

# VMware Virtual Infrastructure (VI)

# Open-E Data Storage Server (DSS)

**Overview and Introduction** 

White Paper Part I

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#### l Synopsis

#### 1.1 Feasibility

All three methods of connection (FCP, iSCSI and NFS) between VMware ESX3 and Open-E DSS can be implemented. VMs can use the relevant files (configuration and vDISKs) on all provided datastores. All storage-specific VMware functions (VMware VMotion, VMware DRS, VMware HA and VMware Storage VMotion) can be used.

#### 1.2 Performance

Achievable performance essentially depends on the storage server used (RAID controller features and disk features). The connection method used is of secondary importance. If scalability (large number of VMs and parallel high-load operation) is paramount, different prioritization may result.

#### 1.3 Manageability

The ESX3 host is either attached directly (VI client, ssh client, VI3 API tools) or attached via a VC server (VI client). The storage server can be controlled via an available server management interface (BMC redirection) and via a web interface. Open-E DSS also offers console access via ssh. The management of storage functions, e.g. snapshots, is not currently possible via Telnet, ssh or any other interface.

#### 1.4 Support

The connection of ESX3 hosts to the Open-E DSS is currently listed in the community certified HCL.



## 2 Introduction

#### 2.1 Customer motivation

Server consolidation via virtualization is on everyone's lips. Various analysts have called this IT trend one of the most important issues (<u>http://www.virtualization.info/predictions</u>) and predict wide distribution of virtual systems in the future. The market has since experienced very heavy growth, which means an increase in providers and that the advantages of server consolidation through virtualization have achieved a high degree of publicity.

Features and advantages

#### Server consolidation

Server consolidation through virtualization creates a variety of beneficial features:

- Hardware-independence (a VM only has certain hardware components and is thus independent and can run on any physical hardware)
- Encapsulation (a VM is defined by a set of files on the virtualization host)
- Insulation (VMs are insulated from one another, even though the physical hardware is shared)
- Hardware load (several VMs on one host lead to a greater load to consolidation ratio)

#### Data security

Essentially, VMs can be stored in very different storage systems, including local storage. The use and thus the storage of VMs on "shared storage", especially in VMware ESX3 architectures, is almost obligatory and sometimes necessary for certain functions (VMotion, HA and DRS). This "forces" the user to switch to more robust and secure storage architectures. This gives rise to the following attributes:

- The use of storage appliances (special hardware/software with precisely customtailored functions)
- The use of any available "layered applications" (snapshot and replication functions)
- Very easy to use DR offer through shared storage (starting a VM anew on another host of the same datastore). The storage of many VMs in a single "shared storage" unit very quickly leads to a single point of failure, however.

#### **Provision of virtual systems**

The provided management tools (especially of VMware) enable administrators to very quickly create new VMs (e.g. rolling out template VMs). Both traditional and new (via VM management) methods can be used to create VMs:

- Installation of guest OS via data medium
- Via OS deployment mechanism (MS RIS, Altiris, NetInstall OSD etc.)
- By copying deactivated VMs (unique OS features generally must be reset)
- By cloning activated VMs with third-party tools (cloning tools)
- Using management functions (e.g. VMware templates)



## Agility

Virtualization enables especially quickly-growing companies to respond to IT needs, i.e. to roll out new VMs in a short period of time and to respond to other load requirements.

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## 2.2 Virtualization with VMware products

VMware makes a whole array of products available. This includes products for *virtualization*:

- VMware Workstation
- VMware Fusion
- VMware ACE
- VMware ESX3
- VMware ESX3i

The following products are free to use:

- VMware Player
- VMware Server



Representation of the advantages of virtualization

Figure 1 – VMware basics



Increase in the load

Figure 2 – Load increase





Increase in the load

Server consolidation reduces the number of physical servers. The ratio of the sum of all vCPUs to the number of host pCPUs is called the consolidation ratio. VMware runs on Quad-Core CPUs with a ratio between 2 and 4 per pCPU, i.e. with a standard 2-socket server with a Quad-Core CPU, between 16 and 32 vCPUs can be operated. With an assumed vCPU quantity of one in a VM, this corresponds to between 16 and 32 VMs.



Reduction of the host connections to the storage system

Figure 4 – Reduction of storage connections

An important, but sometimes counterproductive, side effect is so-called storage consolidation. This means that the system and data disks of, for example, 100 physical servers is consolidated on just a few host disks, i.e. this can also be called storage virtualization. This pleases a great number of administrators, as only existing (available) disk space need be allocated for new VMs.



The following advantages are gained:

- + Simple storage allocation with VMware tools
- Resizing (enlargement) of VM vDisks in VI client is possible (note: partitions only grow with dynamic data mediums)
- + Resizing (span with so-called extends) of VMFS3 file systems
- + The number of required ports (FCP and GE) is heavily reduced (10–20 times)

There are also disadvantages, however:

- Disk load measurements on the VM level are relatively difficult to repeat on the storage system
- vDisk prioritization with VMFS3 is not possible on the storage system (it is possible with the so-called RDM, however)
- Existing server disks must be converted to vDisks (not with RDM)



Reduction of the host connections on the network

Figure 5 – Reduction of network connections

Network consolidation has another effect. It defines the reduction in the required host connections, the additional functions (VLANs, security, redundancy and load balancing) and the common use of network resources.

Additional products and functions are primarily provided in the VI3 field and are described on the following pages.



## 2.3 VMware ESX3 and ESX3i



Currently in the third generation, emphasizing management and automation

#### Figure 6 – Product evolution

VMware ESX3 has been used in the data-processing center many times via many important functions and features.

#### Features

- Extremely reliable and robust
- Support for many x86 servers, storage systems and guest operating systems
- Very high scalability (32 logical CPUs, 128 GB RAM, 32 Intel GEs, 20 Intel FEs, 20 Broadcom GEs, 64 TB VMFS3 LUNs, 32 hosts in a cluster, 32 hosts on VMFS3)
- Open architecture with documented API for third-party tools
- Very good management environment with VC server
- Additional new features with ESX3.5 (TSO, JumboFrames, 10 GEs and NPIV)

#### **Functions**

- VMFS (VMware file system)
- Virtual SMP (1, 2 or 4 vCPU in a VM)
- DRS (VM load balancing)
- HA (VM restart after host failure)
- VCB (consolidated backup solution)
- VMotion (live migration of VMs between ESX3 hosts)
- Storage VMotion (VMotion with storage migration)
- Converter (P2V and V2V)
- Virtual Center (centralized management solution)
- Update Manager (patching of ESX3/3i hosts and VMs)
- VDI/VDM (desktop hosting with management functions)
- LabManager/StageManager (solution for VM workflow management)





VI software stack (version 3)



A detailed presentation of these functions is not part of this white paper.



### 2.4 Data storage with Open-E storage servers

All Open-E products are based on an operating system that is completely pre-installed and configured on a USB DOM (Disk On Module). This module is then simply inserted into the server system. Pre-installation of the operating system on the USB DOM enables companies to build up their storage infrastructure very quickly and easily. Downtimes are also reduced considerably, and the storage installations are highly secure thanks to the encapsulated operating system.

Two versions of the OS are present, as with dual bios, where the previous version of the OS is still available and can be called up if necessary. The Open-E storage solutions detect the hardware automatically and install the required drivers of the SAS and RAID controllers, Fiber Channel HBAs, Ethernet cards etc. automatically.

## 2.5 Open-E DSS

The Open-E DSS (Data Storage Server) is a complete IP and FC (Fiber Channel) storage operating system that offers companies of any size NAS, iSCSI and FC functions (target and initiator) in a separate application that is easy to use and that is highly failureproof. Data Storage Servers provide a fast, reliable and scalable platform for IP storage that enables common file access, memory consolidation and backup and restoration. Virtualization, or replication, is another highly relevant area these days and is covered by DDS.

