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Citrix XenServer and NetApp Storage Best Practices

Citrix Systems, Inc. and NetApp, Inc.

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Table of Contents

The Challenge of Today's Enterprise
Citrix XenServer for Enterprise-Ready Virtualization
NetApp Storage Solutions for Enterprise-Ready Virtualization
Overview of XenServer storage 5 Storage repositories (SRs) 5 Virtual Disk Images (VDIs) 5 Managing Storage 6 XenServer Shared Storage Options 5
Configuration and Setup
Fixing Misaligned Windows Guest Operating System
Backup and Recovery
Summary
Appendix A
Appendix B
Appendix C

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The Challenge of Today's Enterprise

IT departments face the constant demand to respond more rapidly to changing business priorities, application demands, and user dynamics – all without compromising security or manageability or increasing server count. They must deliver robust data management, business uptime, and complete backup and recovery capabilities. In order to address these challenges, enterprises need to:

- Standardize on a reduced number of hardware configurations drastically reducing the time required to deploy upgrades and patches
- Provide effective, near-term high-availability for cost-effective protection against physical server and storage failures in an application-agnostic manner
- Adjust allocation of server and storage resources for different application workloads on the fly
- Consider scalability for the largest enterprise applications
- Deploy a tightly unified server and storage virtualization solution that is reliable, not overly complex and leverages all available capabilities

This document presents best practices for using NetApp® storage systems as networked attached storage solutions for Citrix® XenServerTM.

Citrix XenServer for Enterprise-Ready Virtualization

Citrix XenServer is a native 64-bit virtualization platform, with the scalability required by Microsoft Exchange Server, Microsoft SQL Server, Citrix XenApp, Citrix XenDesktop and other business-critical applications. The highest host and guest CPU and memory limits available, coupled with fine-grained controls for processor, network, and disk, enable it to deliver optimal quality of service. With Citrix XenServer virtualization, businesses can increase server and storage utilization, reducing costs of equipment, power, cooling, and real estate. By combining servers and storage into resource pools that can be apportioned to the applications with the highest business need, IT operations can be aligned to changing demands and business priorities. With XenMotionTM, running virtual machines can be migrated to new servers with no service interruption, allowing essential workloads to get needed resources and enable zero-downtime maintenance. Citrix XenServer products install directly on bare metal servers, requiring no dedicated host operating system. Open command-line (CLI) and programming (API) interfaces make it easy for companies to integrate Citrix XenServer virtualization with existing processes and management tools, rather than requiring rip-and-replace reimplementation. Key benefits and features include:

- Enterprise ready performance and scalability
- Simple deployment and installation
- Flexible shared infrastructure
- On-demand deployment of Windows and Linux virtual machines
- Powerful storage management
- Efficient, secure virtual networking
- Live migration
- XenCenterTM multi-server management, included with product
- Deliver server workloads on demand via streaming

NetApp Storage Solutions for Enterprise-Ready Virtualization

Unified storage solutions from NetApp complement the manageability, utilization and cost-saving benefits of Citrix XenServer. NetApp solutions enable powerful thin provisioning, simplified data management and scalable and consistent I/O performance for all IT applications across NAS, Fibre Channel and iSCSI SAN in a single pool of storage. Key benefits and features include:

- Supports SAN, IP-SAN, or NAS
- Scale non-disruptively to 100's of TB
- Easily installed, configured, managed, and maintained
- Rapid backup and recovery with zero penalty snapshots
- Simple, cost effective replication for Disaster Recovery
- Instant space efficient data clones for provisioning and testing
- Dynamically expand and contract storage volumes as needed
- Data deduplication to reduce capacity requirements
- Transparent Storage Cache Sharing to increase I/O performance
- Flash Cache to help reduce virtual desktop storm activities

NetApp storage solutions offers these powerful data management and data protection capabilities allowing Citrix XenServer users the ability to lower cost while meeting their capacity, utilization, and performance requirements.

NOTE: Make sure your configuration is supported by contacting NetApp sales engineer to check <u>NetApp IMT tool</u> at NetApp <u>NOW</u> site.

Overview of XenServer storage

Storage repositories (SRs)

The XenServer host accesses containers named Storage Repositories (SRs) in which Virtual Disk Images (VDIs) are stored. A VDI is a disk abstraction which, when attached to a host, appears as a physical disk drive to the virtual machine.

The interface to storage hardware provided on the XenServer host allows VDIs to be supported on a large number of different SR substrate types. VDIs may be files on a local disk, on an NFS share, Logical Volumes within a LUN or a raw LUN itself directly attached to the VM. The SR and VDI abstractions on the host provide for advanced storage features such as sparse provisioning, image snapshots, and fast cloning to be leveraged on storage targets where available.

Each XenServer host can access multiple SRs in parallel of any type. These SRs can be shared between a pool of hosts, or a dedicated repository to a single host. Shared storage must be accessible to all hosts in a resource pool, and is utilized for both non-live and live migration of VMs via XenMotion. When hosting shared Storage Repositories on a NetApp device, there are 4 options; the Citrix StorageLink feature, an NFS file share, an iSCSI LUN or a Fibre Channel LUN.

Virtual Disk Images (VDIs)



There are two fundamental VDI types (Files and LUNs) that can be accessed with a NetApp device as the backend over 4 different SR driver types:

- NetApp managed LUNs: Managed NetApp LUNs are accessible via the StorageLink feature included in Citrix Essentials for XenServer, and are hosted on a NetApp device running a version of Data ONTAP 7.0 or greater. LUNs are allocated on demand via StorageLink and mapped dynamically to the host via the StorageLink service while a VM is active. All the thin provisioning and fast clone capabilities of the device are exposed via StorageLink.
- VHD files. The VHD format can be used to store VDIs in a sparse format. Being sparse, the image file grows proportionally to the number of writes to the disk by the Virtual Machine (VM), so large portions of the disk which are typically unused do not consume unnecessary space. VHD on NFS, iSCSI, or Hardware HBA storage repositories can be shared among all hosts in a pool.

