

Introduction to the EMC VNXe3200

A Detailed Review

Abstract

This white paper introduces the architecture and functionality of the EMC® VNXe3200. This paper also discusses some of the advanced features of this storage system.

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Executive Summary

The EMC® VNXe3200 storage system is a unified storage solution that is suitable for small to medium businesses (SMB) as well as the Remote Office/Branch Office (ROBO) deployments of larger organizations. This powerful storage system addresses the challenges mentioned above and is designed to be simple such that IT generalists with limited storage expertise are able to leverage the multitude of features that the system provides. The major benefits of the VNXe3200 storage system include:

- **High Availability** – The VNXe3200 has many High Availability considerations, such as hardware redundancy and RAID protection ensuring constant data flow to users and administrators.
- **Performance and Efficiency** – By using the same MCx and FAST VP technologies in the VNX2 series, the VNXe3200 includes the ability to better leverage Flash storage, processor cores, and other technologies to offer better price/performance ratios.
- **Unified Snapshots** – Due to a truly unified infrastructure, the VNXe3200 is able to take point-in-time snapshots of block or file data using the same storage space as the target resource. Unified Snapshots on the VNXe3200 is based on redirect-on-write technology, first seen on the VNX2 series.
- **Expanded Connectivity Support** – VNXe3200 systems support 8 Gb/s Fibre Channel, 10 GbE Optical, and 1 GbE copper through the use of optional I/O modules.
- **Block Replication** – The VNXe3200 offers two forms of replication for ensuring data redundancy and integrity. Asynchronous block storage replication is built into the VNXe3200 to provide a local and remote replication solution with other VNXe3200 systems. A built-in RecoverPoint splitter allows integration with EMC's RecoverPoint Appliance to deliver asynchronous and synchronous protection to another VNXe3200 as well as other EMC products (VNX, VMAX, etc.).
- **VMware Integration** – The VNXe3200 provides best-in-class VMware integration. By utilizing VASA, VAAI, and VMware Aware Integration, the VNXe3200 is able to integrate fully with VMware vCenter and ESXi hosts. This enables the monitoring of storage directly from VMware interfaces and the creation of datastores from Unisphere. In addition, support for VMware Site Recovery Manager (SRM) helps the VNXe3200 fit into a user's disaster recovery plan.
- **UFS64** – The initial deployment of UFS64, the 64-bit file system, is on the VNXe3200. With UFS64 and VNXe3200, a VMware NFS datastore of up to 64 TB in capacity can be created, delivering four times the capacity of a 32-bit file system.

Audience

This white paper is intended for IT planners, storage architects, administrators, partners, EMC employees and any others involved in evaluating, acquiring, managing, operating, or designing an EMC networked storage environment using VNXe3200 storage systems.

Terminology

- **Common Internet File System (CIFS)** – An access protocol that provides access to files and folders from Windows hosts located on a network.
- **Dynamic Host Control Protocol (DHCP)** – A protocol used to assign dynamic IP addresses to devices on a network from a centralized server. A management IP address can be assigned automatically to a VNXe3200 system that is connected to an organization's network that utilizes DHCP.
- **Fibre Channel Protocol** – Transfer protocol used to communicate Internet Protocol (IP) and Small Computer Systems Interface (SCSI) commands over a Fibre Channel network.
- **File Deduplication & Compression** – The process used to consolidate redundant data, allowing space to be saved on a file system. When multiple files have identical data and the data itself has not been recently used, the file system will store a single copy of the data, compress it, and share it among the multiple files.
- **File System** – A storage resource that is associated with file access protocols. File systems are accessed through Windows shares (CIFS protocol) and/or Linux/UNIX shares (NFS protocol).
- **Fully Automated Storage Tiering for Virtual Pools (FAST VP)** – Advanced data service that automatically relocates slices of LUNs or file systems data between storage tiers. Data is relocated to optimal locations within a storage pool based on the tiering policy assigned to the storage resource.
- **Internet Small Computer System Interface (iSCSI) protocol** – Provides a mechanism for accessing raw block-level data over a network connection. The iSCSI protocol is based on the standard client/server model with iSCSI initiators (hosts) acting as storage clients and iSCSI targets acting as storage servers.
- **Link Aggregation** – A high availability feature that allows Ethernet ports that are associated with the same storage resources and have similar characteristics, to be combined into a single virtual device/link. The aggregated link may have a single IP address or multiple IP addresses. The VNXe3200 supports Link Aggregated Groups for Ethernet ports that are not used as iSCSI interfaces.
- **Logical Unit Number (LUN)** – The identifying number of a SCSI storage resource that processes SCSI commands. The LUN is an ID for the logical unit, but the term often refers to the logical unit itself. The LUN is the last part of the SCSI address for a SCSI object.
- **MCx** – “Multicore Everything” initiative that delivers high performance and platform efficiency in VNXe3200 systems. On the VNXe3200, MCx is composed of Multicore Cache, Multicore FAST Cache, and Multicore RAID.
- **Multicore Cache** – VNXe3200 cache that optimizes Storage Processor's DRAM and core usage to increase host write and read performance.

- **Multicore FAST Cache** – Large capacity secondary cache that uses SLC Flash Drives. This secondary cache most greatly benefits applications that are prone to unpredictable spikes in I/O.
- **Multicore RAID** – MCx component that defines, manages, creates, and maintains VNXe3200 RAID protection.
- **Network-Attached Storage (NAS) Server** – A file-level storage server that provides access to multiple clients. A NAS server is required in order to create file systems that contain CIFS and/or NFS shares, or VMware NFS datastores.
- **Network File System (NFS)** – An access protocol that allows users to access files and folders from Linux/UNIX hosts located on a network.
- **Network Data Management Protocol (NDMP)** – A standard for backing up file servers on a network. It allows centralized applications to back up file systems running in a customer's environment.
- **Server Message Block (SMB)** – The underlying protocol used by CIFS to request files, print, and communicate with a server over a network through Ethernet ports. VNXe3200 storage systems support Microsoft's Server Message Block (SMB) 3.0 for CIFS shares.
- **Storage Pool** – A single repository of homogeneous or heterogeneous physical disks from which storage resources may be created. Using a heterogeneous pool enables ease of use and maximizes the potential of technologies such as FAST VP.
- **Storage Processor (SP)** – A VNXe3200 hardware component that provides the processing resources for performing storage operations as well as servicing I/O between storage and hosts.
- **Thin Provisioning** – A storage feature used to allocate storage on an as-needed basis from a larger reserved resource. The amount of storage a Thin storage resource consumes is shown on the VNXe3200 as the Allocated value.
- **Unified Snapshot** – A point-in-time view of data stored on a storage resource. A user can recover files from a snapshot, restore a storage resource from a snapshot, or attach a snapshot to a host.
- **Unisphere Command Line Interface (CLI)** – An interface that allows a user to perform tasks on the VNXe3200 by using commands typed into a command line.
- **Unisphere for VNXe** – A web-based management environment for creating storage resources, configuring and scheduling protection for stored data, and managing and monitoring other storage operations.

VNX Unified Storage Family

VNX Family

The VNXe3200 is a part of the VNX Family of storage systems. They are simple, efficient, powerful, and protected. They utilize the new MCx architecture which optimizes the use of all CPU cores available thereby improving performance and scalability. MCx, along with other features makes these storage systems powerful products in the storage market with various models for different customer needs. At the one end of the spectrum, the VNX8000 stands as the high workload, high IOPS system that serves mid-range to enterprise level customers. At the other end, the VNXe3200 uses the same technology to offer customers incredible storage functionality while boasting a small 2U form factor. This makes the VNXe3200 a powerful, low cost entry-level system.

For more information on the VNX5200-VNX8000 models, please see the paper titled *Introduction to the EMC VNX2 Series* on EMC Online Support.



Figure 1. VNX Family Models

VNXe3200

The VNXe3200 storage system is an ideal platform for businesses with physical server infrastructures, as well as those making the move to server virtualization for drive consolidation and greater efficiency. As an entry-level unified storage system, the VNXe3200 provides high value for smaller user configurations with lighter performance needs. It is designed to support smaller businesses and applications for up to 1000 users. VNXe3200 systems are available with a comprehensive set of features including increased capacity utilization, data protection solutions, availability solutions, and advanced support capabilities.



