Evaluation of the EMC[®] CLARiiON[®] AX4 Storage System

Report prepared under contract with EMC Corporation

Introduction

EMC Corporation commissioned Demartek to perform a hands-on evaluation of EMC's new entrylevel CLARiiON AX4 iSCSI storage system. This evaluation included installing and deploying the AX4 in the Demartek lab facilities and reviewing several features including system installation configuration, provisioning storage to hosts, capacity expansion, data migration within the system, and creation of snapshot copies. All features evaluated by Demartek are included with the base CLARiiON AX4 system.

This report shows the actual steps taken to install and use the AX4 storage system. Screen shots are included.

Evaluation Summary

We found that the AX4 is easy to configure and use. In our opinion, it is an ideal choice for customers consolidating storage for the first time. It provides a strong set of storage management features in an entry-level system, offers a great growth path, and is competitively priced.

Overview of the EMC CLARiiON AX4

The CLARiiON AX4 is EMC's entry-level iSCSI storage system for new installations or consolidated applications. Storage capacities start with as little as 600 gigabytes (GB) and can scale up to 45 TB now and up to 60 TB of raw capacity when 1 TB disk drives are supported later in the first calendar quarter of 2008. This type of solution is suitable for block-oriented applications such as Microsoft Exchange, Microsoft SQL Server, and backup and recovery.

The CLARiiON AX4 is available in either single or dual controller models. The combination of the CLARiiON AX4 architecture, based on Intel Xeon processors, and the CLARiiON FLARE operating environment enable the system to scale from as few as



4 drives up to as many as 60 drives within the system (up to four optional Disk Array Enclosures). The combination of Intel's advanced multiprocessor capability and high degree of data path protection, complement the strengths of FLARE. Such scalability (in both power and capacity) in an entry-level system is rare, and offers a solid growth path for end-users.

These enclosures can be populated with Serial-Attached-SCSI (SAS) disk drives for performancesensitive applications and SATA disk drives that provide large capacity for applications such as backup-to-disk. For those installations needing multiple tiers of storage, the disk drive types can be mixed SATA and SAS, even on the same shelf, as they were for this evaluation. SATA disk drives are available in capacities of 750 GB, with 1 TB SATA drive support coming in Q1'08. SAS disk drives are available in 146GB and 400 GB capacities.

The iSCSI version of the AX4 has a total of four iSCSI host data interfaces, two per storage processor. There is also a version of the AX4 with four Fibre-Channel host data interfaces. This report focuses on the iSCSI version only. Aside from the host interfaces, these two versions of the AX4 are nearly identical.

The CLARiiON AX4 base system comes with an impressive suite of software features. Software capabilities that ship with the system include: wizard-driven installation utilities, simple configuration and management, path management and failover, online capacity expansion, non-disruptive data migration, and local snapshot replication for backup operations.

Installation of the EMC CLARiiON AX4

The installation of the AX4 can be organized into the following general steps.

- 1. AX4 hardware installation and system initialization
- 2. Host server installation of PowerPath software and iSCSI session configuration

Hardware Installation

EMC has designed the AX4 to be installed by customers. A "placemat" showing all the hardware installation steps comes with the unit. In this evaluation, Demartek required less than an hour to unpack the boxes, load the unit into the racks, connect all the cables, turn on power to the system and get ready to perform the initial configuration of the system.

System Initialization

The basic steps to the system initialization are:

- 1. Discover the array
- 2. Set the management port network settings
- 3. Set the iSCSI data port network settings
- 4. Set the administrative username and password

The Navisphere Storage System Initialization utility can be run directly from the CDROM or installed on a host server. This utility scans for, and automatically detects, the AX4 systems on the same subnet as the host server. After detection, the administrator can enter the desired IP addresses for the management ports and the iSCSI data ports. The administrator also sets the username and password for the administrative access to the system. This process required approximately 10 minutes. We believe that any administrator generally familiar with IP networking concepts will have no trouble configuring the AX4 iSCSI storage system.