The section entitled 'XenServer Shared Storage Options' discusses each option in more detail.

Managing Storage

There are four XenServer object classes that are used to describe, configure, and manage storage:

- Storage Repositories (SRs) are storage targets containing homogeneous virtual disks (VDIs). SR commands provide operations for creating, destroying, resizing, cloning, connecting and discovering the individual Virtual Disk Images (VDIs) that they contain. A storage repository is a persistent, on-disk data structure. So the act of "creating" a new SR is similar to that of formatting a disk. SRs are long-lived, and may be shared among XenServer hosts or moved between them.
- Physical Block Devices (PBDs) represent the interface between a physical server and an attached SR. PBDs are connector objects that allow a given SR to be mapped to a XenServer host. PBDs store the device configuration fields that are used to connect to and interact with a given storage target. There are several classes of XenServer SRs available for use with NetApp storage:
 - NFS. With an NFS SR, a new directory on an existing NetApp NFS share is created for the storage of VDIs in VHD format.
 - iSCSI and Fibre Channel. The creation of iSCSI or Fibre Channel (Hardware HBA) SRs involves erasing any existing data on a specified LUN. A LUN will need to be created on the NetApp storage before creating the XenServer SR. Volume management is performed via LVM (Logical Volume Manager), and the underlying VDI storage on an iSCSI or FC SR is VHD.
 - Direct StorageLink-NetApp adapter SR. First introduced in XenServer 4.1, this type of SR is created within XenCenter. With this type of SR, FlexVol resources are allocated on the NetApp device and communication is performed via the iSCSI protocol.
 - StorageLink Gateway. New with XenServer 5.6, this type of SR is initially created from the StorageLink Manager and visible within XenCenter thereafter. The StorageLink Gateway service runs on a general-purpose Windows server or VM. Once brokered by the StorageLink Gateway, the data path between the virtual machine and storage system can be performed via either iSCSI or Fibre channel. It is important to note that the StorageLink Gateway only serves as a broker and a control path; it is not part of the data path between a XenServer host and the NetApp storage infrastructure.
- Virtual Disk Images (VDIs) are an on-disk representation of a virtual disk provided to a VM. VDIs are the fundamental unit of virtualized storage in XenServer. Similar to SRs, VDIs are persistent, on-disk objects that exist independently of XenServer Hosts.



• Virtual Block Devices (VBDs) are a connector object (similar to the PBD described above) that allows mappings between VDIs and Virtual Machines (VMs). In addition to providing a mechanism to attach (or plug) a VDI into a VM, VBDs allow the fine-tuning of parameters regarding QoS (quality of service), statistics, and the bootability of a given VDI.



Figure 1 Graphical Overview of Storage Repository and Related Objects

XenServer Shared Storage Options

When using a NetApp device as your networked, backend storage array, it is recommended with XenServer v5.6 onwards to use the StorageLink Gateway SR type. The architecture of the StorageLink Gateway allows XenServer to utilize the capabilities of the NetApp device to provide data efficiency, high performance and ensure compatibility with existing ONTAP device management tools. This allows for:

- Fast provisioning of VDIs
- Fast cloning of VDIs
- Fast Snapshot® of VDIs

To use non-customized storage options with a NetApp active-active controller configuration, the following types can also be used:

- Network Attached Storage using NFS
- iSCSI
- Fibre Channel



Citrix XenServer and NetApp Storage Best Practices

The following sections give an overview of the above storage types and the benefits associated with them. All shared storage options enable VM agility using XenMotion -- VMs can be started on any XenServer host in a resource pool and migrated between them.

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Shared Storage with the StorageLink Gateway

The StorageLink Gateway is a feature offered with Citrix Essentials for XenServer 5.5, Citrix XenServer 5.6 and Citrix XenServer 5.6 Feature Pack 1, Enterprise Edition. It acts as a broker between XenServer and the NetApp storage system. The StorageLink Gateway service runs on a general-purpose Windows server or VM, and this system can typically be shared with other Citrix Essentials for XenServer components such as Workload Balancing and Workflow Studio. Once brokered by the StorageLink Gateway, the data path between the virtual machine and storage system can be performed via either iSCSI or Fibre channel. It is important to note that the StorageLink Gateway only serves as a broker and as part of the control path; it is not part of the data path between a XenServer host and the NetApp storage infrastructure.

Since the adapter exposes LUNs to the XenServer host as VDIs, there is a one-to-one mapping between the Virtual Machine disks in the XenServer environment and the NetApp disk data abstraction. This enables much simpler integration with existing physical host backup and array provisioning tools that already operate at a LUN granularity.



Shared Storage using the direct StorageLink-NetApp adapter

The direct StorageLink adapter for NetApp was first introduced in XenServer 4.1. While it is still available in XenServer 5.5, XenServer 5.6 and XenServer 5.6 Feature Pack 1, it is primarily intended to maintain backward compatibility with pre-5.5 and 5.6 and 5.6 Feature Pack 1 deployments. Very small environments and Linux-centric deployments may also find this StorageLink option to be useful. For XenServer 5.6 and XenServer 5.6 FP 1 deployments, it is recommended to use the StorageLink Gateway.

The following table provides a comparison of the two StorageLink options for NetApp.

	StorageLink Gateway	Direct StorageLink-NetApp Adapter
Deployment	On separate Windows VM or server	Included within XenServer control domain; no additional VMs or servers are required
VM / LUN relationship	LUN per VDI	LUN per VDI
Protocol support	iSCSI and Fibre Channel	iSCSI
Interoperability with Hyper-V	Yes	No
Interoperability with other vendor storage arrays	Yes	Limited

This legacy StorageLink-NetApp adapter for NetApp Data ONTAP uses the Zephyr API (ZAPI) interface to the device to create a group of FlexVol®s which corresponds to a XenServer SR. VDIs are created as virtual LUNs on the device, and attached to XenServer hosts using an iSCSI data path. There is a direct mapping between a VDI and a raw LUN without requiring any additional volume metadata. Thus, at a logical level, the NetApp SR is a managed volume and the VDIs are the LUNs within the volume. Similar to the StorageLink Gateway, the legacy StorageLink adapter exposes LUNs to the XenServer host as VDIs, and there is a one-to-one mapping between the Virtual Machine disks in the XenServer environment and the NetApp disk data abstraction.