Since the operating system has been optimized for environments with dedicated storage and company networks, the solution is especially suitable for network environments with many clients or applications with a high demand for storage, such as multi-video streaming, HDTV and others that also require high data throughput and I/O. Support for Windows, NIS and LDAP domains enables trouble-free expansion of the existing IT infrastructure. The web-supported graphical user interface for management and administration allows reliable control of the storage unit and the backup process for backing up important data.

#### **NAS components**

NAS systems (Network Attached Storage) are data servers through which the network can be accessed. NAS enables multiple users to use the same storage space at the same time, whereby the overhead is often minimized through centralized management of the hard disks and energy costs can be reduced considerably through centralized data management and efficient use of resources.

The Open-E DSS software provides simple centralized management, variable scalability, high reliability, availability and business-oriented performance. The software is an optimized operating system with which an NAS solution can be quickly and simply set up on a server. Pre-installation of the operating system on the USB DOM ensures minimum downtime and protection of the operating system from viruses.

Solution highlights include the support of an integrated anti-virus application for the protection of drives and a variety of backup and snapshot functions for easy data backup. The system can also be easily integrated into existing infrastructures and enables the authentication of the user via Active Directory etc.



## **iSCSI components**

The new iSCSI standard is currently a hot candidate for domination in the storage solution arena. iSCSI is an IP-supported storage network standard for remote storage management. iSCSI is used to link data storage equipment and to simplify data transmission via the intranet and Internet. The iSCSI Target Modules (ITMs) are managed like local hard disks by the administrators. Due to the high availability and performance of IP networks, iSCSI enables site-independent storage and retrieval of data.

Open-E DSS enables cost-effective, centralized storage without the usual expenditures and incompatibilities normally involved with FC SANs (Storage Area Networks). This makes particular sense, since solutions that enable fast and efficient I/O data transmission on the block level can be implemented in this way. This makes the solution optimum for databases.

In contrast to an FC SAN, iSCSI can be executed via existing Ethernet networks and enables easy migration and administration, since existing knowledge on Ethernet and iSCSI can be used. Open-E software belongs to a new generation of applications that expand the possibilities and performance of storage data transmission on the SAN market. It is an optimum combination of data throughput, security, compatibility, management, cost-effectiveness and flexibility.



## 3 Architecture

## 3.1 VMware ESX3



Figure 8 – ESX3 architecture



Figure 9 – ESX3i architecture



The architecture of both ESX3 host platforms essentially consists of the following components:

- VMkernel (hypervisor for specific server models, see HCL)
- Resource scheduler (CPU, RAM, DISK and LAN)
- Storage stack (multipathing with redundancy and load balancing)
- Network stack (VLAN support, security, redundancy and load balancing)
- Support for distributed VMFS3 (up to 32 hosts can actively access a VMFS3 LUN)
- Support for VM worlds
- Service Console with RedHat Linux (ESX3 only)
- Support for host and VC agents
- Support for third party agents (hardware management agents)
- Support for web access (ESX3 only)
- Support for API access

	VMware ESX Server 3i	VMware ESX Server 3
On-disk Footprint	32MB	2GB
Bootstrap	Direct from bootloader	Service Console driven
Direct Management Interaction	DCUI	Service Console shell session
OEM h/w health Agents	CIM plug-in modules	Full stacks in Service Console
Other Agents	Implemented via VI SDK only	Full stacks in Service Console
Scripts, automation and troubleshooting	DCUI, Remote CLI, and VI SDK	Shell and VI SDK
Other software	Moved to outside environment	Resident in Service Console

Main differences between ESX3 and ESX3i

Figure 10 – Main differences



## 3.3 Open-E DSS

The architecture of the Open-E Data Storage Server software can be divided into several main parts:

- Storage level
- Storage virtualization level
- NAS and SAN
- Network level

#### **Storage level**

The core of every storage server is the storage areas. In general, the Open-E Data Storage System can use either Direct Attached Storage (DAS; hard disks connected directly to the system) or external storage (iSCSI matrices connected via iSCSI initiator or Fiber Channel). Here, a DSS can be the storage of another system based on the FC and iSCSI targets.

#### Storage virtualization level

This level introduces two abstraction levels between the core storage and the operating system, volumes and logical volumes. This allows users to create, delete and expand partitions in NAS, iSCSI and FC operation without the unnecessary demand for downtime or management expenditure. Another important point is that capacity can also be expanded during running operation without deactivation of the production system if the storage systems no longer have available space and the hardware platform used is hotplug-capable.

#### NAS and SAN level

The NAS and iSCSI level lies above the virtual storage level. This layer is transparent to users and functions as a bridge between their data and the storage medium. It enables users to export their data and also provides a variety of security options. Open-E DSS offers users asynchronous data replication on the data level, synchronous block level volume replication and integrated backup utilities that represents a complete storage server for companies of any size.

In addition to other options for data backup on the software level, Open-E supports the DSS hardware RAID controller, the teaming (bonding) of network cards (NIC; Network Interface Controllers), UPSs (Uninterruptible Power Supply) and network UPSs. Support for Microsoft domain manager (PDS/ADS) enables administrators to integrate Open-E DSS into existing heterogeneous architectures.

All features listed above are easily accessible and are configured via a web-based, password-protected (Secure Socket Layer, SSL) GUI on the administrator level.



## 3.4 Infrastructure



VI architecture with all important components:

- VC server
- VI client
- ESX3 hosts





VI LAN architecture with all important components:

- pSwitches
- *pNICs*
- vSwitches
- Portgroups
- vNICs
- VLANs
- Server Console port
- VMkernel port (VMotion, IP storage)

Figure 12 – VI LAN architecture



VI storage architecture with all important options:

- FCP (VMFS or RDM)
- iSCSI (VMFS or RDM)
- NFS



Provision of the infrastructure is one of the most important points for the operation of a virtual environment.

Areas of architecture, such as:

- Management architecture (services, ports etc.)
- LAN architecture (VM port groups)

are outside the focus of this white paper.

In addition, the storage architecture is delved into deeper, as are parts of the LAN architecture for IP storage.



#### 4 Preparation of the hardware and software components

#### 4.1 Base implementation of VMware ESX3

The following is involved in planning a VMware ESX3 implementation:

- Compatibility guides (HCL, approval for x86 systems and I/O adapters)
- Component updates (BIOS, RAID HBA, FC HBA and iSCSI HBA)
- PCI configuration (prevention of PCI interrupt sharing)
- BIOS configuration (NX/XD, VT/AMD-V, time, APIC mode)
- Checklist (keyboard table, boot disk in SAN or local, partitioning boot disk, system information and password)
- Post configuration (ntp, security, storage, network and data center)

The installation of an ESX3 host is comparable to RedHat Linux, Fedora and CentOS installations and has been documented many times. It can be carried out in about 15 minutes and is guided by the user.

The ESX3 host can also be installed on a SAN disk (FCP LUN and iSCSI LUN).

#### 4.2 Base implementation of VMware ESX3i

The following is involved in planning a VMware ESX3i implementation:

- Compatibility guides (HCL, approval for x86 systems and I/O adapters)
- Component updates (BIOS, RAID HBA, FC HBA and iSCSI HBA)
- PCI configuration (prevention of PCI interrupt sharing)
- BIOS configuration (NX/XD, VT/AMD-V, time, APIC mode)
- Post configuration (ntp, security, storage, network and data center)

An ESX3i host can be commissioned in two different ways:

- Embedded (included as the boot medium by the server manufacturer)
- Installable (can be installed from the medium, approx. 5 minutes)

#### 4.3 Base implementation of Open-E DSS

The following is involved in planning an Open-E DSS implementation:

- Compatibility guides (HCL, no limitation for x86 systems, approval for I/O adapters)
- Component updates (BIOS, RAID HBA, FC HBA and iSCSI HBA)
- PCI configuration (prevention of PCI interrupt sharing)
- BIOS configuration (NX/XD, VT/AMD-V, time, APIC mode)
- RAID controller configuration (hardware RAID, software RAID)
- Checklist (system information)
- Post configuration (network, storage and management)



The commissioning of Open-E DSS is very simple and easy to carry out. All x86 servers are supported; for storage adapters, the compatibility guide is essential. The Open-E DSS module can be connected to either an available USB interface in or on the server. It features a write-protection switch that can be activated once the configuration is complete.