Figure 2. The VNXe3200 in the VNX Family

The VNXe3200 supports iSCSI, CIFS, NFS, and Fibre Channel protocols, making it compatible with most network infrastructures. The small footprint of the system makes it an ideal solution for small to medium sized businesses and ROBO deployments. The Unisphere management interface is a simple and intuitive interface for IT generalists that enables storage provisioning, management, and monitoring operations. Some of the major benefits of VNXe3200 storage systems include:

- **Simple and efficient unified storage** – VNXe3200 systems deliver unified storage provisioning in a single enclosure. Unisphere provides a fast, simple user experience for completing everyday tasks, and embeds best practices into the user interface. This results in streamlined operations.
- **Compact storage platform** – VNXe3200 systems provide a highly available design, with a dual-controller Storage Processor design that fits in just 2U of rack space.

Hardware Overview

Quad-Core CPU

The VNXe3200 uses an Intel® Xeon® E5 Quad-Core CPU which runs at 2.2 GHz. The VNXe3200 takes advantage of that processing power by leveraging its MCx architecture to ensure that all the cores are being used optimally.

Disk Processor Enclosure (DPE)

The VNXe3200 has two possible DPE configurations:

- 25-drive DPEs paired with 2.5” drives
- 12-drive DPEs paired with 3.5” drives

Both DPE configurations take up 2U of space in storage racks.

The following figures show the front of the 25-drive DPE that houses 2.5” SAS and Flash drives ([Figure 3](#)), and the front of the 12-drive DPE that houses 3.5” NL-SAS drives ([Figure 4](#)). Both enclosures have LEDs for enclosure fault and power. The 2.5” disks have separate drive power and fault LEDs while the 3.5” disks include a single LED showing power/fault statuses. Note that the front views of the 25-drive and 12-drive Disk Array Enclosures (DAEs) resemble that of the 25-drive and 12-drive DPEs, respectively.

The first four drives in every DPE are called the system drives. The system drives hold important system information for the storage array. Because of this, the first four drives are not portable and need to be replaced immediately if faulted.

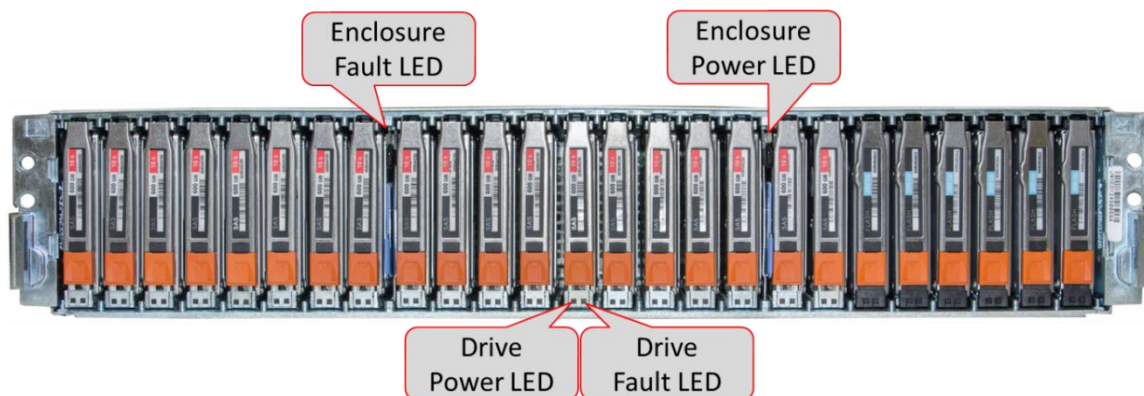


Figure 3. Front of 25-drive DPE/DAE



Figure 4. Front of 12-drive DPE/DAE

The back of the DPE looks the same for both 25-drive and 12-drive DPE configurations (Figure 5). The DPE includes an onboard 4-port 10 GbE Base-T module for each SP which can auto-negotiate between 10 GbE/1 GbE/100 MbE/10 MbE depending on the infrastructure (Figure 6). Also, there are two SAS ports allowing for expansion of storage through DAEs. Both the management and service ports are 1 GbE ports which can auto-negotiate between 1 GbE/100 MbE/10 MbE. The management port is where GUI and CLI commands communicate with the system. If the system is unavailable through the management port, the service port can be utilized using the Serial Over LAN feature over a direct connection or switch. I/O expansion modules are available for the VNXe3200, to add Fibre Channel, 10 GbE Optical, or 1 GbE Ethernet connectivity to the system.

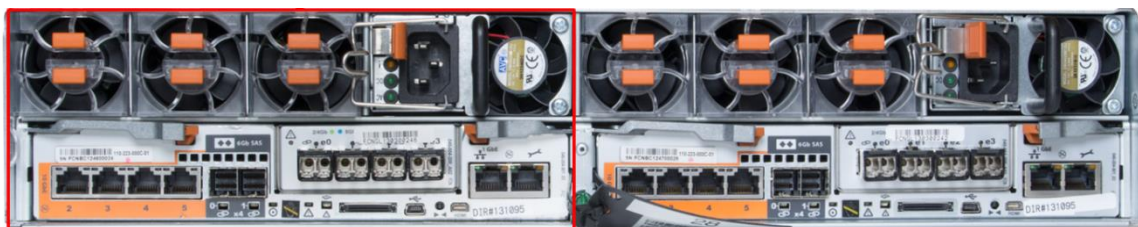
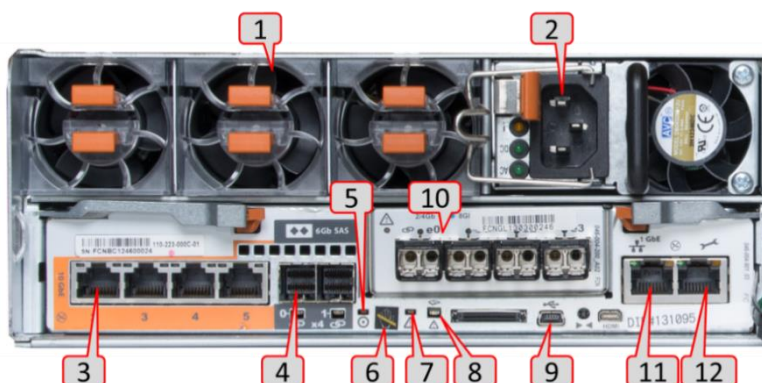


Figure 5. Back of DPE



Number	Component
1	Fan Module
2	Power Supply
3	10 Gb/s Ethernet Port
4	6 Gb/s SAS Port
5	SP Power LED
6	Unsafe to Remove LED
7	SP Internal Fault LED
8	SP Fault LED
9	Mini USB Port
10	I/O Module
11	Management Port
12	Service Port

Figure 6. Close-up of DPE

Disk Array Enclosure (DAE)

The VNXe3200 has two possible DAE configurations:

- 25-drive DAEs paired with 2.5" drives
- 12-drive DAEs paired with 3.5" drives

Both DAE configurations take up 2U of space in storage racks.

The following figures show the back of the 25-drive DAE (Figure 7), and the back of the 12-drive DAE (Figure 8). Both DAEs include LEDs to indicate power supply power and power supply fault status, and the 12-drive DAE includes a power supply fan fault LED.



Figure 7. Back of 25-drive DAE

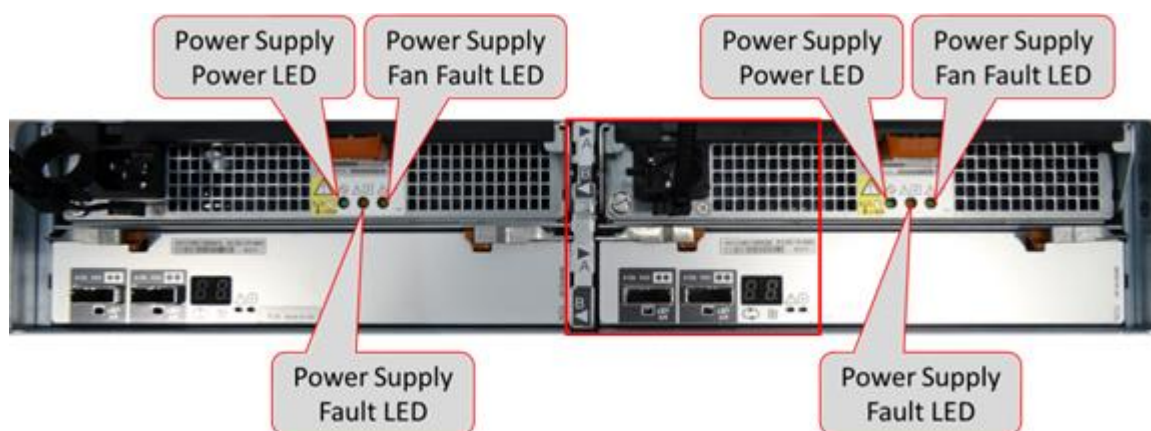


Figure 8. Back of 12-drive DAE

The backs of the 25-drive DAE and 12-drive DAE have similar port configurations (Figure 9 and Figure 10). They both have primary SAS ports to connect to a DPE and expansion ports to connect to other DAEs for extra storage. The back-end bus LEDs show the bus number that the DAE is connected while the enclosure ID LED shows the ID of the DAE relative to the number of other DAEs on the same bus. There are also LEDs to show power, fault, and SAS link status.