For the I/O data path, the NetApp Data ONTAP adapter directly controls the host built-in software initiator and its assigned server iSCSI Qualified Name or IQN to map the data path on demand without requiring user intervention.

Storage can be thinly or fully provisioned depending on the administrative preference for the NetApp array. When thin provisioning is utilized, data de-duping can also be switched on to reclaim common blocks between VM images, thereby conserving even more space. All these configuration options are exposed via the XenServer storage configuration interface and managed by the NetApp Data ONTAP adapter directly.

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Figure 2 Shared storage using NetApp Data ONTAP

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Shared NAS using NFS

XenServer supports shared access to Virtual Disk storage exported as NFS v3 over TCP/IP based on the Microsoft VHD format.

VDIs stored on NFS are *sparse*. The image file grows as the Virtual Machine (VM) writes data into the disk, so unused portions of the virtual disk do not consume space on the array. This is a considerable benefit since VM image files take up only as much space on the NFS device as is required. If a 100-GB VDI is allocated for a new VM and an OS is installed, the VDI file will only reflect the size of the OS data that has been written to the disk.

VHD files may also be *chained*, allowing two VDIs to share common data. In cases where a NFS-based VM is cloned, the resulting VMs will share the common on-disk data at the time of cloning. Each will proceed to make its own changes in an isolated *copy-on-write* version of the VDI. This feature allows NFS-based VMs to be quickly cloned from templates, facilitating very fast provisioning and deployment of new VMs.



Figure 3 Shared NFS storage



The Linux Host Utilities

The Host Utilities provide software programs and documentation that you can use to connect your XenServer host to NetApp storage systems running Data ONTAP. The software is available as an .rpm file that you can download from the <u>NOW</u> site. It is a best practice to install Linux Host Utility on your XenServer.

The Host Utilities include the following components:

• The SAN Toolkit

The toolkit is installed automatically when you install the Host Utilities. This kit provides the following key tools:

Note: This toolkit is common across all configurations and protocols of the Linux Host Utilities. As a result, some of its contents apply to one configuration, but not another. Having unused components does not affect your system performance.

- o The sanlun utility, which helps you to manage LUNs and HBAs.
- The san_version command, which displays the versions of the Host Utilities.

Note: Previous versions of the Host Utilities also included diagnostics programs. These programs have been replaced by the nSANity Diagnostic and Configuration Data Collector and are no longer installed with the Host Utilities. The nSANity program is not part of the Host Utilities. You should download, install, and execute it only when requested to do so by technical support.

Protocols and configurations supported by Host Utilities

The Host Utilities provide support for Fibre Channel, Fibre Channel over Ethernet (FCoE), and iSCSI connections to the storage system using direct-attached, fabric-attached, and Ethernet network configurations.

These protocols enable the host to access data on storage systems. The storage systems are targets that have storage target devices called LUNs. The protocol enables the host to access the LUNs to store and retrieve data.

Shared iSCSI Storage

XenServer provides support for shared SRs on iSCSI LUNs. iSCSI is supported using the open-iSCSI software iSCSI initiator or using a supported iSCSI *Host Bus Adapter* (HBA).

Shared iSCSI support is implemented based on XenServer LVHD, a technology that combines the Logical Volume Manager (LVM) and Virtual Hard Disk (VHD) standards. Virtual machine VDIs are stored on an iSCSI LUN created on the NetApp storage system. Shared storage with iSCSI is a good choice for general purpose virtualization deployments, though it may not be as suitable for demanding workloads or deployments.

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Figure 4 Shared iSCSI storage using Open iSCSI initiator



Figure 5 Shared iSCSI storage using iSCSI HBA

Shared Fibre Channel Storage

XenServer hosts support Fibre Channel SANs using an Emulex or QLogic *host bus adapter* (HBA). Logical unit numbers (LUNs) are mapped to the XenServer host as disk devices.



Like iSCSI storage, Fibre Channel storage support is implemented based on the same LVHD technology with the same benefits as iSCSI storage, just utilizing a different data I/O path.



Figure 6 Shared FC storage



Configuration and Setup

NetApp Device Configuration Basics

This section covers the best practices for configuring the NetApp active-active controller configuration.

Configuring Target Portal Groups for iSCSI connections

Considerations when using Target Portal Groups: (for more information, please consult the Data ONTAP admin guide located at http://now.netapp.com)

- 1. Adding or removing a NIC may change the target portal group assignments. Be sure to verify the target portal group settings are correct after adding or removing hardware, especially in active-active controller configuration.
- 2. When used with multi-connection sessions, the Windows iSCSI software initiator creates a persistent association between the target portal group tag value and the target interfaces. If the tag value changes while an iSCSI session is active, the initiator will be able to recover only one connection for a session. To recover the remaining connections, you must refresh the initiator's target information.

If you want to employ multi-connection sessions to improve performance and reliability, you must use target portal groups to define the interfaces available for each iSCSI session.

Create a target portal group that contains all of the interfaces you want to use for one iSCSI session. However, note that you cannot combine iSCSI hardware-accelerated interfaces with standard iSCSI storage system interfaces in the same target portal group. When you create a target portal group, the specified interfaces are removed from their current groups and added to the new group. Any iSCSI sessions using the specified interfaces are terminated, but the initiator should automatically reconnect. However, initiators that create a persistent association between the IP address and the target portal group will not be able to reconnect.

1. Open console connection to the NetApp active-active controller configuration, and run the iSCSI tpgroup command

```
iscsi tpgroup create [-f] tpgroup_name [-t tag] [interface ...]
```

-f forces the new group to be created, even if that terminates an existing session using one of the interfaces being added to the group.

tpgroup_name is the name of the group being created (1 to 32 characters, no spaces or non-printing characters).

