



**High-Availability Fault Tolerant Computing for Remote and Branch Offices
HA/FT solutions for Cisco® UCS E-Series servers and VMware® vSphere®**

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Table of Contents

UCS E-Series Availability and Fault Tolerance.....	3
<i>Solid hardware</i>	3
<i>Consistent management</i>	3
<i>VMware vSphere HA and FT</i>	3
Storage High Availability and Fault Tolerance	4
<i>Quick-start HA/FT using VMware VSA</i>	4
a. Hardware and software.....	5
b. Planning	5
c. Configuration.....	6
<i>A powerful emerging solution: VSAN on UCS E-Series</i>	7
Beyond HA/FT: off-site replication	8
Conclusions	8

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Introduction

UCS E-Series servers are high-performance virtualization-ready blades housed in a Cisco® ISR G2 networking platform. Running the VMware® vSphere® virtualization platform and remotely managed using vCenter, UCS E-Series servers offer an integrated infrastructure, networking, computing, storage, and virtualization solution for remote and branch offices. UCS E-Series with vSphere consolidates and reduces:

- Service and maintenance costs
- Management cost and complexity
- Space requirements
- Power consumption

UCS E-Series Availability and Fault Tolerance

Cisco UCS E-Series servers with VMware virtualization are engineered for enterprise-level High Availability and Fault Tolerance beyond the reach of other remote-office solutions. These factors, coupled with the platform's high performance, low operating cost, modest space requirements, and remote maintenance options make it one of the most practical solutions for demanding Remote and Branch Office applications.

Solid hardware

Designed and built to serve as components of Cisco's acclaimed Integrated Services Router series Generation 2, UCS E-Series servers use data-center class Intel x86 64-bit blade servers in single or double form factors with up to six cores, 48 GB RAM, 3TB storage, and hardware RAID. Replacing closets full of generic servers with compact, enterprise-grade UCS E-Series not only cuts risks from low-reliability hardware, but eliminates points of failure created by all the servers, cables, switches, and power supplies needed to string a solution together.

Consistent management

When considering High Availability and Fault Tolerance across multiple locations, it's important not to overlook the human factor. Remote-office IT is rarely anyone's full-time responsibility, and staff experience and training vary widely. Replacing patchwork administration with efficient, centralized remote management and VMware vCenter automation standardizes configurations, keeps patch and upgrade levels current, and reduces both planned and unplanned downtime.

VMware vSphere HA and FT

VMware vSphere High Availability detects hardware, network, operating-system, and application failures, and reacts to them by restarting any affected Virtual Machines on unaffected resources. It allows planned maintenance at any time with zero interruption of running applications. This is particularly important in Remote and Branch Office settings where staffing constraints complicate

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after-hours maintenance, or to avoid coordination delays and errors when maintenance is conducted remotely from headquarters.

For selected critical or customer-facing applications, VMware vSphere Fault Tolerance adds continuous availability by maintaining a live shadow instance in lockstep with a designated critical VM, for instant stateful failover in the event of hardware failure. Because failover is completely transparent users see no interruption of service, and delays are typically undetectable. Fault Tolerance allows Remote and Branch Offices to maintain the highest availability levels for critical local services such as banking, e-commerce, or inventory and supply-chain management.

VMware vSphere brings the UCS E-Series platform to even higher levels of application availability and fault tolerance for Remote and Branch Offices. But just as critical applications depend on availability of the information they manipulate and transmit, full implementation of High Availability and Fault Tolerance should cover data storage, and not just applications.

Storage High Availability and Fault Tolerance

UCS E-Series owners already enjoy many highly reliable storage options, including Solid-State Drives, SAS hard drives, and SATA hot-swappable hard drives, as well as several levels of hardware RAID. This Design Guide documents a way to achieve the upper limits of High Availability and Fault Tolerant storage for the UCS E-Series, with two VMware-native HA/FT options for availability of local non-shared storage: a “quick-start” solution using VMware vSphere Storage Appliance (VSA), and a flexible, high-performance solution using VMware Virtual SAN™ (VSAN).

Quick-start HA/FT using VMware VSA

VMware vSphere Storage Appliance is a software-defined storage appliance that pools the storage of one or more ESXi servers into a single resource. VSA offers:

- Clusters for higher performance and resilience
- Continuous availability for applications
- vMotion live migration of applications with no service disruption

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- Transfer of virtual machine disk files from VSA to shared storage hardware and back with no service disruption

