

The Lenovo logo is displayed in white text on a black rectangular background.

SimpliVity OmniStack Solution with Lenovo System x3650 M5

Simplify IT and increase TCO savings through hyperconvergence

Improve performance for mission-critical applications while increasing efficiency

Execute on Recovery Point Objectives (RPOs) in minutes and Recovery Time Objectives (RTOs) in seconds

Achieve IT agility with VM-centric management

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Abstract

This paper describes the hyperconverged solution architecture for SimpliVity OmniStack Solution with the Lenovo System x3650 M5 rack server. The SimpliVity Solution with Lenovo is a 2U building-block that includes all IT below the hypervisor including storage, compute, networking, hypervisor, real-time deduplication, compression, and optimization along with powerful data management, data protection, and disaster recovery capabilities.

The intended audience for this paper includes IT professionals, technical architects, sales engineers, field consultants, and partner engineers who plan to deploy the SimpliVity hyperconverged solution with Lenovo System x3650 M5 servers.

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Introduction

The SimpliVity OmniStack Solution with the Lenovo® System x3650 M5 server is a hyperconverged IT platform that provides all IT services below the hypervisor, including compute, storage, and networking, real-time data deduplication, compression, and optimization functions, along with backup, disaster recovery, and WAN optimization capabilities—all in a single device. The solution combines cloud economics with enterprise-class IT capabilities.

SimpliVity OmniStack provides a scalable, modular, 2U building block of x86 resources that offers all the functionality of traditional IT infrastructure. OmniStack eliminates IT expense and complexity by consolidating 8 to 12 data center components into a single shared resource pool with global unified management. See Figure 1.

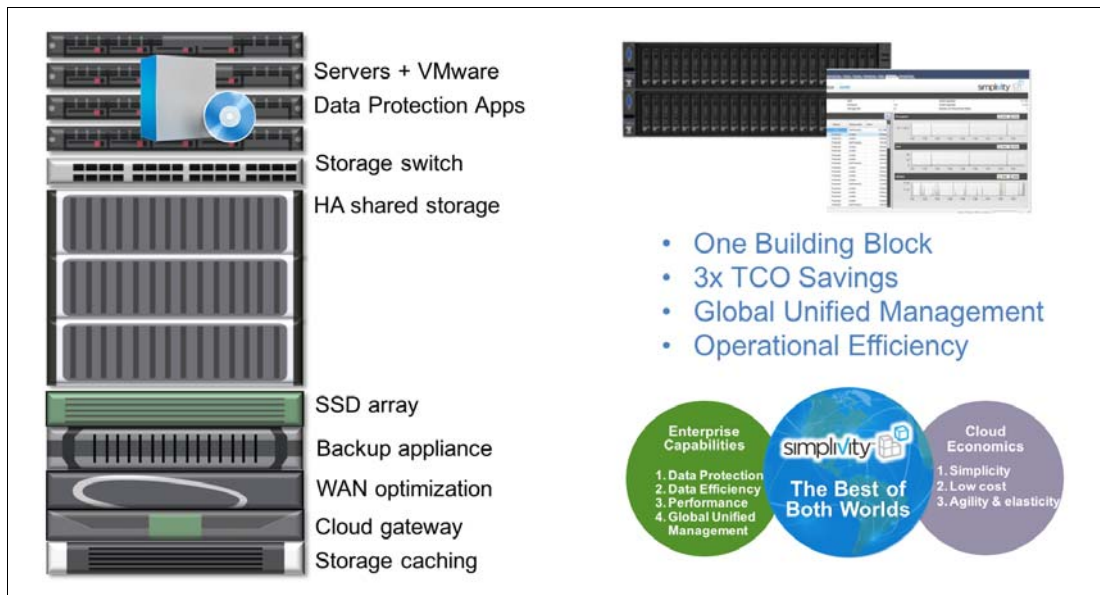


Figure 1 SimpliVity OmniStack Solution with Lenovo eliminates independent IT silos

This paper describes the hyperconverged solution architecture for the SimpliVity OmniStack Solution with the Lenovo System x3650 M5 rack server. The intended audience for this document includes IT professionals, technical architects, sales engineers, field consultants and partner engineers who plan to deploy the SimpliVity hyperconverged solution with Lenovo System x3650 M5 servers.

Business value

Legacy IT infrastructure is too costly and inflexible for today's dynamic business climate. Many organizations are constrained by siloed IT architectures made up of distinct compute, storage and networking components along with disparate data protection and efficiency solutions and a host of other infrastructure products, none of which are architected to work well in virtualized environments. Each technology requires support, maintenance, licensing, power, cooling—not to mention a set of dedicated resources capable of administrating and maintaining the elements.

Even in a virtualized world, deploying a new application—provisioning compute, storage and networking resources and setting up data protection policies—can be a manually intensive,

time-consuming proposition involving a number of distinct systems and management interfaces. Enabling up an IT service to support a new application can take days or even weeks.