-t tag sets the target portal group tag to the specified value. In general you should accept the default tag value. User-specified tags must be in the range 1 to 256.

interface ... is the list of interfaces to include in the group, separated by spaces.

For example, the following command creates a target portal group named xenstorage_iscsi_group that includes interfaces e0c and e0d.

iscsi tpgroup create xenstorage_iscsi_group e0c e0d

- 2. Enable target portal group interfaces to accept iSCSI connections
 - iscsi interface enable eOc iscsi interface enable eOd

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Configuring a Dynamic Multimode Virtual Interface (VIF)

Throughput can be improved by creating a multimode VIF. With a multimode VIF, all interfaces in the VIF are active and share a single IP address. This logical aggregation of interfaces can be effectively used for NFS connections.

The following prerequisite must be met before creating a multimode VIF:

- 1. Identify or install a switch that supports link aggregation over multiple port connections in your network, configured according to your switch vendor's instructions.
- 2. Decide on a case-sensitive name for the VIF that meets the following criteria:
 - a. It must begin with a letter.
 - b. It must not contain a space.
 - c. It must not contain more than 15 characters.
 - d. It must not already be in use for a VIF.
- 3. Decide on the interfaces you want the VIF to consist of.
- 4. Configure all interfaces that will be included in the VIF to be down using the *ifconfig* command.

To create a dynamic multimode (LACP) VIF for NFS datapaths:

1. Open a console session to the NetApp active-active controller configuration, and run the *ifconfig down* command for interfaces that you want to create the vif on.

ifconfig down eOc ifconfig down eOd

2. Run the vif command to create the new vif vif create [multi|lacp] <vif name> -b ip [<interface list>]

It is recommended to use the lacp option and use IP address-based load balancing algorithm. vif create lacp nfs_bond -b ip e0c e0d

- 3. Run the *ifconfig* command on the newly created vif to assign it an IP address ifconfig nfs_bond 192.168.2.203 netmask 255.255.255.0
- 4. Create a corresponding interface on the partner controller and add the following lines to the /etc/rc file. This will allow the configuration to be persistent in case of reboot. The partner command makes the configured IP Adress be taken over by the cluster partner in case of failover

vif create lacp nfs_bond -b ip e0a e0c ifconfig nfs_bond 192.168.2.203 netmask 255.255.255.0 partner nfs_bond



Configuring an Aggregate

An aggregate consists of disk drives; you must specify a number of disks to be added to the new aggregate. Aggregates are the means by which the total IOPs available to all of the physical disks are pooled as a resource. NetApp recommends that whenever possible a small aggregate should be used as the root aggregate. The root aggregate stores the files required for running and providing GUI management tools for the FAS system. The remaining storage should be placed into a small number of large aggregates. On smaller FAS arrays, it may not be practical to have more than a single aggregate, due to the restricted number of disk drives on the system. In these cases, it is acceptable to have only a single aggregate.

Note: Data ONTAP 8.x has support for 64-bit aggregates, which allow for the creation of larger aggregate sizes. Please consult <u>http://now.netapp.com</u> for the maximum aggregate size for your storage system model.

NetApp System Manager is used throughout this document and only the SnapMirror section uses the NetApp FilerView. To download the System Manager please visit <u>http://now.netapp.com</u>.

Data aggregates should have RAID groups of no less than twelve.

1. Open the NetApp System Manager, and click *Aggregates->Create* to add a new aggregate on the device.





2. Choose an aggregate name that reflects the data center that will be using it, along with "XenServer" in the name. This will also make storage configuration easier when accessed via the XenCenter management interface. Choose the *Double Parity* option if there is an extra disk per RAID group available. This is the recommended RAID-level for the aggregate. NetApp RAID-DP® is an advanced RAID technology that is provided as the default RAID level on all FAS systems. RAID-DP protects against the simultaneous loss of two drives in a single RAID group. It is very economical to deploy; the overhead with default RAID groups is a mere 12.5%. This level of resiliency and storage efficiency makes data residing on RAID-DP safer than data stored on RAID 5 and more cost effective than RAID 10. NetApp recommends using RAID-DP on all RAID groups that store XenServer data.



- 3. Select the disk that will be used for the aggregate. Automatic is selected by default for this section.
- 4. Choose the disk size to be used in the aggregate. By default Any Size will be selected.

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5. Assign at least three disks in order to provision an aggregate. Click Next and then Commit to create the aggregate.

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	Block Type: Disk type:	32 bit aggregate ATA or SATA	e			
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Thin Provisioning vs. Thick Provisioning

Thick provisioning preallocates storage; thin provisioning provides storage on demand. Thin provisioning allows the admin to overprovision storage in order to avoid running out of storage and the associated application downtime when expanding the provisioned storage. Although no system can be run at 100% storage utilization, there are methods of storage virtualization that allow administrators to address and oversubscribe storage in the same manner as with server resources (such as CPU, memory, networking, and so on). This form of storage virtualization is referred to as *thin provisioning*.

The value of thin-provisioned storage is that storage is treated as a shared resource pool and is consumed only as each individual VM requires it. This sharing increases the total utilization rate of storage by eliminating the unused but provisioned areas of storage that are associated with traditional storage. The drawback to thin provisioning and oversubscribing storage is that (without the addition of physical storage) if every VM requires its maximum possible storage at the same time, there will not be enough storage to satisfy the requests present more storage space to the VMs connecting to the SR than is actually available on the SR. It is important to note that there are no space guarantees, and allocation of a LUN does not claim any data blocks in the FlexVol until the VM writes data into it.

The following scenarios benefit from thin provisioning

- a. Quick provisioning
- b. Not realistic to decide how much storage is required up front
- c. Allow storage capacity additions without downtime

NetApp recommends that when you enable NetApp thin provisioning, you also configure storage management policies on the volumes that contain the thin-provisioned LUNs. These policies aid in providing the thin-provisioned LUNs with storage capacity, as they require it. The policies include automatic sizing of a volume and automatic Snapshot deletion.