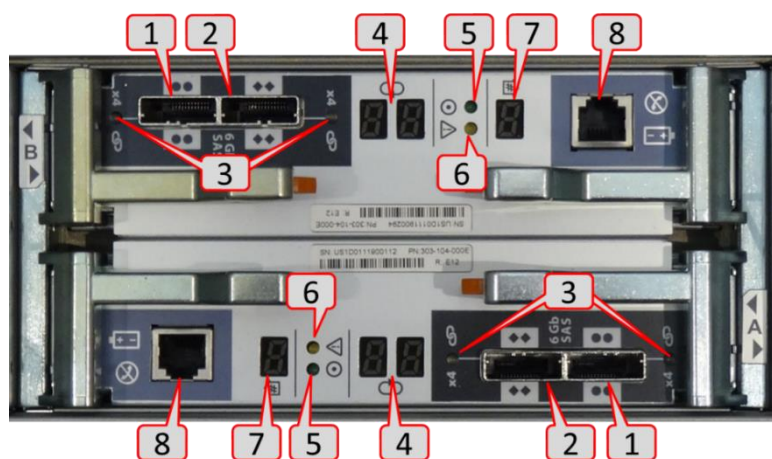
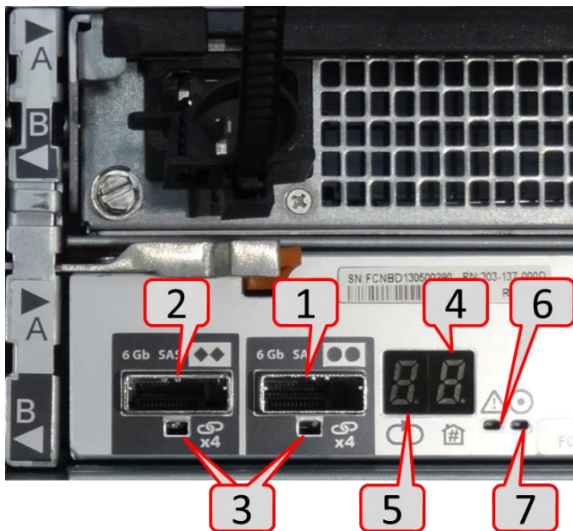


Figure 9. Close-up of 25-drive DAE

Number	Component
1	6 Gb/s SAS Primary Port
2	6 Gb/s SAS Extension Port
3	SAS Link LEDs
4	Back-End Bus LEDs
5	Power LED
6	Fault LED
7	Enclosure ID LED
8	SPS Port (Not Used)



Number	Component
1	6 Gb/s SAS Primary Port
2	6 Gb/s SAS Extension Port
3	SAS Link LEDs
4	Back-End Bus LEDs
5	Enclosure ID LED
6	Fault LED
7	Power LED

Figure 10. Close-up of 12-drive DAE

Customer Replaceable Units (CRU)

Most of the components in a VNXe3200 are customer replaceable. The only non-replaceable components are the DPE/DAE enclosures themselves. Here are some examples of CRUs in the VNXe3200 storage system.

Storage Processor

Every VNXe3200 storage system comes with two Storage Processors (SPs). Each SP can be removed individually from the DPE which makes it easy to service and replace parts (Figure 11). While an entire SP may be replaced, its individual components may also be customer serviced. Note that the SP will need to be removed in order to service these parts.



Figure 11. Storage Processor (Top Removed)

Lithium-Ion Battery Backup Unit (BBU)

A 3-cell Lithium-Ion BBU is located within each SP enclosure (Figure 12). The battery is designed to power systems long enough to flush the SP cache contents to an internal mSATA device in the case of a power failure or in the case of SP removal from

the DPE. At least one BBU is required to be operating normally for SP cache to remain enabled. The BBUs are tested upon every SP power up and every 7 days thereafter to ensure the hardware is functioning properly.



Figure 12. Lithium-Ion BBU

Power Supply

Each DPE has two power supply modules (Figure 13), one for each SP. One of the two power supplies must remain in service for the system to stay in an operational state.



Figure 13. Power Supply (DPE)

Fan Modules

Each SP has three fan modules above it to dissipate heat away from the system (Figure 14). For the system to stay operational, at least two of the three fans on each SP must be active. If either SP has two or more fans inactive, the system will save cache contents and shut down automatically.



Figure 14. Storage Processor Fan Module

Dual-Inline Memory Module (DIMM)

There are three DDR3 memory slots on each SP. They are filled with identical 8 GB DIMMs (Figure 15), which total 24 GB of system memory per SP. If a faulted DIMM is detected upon boot-up, the system will boot into service mode so the faulted memory module can be fixed.



Figure 15. DIMM

mSATA (Mini-Serial Advanced Technology Attachment)

A 32 GB MLC Flash device or mSATA drive is physically found underneath each SP (Figure 16). This device contains a partition that holds the boot image that is read upon initial boot up. In the event of power failure, the memory contents of SP cache are written to the mSATA device. Even if the mSATA becomes corrupted, cache data can be recovered from the peer SP.



Figure 16. mSATA Device

I/O module

The VNXe3200 supports the option to add an additional I/O module for increased connectivity. It is important to note that the Storage Processor configurations must mirror each other. For example, if a Fibre Channel I/O module is installed in Storage Processor A, then an identical Fibre Channel I/O module must be installed in Storage Processor B.

There are three supported I/O modules for the VNXe3200: 8 Gb/s FC Optical, 10 GbE Optical, and 1 GbE Ethernet. All three modules are quad-port and used for frontend connectivity from Storage Processors to host(s). The I/O modules installed on the SPs of a VNXe3200 must be matching.

The Fibre Channel I/O module auto-negotiates to 2 Gb/s, 4 Gb/s, or 8 Gb/s, and has an 8-lane PCI-E Gen-2 interface ([Figure 17](#)). It can be used for FC and NAS host connectivity.



Figure 17. Fibre Channel I/O Module

The 10 GbE Optical I/O module only operates at 10 Gb/s, and has an 8-lane PCI-E Gen-3 interface ([Figure 18](#)). It can be used for iSCSI and NAS host connectivity, as well as for replication.



Figure 18. 10 GbE Optical I/O Module

The 1 GbE Ethernet I/O module auto-negotiates to 10 Mb/s, 100 Mb/s, and 1000 Mb/s, and has a 4-lane PCI-E Gen-2 interface ([Figure 19](#)). It can be used for iSCSI and NAS host connectivity, as well as for replication.



Figure 19. 1 GbE Ethernet I/O Module

Hardware Configurations

Table 1 shows the hardware features available to the VNXe3200 storage system.

Table 1. VNXe3200 details

Model	VNXe3200
Number of SPs	2
Form factor	2U
DAE options	12-drive (3.5"), or 25-drive (2.5")
Minimum/maximum number of drives	6/150
Drive options	100 200 800 GB Flash SLC/MLC 300 600 900 GB SAS 2 4 TB NL-SAS
DPE options	12-drive (3.5"), or 25-drive (2.5")
System Drives options	200 GB Flash (MLC) 300 600 900 GB SAS 2 4 TB NL-SAS
CPU per system	Intel Xeon E5 Quad Core at 2.2GHz
Memory per system	48 GB
Back-end connection	6 Gb SAS
Number of back-end ports per SP	2
Embedded I/O ports per SP	4x 10 GbE
Configurable I/O slots per SP	1
I/O module options per SP	4-port 8 Gb Fibre Channel
RAID options	1/0, 5, 6
Management ports per system	LAN 2x 10/100/1000 Ethernet

Comparison of Drive Types

The VNXe3200 storage systems support Flash, Serial Attached SCSI (SAS), and Near Line-Serial Attached SCSI (NL-SAS) drives. Flash drives are recommended for performance intensive applications or applications with very low response time and high throughput requirements. SAS drives should continue to be the choice for environments with large capacity and high performance requirements. Flash and SAS drives are appropriate for applications, such as database applications that require frequent read and write operations. NL-SAS drives are recommended for modest performance and high capacity environments. In addition, NL-SAS drives can provide energy efficient bulk storage capacity at low costs. They are appropriate for storing large amounts of data that is less frequently used and for users with applications that do not have strict performance requirements.