## 4.4 Base implementation of infrastructure

The following are part of the infrastructure (some are optional):

- LAN
- SAN
- VC server
- VI client

Certain preliminary work is required, depending on the connection variant:

## FCP

#### • LAN

VI management Server management Storage management SAN management VM networks VMotion network VMotion network VMware HA heartbeat network These LANs can be implemented physically and/or via VLAN. With VMs, redundant connection to two switches is recommended.

• SAN

FC switches

## NAS (iSCSI/NFS)

LAN

VI management Server management Storage management Storage network VM networks VMotion network VMotion network VMware HA heartbeat network These LANs can be implemented physically and/or via VLAN. Redundant connection to two switches is recommended for the VM network. Redundant connection to two switches is recommended for the storage network.



## **VC server**

- Consideration of the minimum requirements (see release notes)
- Physical installation or installation as VM
- Operation as a windows AD member or standalone
- Selection of functions (license server, update manager, converter, consolidation) We recommend installing all functions on one system

## **VI client**

- Consideration of the minimum requirements (see release notes)
- Installation of ESX3 host or VC server homepage (via browser)



5 FCP connection

## 5.1 Architecture



Figure 14 – Typical SAN architecture



FCP access paths:

Native multipathing via the VMkernel

One path per LUN

Bandwidth aggregation

Figure 15 – FCP access paths

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#### 5.2 Requirements (hardware/software)

Open-E DSS:

- Two FC HBA (Qlogic FCP target mode)
- Current firmware/BIOS version

SAN:

- Two FC switches with GBICs
- Cabling
- Management and function licenses (NPIV?)
- Current Fabric OS version
- Fabric connection is mandatory for ESX3

ESX3/ESX3i host:

- Two FC HBA (Qlogic or Emulex)
- Current firmware/BIOS version

## 5.3 SAN (zoning, cabling)

Zoning:

- Port or WWPN zoning (with port zoning, the target paths can be better defined)
- One initiator and one target per zone

Cabling:

• Always connect cabling from the low target ports to low switch ports (zoning)

## 5.4 Sizing

The following attributes must be taken into account for proper planning of the required LUN sizes:

VMFS3:

- Minimum size: 1,200 MB
- Metadata overhead: approx. 600 MB
- Maximum size (one extent): 2 TB
- Maximum size (32 extents): 64 TB
- Maximum: 32 hosts

Physical server LUNs:

- Number and size
- Shared SCSI cluster



VMs:

- Small files (configuration files, log files and NVRAM file) up to a certain size are stored in sub-blocks
- vDisk files are created pre-allocated in the standard (fixed reservation of the configured disk space)
- Delta files (VMware snapshots, multiple) grow in 16 MB increments up to the vDisk size
- Memory snapshots are as large as the VM storage configuration
- VMkernel swap file is as large as the VM storage configuration
- RDM files are 1 MB in size

In addition, decisions must be made with regard to:

- Large LUNs (many VMs) and small LUNs (few VMs) Performance (LUN with many VMs <-> few VMs) Backup/restore (large LUN <-> small LUN) Storage snapshot function (LUN with many VMs <-> one VM)
- Use of existing LUNs with RDM
- Replication relationships with other storage servers (LUN with many VMs <-> one VM)
- Number of possible paths (load balancing: MRU, fixed and RR)

To sum up, one could say that a compromise must be found between management expenditure, performance and restoration time.

Some best-practice values have already been mentioned. There is a large range involved here, however. Oftentimes, between 20 and 40 VMs are stored on a VMFS3 LUN and thus the LUN generates between 300 and 600 GB.



## 5.5 Open-E DSS

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k G-	1000	- 🗇 🗗 - M - 😭 Lesen	schen+ 121 blockiert 121 Rect			G Enstellungen
· @ heise	onine - Baumarkblette	👩 vm-dss - Open-E Data St 🗙		G • I	D · m · D M	te + 🥥 Extras +
logout	DSS	DATA STORAG	E SERVER			open-e
SETUP	CONFIGURATI	ON MAINTENANCE	STATUS HELP			
network	administrator	H/W RAID S/W RAID	Fibre Channel ISC	SI Initiator   hardware	e GUI	
	0	Please use fibre channel management tool. Pleas	console management tool o e refer to Qlogic user manua	ir remote il.		
		management tool. Pleas	console management tool o e refer to Qéogic user manua	ir remote il.		
		Please use fibre channel management tool. Pleas QLOGIC Target/Initiator	console management tool e e refer to Qlogic user manua	ir remote il.		
		management tool. Pleas	console management tool o refer to Qlogic user manua			
		management tool, Pleas	e refer to Qlogic user manua			
		management tool. Pleas QLOGIC Target/Initiator Mode: Effects	e refer to Qiogic user manua	1		
	2 4	management tool. Pleas 2LOGIC Target/Initiator Mode: Etrosol T NAME	e refer to Qlogic user manuz X X 21:00:00:e0	и. ] ]		
status	7 0	ALOGIC Target/Initiator Mode: Iferent T NAMI & QLA2342 & QLA2342	e refer to Qlogic user manuz X X 21:00:00:e0	и. ] ими ив:11:06:3а		

Configuration of Qlogic target mode

A reboot is then necessary

Figure 16 – Configuration of Qlogic target mode

	MAINTENANCE S	TATUS HELP	1		volume grou
lume manager NAS settings	NAS resources ISC	SI target manager	FC target manager		J J
Vol. groups					
Propriet And Propriet					
	2 Unit rescan				
			25		
			res	can	
			res	can	
			res	can	
			res	can	
	? Unit manager		res	san	
	2 Unit manager	Size (GB) S4	eriol number Statu:		
		Size (GB) Se 271.09			
	v∕ Unit ⊽ Unit S001	271.09	erial number — Statu: + availab		
	√ Unit	271.09	erial number Statu:		
Vol. replication 🧳 ?	V Unit V Unit S001 Action:	271.09	erial number — Statu: + availab		

Figure 17 – Configuration of volume group



logout DSS	Data Storage Server	open-e	Configuration of FC
SETUP CONFIGURATION	MAINTENANCE STATUS HELP		volume (LUN)
volume manager NAS settings	NAS resources   iSCSI target manager   FC target	manager	volume (LON)
🔉 🚝 Vol. groups 🛛 🦯 ?	Volume group: vg00	1	
- vg00		<u> </u>	- New FC volume
	? Units assigned		- Block size: 512 bytes
	Unit Serial number	Size (GB)	Dioon 6120. 012 Dytos
	Unit 5001 +	271.09	Initialization may take
			some time
	? Volume manager		
	volume manager		
	System volumes	Size (GB)	
	Reserved for swap	4.00 🗶	
o Stol. replication	Reserved for snapshots	0.00	
	Reserved for system	1.00	
	Reserved for replication	0.00	
	Free	266.03	
	Action: new FC volume Blocksize (bytes): 512  bytes		
	Use volume replication  T Initialize		
		A replication: Erwiderung; Ech	
	0 G add: 100.00 GB	266.03	
		apply	

Figure 18 – Configuration of FC volume (LUN)

logout	DSS	DATA STORAG	e Server			open-e
SETUP	CONFIGURATION	MAINTENANCE	STATUS	HELP		
volume mar	nager   NAS settings	NAS resources	iSCSI target	manager	FC target manager	
Group	<b>98</b> / ?					
- Default	Contraction of the second s					
		7 Create net	w group			
		Name:			vmware	1
					-	
					apply	1
e A www	Aliases 🥜 🤶					
A101 0	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1					



Any name can be selected

Figure 19 – Configuration of FC target group

SETUP     CONFIGURATION     MAINTENANCE     STATUS     HELP       volume manager     NAS settings     NAS resources     ISCSI target manager     FC target manager            Q @ Groups           Q @ Create new WWN HBA alias           Alias:           x86esx2hba0 WWN:           21100:00:e0:80:12:f4:5e	open-
Create new WWN HBA alias       O Default       V mware       Image: Create new WWN HBA alias       Alias: M86esx2hba0       WWN:       Image: Image	
O Default     O Default     O vinware     Create new WWN HBA alias     Alias:     WWN:     21:00:00:e0:8b:12:f4:5e	
-o Default -o vmware  Create new WWN HBA alias  Alias: V86esx2bba0  WWN: 21:00:00:e0:8b:12:f4:5e	
Create new WWN HBA alias           Alias:         x86esx2bba0           WWN:         21:00:00:e0:8b:12:f4:5e	
WWN: [21:00:00:e0:8b:12:/4:5e	
	bıA
WWN Allases / ?	