Volume Auto Size is a policy-based space management feature in Data ONTAP that allows a volume to grow in defined increments up to a predefined limit when the volume is nearly full. For Citrix environments, NetApp recommends setting this value to 'on'. Doing so requires setting the maximum volume and increment size options.

- 1. Log in to NetApp console.
- 2. Set Volume Auto Size Policy

```
Vol autosize <vol-name> [-m <size>[k|m|g|t]][-i <size>[k|m|g|t]] on.
```

Snapshot Auto Delete is a policy-based space-management feature that automatically deletes the oldest

Snapshot copies on a volume when that volume is nearly full. NetApp recommends setting this value to delete Snapshot copies at 5% of available space. In addition, you should set the volume option to have the system attempt to grow the volume before deleting Snapshot copies.

- 1. Log in to NetApp console.
- 2. Set Snapshot Auto Delete Policy
- 3. snap autodelete <vol-name> commitment try trigger

```
snap autodelete <vol-name> commitment try triggervolume target_free_space 5
delete_order oldest_first.
```



Fractional Reservation

LUN Fractional Reserve is a policy that is required when you use NetApp Snapshot copies on volumes that contain XenServer LUNs. This policy defines the amount of additional space reserved to guarantee LUN writes if a volume becomes 100% full. For XenServer environments where Volume Auto Size and Snapshot Auto delete are in use, NetApp recommends setting this value to 0%. Otherwise, leave this setting at its default of 100%. To disable Fractional Reserve, follow these steps.

- 1. Log in to NetApp console.
- 2. Set Volume Snapshot Fractional Reserve:

vol options <vol-name> fractional_reserve 0.

Using NetApp De-duplication

NetApp deduplication reclaims redundant disk space by dividing newly-stored data objects into small blocks, each block containing a digital signature, which is compared to all other signatures in the data volume. If an exact block match exists, the duplicate block is discarded and the disk space reclaimed.

Deduplication is enabled on a per flexible volume basis. It can be enabled on any number of flexible volumes in a storage system. It can be run one of four different ways:

- Scheduled on specific days and at specific times
- Manually, by using the command line
- Automatically, when 20% new data has been written to the volume
- Automatically on the destination volume, when used with SnapVault®

Only one deduplication process can run on a flexible volume at a time.

Up to eight deduplication processes can run concurrently on eight volumes within the same NetApp active-active controller configuration.

Beginning with Data ONTAP 7.3.1, deduplication checkpoint restart allows a deduplication process that was interrupted to continue from the last checkpoint. Prior to Data ONTAP 7.3.1, an interrupted deduplication process would result in a restart of the entire deduplication process. If the system is restarted while deduplication is in process, when the system is once again online, the deduplication process automatically restarts from the last checkpoint.

Below are some results on the testing NetApp deduplication

- Supported by all storage data access types; iSCSI, FCP & NFS
- >70% with virtualization environment
- Saves up to 95% for full backups; 25% to 55% for most data sets.

If NetApp deduplication is going to be enabled for the FlexVol® from XenCenter or StorageLink, then note that the volume size should match the maximum supported deduplication limit for the device.

The maximum flexible volume size limitation for deduplication varies based on the platform (this number depends primarily on the amount of system memory). When this limit is reached, writes to the volume fail just as they would with any other volume after it is full.

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This could be important to consider if the flexible volumes are ever moved to a different platform with a smaller maximum flexible volume size. For current volume limits, please consult TR-3505: NetApp Deduplication for FAS and V-Series Deployment and Implementation Guide, available at http://www.netapp.com

The maximum shared data limit per volume for deduplication is 16TB, regardless of the platform type. Once this limit is reached, there is no more deduplication of data in the volume, but writes to the volume continue to work successfully until the volume is completely full.



XenServer Shared Storage Configuration Basics

This section covers the best practices for configuring the various available storage options (Data ONTAP, NFS, iSCSI, FP) with a NetApp active-active configuration. The recommended storage configuration is to utilize the StorageLink Gateway SR type since it provides the most optimized performance as well as maximum flexibility in configuration and protocol selection.

Storage Networking

- 1. Configure physical network infrastructure so that different traffic is on different subnets.
- 2. Configure a new network to make the bond and/or VLAN available
- 3. Create a management interface to use the new network

The next few sections will cover how multipathing and NIC bonding can be used for storage networks. The above three steps will be enumerated in each section.

Storage Multipathing

XenServer 5.0 onwards Active/Active multipathing for iSCSI and FC protocols for I/O data paths is introduced. It is recommended to use the following diagram as a guide to configure multipathing (**D**ynamic **M**ulti**P**athing or DMP)



Figure 7 Graphical representation of DMP configuration

Dynamic multipathing uses a round-robin mode load balancing algorithm, so both routes will have active traffic on them during normal operations. Multipathing can be enabled via XenCenter or on the command line. However, before attempting to enable multipathing, verify that multiple targets are available on your storage server.

XenServer 5.6 and XenServer 5.6 FP 1support ALUA, asymmetric logical unit access. ALUA is a relatively new multipathing technology for asymmetric arrays. NetApp is ALUA compliant. Note ALUA is only available with fiber channel.