For a list of supported drive types, please see [Appendix A: Drive Support](#).

RAID Configurations

With a VNXe3200, drives can be configured into storage pools. Each tier in a storage pool has a RAID type, to provide redundancy while meeting the desired capacity and drive requirements. A FAST VP license is required to support the creation of multi-tier storage pools. The supported RAID levels are 5, 6, and 1/0.

NOTE: Once a tier in a storage pool has been configured, the RAID type cannot be changed for that tier.

RAID 5 is best suited for transactional processing, and is often used for general-purpose storage, relational databases, and enterprise systems. This RAID level provides fairly low cost per gigabyte value while retaining redundancy and high availability. RAID 5 stripes data at a block-level across several disks and distributes parity among the disks. It is important to note that a failed disk reduces storage performance and should be replaced immediately. However, data loss will not occur as a result of a single disk failure.

RAID 6 is appropriate for the same types of applications as RAID 5, but more useful in situations where increased fault tolerance is of the utmost importance. RAID 6 is similar to RAID 5, but uses a double parity that is distributed across different disks, offering higher fault tolerance. Because of the added level of parity, RAID 6 groups require additional backend writes and will typically result in worse performance than the equivalent RAID 5 group. For this reason the tradeoff between protection and performance must be sufficiently considered. In a RAID 6 configuration, storage pools can continue to operate with up to two failed disks per RAID group. VNXe3200 systems have the ability to perform a parallel rebuild in the case of two faulted disks, decreasing the time in a faulted state.

RAID 1/0 is a stripe of mirrors, so only half the total capacity of the drives is usable. This provides high performance and reliability, but at a high cost because of lower usable capacity per disk. RAID 1/0 is appropriate for applications with high processing requirements as well as with write-intensive workloads. RAID 1/0 in VNXe3200 systems requires a minimum of two physical disks. Note that a two disk RAID 1/0 configuration does not use striping. Lastly, a faulted disk must be replaced immediately because this configuration cannot handle the loss of more than one disk in the same mirrored pair.

Software Overview

This section discusses the software features available on the VNXe3200.

Initial Configuration

When configuring a VNXe3200 system for the first time, the management interface must be configured with an IP address. An IPv4 or IPv6 address can be assigned dynamically via DHCP or with a static IP address using the Connection Utility.

Upon initial boot up of the storage system, a DHCP server on the network will assign an IPv4 or IPv6 address to the VNXe3200 system's management interface automatically. If there is no DHCP server, the Connection Utility application is used to assign a static IP address for managing the VNXe3200 storage system. This utility can be downloaded directly from the EMC Online Support website.

When running the Connection Utility from a computer on the same subnet as the storage system, the program automatically discovers any unconfigured VNXe3200 systems. If the Connection Utility computer cannot be placed on the same subnet, the configuration can be saved to a USB drive and applied to the system by plugging the USB drive into a mini USB port on the back of the DPE.

After configuring an IP address for the VNXe3200 management interface, you can access Unisphere by navigating to the assigned IP address from any web browser.

When connecting to a VNXe3200 storage system for the first time, the Unisphere Configuration Wizard starts automatically. This wizard runs you through a series of steps to seamlessly configure the VNXe3200 system and parts of your storage layout in a short amount of time. The following parameters can be set using the Configuration Wizard in Unisphere:

- Password for the administrator user “admin”
- Service password for the “service” account
- Unisphere licenses
- DNS and NTP servers
- Storage pools and FAST Cache
- NAS server and iSCSI interfaces
- SMTP server for product support options
- EMC Online Support Credentials
- EMC Secure Remote Support (ESRS)

Unisphere

Unisphere is a graphical web-based management interface that is the primary monitoring and management tool for VNXe3200 storage systems. It provides tools for creating, configuring, and managing storage resources. To make use of those storage resources, access can be given to users, applications, and hosts using different supported protocols including iSCSI, Fibre Channel, CIFS, and NFS. The files and data stored on the storage system can be protected with an automated scheduler feature to create point-in-time snapshots of stored data. This makes recovering lost files and data quick and easy.

Unisphere enables users to monitor storage operations and system status through a detailed graphical reporting service, which can pinpoint issues to specific components of the storage system. Unisphere also enables monitoring of storage system performance through graphs allowing technical users to see a deeper view of system utilization.

Unisphere provides direct support through ecosystem resources like online documentation, white papers, FAQs, how-to videos, online discussion forums, and chat sessions. Lastly, any software code updates on the VNXe3200 can be easily done through a non-disruptive upgrade (NDU) process in Unisphere.

You can use Unisphere to create, configure, and monitor the following types of storage resources:

- **LUNs** – Provides generic block-level storage, in the form of LUNs, for hosts and applications to access using iSCSI or Fibre Channel protocols.
- **File Systems** – File-level storage for hosts. File systems can be accessed through CIFS and NFS protocols.
- **VMware Datastores** – Provides storage for VMware virtual machines through datastores that are accessible through either the NFS, iSCSI, or Fibre Channel protocol.

For additional information about Unisphere for VNXe3200 storage systems, please see the paper titled *EMC Unisphere for the VNXe3200: Next-Generation Storage Management*.

MCx™

MCx is a combination of the Multicore Cache, Multicore RAID, and Multicore FAST Cache features. MCx enables the array to fully leverage Intel's multi-core CPU architecture. It was designed from the ground-up to ensure optimum performance with little to no customer intervention, by using an adaptive architecture. It is the same patented technology seen in the VNX2 models.

- **Multicore Cache** – Also known as SP Cache, optimizes the SP's DRAM to increase host write and read performance. It provides write caching for all VNXe software layers.
- **Multicore RAID** – Defines, manages, creates, and maintains VNXe RAID protection for any created storage pools. Multicore RAID includes features such as Permanent Sparing, Drive Mobility, Hot Spare Policy, and Improved RAID durability.
- **Multicore FAST Cache** – A large-capacity secondary cache built using FAST Cache Optimized SSDs. It is positioned between the SP's DRAM-based memory cache and the hard drives in storage pools to provide Flash drive performance to highly accessed data in your storage pool. Multicore FAST Cache and FAST VP, discussed below, form a unique storage caching and tiering solution known as the FAST Suite.

For more information on MCx and the FAST Suite, please see the white papers titled *Introduction to the EMC VNXe3200 FAST Suite* and *EMC VNXe3200 MCx*.

FAST™ VP

The Fully Automated Storage Tiering for Virtual Pools (FAST VP) feature is available for both block and file data. FAST VP optimizes storage utilization by automatically moving data between and within storage tiers.

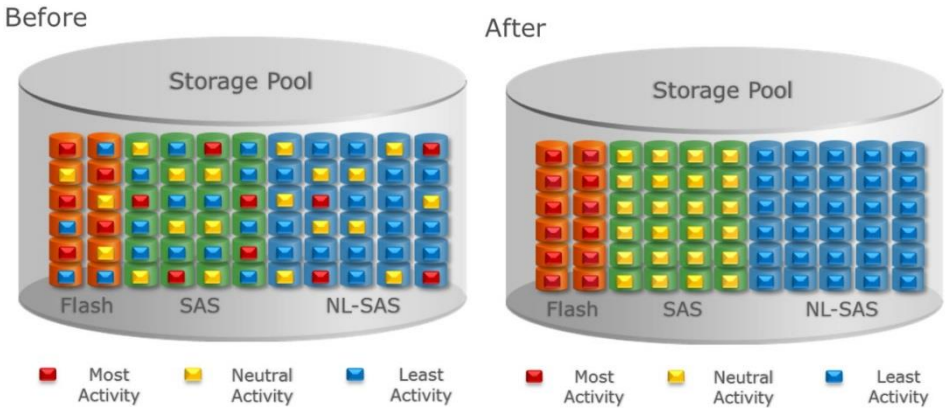


Figure 20. FAST VP Process

Figure 20 illustrates how the FAST VP process works. With the VNXe3200 storage system, data is moved in 256 MB slices to the most effective drives based on the access patterns of the I/O and the storage resource’s tiering policy. This ensures that the appropriate data is housed on the right tier at the right time, which significantly increases efficiency and performance. The user sets policies and schedules to help the system determine how and when the data is moved.

FAST VP Optimized SSDs are available for VNXe3200 systems and can only be used within a storage pool. On the other hand, FAST Cache Optimized SSDs can be used for either FAST Cache or FAST VP. Compared to FAST Cache Optimized SSDs, FAST VP Optimized SSDs are more cost effective and appropriate when data change rates are more moderate.

For more information on FAST VP, please see the white paper titled *Introduction to the EMC VNXe3200 FAST Suite*.