Configuration of WWPN HBA alias

Aliases are defined for the host HBA here

Figure 20 – Configuration of WWPN HBA alias



WB) on a target group

logout	DSS	DATA STORA	ge Serv	/ER						open	Configuration of
SETUP CON		MAINTENANCE	STAT	TUS HEL	P						volume mapping
volume manager	NAS settings	NAS resource	s iscsi	target manaç	ger 🖡	C targ	et m	anager			,
Groups	1 ?	t		FC grou	p: vmw	are				ţ	Mapping of existing
-> Default • vmware		7 Add gro	up volume	s							volumes (LUNs) w
		r. Volume	Rep.	Size (GB)	LUN	RO	wr	Blocksize (bytes)	Action		LUN ID (e.g. 0) an
		Iv0000		100.00	0	П	Г	512	+-		
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n	• 27	available	as access			Sear	ch 🗌		pply		

Figure 21 – Configuration of volume mapping



## 5.6 ESX3

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Line of the local diversion of the local dive	Alama						Abritat

After logon with VI client at VC serve.

Selection of storage adapter

Figure 22 – Configuration -> Storage Adapters -> Before Rescan

invertoy Scheduled Tasks		Maps Coreck		a Manager							ø	
* * 6 6												
Hosts & Ousters	x85-euc2.ntorex.bocal VMware TSX Server, 3.5.0, 70356											
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EP-W2K0R2-1	Rorage		reiba3			5	icst					
a sufged	Retworking		RAID SATA 150	•		- 2						
(3) w3k3-51250	+ Storage Adapters		mbba2 42/23421			-	sest.					
	Network Adapters		rabball			,	Ibre Channel	21:00:00 +0:06:12:	4.50			
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	Advanced Settings		Ne010120	v97640.0.20	dek.		6,01 68	20				
			Torget 1								Hode CURIN	
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			Target 2								PADe LLPA	
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rcent Tasks		une		100	-							
ane	Target	Status Completed			whited by downistration					Sart Time	Complet	
Aescan VMPS Rescan HBA	<ul> <li>abl-ecr2.storer.local</li> <li>abl-ecr2.storer.local</li> </ul>	Completed Completed			diversito eto					22.01.2006.09:45:22 22.01.2008.09:45:16	22.01.2 22.01.2	
1												

After the rescan, the LUN created on the DSS is displayed and can be formatted with VMFS3

Figure 23 – Configuration -> Storage Adapters -> After Rescan

🛛 Add Storage Wizard	
Select Storage Type Do you want to format a	new volume or use a shared folder over the network?
Disk/LUN     Device Location     Current Disk Layout     Properties     Formatting     Ready to Complete	Storage Type Disk/LUN Choose this option if you want to create a datastore or other volume on a Fibre Channel, ISCSI or local SCSI disk. Network File System Choose this option if you want to use a shared folder over a network connection as if it were a Whware datastore. A mount point must be created on the host before it is added as a datastore.
Help	≤ Back Next ≥ Cancel

Figure 24 – Configuration -> Storage -> Add Storage -> Disk/LUN



open-e

location				SAN Identifier contains: •		Ch
k Layout Devi		Capacity	Available	SAN Identifier	LUN	
vmht	ba0:2:0	99,94 GB	99,92 GB	21:01:00:e0:8b:31:08:3a	0	

Fie	aure 25 – Cor	nfiguration ->	Storage -> A	Add Storage -:	> Disk/LUN ->	<b>Device Location</b>
		ijigurution 🔎	Storage - r	au storage /	DISKYLON	Device Location

Disk/LUN Device Location	Review the current disk layout:						
Current Disk Layout Properties Formatting Ready to Complete	Device /vmfs/devices/disks/	Capacity 99,94 GB	Target Identifier vmhba0:2:0	LUN O			
		The hard disk is t	blank.				
	1						

Figure 26 – Configuration -> Storage -> Add Storage -> Disk/LUN -> Current Disk Layout

Add Storage Wizard Disk/LUN - Properties						Datastore name
Labels provide stable acce	ss to VMFS volumes that is not a	ffected by hardware varia				E.g. Storagename Protocol_No
Help			≤Back	Next <u>&gt;</u> C	ancel	

Figure 27 – Configuration -> Storage -> Add Storage -> Disk/LUN -> Datastore Name

SAN identifier = WWPN target HBA

The disk is not partitioned



🛃 Add Storage Wizard		Maximum size of a file
Disk/LUN - Formatting The format of your file s	ystem determines which class of virtual machines it will be able to support.	(vDisk) in a VMFS3:
Disk/LUN     Device Location     Current Disk Layout     Properties	Maximum file size Large files require large block size; the minimum disk space used by any file is equal to the file system block size. These values are adjusted by VMF5-3 file systems on demand.	256 GB -> 1 MB
Formatting Ready to Complete	duck size. There values are adjusted by VMPS-3 the systems on demand.	512 GB -> 2 MB
	Capacity V Maximize capacity	1,024 GB -> 4 MB
		2,048 GB -> 8 MB
Help	≤Back Next ≥ Cancel	

Figure 28 – Configuration -> Storage -> Add Storage -> Disk/LUN -> Maximum File Size

eview this summary bef.	fore completing the wizard.				
N to Complete	Review the proposed of	lisk layout:			
, co complete	Device /vmfs/devices/disks	i]	Capacity 99,94 GB	Target Identifier vmhba0:2:0	LUN O
	Primary Partitions VMFS	5	Capacity 99,92 GB	Description	
	The following VMware f	ile system will be	created:		
	Properties				
	Properties Datastore name:	DSS_FCP_0			
	Properties Datastore name: Formatting	DSS_FCP_0			
	Properties Datastore name: Formatting File system: Block size:	DSS_FCP_0 VMFS-3 1 MB			
	Properties Datastore name: Formatting File system:	DSS_FCP_0 VMFS-3			
	Properties Datastore name: Formatting File system: Block size:	DSS_FCP_0 VMFS-3 1 MB			

Figure 29 – Configuration -> Storage -> Add Storage -> Disk/LUN -> Review

inventory Scheduled Tasks	Evento Administration Mago	Consultation Update Manager	ø
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	Software	Details	Properties
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That's it, VMs can now be stored on this datastore

Figure 30 – Configuration -> Storage



## 5.7 VM storage options

VMs can be stored on an FCP datastore in the following variants:

#### vDisk as a VMFS3 file

- Very easily, set hard disk sizes in the VM configuration are transferred to vDisk file sizes one to one
- + VMFS3 file-level locking (by default a vDisk can only be used by one VM)
- + vDisk size can be changed in the VI client or via CLI
- + Is generated with clone and template deploy processes
- Many VMs (vDisks) are possible
- VMFS3 datastores can be relatively easily overbooked (I/O load)
- Monitoring of the disk load (I/O load and reservation) is recommended
- Operation of storage software (e.g. in-band snapshot control) in the VM is not possible

#### vDisk as RDM

- + Each vDisk has its own LUN
- + LUN traits can be controlled via the storage system (RAID level etc.)
- These vDisks cannot be created via cloning or template deployment (but CLI or thirdparty tools -> white paper II is possible)

#### 5.8 Conclusion

The FCP connection method is very easy to implement. Since this variant is not listed in the VMware compatibility guides, responsibility lies with the owner. The following points should be carefully planned and checked before use:

- The number of ESX3 hosts to be connected to Open-E DSS
- Support of LUN reservation via ESX3 host

Testing revealed this connection to be absolutely stable.