Dedicate NICs for software iSCSI storage traffic

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

1. From *XenCenter*, click on the pool (or standalone server) in the *Resources* tab. Click on the *Network* option followed by the *Configure* button

XenCenter										
<u>File View Pool Server VM</u> St <u>o</u> rag	ge <u>T</u> emplates To	ols <u>W</u> indow <u>H</u> elp								
🕒 Back 👻 💮 Forward 👻 📑 Add New	v Server 🕴 🏪 New	Pool 1 New Storage	e 🛅 New VM	Shut Down	Reboot (D Suspend			V No	System Alerts
Show: Server View 🔎 🗸	Resource P	ool							Logged in as: Loca	l root account
XenCenter	Search General	lemory Storage Netv	vork HA WLI	B Users Logs	1					
Resource Pool	Pool Networks									
DVD drives										
Local storage	Networks									
Removable storage	Name D	escription				VLAN	Auto	Link Status	MAC	MTU
DVD drives	📥 Network 0				NIC	0 -	Yes	Connected	a4:ba:db:1f:4d:d	1 1500
Local storage	A Network 1				NIC	1 -	Yes	Connected	a4:ba:db:1f:4d:d	2 1500
Removable storage										
	Add Network	Properties	Remove Networ	k						
	Management	Interfaces								
	Click Configure to	add, remove or edit your	management inter	rfaces.						
	Server Inte	rface Network	IP Address	Subnet mask	Gateway	DNS				
	R-310-1 Prim	ary Network 0	10.204.132.15	255.255.255.0	10.204.132.1	10.204.132.12	,10.204.6.5	1		
	R-310-2 Prim	ary Network 0	10.204.132.16	255.255.255.0	10.204.132.1	10.204.132.12	,10.204.6.5	1		
	Configure	1								
	Coningure	1								

2. On the Management interfaces section, click on the New Interface button.



Management Interfaces You can configure the primary management in for example, for storage or other types of tra	terface on each server in pool ffic.	"Resource Pool" here. You can also configure ad	(ditional management interfaces,
Primary Network 0	Primary Network: Network 0 Network settings Automatically obtain m Use these network set IP address range: Subnet mask: Gateway: Preferred DNS server: Alternate DNS server:	etwork settings using DHCP ttings: 10.204.132.15 255.255.255.0 10.204.132.1 10.204.132.12 10.204.6.51	to 10.204.132.16
New Interface			QK Cancel



3. Give the new interface a recognizable name, and select the Network you want the dedicated interface on.

🗴 Management Interfaces		? ×
You can configure the primary management i for example, for storage or other types of tr	nterface on each server in pool "Resource Pool" here. You can also configure additional management interface affic.	:S,
Primary Network 0 New Interface Name Network 1	A Interface 1 Name: New Interface Name Network: Network 1 Network settings Automatically obtain network settings using DHCP Use these network settings: IP address range: Subnet mask: Gateway: Remove this Interface	
New Interface	QK Gance	

4. Click on the Use these IP settings: radio button and enter a starting IP address for the NICs in the Network.

X Management Interfaces	<u>? x</u>
You can configure the primary management in for example, for storage or other types of tra	terface on each server in pool "Resource Pool" here. You can also configure additional management interfaces, ffic.
Primary Network 0 Network 1	Interface 1 Name: New Interface Name Network: Network 1 Vetwork: Network settings Automatically obtain network settings using DHCP Juse these network settings: IP address range: 10.204.0.1 Subnet mask: 255.255.0 Gateway: Stateway:
New Interface	

- 5. Repeat the above steps for each NIC dedicated to storage, and click OK
- 6. Open a console session to the XenServer pool master, and run the *iscsiadm* command with *discovery* and *sendtargets* option.

[root@antisana-v5 ~]# iscsiadm -m discovery --type sendtargets --portal
192.168.2.200

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192.168.2.200:3260,1 iqn.1992-08.com.netapp:sn.101173424 192.168.3.200:3260,1 iqn.1992-08.com.netapp:sn.101173424

The command returns multiple targets on the NetApp active-active controller configuration showing that the backend storage device is configured properly.

Configuring Multipathing for iSCSI

1. Modify /etc/multipath-enabled.conf file to include the following in the devices section.

device

```
{
vendor
                             "NETAPP"
                             "LUN"
product
                         group_by_prio
path grouping policy
                            "/sbin/scsi_id -g -u -s /block/%n"
getuid callout
                           "/sbin/mpath_prio_ontap /dev/%n"
prio callout
                           "1 queue_if_no_path"
features
path checker
                            directio
                             immediate
failback
}
```

Configuring Multipathing for Fiber Channel

1. Open a console session to the NetApp active-active controller configuration, set igroup to ALUA.

```
igroup set <initiator_group> alua yes
igroup show -v
```

2. Modify /etc/multipath-enabled.conf file to include the following in the devices section defaults

```
{
      user friendly_names no
      max fds max
      queue without daemon no
}
devices
{
      device{
vendor "NETAPP"
product "LUN"
getuid_callout "/sbin/scsi_id -g -u -s /block/%n"
prio callout "/sbin/mpath prio alua /dev/%n"
features "1 queue_if_no_path"
hardware_handler "0"
path grouping policy group by prio
failback immediate
path checker directio
flush_on_last_del yes
        }
}
```



Enable Multipathing at XenCenter

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

1. From *XenCenter*, right click the server in the pool from the *Resources* pane, and select the option *Enter Maintenance Mode...*



Select Enter maintenance mode from the dialog box. Choose any other server node in the pool as the temporary master.

Ente	r Mainten	ance Mode - R-310-1			<u>? ×</u>
	This operation of the mode.	ation will migrate all running	g VMs from t	this server and transition it in	to maintenance
	This serve pool. Xen	er is the pool master. Enter Center will temporarily lose	ring mainten e its connect	ance mode will nominate a ne ion to the pool.	w master for the
<u>N</u> ew m	aster:	R-310-2			•
Virtual	machines	on this server:			
					,
				Enter Maintenance Mode	<u>C</u> ancel

There is a short delay while *XenCenter* migrates any active virtual machines and unplugs the existing storage; if the server is a pool master, it will be disconnected and may disappear from the *Resources* pane temporarily while a new pool master is assigned.