🛅 Navisphere	Storage System Initialization Wizard	X
<u>F</u> ile <u>O</u> ptions	<u>H</u> elp	
	Use this screen to set the network parameters for the management ports (10/100/1000) on the storage system.	
	System serial number: NECE2073700009 System model number: AX4-5i Management Port (10/100/1000) Network Settings	
	IP Address: 10 . 0 . 2 . 51	
18 S	Storage Processor B IP Address: 10 0 2 . 52	
	Subnet mask: 255 255 0 . 0 Default gateway: 10 . 0 . 1	
	<< <u>B</u> ack <u>N</u> ext >> <u>C</u> ancel	

After setting the IP addresses for the AX4 management ports, the IP addresses and other network configuration parameters are needed for the four iSCSI data ports.

Following the network parameter settings, the only remaining initialization task is to set the administrator username and password.

🛅 Navisphere	Storage System Initialization Wizard	X
<u>F</u> ile <u>O</u> ptions	<u>H</u> elp	
	Use this screen to do the following: Change the name of the storage system. Initialize management security by creating a user account. Users are advised to change the password at the first login to the storage system.	
	System serial number: NECE2073700009	
	Storage system name: NECE2073700009	
	Security settings	
-GROS	User name: Demartek	
TOORS!	Password:	
	Confirm password:	
	<< <u>B</u> ack <u>N</u> ext >> <u>C</u> ance	

A final summary checklist is displayed, with the opportunity to go back and change any of the previous settings, if necessary.

After the AX4 has been installed and initialized, the host servers that will access the iSCSI storage need to be prepared. The servers in the Demartek lab have server-class NICs installed suitable for iSCSI traffic and the Microsoft iSCSI software initiator already installed.

The host server installation steps include the following:

1. PowerPath Installation



2. Configure Host Sessions

PowerPath Installation

The AX4 comes with EMC PowerPath at no additional charge, and is required to provide the proper management as well as load balancing and path failover for highly available connectivity to the AX4. In the Microsoft Windows environment, PowerPath works with the Microsoft iSCSI initiator. PowerPath must be installed on each host server that will use the iSCSI storage of the AX4. For this evaluation, three servers in the Demartek lab were used, running Windows Server 2003 R2 Enterprise x64 Edition.

Installing PowerPath is a very straightforward process, simply following the prompts. This process required less than five minutes per host server. A reboot of the host server is required in order to complete the installation. After PowerPath is installed, very little user interaction with PowerPath is required for basic operation of the AX4.





Host Session

The Navisphere Server Utility steps through the process of establishing a session between a host server and the AX4 system. Just a few clicks are required to create and logon to an iSCSI session between the host server and the AX4. This process took less than ten minutes per host server.

Navisphere Server Utility	X
Ele Options Help	
Ele Options Belp SCSI Targets and Connections Discover New iSCSI Targets Select an option to use to find targets and click: Next' to add them to the target list. O O Discover iSCSI targets on this subnet: 10 0 2 O Find targets with data port addresses on the subnet (255.255.255.01) you specify. Only targets without CHAP enabled will be reported. O Discover iSCSI targets for this iSCSI Target Portat Discover isCSI targets for this iSCSI Target Portat Discover isCSI targets rown to this data port. This may include targets for the same storage system but using a different data port. O Discover iSCSI targets using this iSNS server. Discover iSCSI connections. Find targets registered on this iSNS server. Discover iSCSI connections. Select this option to view the list of available targets for iSCSI connections. O view currently available targets.	
<< <u>B</u> ack <u>N</u> ext >> <u>C</u> ancel	

The iSCSI Target and Connections step will discover all iSCSI storage visible to the host. At the time of this installation, only the AX4 iSCSI storage was visible to the three host servers.