Many IT organizations are looking to the cloud to contain costs and improve service agility, but cloud-based services often lack enterprise-class performance and features. SimpliVity provides the best of both worlds: cloud economics with enterprise capabilities: performance, data efficiency, data protection and global unified management.

OmniStack combines all IT infrastructure and services below the hypervisor into a single shared pool of x86 resources, eliminating the need for discrete IT components. The hyperconverged solution consolidates up to 12 data center components into a single shared resource pool with common management.

The Lenovo System x3650 M5 is a versatile server that offers high performance and pay-as-you-grow flexibility and is a great choice for businesses of all sizes. The x3650 M5 provides outstanding uptime to keep business-critical applications and cloud deployments running safely. Ease of use and comprehensive systems management tools streamline deployment. Outstanding reliability, availability, and serviceability (RAS) and a high-efficiency design help contain operating expenditures (OPEX).

Key benefits of the SimpliVity OmniStack Solution with Lenovo include:

- ▶ Simplified IT and three-fold Total Cost of Ownership (TCO) savings through hyperconvergence.
- ▶ Improved performance for mission-critical applications combined with 40:1 average data compression provides efficiency.
- ▶ Enhanced ability to meet Recovery Point Objectives (RPOs) and Recovery Time Objectives (RTOs).
- ▶ Improved IT agility with a virtual machine (VM)-centric management approach.

Solution overview

The SimpliVity Solution with Lenovo is a unified data center platform that assimilates storage, compute, networking, hypervisor, real-time deduplication, compression, and optimization, along with powerful data management, data protection, and disaster recovery capabilities.

The solution is based on a scale-out x86 architecture for ultimate flexibility and economics. Multiple OmniStack systems can be federated, creating a massively scalable pool of shared resources, enabling efficient data movement and enterprise-class system availability. A central administrator can manage all resources and workloads in a VM-centric fashion from a single pane of glass. See Figure 2. The solution supports a variety of applications and use cases, including data center consolidation, multisite data protection and disaster recovery (DR), as well as business-critical applications.

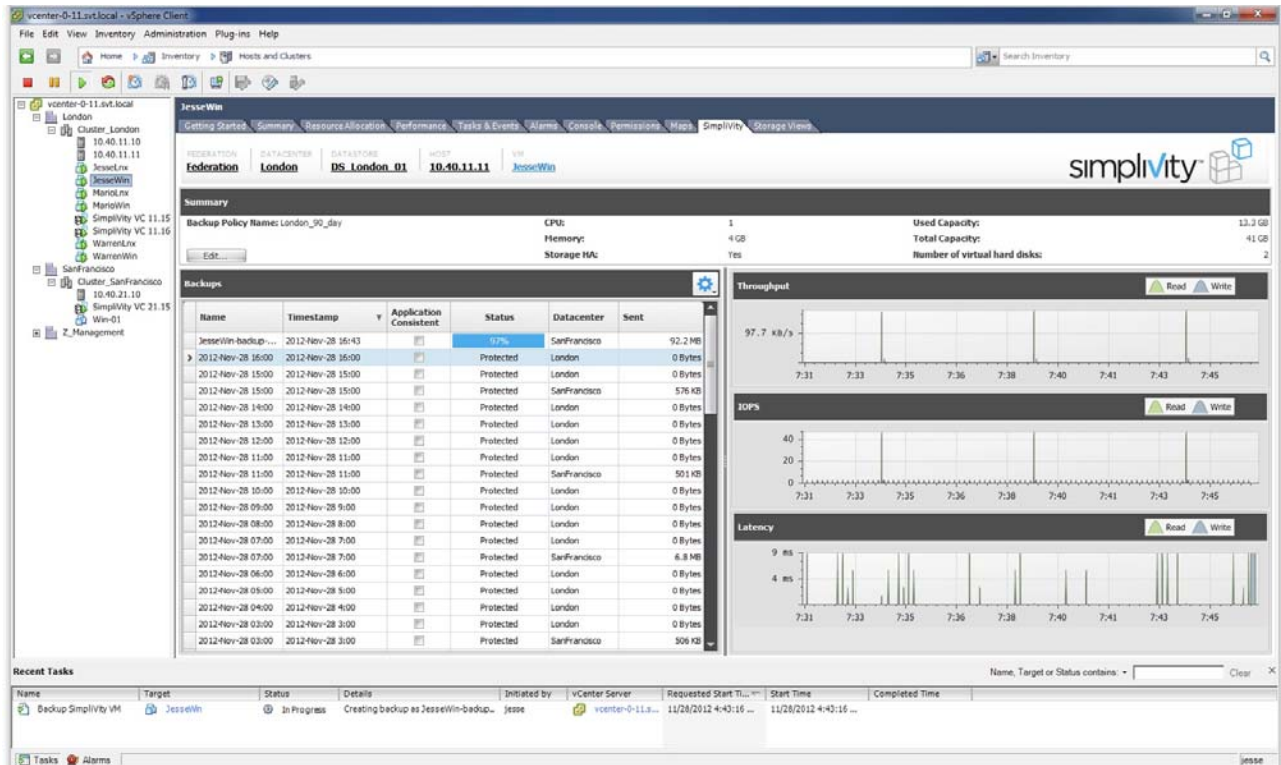


Figure 2 OmniStack Solution with the Lenovo System x3650 M5 rack server

SimpliVity's OmniStack Data Virtualization Platform incorporates three breakthrough innovations:

