vCenter (Windows user, Administrator).
10. Use the vSphere client to create the data center container in vCenter, and the cluster inside of the data center container.
11. Add all hosts (servers that run vSphere ESXi hypervisor) to the cluster. All VMs on ESXi hosts are imported into the cluster (including vCenter VM).

Creating VM template with Microsoft Windows Server 2008 R2

Follow these steps to create the VM template with Microsoft Windows Server 2008 R2:

1. Use the vSphere client to connect to the ESXi host.
2. Create a folder on the data store and upload the ISO file for Windows Server 2008 R2.
3. Create VM for Microsoft Windows 2008 R2 with resources (that is, two virtual processors, 4 GB RAM, 40 GB virtual HDD, and one NIC - VMXNET3) that you prefer.
4. Connect the VM NIC to the correct network, which is the port group for production VMs.
5. Map the VM CD/DVD drive to the ISO file with Microsoft Windows Server 2008 R2.
6. Boot VM from the mapped ISO file and complete the installation of the OS.
7. Install VMware tools to the VM.
8. Run the OS software update inside of VM to apply all the software patches that you want.
9. Complete the configuration and tuning of VM (that is, enable remote desktop, and other steps).
10. When using vSphere Client, click **VM**, and choose to create a template from this VM (Clone to Template).

Installing vSphere Management Assistant

Follow these steps to install the vSphere Management Assistant:

1. Use the vSphere client to connect to the vCenter.
2. vSphere Management Assistant (vMA) provides CLI for configuring vSphere ESXi on hosts.
3. vMA is available, at no cost, on the VMware website download in Open Virtual Machine Format (OVF) format, in the compressed file archive.
4. Download the vMA archive from the VMware website, and extract it on the file system where the vSphere client is running.
5. Use the vSphere client and run the installation wizard. Click **File** → **Deploy OVF Template**.

Installing IBM System Storage Plug-In for VMware vCenter

Follow these steps to install IBM System Storage Plug-In for VMware vCenter:

1. Download the plug-in from the IBM website:

   http://ibmdsstorage.com/software/vcenter-plug-in.html

2. Install the downloaded application on VM, running vCenter.
3. Download the documentation for the plug-in from the prior website.

Installing IBM SmartCloud Entry

Follow these steps to install IBM SmartCloud Entry, previously known as Starter Kit for Cloud:

1. SmartCloud Entry 2.2 can be installed on VM as a software package for Microsoft Windows, or Linux OS. Or, it can be deployed by using the OVF package as a pre-built Linux VM.
2. Download documentation for SmartCloud Entry from the IBM website:

   https://www.ibm.com/developerworks/wiki/smart-cloud-entry

3. Check the website for “Installation and Prerequisite Instructions”. For example, a system that runs IBM Starter Kit for Cloud (SKC) needs to have at least two processors (or two vCPUs in the case of VM).
4. Obtain an SKC software package for your management platform of choice.
5. If using Microsoft Windows OS, install the following components:
   - IBM SmartCloud Entry X86 Edition V2.2 Multiplatform English eAssembly (CRG6CEN)
   - IBM Upward Integration for VMware vSphere V1.0 for Multiplatform Multilingual (CI22 AML)

Ensure that you document installation points for later reference, including your answers to the installation procedure questions. Follow these steps:

1. Find the Secure Sockets Layer (SSL) certificate file on vCenter, and copy the file (`rui.crt`) to a folder on the SmartCloud Entry server. Typically, the file `rui.crt` is in the folder, `C:\ProgramData\VMware\VMware VirtualCenter\SSL`.
2. Install the SSL certificate file on the SmartCloud Entry server:
   a. Run the following command: **`keytool -import -file rui.crt -alias SKC -keystore vmware.keystore`**
   b. The command prompt asks for a password for the keystore.
   c. The file `vmware.keystore` is created in the current directory. Move that file to `C:\Users\Administrator\.skc` (configuration folder).
   d. Restart SKC.
3. By default, the SmartCloud Entry configuration files are in the following folders:
   - `C:\Program Files (x86)\IBM\Starter Kit for Cloud`
   - `C:\Users\Administrator\.skc`
4. Before starting SKC, verify the following configuration settings:
   - `C:\Program Files (x86)\IBM\Starter Kit for Cloud\skc.ini`