Storage Provisioning

The VNXe3200 includes both block and file connectivity. For the block connectivity, a user has the option to use either iSCSI or Fibre Channel for host access. For file connectivity, the user has the option to configure NAS servers which are used to access CIFS and NFS shares. If a user wants to create VMware datastores, they can provision datastores via NFS using an available NFS-enabled NAS server or VMFS using iSCSI or Fibre Channel. Table 2 depicts the different storage types available on the VNXe3200 storage system.

Table 2. VNXe storage details

Storage Type	Hosts	Managed Objects	Interface
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File systems	Linux/UNIX hosts VMware hosts	File systems	NAS server with NFS enabled
	Windows hosts	File systems	NAS server with CIFS enabled
LUNs	Windows, Linux/UNIX or VMware hosts that have iSCSI or FC connections	LUNs	iSCSI/FC
VMware datastores	VMware hosts	NFS datastores	NAS server with NFS enabled
		VMFS datastores	iSCSI/FC

File Systems

A file system is a file-based storage resource that is accessed via file access protocols (CIFS or NFS). A share is an access point through which hosts can access file systems. File systems and shares provide file-level storage resources that hosts can access over network connections.

When file-level storage is enabled on the system, a NAS server maintains and manages the configured file systems, and transfers data to/from hosts and shares. The type of access to a VNXe3200 share varies depending on whether the share is a CIFS share, an NFS share, or a multiprotocol (CIFS and NFS) share.

When creating a NAS server on a VNXe3200 system, the CIFS and NFS protocols can be enabled individually or together (Figure 21). A file system created from a NAS Server that has both protocols enabled, but without multiprotocol sharing can only provision one share type. For example, if the CIFS protocol is chosen when creating a file system, only CIFS shares can be created for that file system. To create NFS shares, a separate file system would have to be created.

However, a NAS Server that has enabled both protocols in a multiprotocol configuration will enable corresponding file systems to be shared simultaneously across both CIFS and NFS protocols. In other words, the same file system can be used to serve clients using either CIFS or NFS. A multiprotocol NAS Server can only host multiprotocol file systems, and a multiprotocol file system can only be hosted on a multiprotocol NAS Server. A multiprotocol NAS Server must be joined to an Active Directory domain, and have Unix Directory Services configured.



Figure 21. NAS Server Wizard

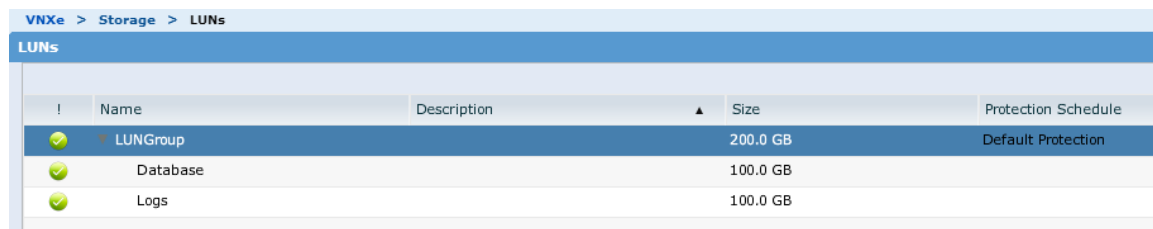
For the CIFS protocol, NAS servers can be created as domain-joined servers or standalone servers. Domain-joined servers are configured using Active Directory (Kerberos authentication). They maintain their own identity in the domain and leverage domain information to locate services, such as domain controllers. Standalone servers do not have access to a Windows domain so they are useful in test and development environments or where domains are unavailable.

For the NFS protocol, a NAS server has the option to enable the Unix Directory Service (UDS). Either Network Information Service (NIS) or Lightweight Directory Access Protocol (LDAP) can be used as service protocol for UDS. For a multi-protocol NAS Server, it is required to enable and configure UDS.

LUNs and LUN Groups

LUNs provide hosts with access to general purpose block-level storage through network-based iSCSI or Fibre Channel connections. After a host connects to a LUN, it can use the LUN as a local storage drive. Unisphere allows users to create, view, manage, and delete LUNs. A LUN's capacity can be increased, but not decreased.

LUN groups are logical containers for LUNs which allow users to organize LUNs into more manageable groups. For example, assume a database application requires one LUN for the database and a separate LUN for log files. The disks can be represented under the same generic storage application in Unisphere by adding the LUNs to a LUN group (Figure 222). LUN groups can be managed as a single entity, allowing for snapshots to be taken of all the LUNs in the LUN group as a whole. This creates a consistency group, since every LUN within the LUN group can be protected on the same timestamp.



!	Name	Description	Size	Protection Schedule
✓	LUNGroup		200.0 GB	Default Protection
✓	Database		100.0 GB	
✓	Logs		100.0 GB	

Figure 222. LUN group with two LUNs

VMware Datastores

Unisphere enables a user to create storage resources optimized for use by VMware vCenter™ servers and ESXi® hosts. VMware datastores are associated with a type of storage access (VMFS or NFS).

The Hosts page in Unisphere allows a user to discover and add VMware ESXi hosts and vCenter server information to Unisphere. Once the VMware host information is imported into Unisphere, information about virtual machines is displayed.

A user can configure VMware datastores by using the VMware Storage Wizard. These datastores, when created, can be scanned and automatically added to the vCenter server or ESXi host.

Virtual Machine File System (VMFS) Datastores

VMFS datastores require iSCSI initiators or Fibre Channel connections on the storage system to be created. After the creation of a VMFS datastore, the capacity can be increased, but not reduced. When VMFS datastores are created and an ESXi host is given access, the new storage is automatically scanned and made available to the ESXi host. Hosts can be given access to the datastore on a LUN, Snapshot, or LUN and Snapshot level.

VMware Network File System (NFS) Datastores

NFS Datastores require a NAS server to be configured. Linux/UNIX hosts can be given host access to the NFS datastores. The following host access configurations can be set for NFS datastores: “Read-Only”, “Read/Write, allow Root”, and “No Access”.

UFS64 is a 64-bit file system architecture that is making its debut on the VNXe3200. In contrast to older 32-bit architectures, a 64-bit file system increases the limits on quantities such as the maximum number of files and maximum number of subdirectories, by multiple orders of magnitude. Another noteworthy increase is in maximum file system size. With the VNXe3200, the maximum size of a UFS64 file system is 64 TB. The VNXe3200 supports UFS64 for creating VMware NFS Datastores. For more information on UFS64, please see the white paper titled *EMC VNXe3200 UFS64*.

Storage Pool Characteristics

VNXe3200 storage resources are provisioned from storage pools. A storage pool is a homogeneous or heterogeneous grouping of physical disks ([Figure 23](#) and [Figure 24](#)), with each tier consisting of disks of similar type. A homogeneous storage pool is a single tier pool using one type of disk. A heterogeneous storage pool consists of multiple tiers using different types of disks.

Heterogeneous pools are available with VNXe3200 systems and require a FAST VP license to use. The three tiers available in the VNXe3200 are extreme performance (Flash), performance (SAS), and capacity (NL-SAS). The RAID configuration can be customized for each tier in a storage pool. Once a RAID configuration has been set, it cannot be changed. In addition, there is a built in hot spare policy which is defined as 1 spare drive per 30 drives. This policy is not user configurable.

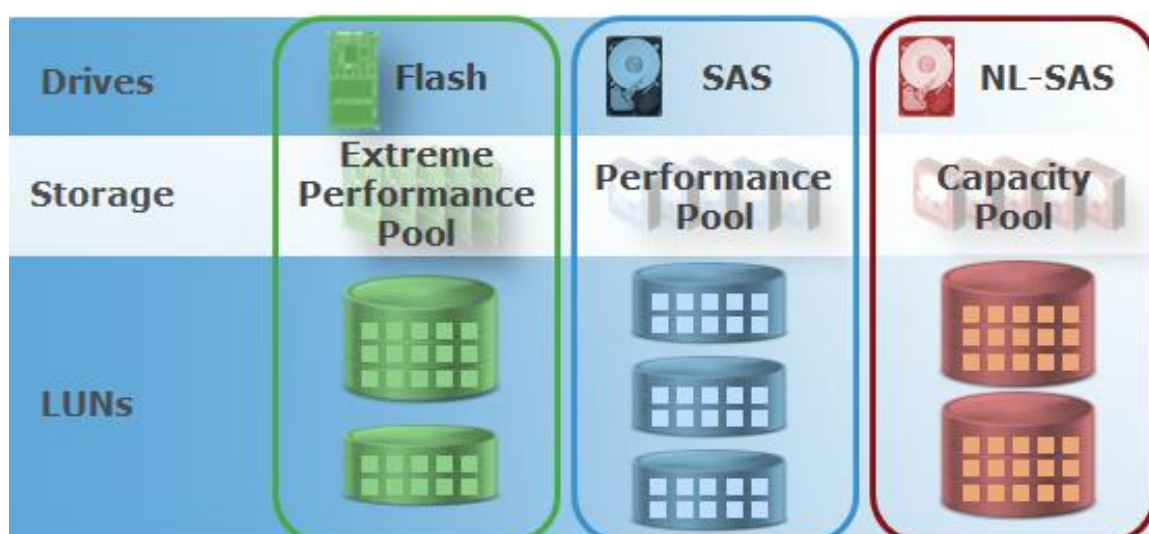


Figure 23. Homogeneous Storage Pools



Figure 24. Heterogeneous Storage Pool

Table 3 shows the default RAID configurations for each tier of a storage pool configuration on a VNXe3200 system.