- ▶ Accelerated data efficiency

With the OmniStack Accelerator Card, a PCIe card deduplicates, compresses, and optimizes all data inline, in real-time, at inception, in unique 8K blocks, one-time, across all stages of the data lifecycle, globally. On average, SimpliVity customers achieve an average of 40:1 data efficiency while simultaneously increasing application performance.

- ▶ Built-in data protection

The solution provides full, logical local and remote backups without sacrificing performance. IOPS are not consumed, because the backup is simply a metadata update. OmniStack employs simple rules that define frequency, retention, and destination of backups, all done at the VM level.

VM-centric backup and WAN-efficient replication create tremendous efficiencies versus third-party backup, replication, and deduplication software and hardware. Data doesn't have to be rehydrated (returned to its original state) as it moves from its original production storage location to its backup destination within the OmniStack federation.

OmniStack's native data protection also trumps storage-level protection strategies that snapshot and replicate LUNs between storage systems, which inefficiently capture and transfer multiple datastores containing multiple virtual machines.

- ▶ Global unified management:

All distributed instances of OmniStack within a cluster form a federation—an intelligent network of collaborative systems and a single pool of resources. SimpliVity uniquely abstracts the underlying hardware from the hypervisor, providing VM-centric management and mobility. The entire infrastructure can be managed from vCenter with support for orchestration and automation tools, such as VMware vRealize Automation.

The OmniStack Solution with Lenovo is delivered as a turnkey solution that includes:

- ▶ Lenovo System x3650 M5 rack server with integrated storage elements
- ▶ SimpliVity OmniStack Accelerator Card
- ▶ SimpliVity OmniStack Data Virtualization Platform software
- ▶ VMware vSphere ESXi hypervisor

Hardware components

This section describes the major hardware components of the solution.

Lenovo System x3650 M5 rack server

The x3650 M5, Figure 3, is a versatile 2U two-socket business-critical server that offers high performance and pay-as-you-grow flexibility.



Figure 3 Lenovo System x3650 M5

Integrated with up to two Intel E5-2600 v3 series CPUs and industry leading two-socket storage capacity, the x3650 M5 is a great choice for small and medium businesses, as well as large enterprises. The x3650 M5 provides outstanding uptime to keep business-critical applications and cloud deployments running safely. Ease of use and comprehensive systems management tools streamline deployment. Outstanding reliability, availability, and serviceability (RAS) and a high-efficiency design help contain OPEX.

The key features of the x3650 M5 include the following:

- ▶ Scalability and performance
 - Superior system performance with up to 18-core processors, up to 45 MB of L3 cache, and up to 9.6 GT/s QPI interconnect links
 - Support for up to two processors, 36 cores, and 72 threads maximizes the concurrent execution of multithreaded applications
 - Intelligent and adaptive system performance with energy-efficient Intel Turbo Boost Technology allows CPU cores to run at maximum speeds
- ▶ Availability and serviceability
 - Toolless cover removal provides easy access to upgrades and serviceable parts, such as processors, DIMMs, and adapters

- Available redundant hot-swap power supplies
- Predictive Failure Analysis detects when system components (processors, VRMs, memory, drives, fans, and power supplies) operate outside of standard thresholds
- ▶ Manageability and security
 - Integrated Management Module II (IMM2) enables remote server monitoring and management
 - Industry-standard Unified Extensible Firmware Interface simplifies setup, configuration, and updates, and error handling
 - Comprehensive systems management tools help increase uptime, reduce costs, and improve productivity
- ▶ Energy efficiency
 - Energy-efficient planar components help lower operational costs
 - High-efficiency power supplies with 80 PLUS Platinum and Titanium certifications
 - Intel Intelligent Power Capability powers individual processor elements on and off as needed, to reduce power draw

For additional information visit:

- ▶ x3650 M5 product guide
<https://lenovopress.com/tips1193-lenovo-system-x3650-m5>
- ▶ x3650 M5 product web page
<http://shop.lenovo.com/us/en/systems/servers/racks/systemx/x3650-m5/>

OmniStack Accelerator Card

The OmniStack Accelerator Card, Figure 4 on page 8, is a specially architected SimpliVity PCIe module that processes all writes and manages the compute-intensive tasks associated with data deduplication, and compression.

It performs inline data deduplication, compression, and optimization on all data at inception across all phases of the data lifecycle (primary, backup, archive, WAN, and on the cloud), across all tiers within a system (DRAM, Flash/SSD, and HDD), all handled with fine data granularity of just 4KB-8KB.