     And add the line: `-XX:MaxPermSize=128m`

- C:\Users\Administrator\.skc\email.properties

  Change email relay host

- C:\Users\Administrator\.skc\email.properties\approvals.properties

  Change request.lifecycle → true

5. Start SKC by clicking the desktop icon, which is the shortcut for C:\Program Files (x86)\IBM\Starter Kit for Cloud\skc.exe. This command opens the SmartCloud Entry console window. This window needs to be open for the SmartCloud Entry 2.2 web service to work.
6. Install the latest fix packs for SKC. The details are in "Installing IBM SmartCloud Entry fix pack".
7. Connect to the SmartCloud Entry web interface at address (replace *localhost* with correct address) http://*localhost*:8080/cloud/web/index.htm
8. Define projects on the Projects tab. Workloads and Appliances (VM templates) are associated to projects. In the SmartCloud Entry web interface, only one project is selected at any time (drop-down list is in the upper-right corner). Only the workload for that particular project shows.
9. Define user accounts in the SmartCloud Entry on the Users tab.
10. Define Networks, which are templates that are applied to appliances (VM templates).
11. Submit a request for new workloads by selecting **Appliance**, and selecting action **Deploy**. The new request is listed under the **Requests** tab and is waiting for approval by a user with administrator privileges.
12. SmartCloud Entry 2.2 offers metering and billing but they are not enabled by default. Enable these functions by editing the configuration files.

Installing IBM SmartCloud Entry fix pack

Follow these steps to install the IBM SmartCloud Entry fix pack:

1. Download the SmartCloud Entry fix pack, the fix pack readme file, and the HTML file with extension readme file.
2. Extract the fix pack in a local folder on the SmartCloud Entry server.
3. Go to the application console and add a folder path as a repository (*use a forward slash in the PATH*):