Navisphere Server Utility				
Eile Options Help	ICCCI Tarrette			
	You must be connected to an ISCSI connect, select an 'Inactive' ISCSI to To disconnect, select a 'Connected' To remove all discovered (except for select an 'Inactive' target from the st After connecting, click 'Next' to list c	target in order to u arget and click "Loy target and click "L m iSNS) targets fr orage system and o onnected storage	se a storage sy ogoff'. om a storage sy click 'Remove'. systems and de	stem. To vstem, vvices.
	Name	Target IP Addr	Status	Netwo
	ign.1992-04.com.emc:cx.nece2073700009.a0	10.0.2.53	Inactive	N/A
	ign.1992-04.com.emc:cx.nece2073700009.a1	10.0.2.54	Inactive	N/A
	iqn.1992-04.com.emc:cx.nece2073700009.b0	10.0.2.55	Inactive	N/A
	ign.1992-04.com.emc:cx.nece2073700009.b1	10.0.2.56	Inactive	N/A
	Logon Options Also logon to peer ISOSI target: for High A Server Network Adapter IP (Recommended: Default)	vailability (recomme	endedj	
	Logon	Remov	/8	
	<< <u>B</u> a	ack <u>N</u> ext	>>	<u>C</u> ancel

The Navisphere Server Utility can logon and establish the iSCSI session using all available host ports and connect to all available iSCSI target ports. If the logon option is chosen, it will immediately logon to the AX4 IQN (iSCSI Qualified Name) that is selected and its pair partner. In this example, the IQN that ends with "a0" and "b0" are considered partners and "a1" and "b1" are

considered partners. The logon is also established as a persistent iSCSI connection, so that whenever the host server is rebooted, the iSCSI session is automatically reestablished at system startup without user intervention.

The overall installation process was simple and straightforward. We believe that any administrator familiar with basic IP networking concepts would have no trouble installing an AX4 system.

Managing the CLARiiON AX4 Using Navisphere Express

EMC provides the Navisphere Express software to manage the AX4. The Navisphere Express provides wizards to assist with many of the functions, making them easy to perform. The basic functions include:

- 1. System administration settings
- 2. Host server information
- 3. Storage configuration

The first time Navisphere Express is launched, a few items that need attention will be highlighted and these items can serve as a checklist for some logical first steps for the administrator to insure high availability and the best use of the AX4. The configuration of these items is explained below.

System Administration Configuration

To begin our configuration, we changed the name of the system, specified an email address to use for AX4 system notifications and set the AX4 system time.

Host Server Configuration

Clicking on the "Connections" menu item allows the administrator to configure a host server connection. Four pieces of information are required to complete this step:

- 1. The IQN of the host server
- 2. The operating system type
- 3. The name of the host server
- 4. The IP address of the host server

This series of steps is repeated for each desired server connection. The connections are configured to use all available active iSCSI ports. Here we see the results of configuring three host servers.

🖉 Navisphere Express - W	indows Internet Explorer		
	a/NaviMain.html?NST=R7So2aPgtY2XvNFd 🛛 🗸 😵 Ce	ertificate Error	P -
<u>File Edit View</u> Favorites	<u>I</u> ools <u>H</u> elp		
🔶 🔅 🖉 Navisphere Expre	255	🗄 • 🗟 · 🖶 •	Page • ③ Tools •
Navi <mark>sphere</mark> Express	Name: Demartek-NECE207 Model: AX4-5i	3700009	Normal
Manage Storage System Disk Pools Virtual Disks Hot Spares Servers Connections Snapshots SAR Copy	Manage Connections The following table lists all connections to the storage sy that are connected to but not yet registered with the st unregistered status), use the 'Server Utility' on the attack Troubleshoot Inactive Connection	Help ystem. To register any servers corage system (Active- ched servers.	
15051	Connection Info	SP/Port Status	
Components Events System Services Software Language Help Help Center About Refresh Logout	IP Address: 10.0.1.33 IB HBA Port Type: ISCSI Initiator: ign.1991-05.com.microsoft:dmrtk-srvr-b2 Initiator Type: Server Operating System: STANDARD Server: dmrtk-srvr-f2 IP Address: 10.0.1.71 IB HBA Port Type: ISCSI Initiator: ign.1991-05.com.microsoft:dmrtk-srvr-f2 IP Address: 10.0.1.61 IB HBA Port Type: ISCSI Initiator: ign.1991-05.com.microsoft:dmrtk-srvr-e2 IP Address: 10.0.1.61 IB HBA Port Type: ISCSI Initiator: ign.1991-05.com.microsoft:dmrtk-srvr-e2 Initiator Type: Server Operating System: STANDARD To remove any unnecessary connections, select them an Deregister To change a server's information, select it and click 'Mod Modify To create a new server connection without running the : New	A-0 Active B-0 Active B-1 Active A-1 Active B-1 Active	
		✓ Trusted sites	€ 100% ·