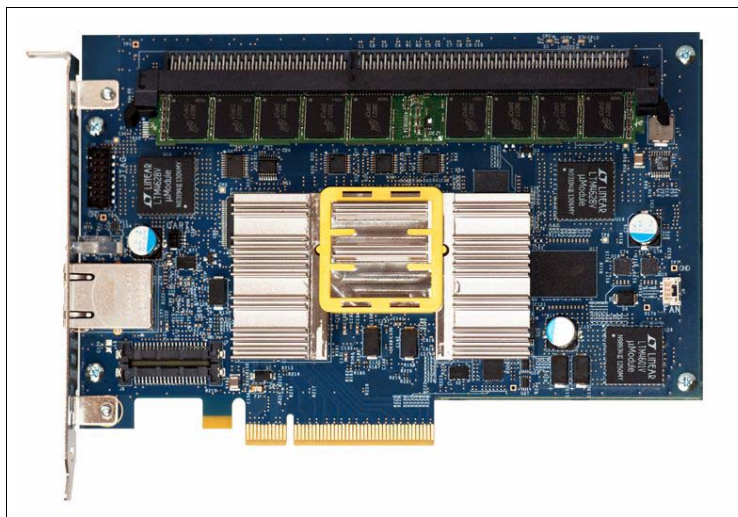


Figure 4 OmniStack Accelerator Card

Most systems deduplicate at only one phase of the data life cycle and only after another operation has happened.

Here are some examples of traditional approaches to deduplication:

- ▶ Postprocess deduplication: data is first written to storage, and then deduplicated after the fact.
- ▶ Inline deduplication in a storage system: data is first written by the application to the server, and then transferred over a storage array network to the array.
- ▶ Inline deduplication in a backup system: data that has already been written to the array is read and transferred again across the network to the backup appliance, which then deduplicates it
- ▶ Deduplication can also occur in the WAN optimization device, in the cloud gateway, etc.

These forms of deduplication always incur some sort of penalty or tax. For example:

- ▶ Postprocess deduplication requires sufficient space up front to first ingest the data before deduplicating.
- ▶ Postprocess deduplication requires additional IOPS to write the data, then read the data to perform the deduplication, and then write it again in deduplicated form.
- ▶ Postprocess deduplication requires additional WAN bandwidth to transfer the blocks over the wire before deduplication occurs.
- ▶ Inline deduplication imposes a performance penalty on production VMs as it requires CPU and Memory resources.

SimpliVity's accelerated data efficiency capabilities provide all of the benefits of deduplication, without the penalties. The OmniStack Accelerator Card—a PCIe card with an FPGA and NVRAM, protected with super capacitors—supports data processing at near-wire speeds, delivering enterprise-class performance with lower latency.

All data is deduplicated, compressed, and optimized at inception, before it ever hits permanent storage. Not only does this save capacity and prevent administrators from overprovisioning hardware, it also increases performance because it eliminates IOPS. As duplicate writes enter the system the Accelerator Card deduplicates the writes, acknowledges the writes in real time back to the application, and updates the metadata table, without ever accessing the storage media.

The SimpliVity solution eliminates the need for separate devices for WAN optimization, backup deduplication, or cloud gateway devices.

Software components

This section describes the major software components of the solution.

VMware vSphere ESXi hypervisor

VMware vSphere ESXi is the industry-leading, purpose-built bare-metal hypervisor. It enables a physical System x3650 M5 rack server to be partitioned into multiple logical servers (virtual machines).

VMware vCenter Server provides centralized visibility, proactive management and extensibility for VMware vSphere from a single console.

SimpliVity OmniStack Data Virtualization Platform software

OmniStack Data Virtualization Platform software runs as a controller on ESXi. It abstracts data from its underlying hardware, and shifts the management paradigm from hardware resources to application workloads. Virtual machine files map to blocks on storage.

When data is written to the environment, the Data Virtualization Platform deduplicates, compresses, and optimizes data segments before the data is written to storage, comparing incoming data against all other unique data in the OmniStack federation. The Data Virtualization Platform maintains a map to the unique deduplicated blocks on physical drives within the global federation and only stores the unique 4-to-8KB blocks. Virtual machine data remains in this optimized state perpetually.

There are tremendous benefits from this architecture. OmniStack maintains data in an optimized state across all phases of its lifecycle, including production, backup, test/development and other copies replicated within the federation and to a public cloud. Data is maintained in an optimized state across all tiers within a system, including DRAM, flash/SSD, and HDD, as well as all data centers, geographies, and the public cloud.