Table 3. VNXe3200 Storage Pool Defaults

Tier	Drive Type	Default RAID Configuration
Extreme Performance	Flash	RAID 5 (4+1)
Performance	SAS	RAID 5 (4+1)
Capacity	NL-SAS	RAID 6 (6+2)

If a license for FAST VP is not available, a Quick Start Mode will be available in the Storage Pool Wizard. This Quick Start Mode will automatically create homogeneous storage pools using a best fit algorithm for all of the available disks on the system while incorporating the built in hot spare policy. Quick Start Mode will configure RAID 5 for the extreme performance and performance tiers, and will configure RAID 6 for

the capacity tier. If automatic pool creation is not desired, users can create custom homogeneous storage pools.

When creating a custom storage pool, users have the option to specify stripe width or choose maximum capacity which will use a best fit algorithm for the available disks. The allowed stripe widths for each RAID type for VNXe3200 systems are as follows:

- RAID 5: 4+1, 8+1, 12+1
- RAID 6: 6+2, 8+2, 10+2, 14+2
- RAID 1/0: 1+1, 2+2, 3+3, 4+4

Other Advanced Features

Despite being designed with the IT generalist in mind, the VNXe3200 comes packed with advanced functionality. These advanced features are found in sub-menus and in settings tabs. This keeps the main interface clean, simple, and easy to use.

VNXe3200 storage systems have the following advanced features:

- Anti-Virus Protection
- Asynchronous Block Replication
- Capacity and Performance Metrics
- File Deduplication and Compression
- File-Level Retention (FLR) Enterprise
- LDAP Integration
- Link Aggregation
- Thin Provisioning
- RecoverPoint Support
- Serial Over LAN
- Unified Snapshots
- Unisphere CLI Support
- User Management

Anti-Virus Protection

VNXe3200 storage systems support third-party anti-virus servers that perform virus scans and reports back to the VNXe3200. For example, when a client creates, moves, or modifies a file, the storage system invokes the anti-virus server to scan the file for known viruses. If the file does not contain a virus, it is written to the VNXe3200. If the file is infected, corrective action is taken as defined by the anti-virus server.

Asynchronous Block Replication

The VNXe3200 supports asynchronous replication. Leveraging the Unified Snapshots technology, asynchronous replication enables users to replicate LUNs, LUN Groups, and VMFS Datastores across VNXe3200 systems. The synchronization of data is performed on a user-configurable basis and can be set to automatic or manual execution.

In order to create a replication session, a replication connection must first be established between two VNXe3200 storage systems. Once a connection is made, a session is created from the intended source location. A storage resource of matching

type (e.g. LUN to LUN) is identified at each side and designated for the replication session. A created session can be paused, failed over and back, resumed, renamed, and deleted.

For more information about asynchronous replication, please see the white paper titled *EMC VNXe3200 Replication Technologies*.

Capacity and Performance Metrics

VNXe3200 storage systems provide storage administrators the ability to view capacity and performance metrics within the Unisphere and Unisphere CLI interfaces. With this information, storage administrators will have the ability to analyze their storage system's performance and capacity details. This can be useful when diagnosing or troubleshooting issues, planning for future initiatives, or forecasting future needs within their storage environment. A metrics database that stores metrics data is automatically configured on the system drives of the VNXe3200. The database is fixed to 8 GB in size. For more information on Capacity and Performance Metrics, please see the white paper titled *EMC VNXe3200 Capacity & Performance Metrics*.

File Deduplication and Compression

VNXe3200 storage systems have integrated deduplication support for file-based storage (file systems and VMware NFS datastores). Deduplication optimizes storage efficiency by eliminating redundant data from the stored files, thereby saving storage space. From an end-user's perspective, the NAS clients are not aware that they are accessing deduplicated data.

Deduplication operates on whole files that are stored in a file system. For example, if there are 10 unique files in a file system that is being deduplicated, 10 unique files will still exist, but the data will be compressed. This will yield a space savings of up to 50 percent. On the other hand, if there are 10 identical copies of a file, 10 files will still be displayed, but they will share the same file data. The one instance of the shared file is also compressed, providing further space savings.

During deduplication, each deduplication-enabled file system is scanned for files that have not been accessed in 15 days. When a file is found that matches the criteria, the file data is deduplicated and compressed. Files can be excluded from deduplication and compression operations on a file extension or path basis. Since file metadata is not affected by deduplication, different instances of the file can have different names, security attributes, or timestamps. For more information on file deduplication and compression, please see the white paper titled *EMC VNXe3200 File Deduplication & Compression*.

File-Level Retention (FLR) Enterprise

File-Level Retention (FLR) provides a way to set a restriction on a per-file basis to prevent modification to the selected files for a specific period of time. FLR ensures the integrity of data during that period by creating an unalterable set of files and directories. FLR can only be enabled when initially creating a file system. After a file system is created and enabled with FLR, protection is applied on a per-file basis. Only

FLR-Enterprise (FLR-E) is available for VNXe3200 systems. With FLR-E, an administrator can delete an FLR-E file system even if it has protected files, but he/she cannot modify or delete individual protected files.

A file in an FLR-enabled file system is always in one of the following four states:

- **Not Locked** – A file that is not locked is treated exactly the same as a file in a file system that is not enabled for FLR. The file can be renamed, modified, or deleted.
- **Locked** – A file in a locked state can be managed by setting retention dates that prevent the files from being modified or deleted until the dates have passed.
- **Append** – A file in an append state cannot be deleted or renamed. Existing data in this file cannot be modified, but new data can be added.
- **Expired** – A file in an expired state cannot be renamed, modified, or appended to. The file can be deleted or relocked, if needed.

For more information about File Level Retention, please see the white paper titled, *Managing an FLR-Enabled NAS Environment with the EMC File-Level Retention Toolkit*.

LDAP Integration

Lightweight Directory Access Protocol (LDAP) is an application protocol for querying and modifying directory services running on TCP/IP networks. LDAP provides a management service for network authentication by centralizing user and group management across the network. Integrating Unisphere users into an existing LDAP environment provides a way to control management access to the VNXe3200 system based on established user and group accounts within the LDAP directory. In Unisphere, LDAP settings can be configured under the Directory Services tab of the Manage Administration page.

NOTE: The LDAP settings mentioned here are used only for controlling access to Unisphere, and not for controlling access to VNXe3200 storage resources.

Link Aggregation

VNXe3200 systems support link aggregation allowing up to four Ethernet ports to be combined into one logical link. The cabling on Storage Processor A (SPA) must be identical to the cabling on Storage Processor B (SPB). Link aggregation provides the following advantages:

- **High availability of network paths to and from the VNXe3200** – If one physical port of a link aggregated port group fails, the VNXe3200 system does not lose connectivity.
- **Possible increased overall throughput** – Throughput can be increased because multiple physical ports are bonded into one logical port.

For example, if two physical ports are combined into one logical port and one of the links fails, the other link carries the network traffic without disrupting host access. Once the link returns, network traffic runs on both healthy links again.

In order to configure link aggregation both linked ports must be connected to the same switch or the same logical switch, if the switches support stack interconnects that allow cross-stack link aggregation. The switch must be configured to use link aggregation using the Link Aggregation Control Protocol (LACP). LACP allows the combination of any Ethernet port to any other Ethernet port on the same card. Note that Ethernet ports participating in link aggregation cannot also serve as iSCSI interfaces.

For additional information about link aggregation in VNXe3200 storage systems, please see the white paper titled *EMC VNXe3200 High Availability*.