Up to 128 iSCSI initiators (64 high availability hosts) can be configured. These can be physical hosts or hosts in a virtual server environment such as VMware[®].

Storage Configuration

For the storage configuration, the disk pools need to be created, and hot spares need to be assigned. After creating disk pools, virtual disks are created that can be assigned to host servers. If the host servers have already been configured, then the virtual disk can be assigned to specific host servers when they are created. If the host servers have not been configured, the virtual disks can be assigned later.

Because the evaluation unit included both SATA and SAS disk drives, we configured one hot spare of each type before configuring the disk pools. In this example we see that one SATA and one SAS disk drive are listed as a "Hot Spare" disk.



We configured two disk pools, one for each type of disk. This allows us to create a two-tier storage system.

The SAS disk pool spans enclosures. Disk pools can span enclosures and can have up to 16 disk drives per pool.



After creating these disk pools, we configured the remaining available disk drives as hot spares.



There is no limit to the number of disk pools that can be created. The physical number of disks and the type of RAID grouping are the limiting factors.

After creating disk pools, virtual disks are created and assigned to specific hosts. The virtual disk creation process is straightforward, requiring the following pieces of information:

- 1. Disk pool from which to create the virtual disk
- 2. Name, capacity and number of virtual disks to create
- 3. Server to assign the virtual disk when completed.

Virtual disks can be created one-at-a-time or can be created in groups to expedite the process. If more than one virtual disk of the same size is needed, the size and the number of virtual disks can be specified with no server initially assigned. The host servers can be assigned to virtual disks later.

A total of 512 virtual disks can be created with a maximum of 128 virtual disks per disk pool. A single initiator could have up to 256 virtual disks assigned to it. A dual-connected host, such as in our configuration, can have up to 512 virtual disks assigned to it.

🖉 Navisphere Express - Wi	indows Interne	et Explorer								
🚱 🗸 🖉 https://ax4-a	a/NaviMain.html?NS	ST=R7So2aPgtY2	XvNFd	✓ (Certifica	te Error	47 🗙	Live Search		P -
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites	Tools Help									
😭 🏟 🌈 Navisphere Expre	255							• 🗟 • 🖶 • 🖪	<mark>≩ <u>P</u>age →</mark>	
Navi <mark>sphere</mark> E x p r e s s		Na Mo	me: NE del: AX	CE20737 (4-5i	0000	9				Normal
Manage Storage System	Create '	Virtual	Disks					Help		
Disk Pools Virtual Disks Hot Spares	Step 1: Se	lect the disk	pool on wh	ich to create t	he virtu	al disk(s).			
Connections	Disk Pool		Largest I Virtual D	Possible isk	Total Space	Free	Num	ber Of Virtual		
SAN Copy	⊙ 1	RAID1/0	1340.93 GE	3	1340.93	3 GB	0			
ISCSI	0 2	RAID1/0	1066.98 GB	3	1066.98	B GB	0			
View Components Events System	Step 2: En operating sy Tbytes). See	ter a name a stems may r e your opera	and capacity not be able ting system	y for the new v to mount a larg documentatio	irtual dis le virtua n for det	sk(s). No I disk (ty ails.	ote tha ypically	t some server greater than 2		
Settings	Name:			Virtual Disk 1						
Services Software	Capacity:			400		GB	*			
Language	Number Of V	/irtual Disks:		1 💌	•					
Help Help Center About	Step 3: As	sign a serve	r to the virt	ual disk(s) or s	elect 'No	one' to a	issign o	one later.		
Refresh	Server:	No	ne 💌							
Logout	Step 4: Cli	ck 'Apply dm dm ncel	re tik-srvr-b2 tik-srvr-f2 tik-srvr-e2	new virtual dis	k(s).					
Done								Trusted sites		🕄 100% 👻 💡