## 6 iSCSI connection

## 6.1 Architecture



Representation of both iSCSI implementation variants

Figure 31 – iSCSI architecture



iSCSI access paths:

Redundancy through VMkernel

One path for all LUNs

No bandwidth aggregation

Figure 32 – iSCSI access paths

иреп-е

#### 6.2 Requirements (hardware/software)

Open-E DSS:

- Two GE ports
- Current firmware/BIOS version

LAN:

- Two GE switches
- Cabling
- Management and function licenses (VLAN)
- Current OS version
- Necessary for ESX3

ESX3/ESX3i host:

- Two iSCSI HBAs (Qlogic) (cannot be combined with software iSCSI)
- Two GE ports for software iSCSI (cannot be combined with iSCSI HBA)
- Current firmware/BIOS version

## 6.3 LAN (zoning, cabling)

#### Zoning:

- If a dedicated IP storage LAN is not feasible, segmenting can be implemented with a VLAN

Cabling:

- Fixed port settings for GE ports

## 6.4 Sizing

The following attributes must be taken into account for proper planning of the required LUN sizes:

VMFS3:

- Minimum size: 1,200 MB
- Metadata overhead: approx. 600 MB
- Maximum size (1 extent): 2 TB
- Maximum size (32 extents): 64 TB
- Maximum: 32 hosts

Physical server LUNs:

Number and size



VMs:

- Small files (configuration files, log files and NVRAM file) up to a certain size are stored in sub-blocks
- vDisk files are created pre-allocated in the standard (fixed reservation of the configured disk space)
- Delta files (VMware snapshots, multiple) grow in 16 MB increments up to the vDisk size
- Memory snapshots are as large as the VM storage configuration
- VMkernel swap file is as large as the VM storage configuration
- RDM files are 1 MB in size

In addition, decisions must be made with regard to:

- Large LUNs (many VMs) and small LUNs (few VMs) Performance (LUN with many VMs <-> few VMs) Backup/restore (large LUN <-> small LUN) Storage snapshot function (LUN with many VMs <-> one VM)
- Use of existing LUNs with RDM
- Replication relationships with other storage servers (LUN with many VMs <-> one VM)
- The number of possible paths (only with iSCSI HBA, load balancing: MRU, fixed and RR)

To sum up, one could say that a compromise must be found between management expenditure, performance and restoration time.

Some best-practice values have already been mentioned. There is a large range involved here, however. Oftentimes, between 10 and 20 VMs are stored on a VMFS3 LUN and thus the LUN generates between 150 and 300 GB.



## 6.5 Open-E DSS

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DATA STORAGE SERVER	open-e
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Volume manager	
Blocksize Sk	
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	.00 📧
System volumes (G	8)
	.00 🗙
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	.00
Vol. replication	.00
Free 100.	00
Action: new dCSI volume	
C Use volume replication	
₽ Initialize	
0 add: 50.00 GB	100.00
(A) add (S0.00) (8)	
stidus: Not for resale.	
Open-E Data Storage Server. All rights reserved	*, 100%

Configuration of iSCSI volume (LUN)

- New iSCSI volume

Initialization may take some time. The volume group was already created in the FCP part

#### Figure 33 – Configuration of iSCSI volume (LUN)

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logout DSS	DATA STORAGE SERVER	open-e
SETUP CONFIGURATION	MAINTENANCE STATUS HELP	
volume manager NAS settings	NAS resources iSCSI target manager FC target m	anager
	1022 C 1	ran.2006-02-tissmob.target(b) target(5
ያ 🍂 CHAP users 🖉 ?	CHAP user target access	
P     CHAP users     Image: Chap users       Image: Chap users     Image: Chap users     Image: Chap users       Image: Chap users     Image: Chap users     Image: Chap users		

Configuration of iSCSI target

Any name can be selected

Figure 34 – Configuration of iSCSI target



🕼 dssmob - Open-E Data Storage Server - Windows Internet E	uplater				. Dix
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	Target IP access				
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Configuration of volume mapping

Mapping of existing volumes (LUNs) with LUN ID (e.g. 0) and properties (RW and WB) on a target

Figure 35 – Configuration of iSCSI target mapping

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Ge		<ul> <li>(m) • (r) Sets • (i) Extras</li> </ul>
logout DSS	DATA STORAGE SERVER	open-e
	MAINTENANCE STATUS HELP	
volume manager NAS settings	NAS resources ISCSI target manager FC target manager	
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Le target0	Target volume manager	
	Volume Rep. Size (GB) LUN RO WB	Action
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o År CHAP users 2 2	Enable CHAP user access authentication	_
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	obeilut nam onnahlt seinen wir uffen Lebennen	

Figure 36 – Configuration of iSCSI target access

Configuration of iSCSI target access

Definition of impermissible-/permissible initiator addresses

In addition, session handling can be secured with CHAP (CHAP must then also be activated on the iSCSI target)
open-e

and the second sec	a Storage Server - Windows Internet Explorer			Active iSCSI
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			-	
status: 🚦		Not for resale.		
	Open-E Data 1	torage Server. All rights reserved		
Ferbig		📑 😡 Internet	100% ·	

Figure 37 – Active iSCSI connections



#### 6.6 ESX3

The configuration on the ESX3 side is different for the iSCSI HBA and the software iSCSI. It also differs between the ESX3 and the ESX3i. The following shows the configuration for software iSCSI and an ESX3 host is displayed.

Differences between iSCSI HBA and software iSCSI:

iSCSI HBA:

- Requires no configuration under networking
- Settings in BIOS or in VI client for storage adapters
- Adapter is displayed as vmhba standard
- Supports dynamic and static discovery
- Does not require a Service Console connection to IP storage
- Does not require an available 3260 iSCSI port

#### Software iSCSI:

- Requires explicit configuration under networking (VMkernel port and, if applicable, an additional Service Console port)
- Settings only in VI client for storage adapters
- Adapter is displayed as vmhba32 (for ESX3: as vmhba40) or vmhba33
- Only supports static discovery
- Explicitly requires a service console connection to IP storage (via router or, better yet, with a second interface)
- Requires an available 3260 iSCSI port

Differences between ESX3 and ESX3i:

#### ESX3:

- Requires a Service Console port for software iSCSI
- Software iSCSI adapter is displayed as vmhba32 (for ESX3: as vmhba40) ESX3i:
- Does not require a Service Console port for software iSCSI
- Software iSCSI adapter is displayed as vmhba33

open-e

Add Network Wizard Connection Type Networking hardware o	can be partitioned to accommodate each service requiring connectivity.	-02
Connection Type Network Access Connection Settings Summary	Connection Types  Virtual Machine  Add a labeled network to handle virtual machine network traffic.  VMkernel  The VMiernel TCP/IP stack handles traffic for the following ESX server services: VMware VMotion, ISCSI, and NFS.  Service Console  Add support for host management traffic.	
Help	≤ Back. Next ≥ C	Cancel