The data architecture of the OmniStack Data Virtualization Platform provides several key benefits:

- ▶ **Performance:** drives efficiency at the data's point of origin, and reduces IOPS requirements across the environment
- ▶ **Capacity:** deduplicates, compresses, and optimizes data at inception in real time to reduce capacity requirements
- ▶ **Mobility:** takes a VM-centric perspective, tracking what data belongs to which virtual machine, enabling efficient mobility
- ▶ **Manageability:** creates a global pool of local and remote infrastructure resources, enabling management of resources and workloads across the global pool, and greatly reducing complexity and cost
- ▶ **Data Protection:** maintains data in its deduplicated and compressed state, which allows for built-in backup to make optimized copies of virtual machines and eliminates the need for traditional backup and disaster recovery solutions.?

Specifications

The specifications of the SimpliVity OmniStack solution with the Lenovo System x3650 M5 rack server are listed in Table 1

Table 1 Specifications of the SimpliVity OmniStack offerings

Specifications	Small Enterprise	Midsize Enterprise	Large Enterprise
Targeted use case	All workloads in small to medium environments, including remote office / branch office (ROBO)	Majority of workloads across a wide range of environments from the smallest IT organizations to large enterprises	Ultrahigh-performance workloads for enterprise and cloud providers
Configuration	2x 480GB SSDs 8x 1TB 7.2K RPM HDDs	4x 480GB SSDs 20x 1TB 7.2K RPM HDDs	4x 480GB SSDs 20x 1.2TB 10K RPM HDDs
Effective capacity	5-10 TB ^a	18-36 TB ^a	20-40 TB ^a
CPU	Single or dual Intel Xeon E5-2600 v3 with 8-28 cores	Dual Intel Xeon E5-2600 v3 with 16-28 cores	Dual Intel Xeon E5-2600 v3 with 16-28 cores
RAM usable capacity	71-1479 GB ^b	156-1436 GB ^b	284-1436 GB ^b
Network connections	4x 1GbE 2x 10 GbE ports with SFP+	4x 1GbE 2x 10 GbE ports with SFP+	4x 1GbE 2x 10 GbE ports with SFP+
Physical dimensions	Height: 8.65 mm (3.4 in) Width: 44.56 mm (17.5 in) Depth: 71.2 cm (29.7 in)	Height: 8.65 mm (3.4 in) Width: 44.56 mm (17.5 in) Depth: 71.2 cm (29.7 in)	Height: 8.65 mm (3.4 in) Width: 44.56 mm (17.5 in) Depth: 71.2 cm (29.7 in)
Weight	55 lbs (25 kg)	75 lbs (34 kg)	75 lbs (34 kg)
Power Supply	Dual Redundant 900W @120/240VAC 50/60Hz auto-switching	Dual Redundant 900W @120/240VAC 50/60Hz auto-switching	Dual Redundant 900W @120/240VAC 50/60Hz auto-switching

a. Effective capacity varies by environment, and is a function of the realized deduplication and compression rates. The capacities mentioned above offer a conservative range based on compression and deduplication rates found in standard primary storage use cases.

b. RAM usable capacity represents estimated memory resources available to virtual applications.

Lenovo Configurations for SimpliVity

Table 2 on page 10 lists the 14 Deployment Ready Offerings (DROs), providing coverage from a single CPU small solution to large configurations.

Table 2 Deployment Ready Offerings

Config number	Lenovo x3650 M5 BOM reference number	CPU	Memory	Storage	SimpliVity OmniStack SKU
Target use case: Small to medium environments, remote office / branch office (ROBO)					
1	HCSVTEA1A54	1x E5-2640 v3 (8C)	128 GB	8x 1TB HDD 2x 480GB SSD	OS-L-X3650M5-S1-8-10C
2	HCSVTEA2B54	1x E5-2640 v3 (8C)	256 GB	8x 1TB HDD 2x 480GB SSD	OS-L-X3650M5-S1-8-10C

Config number	Lenovo x3650 M5 BOM reference number	CPU	Memory	Storage	SimpliVity OmniStack SKU
3	HCSVTEB1A54	2x E5-2640 v3 (8C)	256 GB	8x 1TB HDD 2x 480GB SSD	OS-L-X3650M5-S2-8-10C
4	HCSVTEB2B54	2x E5-2640 v3 (8C)	384 GB	8x 1TB HDD 2x 480GB SSD	OS-L-X3650M5-S2-8-10C
5	HCSVTEC1A54	2x E5-2680 v3 (12C)	384 GB	8x 1TB HDD 2x480GB SSD	OS-L-X3650M5-S2-12-14C
6	HCSVTED4D54	2x E5-2697 v3 (14C)	512 GB	8x 1TB HDD 2x480GB SSD	OS-L-X3650M5-S2-12-14C
Target use case: Majority of workloads across a wide range of environments from smallest IT organizations to larger enterprises					
7	HCSVTEB3C54	2x E5-2640 v3 (8C)	256 GB	20 x1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-8-10C
8	HCSVTEB4D54	2x E5-2640 v3 (8C)	384 GB	20 x1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-8-10C
9	HCSVTEC2B54	2x E5-2680 v3 (12C)	384 GB	20 x1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-12-14C
10	HCSVTEC3C54	2x E5-2680 v3 (12C)	512 GB	20 x1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-12-14C
11	HCSVTED1A54	2x E5-2697 v3 (14C)	384 GB	20 x1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-12-14C
12	HCSVTED2B54	2x E5-2697 v3 (14C)	512 GB	20x 1TB HDD 4x 480GB SSD	OS-L-X3650M5-M2-12-14C
Target use case: Ultra high-performance workloads in the enterprise and cloud providers					
13	HCSVTEC4D54	2x E5-2680 v3 (12C)	512 GB	20x 1.2TB HDD 4x 480GB SSD	OS-L-X3650M5-L2-12-14C
14	HCSVTED3C54	2x E5-2697 v3 (14C)	512 GB	20x 1.2TB HDD 4x 480GB SSD	OS-L-X3650M5-L2-12-14C