🖉 Navisphere Express - Windows Internet Explorer											
G → Image: A the state of t	a/NaviMain.html?NST=1pCmavZ10KO4	t92e 💙	😵 Certificate Error	♭ 🗙 Live	Search	P					
<u>File E</u> dit <u>V</u> iew F <u>a</u> vorites	Tools Help										
🖌 🏟 🖉 Navisphere Expre	226			- 6	- 📇 - 🕞 Page -	Tools - »					
W W W W											
Navisphere	Name: De	martek-	NECE20737	00009		Normal					
Express	Model: AX	4-5i				Normai					
Manage											
Storage System	Manage Virtual	Disks			H	elp					
Disk Pools											
Virtual Disks Hot Spares	The following table lists all	virtual disks	in the storage sys	stem. Click	the name of a virtu	al					
Servers	uisk to view details for the	virtual ulsk.									
Connections	Virtual Disk Name	State	RAID Type	Size	Assigned To						
SNAPSNOTS SAN CODV	Virtual Disk 1	Normal	RAID1/0	400 GB	dmrtk-srvr-b2						
iSCSI	Virtual Disk 2	Normal	RAID1/0	400 GB	dmrtk-srvr-e2						
	Virtual Disk 3	Normal	RAID1/0	400 GB	dmrtk-srvr-f2						
Components	Virtual Disk 4	Normal	RAID1/0	200 GB	dmrtk-srvr-e2						
Events	Virtual Disk 5	Normal	RAID1/0	200 GB	dmrtk-srvr-e2						
	Virtual Disk 6	Normal	RAID1/0	50 GB	dmrtk-srvr-e2						
System	Virtual Disk 7	Normal	RAID1/0	200 GB	dmrtk-srvr-f2						
Services	Virtual Disk 8	Normal	RAID1/0	200 GB	dmrtk-srvr-f2						
Software	Virtual Disk 9	Normal	RAID1/0	50 GB	dmrtk-srvr-f2						
Language											
Help	Create New Virtual Disk										
Help Center											
About											
GRefresh											
<u>.</u>											
Logout											
						•					
				🗸 Tru	sted sites	💐 100% 🔻 .:					

The creation of virtual disks is simple and easy, with all the information needed available on one screen. The virtual disks must complete their initialization before the host servers can access the storage. This initialization time depends on the size of the virtual disk and the type of disks (SATA or SAS) on which the virtual disks have been created.

After the virtual disks have completed the AX4 system initialization, they ready for use by the host servers. The host servers follow normal procedures for creating partitions and formatting as with any other disk storage

Online Capacity Expansion

Storage environments generally are not static and over time individual storage volumes often need to be expanded. The AX4 provides a non-disruptive expansion function for virtual disks. If there is unallocated capacity in a disk pool, a virtual disk can be expanded very easily. The virtual disk expansion function allows for growth either by a percentage or specific amount of storage. The administrator selects the amount and presses "apply". In this example, a 200 GB virtual disk is expanded by 10 GB.