2. When connection is restored, click on the server and then the *General* tab.

🗴 XenCenter			
<u>File View Pool S</u> erver VM St <u>o</u> rag	ge <u>T</u> emplates Too <u>l</u> s <u>W</u> ir	ndow <u>H</u> elp	
🕒 Back 🔹 💮 Forward 👻 📑 Add New	w Server 🕴 🚏 New Pool 👘	🛚 New Storage 💼 New VM 🕹 Shut Down 🛞 Reboot 🕕 Suspend	System Alerts: 2
Show: Server View 🔎 🗸	📴 R-310-1		Logged in as: Local root account
🖂 😣 XenCenter	Search General Memory	Storage Network NICs Console Performance Users Logs	
	Server General Prope	erties	
DVD drives			
Local storage	Properties		Expand all Collapse all
Removable storage	Description:	Default install of XenServer	_
DVD drives	Tags:	<none></none>	
Local storage	Folder:	<none></none>	
Removable storage	Pool master:	No	
	Enabled:	In maintenance mode	
	iSCSI IQN:	iqn.2010-12.com.example:6263a3cc	
	Log destination:	Local	
	Server uptime:	6 days 20 hours 18 minutes	
	Toolstack uptime:	1 minute	
	Domain:	hzlab.local	
	UUID:	ba905564-7e35-4d1f-9505-e650fffc11f9	
	Management Inter	faces	
	Memory		
	Version Details		
	License Details		
			_
			.::

Click the *Properties* button and then click on the *Multipathing* tab. Select the *Enable multipathing on this server* check box, and click *OK*.

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There is a short delay while XenCenter saves the new storage configuration.

3. Take the server back out of Maintenance mode by right clicking on the server in the *Resources* pane and click *Exit Maintenance Mode*.



4. Repeat the above steps for all servers in the pool that multipathing needs to be enabled on.



NIC Bonding

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

NIC bonds can improve XenServer host resiliency by using two physical NICs as if they were one. If one NIC within the bond fails the host's network traffic will automatically be routed over the second NIC. NIC bonds work in an Active/Active mode, with traffic balanced between the bonded NICs on XenServer 5.6. On XenServer 5.6 Feature Pack 1, NIC bonds can work in either an active/active mode, with traffic balanced between the bonded NICs or in an active/passive mode.

As such, XenServer host NICs should be bonded for NFS traffic to the NetApp active-active controller configuration. It is recommended to use the following diagram as a guide to configure NIC bonding.



Figure 8 Graphical representation of NIC bonding configuration

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1. From XenCenter, click on the pool in the *Resources* pane (or server if this is a standalone server), and click on the *Network* tab.

🗴 XenCenter							
<u>F</u> ile <u>V</u> iew <u>P</u> ool <u>S</u> erver V <u>M</u> St <u>o</u> ra	ge <u>T</u> emplates Too <u>l</u> s <u>W</u> indow <u>H</u> elp						
😋 Back 🔹 💿 Forward 🕞 📴 Add New Server 🏪 New Pool 🛅 New Storage 🛅 New VM 🔘 Shut Down 🛞 Reboot 🕕 Suspend 🥺 System Alerts: 2							
Show: Server View 🔎 🗸	Resource Pool	Logged in as: Local root account					
 ★ XenCenter ★ Resource Pool ★ R-310-2 ↓ DVD drives Local storage ★ R-310-1 ↓ VVD drives ↓ Removable storage ↓ Local storage ↓ Local storage ↓ Local storage ↓ Local storage ↓ Local storage ↓ Local storage ↓ Removable storage 	Search General Memory Storage Network Pool Networks Name Description NIC ^ VLAN Auto Link Status Network 0 NIC 0 - Yes Connected Network 1 NIC 1 - Yes Connected Add Network Properties Remove Network Image: Network	MAC MTU a4:ba:db:1f:4d:d1 1500 a4:ba:db:1f:4d:d2 1500					

2. Click on the Add Network... button. Select the Bonded Network radio button, and click Next>.

New Network - Resource Pool		
Choose the type of r	network to create	0
Select Type	Select the type of new network you would like to create:	
	O External Network	
	Create a network that passes traffic over one of your VLANs.	
	O Single-Server Private Network	
	Create a network that does not leave each XenServer host. This can be used as a private connection between VMs on the same host.	
	C Gross-Server Private Network	
	Create a network that does not leave the XenServer pool. This can be used as a private connection between VMs in the pool. This type of network requires the vSwitch Controller to be running.	
	Bonded Network	
	Create a network that bonds together two of your NICs. This will create a single higher performing channel.	
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	< <u>P</u> revious <u>N</u> ext > Einish	Cancel



3. Select the NICs that need to be bonded from the *Available NICs* pane. Click *Finish*.

New Network - Resource Pool						
Select members for th	he new bonded network					0
Select Type	Select the NICs you would like to	use in this bond and confirm	whether this netwo	ork should be added	i to new VMs.	
Bond Members	NIC MAC	Link Speed	Duplex Ve	ndor	Device	PCI Bus Path
	NIC 0 a4:ba:db:1f:4d:01	Connected 1000 Mbit/s	Full Bro	adcom Corporation	NetXtreme II BCM5716 Gigabit Ethernet	0000:02:00.0
	NIC 1 a4:ba:db:1f:4d:02	Connected 1000 Mbit/s	Full Bro	adcom Corporation	NetXtreme II BCM5716 Gigabit Ethernet	0000:02:00.1
	MTU: 1500					
CITRIX.	Automatically add this netwo	rk to new virtual machines				
					< Previous Next >	ish Cancel

4. This will create a new network named Bond 0 + 1.

🛞 XenCenter								
Elle View Pool Server VM Storage Templates Tools Window Help								
🕞 Back 👻 💿 Forward 👻 🛃 Add New Server 🏪 New Pool 🛅 New Storage 🛅 New VM 🔘 Shut Down 🛞 Reboot 🕕 Suspend 🧟 System	n Alerts: 2							
Show: Server View 🔎 📲 Resource Pool Logged in as: Local re	oot account							
Search General Memory Storage Network HA WLB Users Logs								
Resource Pool	Pool Networks							
E w store	Networks							
Local storage Networks								
Removable storage	MTU							
□ □ ■	1500							
Removable storage								
Add Network Properties Remove Network								
Management Interfaces								
Click Configure to add, remove or edit your management interfaces.	Click Configure to add, remove or edit your management interfaces.							
Server Interface Network IP Address Subnet mask Gateway DNS								
R-310-2 Primary Bond 0+1 10.204.132.16 255.255.255.0 10.204.132.1 10.204.132.12,10.204.6.51								
R-310-1 Primary Bond 0+1 10.204.132.15 255.255.255.0 10.204.132.1 10.204.132.12,10.204.6.51								
Configure								

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5. Select Bond 0 + 1, and click the Properties button to give the new network a more meaningful name and description.