Systems management

OmniStack features VM-centric, global unified management. All actions, polices and management functions are performed on a per-VM basis. A central administrator manages the entire global infrastructure through a simple graphical user interface (GUI), Figure 5, that is fully integrated with VMware vCenter—a tool VMware administrators already use regularly.

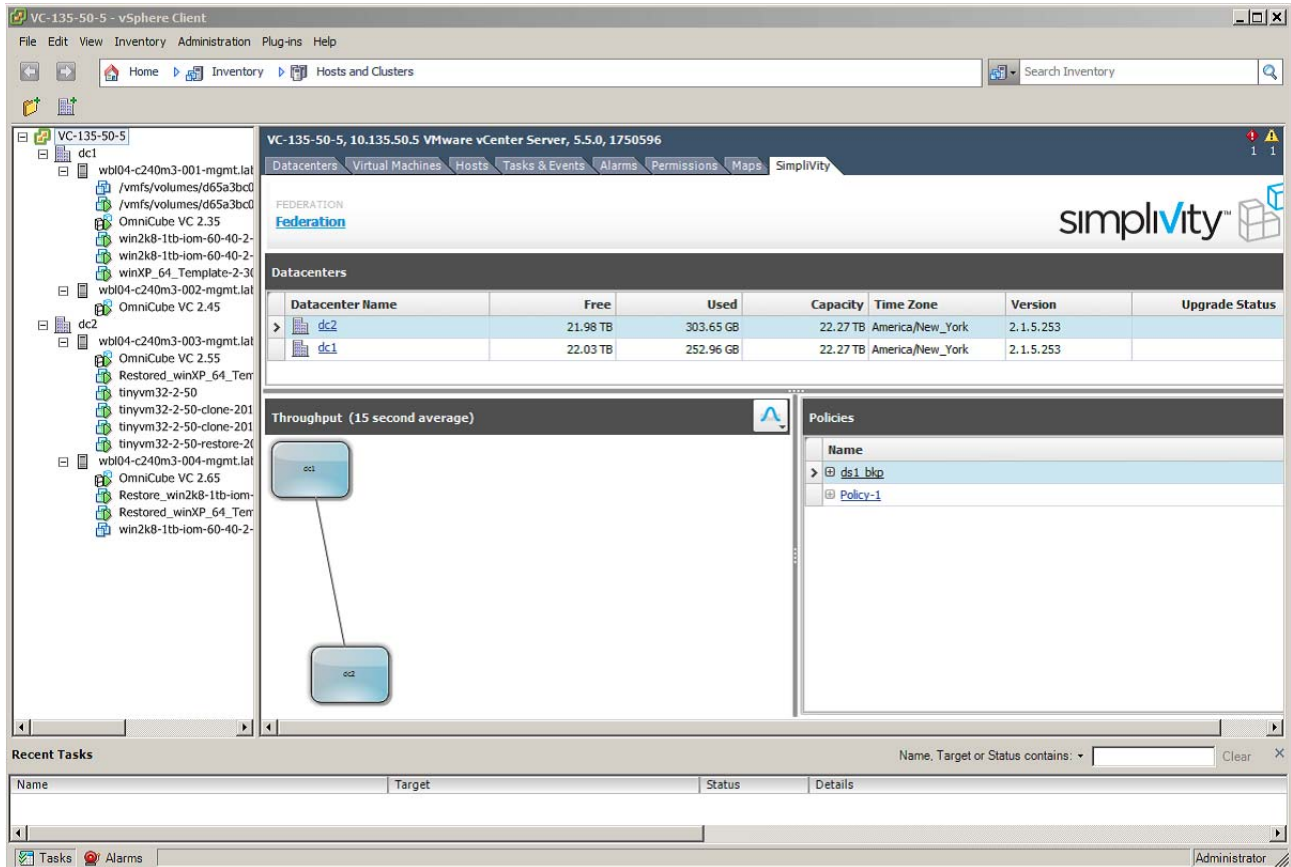


Figure 5 Federation View within VMware vCenter

With SimpliVity, administrators can easily view and manage applications and VMs using simple operations. All analysis, reporting, actions, and management tasks are VM-centric, to eliminate the complexity that exists between vSphere and traditional storage arrays and storage area networks.