🖉 Navisphere Express - V	Vindows Internet Explorer				
🔆 🕞 🗸 🖉 https://ax4	-a/NaviMain.html?NST=lvPAqwPS)	(7eBZORI 🛛 👻 😵 (ertificate Error	X Live Search	P -
Ele Edit View Favorites	Tools Help				
🚖 🏟 🌈 Navisphere Exp	ress			🔄 • 📾 • 🖶 • 🔂 Bage	🔹 💮 Tgols 🔹
Navisphere	Name:	Demartek-NEC	E2073700	009	Nermal
Express	Model:	AX4-5i			Normai
Manage	Expand Virtua	l Disk - Virtua	l Disk 4	He	p
Disk Pools					-
Hot Spares	Step 1: Verify the de	tails for the virtual disk	you want to exp	and.	
Servers Connections	Name: Virtual Disk 4				
Snapshots SAN Copy	Capacity: 200 GB				
ISCSI	Total available free us	er space on disk pool 2:	166.98 GB		
Components	Step 2: Enter the am	ount by which to expan	d the virtual disk	. 'Percentage' expands th	e
Events	capacity by a percent	age of the original virtu	al disk. 'Size' exp	ands the capacity by a	
System	large virtual disk (typic	ally greater than 2 Tby	tes). See your o	perating system	
Settings Services	documentation for dec	alls.			
Software Language	OPercent	10	96		
telp	 ⊙ Size 	10	GB 💌		
Help Center About	Step 3: Click 'Apply'	to expand the virtual di	sk.		
Refrech	Apply Cancel				
Succession					
Logout					
Done	-		2	Trusted sites	🔍 100% 🔹

For a few minutes, while the virtual disk is expanding, its status is displayed. When the expansion is complete, the host can then use standard commands to expand the volume into the new space. In the Windows environment, this step is accomplished by the "DISKPART" command.

🖉 Navisphere Express - W	/indows Internet Explor					C Nav	isphere Express - W	indows Internet Explorer					
() - 1 https://ax4-	a/NaviMain.html?NST=lvPAqu	PSX7eBZORI 🛛 😽 🚱 Certificati	e Error 🏼 🍕 🗙	Uve Search	P -	G	-	a/NaviMain.html?NST=lvPAqwPSX7eBZO	RJ	V 😧 Certificate Bro	- 4 ×	Live Search	P-1
File Frit View Faurriter	Toole Help					51a 1	Left View Enveriter	Taala Hala					
A A	Tease Tea			- D - D - D -	(h Turk)	0e 1	on ten revolues	Tone Teh					· · · · »
Navisphere Expr	ess		21	· D · B · D Beer	OF IGON .	× •	Navisphere Expr	ess			<u>.</u>	🖾 . 👜 . 🔂 Babe	• (C) Tools •
Navisphere	Name	: Demartek-NECE20	7370000	9		Na	wisnhere	Name: Der	nartek	-NECE2073	70000	•	
Express	Mode	AX4-5i			Normai	E	xpress	Model: AX	4-51				Normal
Manage	- Touc				_	1 and		Houen Ax					
Storage System	Manage Virt	ual Disks		Help		Stor	age System	Manage Virtual D	isks			He	
Disk Pools						Disk	Pools						
Hot Spares	disk to view details	for the virtual disk.	le system. Cic	k the name of a virtual		Hot	Spares	disk to view details for the	virtual disks	s in the storage s	ystem. Click	the name of a virtual	
Servers						Serv	ers						
Snapshots	Virtual Disk Nam	ie State	RAID Type	Size Assigned To		Snap	shots	Virtual Disk Name	State	RAID Type	Size	Assigned To	
SAN Copy ISCST	Virtual Disk 1	Normal	RAID1/0	400 GB dmitk-srvr-02		SAN	Сору	Virtual Disk 1	Normal	KAID1/0	400 GB	dmrtk-srvr-b2	
	Virtual Disk 2	Normal	RAID1/0	400 GB dmrtk-srvr-f2		1000	·	Virtual Disk 2	Normal	RAID1/0	400 GB	dmitk-styr-ez	
View	Virtual Disk 4	Transitioning, Expanding (0%)	RAID1/0	200 GB dmrtk-srvr-e2		View		Virtual Disk 4	Normal	RAID1/0	210 GB	dmrtk-srvr-e2	
Events	Virtual Disk 5	Transitioning	RAID1/0	200 GB dmrtk-srvr-e2		Ever	ponents	Virtual Disk 5	Normal	RAID1/0	200 GB	dmrtk-srvr-e2	
Countrance	Virtual Disk 6	Transitioning	RAID1/0	50 GB dmrtk-srvr-e2				Virtual Disk 6	Normal	RAID1/0	50 GB	dmrtk-srvr-e2	
Settings	Virtual Disk 7	Transitioning	RAID1/0	200 GB dmrtk-srvr-f2		Syste	em	Virtual Disk 7	Normal	RAID1/0	200 GB	dmrtk-srvr-f2	
Services	Virtual Disk 8	Transitioning	RAID1/0	200 GB dmrtk-srvr-f2		Serv	ices	Virtual Disk 8	Normal	RAID1/0	200 GB	dmrtk-srvr-f2	
Software	Virtual Disk 9	Transitioning	RAID1/0	50 GB dmrtk-srvr-f2		Soft	ware	Virtual Disk 9	Normal	RAID1/0	50 GB	dmrtk-srvr-f2	
	Create New Virts	al Disk					lange	Create New Virtual Diek					
Help Help Center	Cicate New Yill	ar bisk				Help	Contor	Greate ivew viltual Disk	·				
About						Abo	it						
Refresh						. C.	ofrach						
9													
Logout						1 T L	ogout						
-						-							
		P		Trusted sites	R 100% •	Done				F	✓	Trusted sites	R 100% ·