Configuration of VMkernel port at an existing or additional vSwitch



twork Access	using the unclaimed network	adapters listed belo	k traffic for this connection. You may also create a new w.	/ vircual switch
nection Settings mary	Create a virtual swit	ch Speed	Networks	
, and the second s	🖂 📟 vmnic1	1000 Full	192.168.65.1-192.168.65.1	
	🖂 🛄 vmnic3	1000 Full	192.168.65.1-192.168.65.1	
	Vmnic2	1000 Full		
	C Use vSwitch0	Speed	Networks	
	🔲 🛄 vmnic0	1000 Full	192.168.65.1-192.168.65.1	
	- VMkernel Port		mbassal education	
	VMkernel Port	0	- Physical Adapters	

Selection of the physical port

This is displayed as vmnic. The VMkernel also displays found network info, if applicable. We recommend selecting at least two adapters for redundancy here

Figure 39 – Configuration of vSwitch for IP storage



Network Access Connection Settings Network Label:	
	IPSTORAGE
Summary VLAN ID (Optional):	
	Use this port group for VMotion
- IP Settings	
IP Address:	192 , 168 , 48 , 211
Subnet Mask:	255 , 255 , 255 , 0
Preview:	
	Physical Adapters
192.168.48.211	

Configuration of IP information for the VMkernel port

Any name can be selected

VMotion can also be activated

Segmenting with VLAN is also possible

Figure 40 – Configuration of software iSCSI initiator address

File Edit Vess Inventory Add	nastructure Client sinstration Plugns Help			كلعا	Completed software
Investory     Administration       Investory     Investory				e	iSCSI network
VOn1.vO.local	vi3n1.vi3.local VMware 15X Server, 3.				oormgaration
	Bettro Stated Curriery Vital Ma Hardware	Networking	Informances Configuration Users & Groups 1	Sente Permitters	
	Processors Henory Stronge • Networking Stronge Adapters Nationark Adapters	Wrtuel Switch: vSwitch0 Service Console Part Service Console vswif0 : 192,160,65,1	Renove. Properties.		Additional Service Console port
	Software	Wrbuel Switch: vSwitch1	Renzve Properties		
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Recent Tasks	1				• ×
Name	Target Sta	tus -	Invitated by	+- fine Start Time	-
Update Network Config     Update Network Config     Update Network Config     Remove Vetual Switch	vi3n1.vi3.local	Completed Completed Completed	root root root	16.12.2007 17:40:01 16.12.2007 17:4 16.12.2007 17:39:12 16.12.2007 17:3 16.12.2007 17:37:23 16.12.2007 17:3	9
Taska				ho ho	x h



eneral Dynamic Discovery Sta	atic Discovery CHAP Authentication
-iSCSI Properties	
iSCSI name:	ign.1998-01.com.vmware:vi3n1-65b53374
iSCSI alias:	vi3n1.vi3.local
Target discovery methods:	Send Targets
– Software Initiator Properties –	
Status:	Enabled

Activation of the software iSCSI initiator

The initiator name can be changed. An ESX3 host reboot is then necessary, however

Figure 42 – Configuration of software iSCSI initiator



iSCSI Initiator (vmhba32) Properties	<u>- 🗆 ×</u>	Confi
General Dynamic Discovery Static Discovery CHAP Authentication		
Send Targets Obtain information about target devices directly from the following iSCSI ser SendTargets command.	vers using the	Defin
iSCSI Server		
192.168.48.15:3260		
AddEdit	Remove	
Close	e Help	

Configuration of target discovery

Definition of target IP address

Figure 43 – Configuration of target discovery

acce	ssing services on remote hosts.	-	this host, and local clients		
	rovide access to a service or client,			erwise, daemons	will start
auto	matically when any of their ports are	opened and stop when all	of their ports are closed.		
	Label	Incoming Ports	Outgoing Ports	Protocols	Daemon 🔺
Req	juired Services				
Sec	ure Shell				
~	SSH Server	22		TCP	Running 🛄
	SSH Client		22	TCP	N/A
Sim	ple Network Management Prot	ocol			
	SNMP Server	161	162	UDP	N/A
Ung	rouped				
$\mathbf{Z}$	Software iSCSI Client		3260	TCP	N/A
$\checkmark$	VMware VirtualCenter Agent		902	UDP	N/A
~	VCB		443,902	TCP	N/A
Π.	Active Director Kerberos		464.88	TCP	N/A
4					

With ESX3, it is necessary to open port 3260 in the Service Console

Figure 44 – Configuration of Service Console firewall



Administration								
* 8 8								
v0n1.v03local	vi3n1.vi3.local VMware ESX S							
	Eleting Stated & Summary	Vyrual Maci	west Resource All	cition Fedorances	Conliguration	Units & Groups E	ands Permittens	
	The VMware ESX Ser To no virbal machines, create Note: If you plan to use ISCSI o To add storage now, click here to	at least one r a network	datastore for maintai Ne system (NPS), ens	ving virtual machines and of			serly configured before continu	ing.
	Hardware	- 23	Storage Adapte					Rescar
	Processors	1	Device			Type	SAN Identifier	-
	Memory Storage		S3c1030 PCI-X ynhba0 ISCSI Software	Fusion-MPT Dual URra3	20 5051	5051		
	Networking     Storage Adapters     Network Adapters		O vnhba32			6CSI	ign.1996-01.com.vmware	t-r
	Software		Details					
	Ucensed Peakures Time Configuration DNS and Routing Virtual Machine Startup/Shu	táwn	wmhba32 Model: ISCSI Name: ISCSI Alas:	ISCSE Software Adapter ign. 1998-01.com.vmware vi3nd.vt0.local	-v0n1-69533	4	IP Address: Discovery Methods: Targets:	Properties. Send Targets 1
	White Machine Swapfile Los Securty Profile System Resource Alocation Advanced Settings		SCSI Target 0 GCSI Name GCSI Alias Target UUN=	ian 2008-02 duimab h	wgei0			Hide LUR
			Path	Canonical Path	Type	Capacity	LUN ID	
			vmhba32:0:0	vm/ba32:0:0	dsk	49,96 68	0	
t Tasks	1		1					
	Target	3.4	5		Initiated by		F	Time Start Time
		-	Contraction of the second s		oot			
Rescan VMPS Rescan HEA	vi0n1.vi0.local vi0n1.vi0.local		Completed Completed		oot			45:29 16.12.2007 17 45:22 16.12.2007 17

After completion of the configuration

Rescan

The located LUN is displayed

#### Figure 45 – Result after the adapter rescan

		Add Storage
Destination         Develop (Section)         Develop (Section)         Develop (Section)         Press           Name         Details         Verbial20001         Verbial2001	e Type	
Processors     Device     County     Pres       9 Trage     Stanger     Stanger     Stanger     Stanger       10 Stanger     10 Stanger     Stanger     Stanger       10 Stanger     10 Stanger     Stanger     Stanger		Properties
Software         Defail           Locase Features Two Cologization DRG well-strate Water Horder Stately Exclusion System Resource Alcocom Advanced Setting         GetS JSCS11 (SSSSS12)         655, JSCS11 (SSSSS12)         655, JSCS11 (SSSS12)	C	Properties
Lonstat Features Two Colly Join DKE and Barry Would Michael Marting Strateging Would Michael Marting Strateging Michael Michael Marting Strateging Michael Michael Michael Michael Michael Michael Michael Michael System Resource Alocson Advanced Setting Total 1 Prematting Distance Michael Mich	G	-
Security Profile         Path Selection         Properties         Detects           System Resource Monitorin         Predit         Watern schedule         Distribution         Distribution           Advanced Sectrop         Peter         Termatting         Total I         Termatting           Distribution         Predition         0         Peters         Versition		
	49,95 @ 500ty 49,75 @	
Recent Taiks		
Name Target Status Initiated by	4- Tes	ne   Start Time
1) Create HYS Datatore Under And Lood @ Completed root 2) Rescur HYS Under @ Completed root 2) Rescur HYS Under @ Completed root	16-12-2007 17:45:2	20 16.12.2007 17:46 29 16.12.2007 17:46 22 16.12.2007 17:46