   a. addrepo file:PATH_TO_DIRECTORY

   b. Type the command **installupdates**

4. Restart the SmartCloud Entry application.

B

Sample Juniper Networks EX2200 Ethernet Switch configuration

This appendix outlines a high-level script of the parameters that are used to configure Juniper Networks EX2200 Ethernet Switches.

```
system {
    host-name sw1;
    time-zone America/New_York;
    root-authentication {
        encrypted-password bJlDKIKtpnDMk; ## SECRET-DATA
    }
    login {
        user admin {
            uid 2000;
            class super-user;
            authentication {
                encrypted-password "$1$rv1Pt8/9$s/jPJ.COR3aGzUIk9C/3e."; ##
SECRET-DATA
            }
        }
    }
    services {
        ssh {
            protocol-version v2;
        }
        telnet;
        netconf {
            ssh;
        }
        web-management {
            http;
        }
```

```
    }
    syslog {
        user * {
            any emergency;
        }
        file messages {
            any notice;
            authorization info;
        }
        file interactive-commands {
            interactive-commands any;
        }
    }
}
chassis {
    aggregated-devices {
        ethernet {
            device-count 4;
        }
    }
}
interfaces {
    ge-0/0/0 {
        description "Node-1 Port_LAN1";
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
            }
        }
    }
    ge-0/0/1 {
        description "Node-2 Port_LAN1";
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
            }
        }
    }
    ge-0/0/2 {
        description "Node-3 Port_LAN1";
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
            }
        }
    }
    ge-0/0/3 {
        description "Node-4 Port_LAN1";
        unit 0 {
            family ethernet-switching {
                port-mode trunk;
            }
        }
    }
    ge-0/0/4 {
```

```
    description "Node-1 Port_1/1";
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/5 {
    description "Node-2 Port_1/1";
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/6 {
    description "Node-3 Port_1/1";
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/7 {
    description "Node-4 Port_1/1";
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/8 {
    description "Node-1 Port_1/3";
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
        }
    }
}
ge-0/0/9 {
    description "Node-2 Port_1/3";
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
        }
    }
}
ge-0/0/10 {
    description "Node-3 Port_1/3";
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
        }
    }
}
ge-0/0/11 {
    description "Node-4 Port_1/3";
    unit 0 {
        family ethernet-switching {
```

```
            port-mode trunk;
        }
    }
}
ge-0/0/12 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/13 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/14 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/15 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/16 {
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/17 {
    mtu 9216;
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/18 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/19 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/0/20 {
    ether-options {
        802.3ad ae0;
    }
}
ge-0/0/21 {
    ether-options {
        802.3ad ae0;
    }
```

```
}
ge-0/0/22 {
    ether-options {
        802.3ad ae1;
    }
}
ge-0/0/23 {
    ether-options {
        802.3ad ae1;
    }
}
ge-0/1/0 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/1/1 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/1/2 {
    unit 0 {
        family ethernet-switching;
    }
}
ge-0/1/3 {
    unit 0 {
        family ethernet-switching;
    }
}
ae0 {
    description "Link to sw2";
    mtu 9216;
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
        }
    }
}
ae1 {
    description "Upink to corporate net";
    mtu 9216;
    unit 0 {
        family ethernet-switching {
            port-mode trunk;
        }
    }
}
me0 {
    unit 0 {
        family inet {
            address 10.13.97.31/24;
        }
    }
```

```
    }
}
snmp {
    location rack1;
    contact Admin-contact-info;
    community eLite {
        authorization read-only;
    }
}
routing-options {
    static {
        route 0.0.0.0/0 next-hop 10.13.97.1;
    }
}
protocols {
    igmp-snooping {
        vlan all;
    }
    rstp {
        bridge-priority 44k;
    }
    lldp {
        interface all;
    }
    lldp-med {
        interface all;
    }
}
ethernet-switching-options {
    storm-control {
        interface all;
    }
}
vlans {
    IMM-MGMT {
        vlan-id 51;
        interface {
            ae0.0;
            ae1.0;
            ge-0/0/14.0;
            ge-0/0/15.0;
        }
    }
    LM {
        vlan-id 40;
        interface {
            ae0.0;
            ae1.0;
            ge-0/0/0.0;
            ge-0/0/1.0;
            ge-0/0/2.0;
            ge-0/0/3.0;
        }
    }
    MGMT {
```

```
    vlan-id 50;
    interface {
        ae0.0;
        ae1.0;
        ge-0/0/0.0;
        ge-0/0/1.0;
        ge-0/0/2.0;
        ge-0/0/3.0;
        ge-0/0/18.0;
        ge-0/0/19.0;
    }
}
VM31 {
    vlan-id 31;
    interface {
        ae0.0;
        ae1.0;
        ge-0/0/8.0;
        ge-0/0/9.0;
        ge-0/0/10.0;
        ge-0/0/11.0;
    }
}
VM32 {
    vlan-id 32;
    interface {
        ae0.0;
        ae1.0;
        ge-0/0/8.0;
        ge-0/0/9.0;
        ge-0/0/10.0;
        ge-0/0/11.0;
    }
}
VM33 {
    vlan-id 33;
    interface {
        ae0.0;
        ae1.0;
        ge-0/0/8.0;
        ge-0/0/9.0;
        ge-0/0/10.0;
        ge-0/0/11.0;
    }
}
iSCSI-1 {
    vlan-id 11;
    interface {
        ae0.0;
        ae1.0;
        ge-0/0/4.0;
        ge-0/0/5.0;
        ge-0/0/6.0;
        ge-0/0/7.0;
        ge-0/0/16.0;
```

```
            ge-0/0/17.0;
        }
    }
    iSCSI-2 {
        vlan-id 12;
        interface {
            ae0.0;
            ae1.0;
        }
    }
}
```

Related publications

The publications listed in this section are considered suitable for a more detailed discussion of the topics covered in this paper.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Some publications referenced in this list might be available in softcopy only.