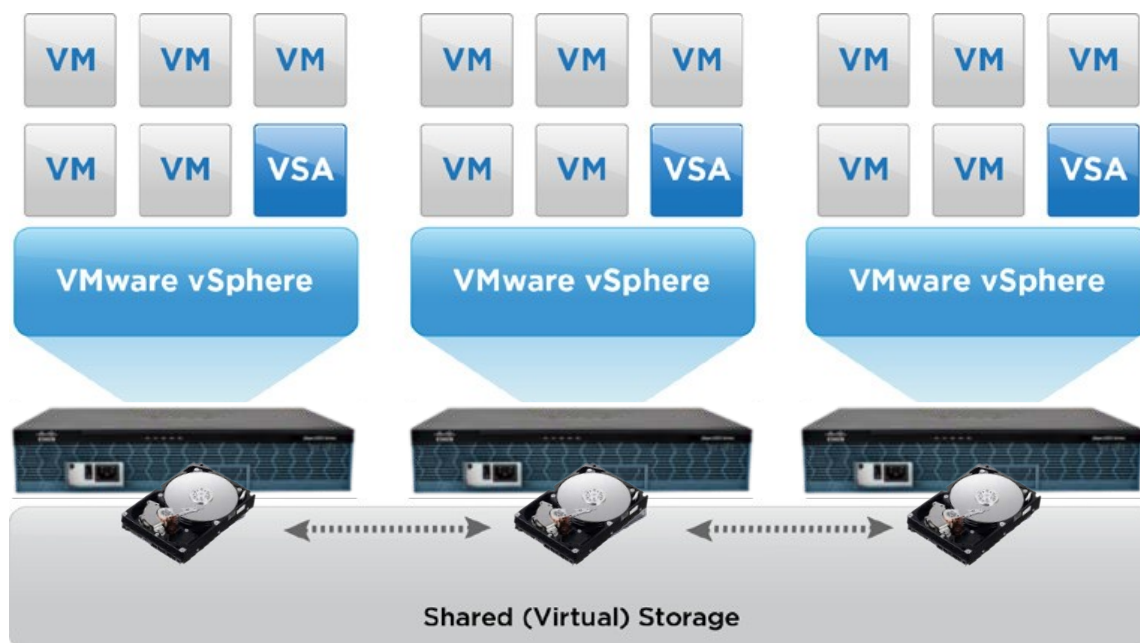


Figure 1: VMware vSphere Storage Appliance delivers shared storage capabilities across the storage assets of UCS E-Series server blades without the cost, complexity, or additional point of failure introduced by shared storage hardware.

a. Hardware and software

This guide assumes a Cisco ISR G2 configured with:

- Two single-wide UCS E-Series blade servers, each running vSphere with the available HA and FT features. Note that models such as the G2 2911 with only one service module slot do not support this solution.
- Windows Server 2003 or 2008 64-bit and vCenter Server installed and running on one of the ESXi hosts
- Hardware and network capabilities, and additional software, as detailed in the [VSA 5.5 Installation and Administration Guide](#)
- External Ethernet ports of the two blades connected (backplane port will connect automatically)

b. Planning

Prior to installation, determine or decide:

- The scale and capacity you require from the VSA cluster, considering factors such as:
 - Number of virtual machines

High-Availability Fault Tolerant Computing for Remote and Branch Offices

HA/FT solutions for Cisco® UCS E-Series servers and VMware® vSphere®

- Processor requirements for each
 - Memory requirements for each
 - Type and amount of storage required per cluster
 - Application requirements for specific types of storage
 - Whether you need a 2-member or 3-member VSA cluster (you will not be able to add a member to a running cluster)
 - The number of virtual machines you expect to run in the VSA cluster
 - Whether to virtualize the storage in which the vCenter Server will run (doing so complicates storage management in case of a problem with VSA)
- c. Configuration

To configure and bring up VSA:

- Install the VSA Manager plug-in for the vSphere Web Client you will use to manage the VSA cluster
- From the VSA Manager panel of vCenter, install VSA Cluster across ESXi VMs running on both blades that you wish to include

This last step launches an automated sequence that will:

- Configure the VSA cluster network
- Deploy vSphere Storage Appliance
- Create and install VSA cluster:
 - Locating and consuming physical storage from ESXi servers
 - Configuring and deploying HA by mirroring each datastore
- Mount the datastores

VSA is now up and running under management of VSA Manager. Data between the nodes will be continuously replicated. In the event of hardware failure of one UCS E-series or its storage data written is still protected and the system will fail over to the secondary server with no service interruption.

Where network bandwidth is sufficient, it is possible to configure VSA to replicate to resources located elsewhere on site, or even at a different facility. This capability stems from the fact that ESXi doesn't require a target LUN to be local, or even for its type to match. Organizations considering this approach will want to balance the modest gains in availability against the increased complexity of managing a distributed solution.