RecoverPoint Support

The VNXe3200 storage system includes on-array integration with EMC RecoverPoint/EX, an appliance based solution that supports continuous local and remote replication of data. RecoverPoint supports both synchronous and asynchronous replication sessions. In addition, RecoverPoint allows for replication to/from a VNXe3200 with a variety of other EMC products, including VNX, VNX2, and VMAX. Through the use of the VNXe3200's built-in splitter, writes to the VNXe3200 are delivered to the RecoverPoint Appliance (RPA). The RPA handles the replication operations and leverages additional efficiencies, such as deduplication and compression, to perform replication with the lowest impact on bandwidth. For more information on using the VNXe3200 with RecoverPoint, please see the white paper titled *EMC VNXe3200 Replication Technologies*.

Thin Provisioning

Thin provisioning is the ability to present a server with more capacity than is actually allocated for that specific storage resource.

When a user enables thin provisioning for a storage resource, the amount of storage requested is not allocated to the resource immediately. Instead, the system allocates a smaller quantity of storage, known as the initial allocation, for file resources. There is no initial allocation for block resources. When the amount of storage consumed within the storage resource approaches the limit of the current allocation, the system automatically allocates additional storage space to the storage resource from the storage pool. Thin provisioning is supported on all storage types in a VNXe3200 storage system and is enabled by default via checkbox in the various storage creation wizards.

VNXe3200 systems allows multiple storage resources to subscribe to a common storage pool and, with thin provisioning, the system allocates only a portion of the physical capacity requested by each storage resource ([Figure 25](#)). The remaining storage is available in the pool for use by other storage resources.

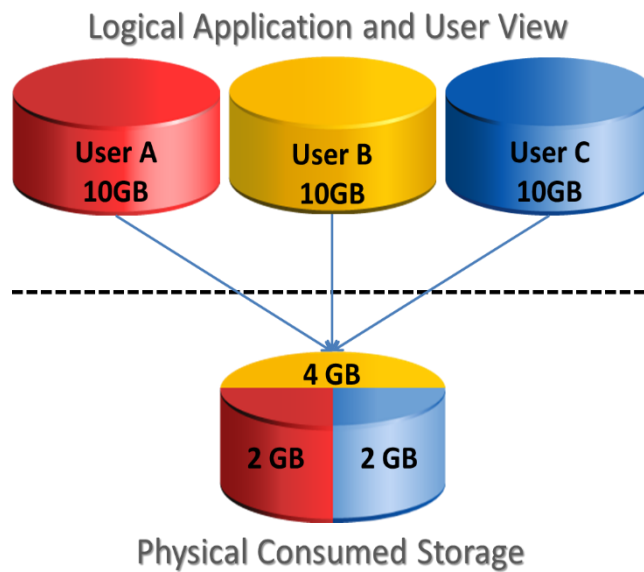


Figure 25: Thin Provisioning

VNXe3200 systems also allow the storage pools to be oversubscribed. Oversubscription is a storage provisioning method that allows storage administrators to provision more capacity than may be physically available in a particular storage pool. When groups of thin-provisioned storage resources are associated with a storage pool, they can request (or subscribe to) more storage capacity than is actually in the pool. This is possible because storage from the pool is incrementally allocated to each storage resource based on the amount of used storage on that resource. When the collective amount of storage used within the pool approaches the pool's physical capacity (default is 70%), Unisphere generates notification messages that more storage may soon be required.

Thin provisioning allows users to improve storage efficiency since organizations can purchase less storage capacity up front, and increase capacity by adding disks as needed according to actual storage usage. Without thin provisioning, organizations must base disk requirements on predictions or on the requests of application owners.

Serial Over LAN

The Serial Over LAN (SOL) feature allows EMC personnel and storage administrators to service/support the VNXe3200 system in the case that ESRS or SSH is not working or configured. To use the feature, two Ethernet cables need to be connected to the service ports on both SPs with the other ends connected to a laptop set up on the same subnet as the internal IPs of the VNXe3200. To start an SOL session, an Intelligent Platform Management Interface (IPMI) tool must be installed on the laptop. The IPMI tool then communicates with the Baseboard Management Controller (BMC) to redirect serial data over the service port on the SP to establish an SOL session. Once the session is started, regular commands can be run on the system like in SSH.

NOTE: Files cannot be transferred over the service port.

For more information on Serial Over LAN, please see the technical note *EMC IPMI Tool 1.0* on EMC Online Support.

Unified Snapshots

The Unified Snapshots feature creates point-in-time views of data for both block and file storage resources. Unified Snapshots are based on Redirect on Write (ROW) technology which redirects new writes to the storage resource to a new location in the same storage pool. Therefore, a snapshot does not consume space from the storage pool until new data is written to the storage resource or to the snapshot itself.

Unified Snapshots are easy to manage and all required operations can be done using Unisphere. Unified Snapshots also provide the ability to schedule snapshots. This means users can automatically protect their data periodically and can recover that data in the event of a deletion or corruption. For more information on Unified Snapshots, please see the white paper titled *EMC VNXe3200 Unified Snapshots*.

Unisphere CLI Support

The Unisphere CLI in the VNXe3200 system enables a user to perform the same management of their VNXe3200 as seen in the Unisphere GUI, over a command-line interface. It can serve as a vehicle for creating scripts to automate commonly performed tasks. The VNXe3200 management IP address is used with Unisphere CLI to execute commands on that system.

To use Unisphere CLI, the Unisphere CLI client must be installed on a host machine. The same client can be used to manage multiple VNXe3200 storage systems. For more information about the Unisphere CLI format and options, please see the *VNXe Unisphere CLI User Guide* on EMC Online Support.

User Management

VNXe3200 storage systems provide tools for creating user accounts for managers and administrators who configure and monitor VNXe3200 systems. When users access Unisphere, they are prompted to log in with account-based credentials before they can access the system. Unisphere user accounts combine a unique username and password with a specific role for each account. The role determines the types of actions that the user can perform after logging in.

The following user roles are available in Unisphere:

- **Operator** – This role can view Unisphere system and storage status information, but cannot change system settings.
- **Storage Administrator** – This role can view VNXe3200 storage system data, edit Unisphere settings, use Unisphere tools, create/delete storage resources, and create/delete host configurations. This role cannot add user accounts, perform initial configuration of the system, modify network settings, modify NAS Server configuration, or upgrade system software.
- **Administrator** – This role can perform all tasks accessible through Unisphere.

- **VM Administrator** – This role can only establish a VASA connection from vCenter to the storage system. A VM Administrator does not have access to Unisphere.

High Availability (HA)

VNXe3200 storage systems offer several built-in HA features. HA is provided through redundant components, meaning if one component fails, there is another available to take over. The redundant components include SPs, cooling fans, AC or DC power cords, power supplies, I/O modules, and Link Controller Cards (LCCs). Network HA is provided through link aggregation and multipathing.

For block storage resources, multiple paths to the storage resource are made available to the host, and requests can be made to either SP. Note that multipathing software must be installed on the host in order for the host to take advantage of this feature. In the event of a failure, the surviving SP will handle residual requests made to the inaccessible SP.

For file systems, an SP failure will initiate a failover of the NAS server and its associated file system. Once the failed SP has returned, the file system and NAS servers can be failed back to the original SP. In the event of a link failure, having the ports of a NAS server assembled in a link aggregation will allow service to continue over the other paths. For proper handling of file system failover, SP port and network connectivity of the relevant NAS server must be identical.

The Unisphere management service runs on one SP at a time. In the event of an SP failure, management will fail over to the other SP with minimal downtime. To achieve high availability of the management interface, the cable on each SP needs to have the same connectivity. For example, if the management port on SPA is plugged into a switch configured for subnet 192.168.0.1, the management port on SPB must also be connected to that subnet.

For additional information about HA in VNXe3200 storage systems, please see the white paper titled *EMC VNXe3200 High Availability*.

Virtual Integration with VMware vSphere

The VNXe3200 storage system offers tight integration with VMware vSphere. VMware administrators can take advantage of this functionality when managing their virtual environment.

vStorage API for Storage Awareness (VASA)

VASA is a VMware-defined, vendor neutral, API for storage awareness. The API requests basic information about storage components from a VNXe3200 system, which facilitates monitoring and troubleshooting through vSphere. Using VASA, vSphere can monitor and report storage policies set by the user. It can also tell when datastore capabilities are not compliant with a VM's configured profile. For example, if a datastore has Auto-Tiering and Thin capabilities and a VM profile is configured for Auto-Tiering and Thick, the datastore would be seen as non-compliant when using that VM profile. Lastly, VNXe3200 has native vCenter interfaces so VASA does not need to use a separate plug-in to connect to the system.