The creation of a VMFS3 file system is identical for FCP LUNs and iSCSI LUNs. If creation of the partition in the VI client is not possible, the fdisk command can be used for ESX3

Figure 46 – Result after the creation of a VMFS3



#### 6.7 VM storage options

VMs can be stored on an iSCSI datastore in the following variants:

#### vDisk as a VMFS3 file

- Very easily, set hard disk sizes in the VM configuration are transferred to vDisk file sizes one to one
- + VMFS3 file-level locking (in the standard, a vDisk can only be used by one VM)
- + vDisk size can be changed in the VI client or via CLI
- + Is generated with clone and template deploy processes
- + Many VMs (vDisks) are possible
- VMFS3 datastores can be relatively easily overbooked (I/O load)
- Monitoring of the disk load (I/O load and reservation) is recommended
- Operation of storage software (e.g. in-band snapshot control) in the VM is not possible

#### vDisk as RDM

- + Each vDisk has its own LUN
- + LUN traits can be controlled via the storage system (RAID level etc.)
- These vDisks cannot be created via cloning or template deployment (but CLI or thirdparty tools -> white paper II is possible)

#### 6.8 Conclusion

The iSCSI connection method is very easy to implement. Since this variant is not listed in the VMware compatibility guides, responsibility lies with the owner (There is an entry in the community HCL). The following points should be carefully planned and checked before use:

- The number of ESX3 hosts to be connected to Open-E DSS
- Support of LUN reservation via ESX3 host

Testing revealed this connection to be absolutely stable.



#### 7 NFS connection

#### 7.1 Architecture



NFS access paths:

Redundancy through VMkernel

Each volume via its own release (its own IP address)

Possible bandwidth aggregation

Figure 47 – NFS access paths

#### 7.2 Requirements (hardware/software)

Open-E DSS:

- NFS V3 over TCP
- Two GE ports
- Current firmware/BIOS version

LAN:

- Two GE switches
- Cabling
- Management and function licenses (VLAN)
- Current OS version
- Necessary for ESX3

ESX3/ESX3i host:

- Two GE ports for IP storage
- Current firmware/BIOS version



#### 7.3 LAN (zoning, cabling)

Zoning:

• If a dedicated IP storage LAN is not feasible, segmenting can be implemented with a VLAN

Cabling:

• Fixed port settings for GE ports

#### 7.4 Sizing

The following attributes must be taken into account for proper planning of the required volume sizes:

VMs:

- Small files (configuration files, log files and NVRAM file)
- vDisk files are created thin in the standard (dynamic reservation of the configured disk space)
- Delta files (VMware snapshots, multiple) grow in 16 MB increments up to the vDisk size
- Memory snapshots are as large as the VM storage configuration
- VMkernel swap file is as large as the VM storage configuration

In addition, decisions must be made with regard to:

- Large volumes (many VMs) and small volumes (few VMs) Performance (volume with many VMs <-> few VMs) Backup/restore (large volume <-> small volume) Storage snapshot function (volume with many VMs <-> one VM)
- Replication relationships with other storage servers (volume with many VMs <-> one VM)

To sum up, one could say that a compromise must be found between management expenditure, performance and restoration time.

Some best-practice values have already been mentioned. There is a large range involved here, however. Oftentimes, between 10 and 20 VMs are stored on an NFS datastore and thus the volume generates between 150 and 300 GB.



### 7.5 Open-E DSS

Gdssmob - Open-EData Storage Server - Win	dows Internet Explorer				-101>
() • (2) https://192.168.48.15/index.php		T Zertifkatfehler	curle.		P -
Google G-	Ksi 4 🔊 🥥 😫 • M • 😭	Lesezeichen • 👰 123 blockiert 👘			
😭 🏟 🎢 dssmob - Open-E Data Storage Server			₫•⊡·	inter • Er Senta	e • 🕜 Extras • '
logout DSS	DATA STORAGE	SERVER			
SETUP CONFIGURATION	MAINTENANCE STATU	S HELP			
volume manager NAS settings	NAS resources   ISCSI t	arget manager   FC targe	t manager	]	
o 😂 Vol. groups		Volume group:	vg00		
Le vg00	Logical Volume	Type Snap. Rep.	Init.	Blocksize (bytes)	e Size (GB)
	1v0000	24	V	N/A	50.00 🗙
	Iv0002	- Contraction of the contraction	V	512	44.00 🔀
	System volumes				Size (GB)
	Reserved for swap	i i			4.00 🔀
	Reserved for snap	shots			0.00
	Reserved for syste	em			1.00
	Reserved for replic	cation			0.00
o 🥩 Vol. replication 🥢	Free				50.00
0.0	Action:	new NAS volume			
	Use volume repl	ication			
	0	50.00 G8			50.00
					apply
3					11
status:		ot for resale.	_	_	_
	Open-E Data Storage Se	rver. All rights reserved			

Configuration of NAS volume for NFS access

Volume group already exists

#### Figure 48 – Configuration of NAS volume

	rage Server - Windows Internet Explo	er V 2ertifkatfetier + X Google		Activation of NFS
Google C-		<ul> <li>Zertindsterer</li> <li>Zertindsterer</li> <li>Rechtschrebprüfung • »</li> </ul>		protocol
	Data Storage Server	   _		
logout	DSS DATA S	TORAGE SERVER		
		STATUS HELP		
volume manager	NAS settings NAS resource	s iSCSI target manager FC target manager		
	Authentication meth     Workgroup (Interna Workgroup (externi Windows (PDC) Windows (ADS) Workgroup (NIS Se Workgroup:	LDAP) II LDAP)		
	Show advanced >:			
	? NFS settings			
	P Use NFS	apply		
status:		Not for resale.	-	
	Open-E Da	a Storage Server. All rights reserved		
/index.php?module=main8id=1.1		📑 😜 Internet	100% -	

Figure 49 – Activation of NFS

open-e

<ul> <li>R https://192.168.48.15/ndex.</li> </ul>	php	💌 🐓 🗶 Googl	
ogle G-	is geht's   🗤 🧊 🧭 🛃 🔹 🕅 👻 🏠 Lesezeich		
🔗 🄏 dssmob - Open-E Data Storage S			- 📾 - 📄 Sete - 🎯 Extras - *
			and the second se
logout DSS	DATA STORAGE SER	VER	
SETUP CONFIGURATION	MAINTENANCE STATUS	HELP	
volume manager   NAS setting	gs NAS resources ISCSI target n	anager   FC target manage	н I
Shares	li in the second se		1
	? Create new share		
		1	
	Name:	NFS1	
	Comment:		3
•	@ Default path:	//v0001/	×
Users	C Specified path:	1	
			apply
	2 ACL (Access control li	st)	
44			
Groups	Concerning and the second seco		-
	Browser Users & Groups Ac	cess Permissions	
	Browser Users & Groups Ac Selection:	cess Permissions	
Groups	The second se	cess Permissions	
	Selection:	Cess Permissions	
	The second se	Cess Permissions	
	Selection:	Cass Parmissions	
	Selection:	cale.	

# Configuration of NFS release

Definition of the release name

#### Figure 50 – Configuration of NFS release I

Comment of Control of Comments of Control of	a Storage Server - Windows	Internet Explorer			د اهله
0	192.168.48.15/index.php		A STATE OF A	ty X Google	P
ogle G+	<ul> <li>Los geht'st er</li> </ul>	00B • M • 1	Lesezeichen 👻 🔯 123 blockiert	** Rechtschreitprüfung + >>	C Einstellungen
🔗 🏾 🏀 dssmob - Og	en-E Data Storage Server			🗿 • 🖾 · 🖷 • 📄 Septe	• 🕜 Extras •
logout	DSS	Data Storag	e Server		
SETUP CON	FIGURATION		US HELP		
volume manager	NAS settings N	AS resources ISCSI	target manager   FC ta	rget manager	
Shares	1		Share: M	IFS1	
Users		NFS share acc     Use NFS     Allow access II     Allow write IP:     Insecure     Synchrono     Insecure lo     All squash     R No root square	P: US Seks	192.168.48.0/24 192.168.48.0/24	
Groups		? HTTP share ac	cess		appiy
	a		enable "HTTP share browse tion "HTTP share access s	er" in CONFIGURATION -> NA etup" to use this option!	S settings
status.	21		Not for resale.		