High-Availability Fault Tolerant Computing for Remote and Branch Offices HA/FT solutions for Cisco® UCS E-Series servers and VMware® vSphere®

A powerful emerging solution: VSAN on UCS E-Series

VMware Virtual SAN is a new software-defined storage tier that pools computing and direct-attached storage resources, clustering server disks and flash into highly resilient shared storage. An extension and logical successor to VSA, VSAN dramatically simplifies storage management, improves performance, and cuts expenses

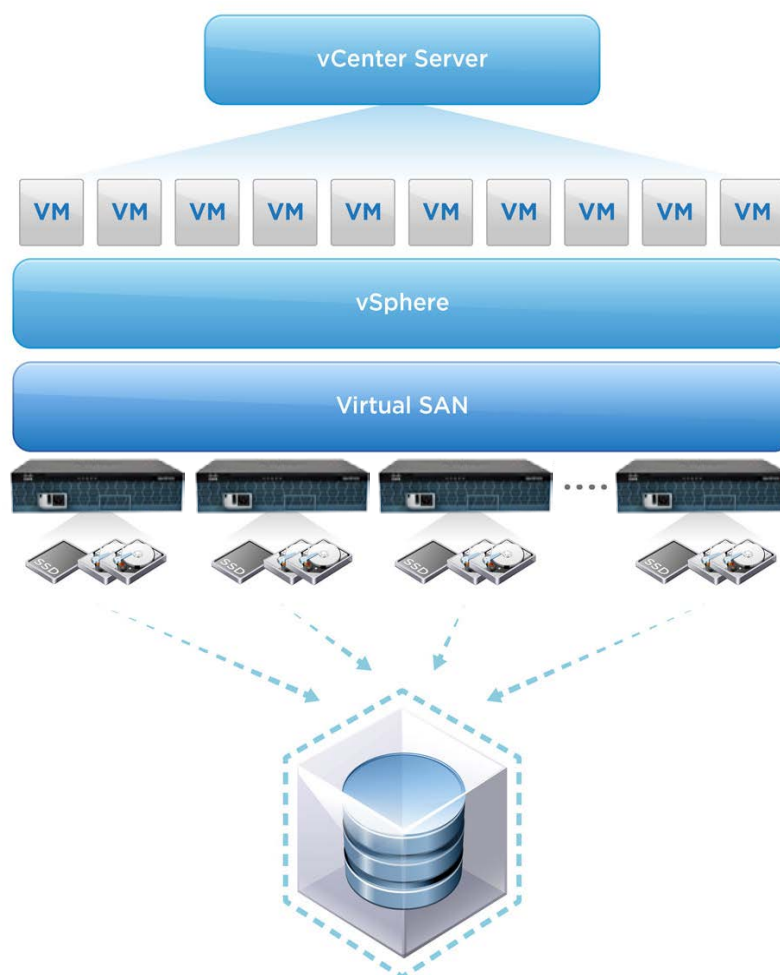


Figure 2: VMware Virtual SAN Clustered Datastore Storage Appliance creates a new, software-defined storage tier by pooling computing and direct-attached storage resources, clustering server disks and flash to create high-performance, resilient shared storage.

From the viewpoint of UCS E-Series High Availability and Fault Tolerance, VSAN offers:

- High performance SSD caching so UCS E-Series can handle even larger, more dynamic loads without compromising application performance
- Resiliency against multiple disk and node failures, and a time-saving break/replace approach to hardware maintenance

High-Availability Fault Tolerant Computing for Remote and Branch Offices

HA/FT solutions for Cisco® UCS E-Series servers and VMware® vSphere®

- Dynamic scaling of performance and capacity, including adding hosts on the fly or “hot” adding disks to server nodes, eliminating a significant source of planned downtime

Beyond HA/FT: off-site replication

Organizations that wish to minimize the hardware footprint at Remote and Branch Office locations while still maintaining the very highest levels of availability and fault tolerance may wish to consider off-site replication using vSphere Replication. This capability, included with vSphere at no charge, can be configured to replicate all virtual machine data along with consistent application data, to an off-site location such as the regional or global headquarters data center. Automatic integration with Microsoft® Volume Shadow Copy Service assures that Microsoft Exchange and Microsoft SQL Server databases are quiescent and consistent when replica data are generated, so that all information replicated is static and fully recoverable. Detailed information about VMware vSphere Replication is available [here](#).

Conclusions

High Availability and Fault Tolerance can easily be achieved in single-box UCS E-Series deployments by adding vSphere Storage Appliance to the native HA/FT capabilities of vSphere. The solution sets up quickly, offers flexibility and scalability beyond the requirements of most remote or branch offices, and is easily managed locally or remotely through VMware vCenter.

With data-center-grade hardware and consistent remote management already available in UCS E-Series with vSphere, VSA extends the solution’s availability and fault tolerance to levels that will satisfy the most demanding policy and regulatory environments.

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Cisco and VMware continue to work together to advance the benefits of their remote- and branch-office solution, by applying VMware’s next-generation storage solution, VSAN, to the UCS E-Series all-in-one networking, computing, and virtualization platform.