- “IBM System Storage DS3500”

  http://www.redbooks.ibm.com/abstracts/tips0836.html
- *IBM System Storage DS3500 Introduction and Implementation Guide*

  http://www.redbooks.ibm.com/abstracts/sg247914.html
- “Juniper EX2200 Ethernet Switch”

  http://www.redbooks.ibm.com/abstracts/tips0816.html

Online resources

These websites are also relevant as further information sources:

IBM System x resources

- IBM System x3650 M3 product page

  http://www.ibm.com/systems/x/hardware/rack/x3650m3/

IBM DS3524 resources

- IBM System Storage DS3500 Express product page

  http://www.ibm.com/systems/storage/disk/ds3500/
- IBM System Storage DS3500 Express specifications

  http://www.ibm.com/systems/storage/disk/ds3500/specifications.html

Juniper EX2200 resources

- IBM product page for the Juniper Networks EX2200 Ethernet Switch

  http://www.ibm.com/systems/x/options/networking/juniperex2200/
- Juniper EX2200 product page

  http://www.juniper.net/us/en/products-services/switching/ex-series/ex2200/
- Juniper EX2200 support page

  http://www.juniper.net/customers/support/?ex2200
- Juniper EX2200 Switch Quick Start

  http://www.juniper.net/techpubs/en_US/release-independent/junos/information-products/topic-collections/hardware/ex-series/ex2200/quick-start-ex2200.pdf

- Day One: Configuring EX Series Ethernet Switches

  http://www.juniper.net/us/en/community/junos/training-certification/day-one/fabric-switching-tech-series/config-ex-series/

- Junos as a Switching Language: An Introduction to Using Junos Software on EX Series Switches

  http://www.juniper.net/us/en/training/elearning/junos_switching/course_start.html

SmartCloud Entry resources

- IBM SmartCloud Entry on IBM DeveloperWorks

  https://www.ibm.com/developerworks/wiki/smart-cloud-entry

vSphere ESXi resources

- IBM x86 solutions for VMware vSphere Hypervisor

  http://www.ibm.com/systems/x/os/vmware/esxi/

- Download VMware vSphere 5.0

  http://downloads.vmware.com/d/info/datacenter_cloud_infrastructure/vmware_vsphere/5_0

- VMware vCenter Server product page

  http://www.vmware.com/products/vcenter-server/overview.html

- vSphere Management Assistant Documentation

  http://www.vmware.com/support/developer/vima/

- VMware vSphere 5 Documentation

  http://pubs.vmware.com/vsphere-50/index.jsp

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IBM Reference Configuration for VMware on System x with SmartCloud Entry

Understand components of the IBM Reference Configuration

Learn about infrastructure and planning steps

Follow preferred practices to create the solution

IBM SmartCloud Entry provides a fully integrated software stack for transforming a virtualized environment to a cloud environment. The intuitive self-service portal allows users to get up and running quickly. Built-in workload metering and additional tools enable tight controls and planning.

The IBM Reference Configuration for VMware on IBM System x with SmartCloud Entry provides an affordable, easy to deploy, private cloud architecture with configurations based on leading-edge technology from IBM, VMware, and Juniper Networks. The reference configuration is for midsized companies who need simpler and affordable IT solutions, without compromising on functionality. IBM and VMware, world leaders in enterprise-class IT solutions, are now bringing IT solutions tailored to the midmarket.

This IBM Redpaper provides setup, configuration, and deployment details for the reference configuration, and is intended for IT professionals who are familiar with software and hardware setup, and configuration.

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