Configuration of NFS release

Definition of the access attributes

Figure 51 – Configuration of NFS release II



lssmob - Ope	n E Data Storage Server - W	indows Internet Explorer	and the second		_[[] ×
🕒 - 🖪	) https://192.168.48.15/index.ph	φ.		💌 🔩 🗙 Google	P -
ogle C+	V Los g	ehr'si 4 🤝 🥥 🥵 • M •	🔓 Lesezeichen + 👰 123	i blockiert 🛛 🍜 Rechtschreibprüfung 👻 😕	🔾 Einstellungen 🕶
A (8 da	ismob - Open-E Data Storage Serv	vor		🗿 • 📾 • 👘 • 🔂	Seite • 🅜 Extras • 🏾
logout	DSS	Dara Stop	AGE SERVER		
inglowi	055	DATA STOR	AGE SERVER		
SETUP	CONFIGURATION	MAINTENANCE	TATUS HELP		
network	logical volume co	nnections system	hardware tasks	S.M.A.R.T.	
	2 Ac 19 Add 192,165,4 192,168,4	8.225 8.211	2255	nected resource names	]
		tive Appletalk users co	1.00 X		] _
	User n	ame		Address/Host	
			Not for resale.		
of the tanks					
status:		Open-E Data Stor	age Server. All rights reser	ved	

Display of the active NFS connections

Figure 52 – Active NFS connections

🛃 Add Storage Wizard	Configuration of
Select Storage Type Do you want to format a	ww volume or use a shared folder over the network? On ESX3 or ESX
■ NAS Network File System Ready to Complete	Storage Type          © Disk/LUN         Choose this option if you want to create a datastore or other volume on a Fibre Channel, ISCSI or local SCSI dak.         C* Network File System         Choose this option if you want to use a shared folder over a network connection as if it were a Wilware datastore. A mount point must be created on the host before it is added as a datastore.





Locate Network File System Which shared folder will be u	used as a VMware datastore?	
NAS Network File System Ready to Complete	Properties           Server:         [192.168.48.15]           Examples: nas, nas.ik.com or 192.168.0.1           Folder:         [/NF51]           Example:         /vols/vols/datatore-001           Mount NFS read only           Datastore Name           [PSS]_NF51	

Configuration of NFS properties

Server name or IP address

NFS share name (MUST be identical to release)

Datastore name (MUST be the same on all ESX3 hosts)

#### Figure 54 – Configuration of NFS properties

🛃 Add Storage Wizard	A CONTRACTOR OF A DESCRIPTION OF A DESCRIP	- O ×	Automatic completion
Network File System The following network file	of system		
Ready to Complete	Review this summary before finishing the wizard. Server: 192.168.48.15 Folder: /NF51 Volume Labei: DSS_NF51		
		Cancel	



For sell shares i the	netration (Sugna Linita						
entory Advariation							ø
* 6 0							
WonLwoJocal	vi3n1.vi3.lacal VMware ESX Server, 3						
	Effering Statist, Thursday, Thistacht	enterers Freisbarre AMC eine	Configuration	Uners & Groupe	Personal Per		
	Hardwore	Storage			heliesh	Renove	Add Storage
	Processors	Identification	Device	Capacity	Pres Type	Carl Contract over	No. of Concession, Name
	Memory	DSS_ISCER	vnhba32:0:0:1	49.75 GB	49.24 GB veds3	_	
	+ Storage	DSS_NPS1	192.165.40.15./NFSI	49.90 GB	49.90 GB NFS		
	fastworting						
	Storage Adapters						
	Network Adapters						
	Software	i I					
	Lawrend Features	Details					Properties
	Time Configuration	055_NF51		49,90 GB Capacity	-		<b>A</b>
	DRS and Routing	Server: 192.16	3.48.15	200.00 KB 🖬 Used			
	Wroad Machine Startup/Shubdown	Folder: /NPSL		49,95 GB E Free			
	Virtual Machine Swapfile Location						
	Security Profile						
	System Resource Alocation						
	Advanced Settings						
	L	-					
							_
	1						-1
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	1						
	1						
t Tasks	1						
C Lanks	Target St	MUN	I solitated by			Time	Sat True
Create NAS C-Mastore		Completed	FOOL		16.12.2		16.12.2007 17:53
Create VIII'S Datastore		Completed	root				16.12.2007 17:46
		Conpleted	root				16.12.2007 17:45
Rescan VMP5							

Complete, set-up datastore for NFS

Figure 56 – NFS datastore



#### 7.7 VM storage options

VMs can be stored on an NFS datastore very easily:

vDisk as a file

- Very easily, set hard disk sizes in the VM configuration are transferred to vDisk file sizes one to one.
- + VMFS3 file-level locking (by default a vDisk can only be used by one VM).
- + vDisk size can be changed in the VI client or via CLI
- + Is generated with clone and template deploy processes
- + Many VMs (vDisks) are possible
- + Simple DR processes possible

#### 7.8 Conclusion

The NFS connection method is very easy to implement. Since this variant is not listed in the VMware compatibility guides, responsibility lies with the owner (There is an entry in the community HCL). The following points should be carefully planned and checked before use:

The number of ESX3 hosts to be connected to Open-E DSS

Testing revealed this connection to be absolutely stable.



### 8 Other sources of information

### 8.1 VMware

http://www.vmware.com

http://communities.vmware.com

### 8.2 Open-E

http://www.open-e.com

http://forum.open-e.com

### 8.3 Community

http://www.vmware-land.com



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9.3	Abbreviation index	
	APIC	Advanced Programmable Interrupt Controller
	BMC	Baseboard Management Controller
	CLI	Command Line Interface
	CPU	Central Processing Unit
	DRS	Distributed Resource Scheduler
	DSS	Data Storage Server
	ESX	Name of the VMware enterprise hypervisor product
	ESX3i	Name of the embedded hypervisor
	FC	Fiber Channel
	FCP	Fiber Channel Protocol
	НА	High Availability
	НВА	Host Bus Adapter
	HCL	Hardware Compatibility List
	HV	"Hochverfügbarkeit" (high availability)
	iSCSI	SCSI over TCP/IP
	MRU	Most Recently Used
	NFS	Network File System
	NIC	Network Interface Card
	NPIV	N Port ID virtualization
	NX	No execution
	OS	Operating System
	pCPU	physical CPU
	pDISK	physical DISK
	рНВА	physical HBA
	pMEMORY	physical MEMORY
	pNIC	physical NIC
	pSWITCH	physical SWITCH
	P2V	Migration from physical to virtual



RDM	Raw Disk Map
RR	Round Robin
SAN	Storage Area Network
TSO	TCP/IP Segment Offloading
VC	Virtual Center
VCS	Virtual Center Server
V/3	Virtual Infrastructure 3
VM	Virtual Machine
vCPU	virtual CPU
vDISK	virtual DISK
vHBA	virtual HBA
VMEMORY	virtual MEMORY
vNIC	virtual NIC
vSWITCH	virtual Switch
V2P	Migration from virtual to physical
V2V	Migration from virtual to virtual
VT	Virtualization Technology
WWN	World Wide Number
WWNN	World Wide Node Number
WWPN	World Wide Port Number
XD	Execution Deny



# 10 Appendices

# 10.1 Tables

File	Version	Remark	

#### Table 1 – Tables and configuration diagrams

File	Version	Remark

Table 2 – Documents