VMware Aware Integration (VAI)

VAI is an end-to-end discovery of a VMware environment from a VNXe3200. VNXe3200 uses VAI to import and view VMware Virtual Centers, ESXi servers, virtual machines, and VM disks. Also, ESXi hosts can be automatically registered when a vCenter is imported. The polling process to import information is done in the background and can poll a single host or all hosts for updated information. The VNXe3200 system can also create and monitor VMware datastores from Unisphere using VAI.

Virtual Storage Integrator (VSI)

VSI allows VMware administrators to provision and manage certain VNXe3200 storage configurations. EMC's VSI for VMware vSphere Web Client can be utilized for the following:

- Creating NFS datastores, VMFS datastores, and RDM volumes
- Viewing storage property details

For additional information about VSI Storage Management, please see the product guide titled *EMC VSI for VMware vSphere Web Client* on EMC Online Support.

vStorage API for Array Integration (VAAI)

VAAI improves ESXi host resource utilization by offloading related tasks to the VNXe3200. With VAAI, NFS and block storage tasks are processed by the storage system, thus reducing host processor, memory, and network resources required to perform select storage operations. For example, an operation such as provisioning full clones for virtual environments from a template VM can be done while the ESXi host streams write commands to the VNXe3200 target. The VNXe3200 storage system processes these requests internally, performs the write operations on the given SP, and returns an update to the host when the requests are completed. The impacts on

the host resources and front-end ports of the VNXe3200 system are significantly reduced when the load is shifted to the storage system.

The following tasks can be offloaded to VNXe3200 storage systems:

- NAS
 - Fast Copy
 - Snap-of-Snap
 - Extended Statistics
 - Reserve Space
- Block
 - Fully Copy or Hardware-Assisted Move
 - Block Zero or Hardware-Assisted Zeroing
 - Atomic Test and Set (ATS) or Hardware-Assisted Locking
 - Thin Provisioning (Dead Space Reclamation)

Remote Monitoring

The status of a VNXe3200 system can be managed remotely by EMC personnel or customers through ESRS and monitoring products such as Unisphere Central. Other monitoring products that support VNXe3200 are EMC Storage Analytics (ESA), VNX Family Monitoring and Reporting (M&R), and EMC Storage Integrator (ESI), which are not detailed in this paper.

EMC Secure Remote Support (ESRS)

The EMC Secure Remote Support (ESRS) feature provides an authorized EMC service provider with remote access capabilities to a configured VNXe3200 system by using a secure and encrypted tunnel. This feature helps EMC technical support more rapidly resolve issues. For outbound access, the VNXe3200 management IP network must allow outbound and inbound HTTPS traffic. This secure tunnel can also be used to transfer files to the VNXe3200 system or transfer files back to EMC's network.

Unisphere Central

Unisphere Central is a centralized easy-to-use network application that provides administrators with a way to centrally monitor their CX4, VNX, and VNXe storage systems.

Unisphere Central enables a user to:

- Monitor up to 1,000 CX4, VNX, and VNXe systems from a single interface.
- View aggregated alerts, health, capacity, and CPU usage for multiple systems.
- Control access to the monitoring interface by setting up local Unisphere remote users or integrating existing LDAP enabled users and groups.
- Organize views of the storage nodes in logical ways, including by location, type, department, etc.
- Launch Unisphere from Unisphere Central to manage individual systems. With the VNXe3200, “single sign on” and “single sign off” functionality is possible.

NOTE: Unisphere Central does not actively manage the systems in a customer's environment. Instead, it leverages the capabilities in Unisphere by linking to it and launching the specific system to manage.

The Unisphere Central environment consists of a Unisphere Central server running in a VMware virtualized environment, one or more CX4, VNX, and VNXe systems, and a remote system to access the Unisphere Central sever.

For more information on Unisphere Central, see the paper titled *Unisphere Central for VNX Family: Next-Generation Storage Monitoring – A Detailed Review* on EMC Online Support.

VNXe3200 Support Ecosystem

VNXe3200 storage systems are customer-installable and customer-maintainable. When there is a hardware or software fault in a VNXe3200 system, the user is informed through the alert mechanism in Unisphere. All alerts have a severity associated with it as well as a detailed message describing the alert. Alerts also provide links to context-sensitive knowledgebase articles that help correct the fault. For example, if there is a faulted disk in the VNXe3200 system, an alert message pops up that specifies which disk has faulted. Additionally, there are links to the Online Help and knowledgebase document that provides instructions for ordering a new disk and replacing a faulted disk in the VNXe3200 system.

The Support window in Unisphere provides links to resources for learning about and getting assistance for a VNXe3200 storage system. It provides the following features:

- **How to Videos** – Videos to learn about the storage system. For example, instructions on how to replace a failed component.
- **Online Documentation** – Online documents that provide the latest information about the product. These are routinely updated to ensure the most current information.
- **Online Training** – Videos, slideshows, and other educational material for learning about VNXe3200 systems.
- **Search EMC Support** – Articles, white papers, and other information regarding known issues and solutions related to system installation, configuration, and operation.
- **Community** – A way to interact with other VNXe3200 customers and read, contribute, or ask questions about the storage system.
- **Live Chat** – A way to quickly contact and chat with support personnel who can help a user in real time. Note that this option is available only to VNXe3200 systems that are under a maintenance contract.
- **Service Center** – A place to access information about open service requests.
- **Product Support Page** – A way to access all the system support needs such as information about maintaining hardware as well as steps to install and license the system.
- **Customer Replaceable Parts** – A place to order or return a part for the storage system.

Also, most wizards and screens in Unisphere display help icons that lead you to specific pages in the Unisphere Online Help.

- **Unisphere Online Help** – Includes information to enable users to complete tasks more efficiently and better understand Unisphere features.

Conclusion

The VNXe3200 storage system provides a consolidated platform for provisioning, managing, and monitoring data storage for a wide range of organizations and networks. Because these storage systems support SAN (iSCSI and FC) and NAS (network-attached storage) storage access, they provide storage resources for clients and hosts running a variety of operating systems and applications. The VNXe3200 system is a truly unified data storage system.

Since VNXe3200 software automatically implements best practices when configuring storage, a user does not need detailed knowledge about storage and application technologies. Along with powerful features like MCx and FAST VP, VNXe3200 systems are designed to be easily installed, configured, and maintained by an IT generalist. Comprehensive, easy-to-understand guidance is also available through the VNXe3200 support ecosystem.

From a hardware point of view, a user can start with a small configuration based on current requirements, and easily scale up as requirements change. The ability to easily implement advanced storage features with application wizards such as File Deduplication and Compression, Thin Provisioning, and Unified Snapshots in a solution that is also integrated with VMware vCenter makes VNXe3200 storage systems unique in the marketplace.

IT departments can greatly benefit from using the VNXe3200 as it helps businesses handle exponentially growing storage capacity demands while providing reliable performance, availability, and support.

References

The following documents can be found on the EMC Online Support:

- *EMC Unisphere for the VNXe3200: Next-Generation Storage Management*
- *EMC VNXe3200 Asynchronous Replication*
- *EMC VNXe3200 Capacity and Performance Metrics*
- *EMC VNXe3200 File Deduplication and Compression*
- *EMC VNXe3200 High Availability*
- *EMC VNXe3200 Next-Generation File System*
- *EMC VNXe3200 Pool Provisioning*
- *EMC VNXe3200 Unified Snapshots*
- *Introduction to EMC VNXe3200 SMB 3.0 Support*
- *Introduction to the EMC VNXe3200 FAST Suite*
- *Managing an FLR-Enabled NAS Environment with the EMC File-Level Retention Toolkit*

Appendix A: Drive Support

Below is a list of supported drives.

Table 4. Supported Drives

Drive Type	Capacity	Size	12-Drive DAE*	25-Drive DAE
FAST Cache Optimized SSD	100GB	2.5"	✓	✓
FAST Cache Optimized SSD	200GB	2.5"	✓	✓
FAST VP Optimized SSD	100GB	2.5"	✓	✓
FAST VP Optimized SSD	200GB	2.5"	✓	✓
FAST VP Optimized SSD	800GB	2.5"	✓	✓
15K RPM SAS	300GB	2.5"	✓	✓
10K RPM SAS	600GB	2.5"	✓	✓
10K RPM SAS	900GB	2.5"	✓	✓
15K RPM SAS	300GB	3.5"	✓	
15K RPM SAS	600GB	3.5"	✓	
7.2K RPM NL-SAS	2TB	3.5"	✓	
7.2K RPM NL-SAS	4TB	3.5"	✓	

* 2.5" Drives are supported in 12-drive DAEs by using 3.5" carriers