This means all storage related policies, actions, and monitoring are accomplished on a per-VM basis across the multisite federated network. One user can manage the entire global infrastructure spanning one or more sites through one simple interface. Simplified IT administration results in improved productivity and lower costs. The solution works with leading orchestration and workflow solutions, such as VMware vRealize Automation.

Network cabling options

There are different options for cabling the 10 GbE interfaces used for the Storage and Federation networks, and the 1GbE interfaces, used for the Management network. You can select the configuration that best meets the needs of your environment.

10GbE-only network configuration

The minimum network configuration for a Federation with two x3650 M5 systems employs redundant 10GbE connections to two 10GbE switches, and uses VLANs to separate the SimpliVity Storage, Federation, and Management networks. See Figure 6.

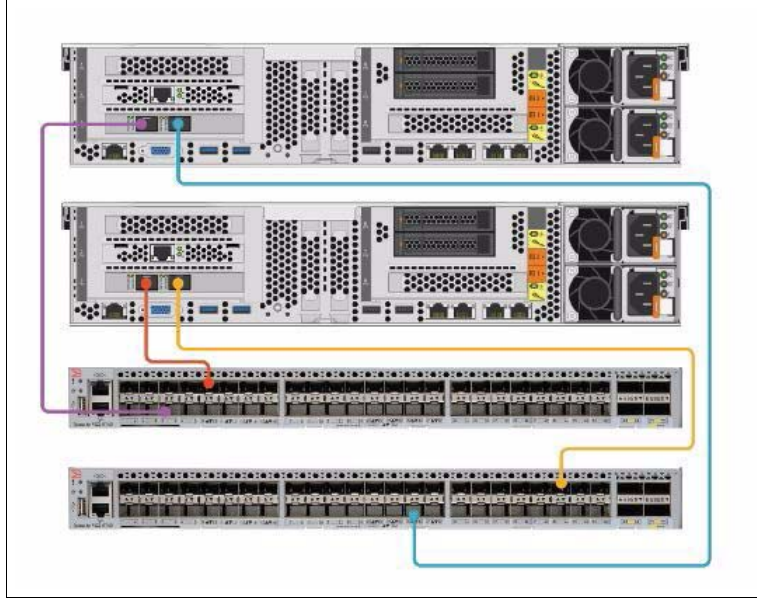


Figure 6 10GbE-only network configuration

Direct-connected storage network configuration

A direct-connected network configuration for a federation with two x3650 M5 systems uses 10GbE connections for the SimpliVity Storage and Federation networks. It uses redundant 1GbE connections to 1GbE switches for the Management network as shown in Figure 7 on page 13.

Note: You cannot use direct connections for the storage network if you have three or more x3650 M5 systems in a data center.

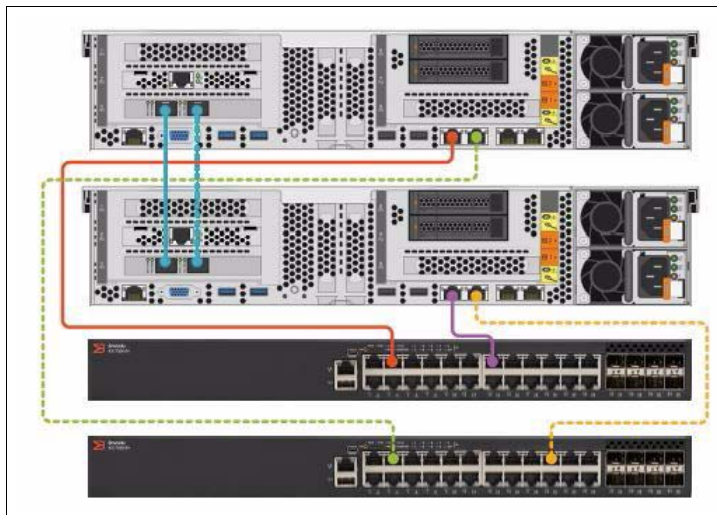


Figure 7 Direct-connected storage network configuration

Switch-connected storage network configuration

The switch-connected network configuration for a Federation with two x3650 M5 systems uses redundant connections to 10GbE switches for the Storage and Federation networks, Figure 8. It uses redundant 1GbE connections to 1GbE switches or, optionally, 10GbE connections to 10GbE switches for the Management network.