Disk pools can also be expanded easily and non-disruptively. The process is similar to the virtual disk expansion process. In this example, we began with a fresh RAID-5 disk pool that was originally configured with four disk drives and expanded the pool to add three more drives, from the second enclosure, to the pool.



"In-the-box" Data Migration

On some occasions, it will be advantageous to move a virtual disk from one disk pool to another disk pool. This may be due to changing performance requirements or to better utilize capacity. This process is also easy to perform. In this example, we migrated virtual disk 9, from disk pool 2 to disk pool 1. This process for migrating the data from SAS drives to SATA drives was accomplished from the AX4 platform, without any intervention required from the host server, and while the volume was mounted by the host server. This "in-the-box" data migration feature is extremely valuable for end-users deploying a mix of SAS and SATA drives within the same system.



🗃 🕑 👻 🙋 https://ax4-i	a/NaviMain.html?NST=lvPA	qwPSX7eBZORI	Certificate Error	Uve Search	2
le Edit Yew Favorites	Tools Help				
🖌 🎸 🄏 Navisphere Expr	195				Page • 💮 Tools •
Navisphere	Nam	e: Demartek-I	NECE207370	0009	Nemer
Express	Mode	el: AX4-5i			Normai
anage	Migrate Vir	tual Disk 9			Help
Storage System Disk Pools	ingrate in				
/irtual Disks Hot Spares	Step 1: Select th	ne disk pool on which t	o migrate the virtua	al disk.	
Servers	Disk Pool N	ame RAID Typ	e Drive Type	Total Free Space	
Snapshots		RAID1/0	RAID1/0	140.93 GB	
SAN Copy SCSI	Step 2: Click 'Ap	ply' to migrate Virtual [oisk 9 to a new Virtu	ual Disk.	
iew		., .			
Components	Apply				
events					
ystem Settings					
Services					
Language					
elp					
Help Center About					
Refrech					
Logout					



Snapshot Local Replication

There are many occasions where it is advantageous to have a "point-in-time" copy of a virtual disk, known as a "snapshot" on the AX4. Snapshots can be used for creating backup copies of data, test copies of data or any other similar purpose. A snapshot copy can be allocated to a secondary server without damaging the source data. The second server has access to data and can read or write to the snapshot copy. Up to 16 snapshots can be created per AX4, with one snapshot per virtual disk.

In this example, we use a 50 GB virtual disk allocated to one server. Using the snapshot feature, we make a copy of this virtual disk and allocate it to a second server. The process is simple and straightforward.