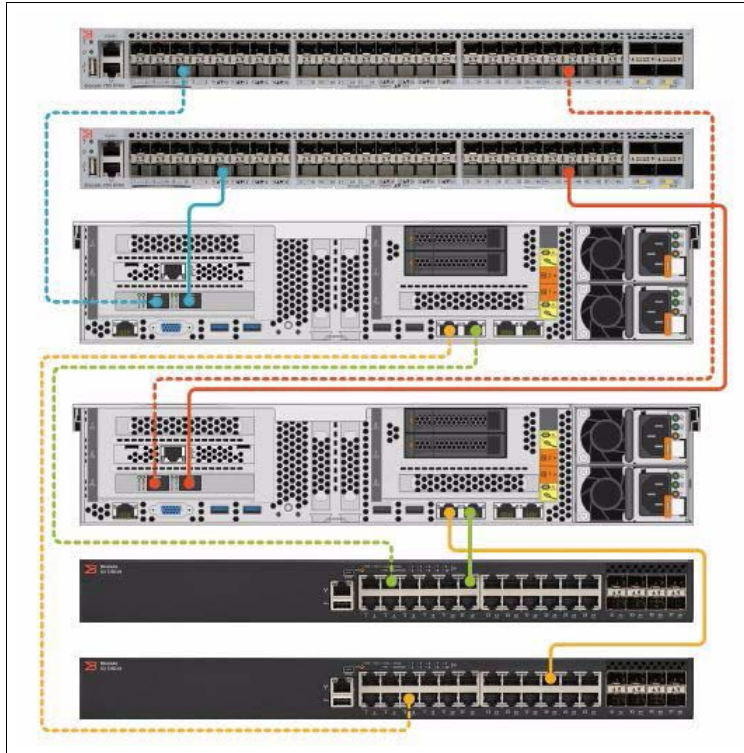


Figure 8 Switch-connected storage network configuration

Deployment examples

SimpliVity OmniStack enables a wide variety of applications and use cases. Typical deployment scenarios include:

- ▶ Data center consolidation:

Eliminates technology silos and reduces equipment requirements by consolidating numerous IT functions onto a single platform: one hyperconverged 2U scalable, modular building block providing 3x TCO savings.

- ▶ Mission-critical applications:

Runs enterprise applications like Microsoft Exchange, SQL Server, SharePoint, Oracle, SAP or industry-specific line-of-business applications.

- ▶ Remote office / branch office (ROBO):

Enables global federated management across all remote sites worldwide, from a single pane of glass using VMware vCenter.

- ▶ Built-in data protection:
SimpliVity uniquely offers native data protection at the VM-level. SimpliVity's VM-centric data protection allows administrators to backup and restore every VM from a single click in the GUI or via automated policy.
- ▶ Data migration:
With SimpliVity, data migration is as simple as right-clicking a VM and pressing "move." SimpliVity OmniStack takes care of the rest and the data is deduplicated, compressed, and optimized to ensure limited impact on network bandwidth.
- ▶ Dev / Test / QA:
Today, most organizations maintain separate environments for development, test, quality assurance, and production. With SimpliVity, independent technology silos can be consolidated to contain CAPEX and OPEX and streamline operations. Test and development teams can also develop new applications faster by having more frequent access to copies of production data via SimpliVity's efficient cloning process.
- ▶ Cloud Computing:
Seamlessly connect to the Amazon Web Services cloud via SimpliVity's integrated Cloud Data Center. Using SimpliVity's built-in capabilities, enterprises can backup and restore to Amazon via the same single pane of glass: VMware vCenter. Cloud providers can deploy profitable cloud services on OmniStack, enabling multiple cloud models, including hosted backup, hosted disaster recovery, hosted private cloud, hybrid cloud, or public cloud
- ▶ Virtual Desktop Infrastructure (VDI):
SimpliVity is a cost-effective solution for persistent desktops in the enterprise. Previously, organizations had difficulty balancing the financial implications (persistent desktops cost too much in storage) against the user experience. With SimpliVity's Data Virtualization Platform, VDI no longer needs to be relegated to "second-class citizen" status in the data center. IT teams can commit to, and fulfill SLAs to the business while improving RTOs and RPOs for VDI.

Resources

For more information on SimpliVity OmniStack visit www.simplivity.com or see the following resources:

- ▶ SimpliVity OmniStack Solution with Lenovo System x3650 M5 webpage
<https://simplivity.com/products/omnistack-solution-with-lenovo-system-x3650-m5/>
- ▶ SimpliVity Product Data Sheets
<https://simplivity.com/resources/product-information/>
- ▶ SimpliVity White Papers and Reports
<https://simplivity.com/resources/papers-reports/>

For more information on the Lenovo System x3650 M5 visit <http://shop.lenovo.com/us/en/systems/servers/racks/systemx/> or see the following resources:

- ▶ Lenovo System x3650 M5 Datasheet
http://www.lenovo.com/images/products/server/pdfs/datasheets/systemx_x3650m5bd_ds.pdf
- ▶ Lenovo System x3650 Product Guide
<https://lenovopress.com/tips1193-lenovo-system-x3650-m5>

For more information on VMware vSphere and vCenter visit www.vmware.com or see the following resources:

- ▶ VMware ESXi
<http://www.vmware.com/products/esxi-and-esx/overview>
- ▶ vCenter Server information
<http://www.vmware.com/products/vcenter-server/>

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