🖉 Navisphere Express - W	findows In	iternet Explorer								
	a/NaviMain.l	html?NST=XXV4mpwRUZEXHq	Yg 🛛 👻 😧 Certificate Error 😽	X Live Search						
Ele Edit View Favorites	Tools H	elp								
😭 🕸 🌈 Navisphere Expr	ess			🙆 • 📾 · 🖶	• 🔂 Bage • (💮 Tools 🗸 🦥				
Navisnbore		Name: Dem	artek-NECE207370	0000		🖉 Navisphere Express - V	/indows Internet Explorer			
Express		Model: AX4	-5i	0005	1	- 🖉 🗸 🗸	a/NaviMain.html?NST=XXV4mpwRUZ	EXHqYg 🛛 🖌 😵 Certificate Error	€ Vive Search	P •
Manage	_	Froucht Abt-F	51			<u>Elle Edit View Favorites</u>	Tools Help			
Storage System	Prep	are Snapshot			He	👾 🏟 🔏 Navisphere Exp	ress		🚹 • 🖾 · 🖶 • 🕞 🕫	ige • 🎯 T <u>o</u> ols • 🎽
Virtual Disks	Step 1	Select the virtual d	lisk for which you want to prep	are a snapshot		Navisnbere	Name: De	martek-NECE2073	700009	
Hot Spares Servers		Namo	Accianad To	Sizo	State	Express	Model: A)	(4-5i	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Normal
Connections Snapshots	•	Virtual Disk 15	dmrtk-srvr-e2	50 GB	Normal	Manage				
SAN Copy ISCSI	Stop 2	Accient to converte	the encoded. This conver will I	a able to accer	a the enanch	Storage System	Manage Snapsh	iots		Help
View	once th	ne snapshot has been	started and activated.	se able to acce.	a che anapan	Virtual Disks	The following table lists a	all snapshots in the storage sy	stem. Click the snapshot na	me for
Components	dmrtk-s	invr-f2 💌				Servers	details for the snapshot.			_
Events						Connections Snapshots	Snapshot:	Snapshot of Virtual Disk 15		
System Settings	Step 3	Click Apply to allo	cate the required resources for	the snapshot.		SAN Copy ISCSI	State:	Ready		
Services Software	Apply	Cancel				View	Snap Resource Usage: Source:	N/A Virtual Disk 15		
Language						Components	Source Assigned To:	dmrtk-srvr-e2		
Help						Events	Prepare New Snapsho			
About						System Settings	<u> </u>			
Refresh						Services Software				
. .						Language				
Logout						Help				
						About				
						GRefresh				
						Logout				
			(21)	Trusted sites						
						Done		100	Trusted sites	3 100% •

On the hosts, the Navisphere Server Utility is then used to prepare the snapshot on the first server and to allow access to it from the second server.

Summary and Conclusion

As initially stated in the Evaluation Summary, we would like to confirm that the EMC AX4:

- Is an easy-to-use storage platform
- Is ideal for customers consolidating storage for the first time
- Is competitively priced, especially considering the software features included with the base system
- System scalability and Optional/Advanced software capabilities offers great growth path for end-users.

The AX4 is an easy to configure and easy to use iSCSI storage solution. It provides flexibility for mixing disk drive types in the same system to facilitate storage tiering; as well as easy migration of virtual disks (host volumes) from one type of disk to another and easy expansion of disk pools and virtual disks. Replication using the AX4-based snapshot feature is simple and easy to perform.

With the included PowerPath software, multi-path configurations are straightforward.

Customers who are looking for an entry-level storage consolidation solution should strongly consider the CLARiiON AX4.

EMC and CLARiiON are registered trademarks of EMC Corporation. VMware is a registered trademark of VMware, Inc.

All other trademarks are the property of their respective owners.

Appendix – Technical Specifications

This report was prepared by Demartek at the Demartek lab facilities in Arvada, Colorado. The AX4 storage system was installed at the Demartek lab and connected to three Demartek servers using an existing Gigabit Ethernet infrastructure.

AX4 Technical Specifications

- 1 GB memory per SP, write caching only available on dual SP models.
- 4Gb/sec FC front end or 1 Gb/sec iSCSI front end
- ♦ 2U in height.
- 2 550W hot swappable power supply/blower modules.

The AX4 installed at the Demartek lab included:

- ♦ Dual-SP
- iSCSI model with four iSCSI host ports
- Two disk enclosures
- 24 disk drives (6 x 750 GB SATA, 18 x 146 GB SAS)