<u>File View P</u> ool <u>S</u> erver VM St <u>o</u> rage <u>T</u> emplates Tools <u>Wi</u> ndow <u>H</u> elp	
🕒 Back 👻 💿 Forward 👻 🛺 Add New Server 🏪 New Pool 👕 New Storage 🛅 New VM 🕑 Shut Down 🛞 Reboot 🕕 Suspend 🐼 System	<u>lerts: 5</u>
Show: Server View 🔎 🔹 R515 Logged in as: Local roo	account
Search General Memory Storage Network NICs Console Performance Users Logs	
Resource Pool	
Removable storage	
DVD drives	0
E Local storage	00
Removable storage Network 3 NIC 3 - Yes Disconnected 00:05:1e:t4:c9:96 12	00
Removable storage Add Network Properties Remove Network	
Management Interfaces	
Caloc Comigure to add, remove or edit your management interfaces.	
Server Interface Network IP Address Subnet mask Gateway DNS	
R515 Primary Bond 0+1 10.204.151.60 255.255.255.0 10.204.151.1 10.204.151.12,10.204.6.51	
Configure	
Congrigation -	

6. On the Management interfaces section, click on the Configure, and select New Interface button

🗴 Management Interfaces		<u>? ×</u>
You can configure the primary management in storage or other types of traffic.	Iterface on server "R515" here. You can also configure additional management interfaces, for example, for	
Primary Bond 0+1	A Primary	
	Network: Bond 0+1	.
	Network settings O Automatically obtain network settings using DHCP	
	© Use these network settings:	
	IP address: 10.204.151.60 Subnet mask: 255.255.0	-
	Gateway: 10.204.151.1	
	Preferred DNS server: 10.204.151.12 Alternate DNS server: 10.204.6.51	-
N <u>e</u> w Interface	<u>QK</u> <u>Can</u>	:el



- 7. Click on New Interfaces in the Management interfaces wizard.
- 8. Give the new interface a name, and choose the Network created in previous steps from the drop down. Click OK.

X Management Interfaces You can configure the primary management in for example, for storage or other types of tr	
Primary NFS Storage Traffic NFS Storage Traffic NFS Storage Traffic	♪ Interface 1 Name: NFS Storage Traffic Network: NFS Storage Traffic (in use by Primary) Network 0 NFS Storage Traffic (in use by Primary) Network settings ▲ utomatically obtain network settings using DHCP ♥ Lise these network settings: IP address range: 10.204.151.60 §ubnet mask: 255.255.255.0 ④ ateway: 10.204.151.1
N <u>e</u> w Interface	<u>QK</u> <u>Cancel</u>
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Integrated StorageLink SR configuration

You can now use XenCenter to create new Storage Repositories (SRs) that use the existing StorageLink storage infrastructure, allowing you to access a range of different native storage services using any of the leading architectures and protocols, including DAS, NAS, SAN, iSCSI and Fibre Channel. XenCenter's new StorageLink SR management capabilities allow you to create, remove and use StorageLink SRs without having to install the StorageLink Manager. From XenCenter, you can:

- View StorageLink servers and storage architecture storage systems, pools, volumes, and SRs in the Resources pane. Here, you can see information about arrays including capabilities, name, and serial number, and also see the amount of free space and capacity on your storage volumes and pools.
- View, add and remove Storage credentials.
- Connect to a StorageLink license server.
- Create and destroy SRs on storage managed by StorageLink.

Installation and configuration of the StorageLink service must be done outside of XenCenter; for more information, please refer to the StorageLink documentation.



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Shared Storage using StorageLink Gateway

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

Use of the StorageLink Gateway for shared storage is the recommended approach for deployments of XenServer with NetApp. This type of storage repository is available with Citrix XenServer, Enterprise Edition, Platinum Edition and requires the installation of the StorageLink Gateway service on a Windows Server virtual machine or physical server. In addition to XenServer, StorageLink Gateway also supports Hyper-V hosts and provides storage interoperability between the two platforms. As mentioned before, the StorageLink Gateway only serves as a broker, and is not part of the data path between a XenServer host and the NetApp storage infrastructure.

If installing the StorageLink Gateway on a XenServer virtual machine, the virtual machine disks will need to be connected via a standard NFS, iSCSI, or Hardware HBA storage repository type. For highly available configurations, it is recommended that StorageLink be implemented in an isolated resource pool and using an iSCSI or Hardware HBA storage repository type (ideally the same SR used for the XenServer HA heartbeat disk). The StorageLink Gateway services do not need to be available while VMs are running, however many operations such as VM start require the service for a short period of time.

Once the StorageLink Gateway Service and Manager (management console) have been installed on a virtual machine or physical server, the following process can be followed to create the storage repository.

1. Open the StorageLink Manager console.

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2. Click "Connect to the StorageLink Gateway" in the center pane, and enter the credentials entered during installation.

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S Citrix StorageLink Manager - [Console Root	Citrix StorageLink Manager]	_ 🗆 ×
File Action View Help		
		[• ·:·
Hypervisor Hosts «	Details	Actions
	Home	
1		
		Change password
	CITPIX' StorageLink Manager	Set License Server Location
	StorageLink Manager - Connect to Citrix StorageLink Gateway	NG Refresh
		Rescan
	Connect to a storageLink Gateway by entering its 1P address or nostname:	Create Virtual Machine(s)
	Hostname: localhost	Create Storage Repository
	,	le Alerts
		Alert Options
	Password:	Save Log As
Hypervisor Hosts	Test Connection	About
Virtual Machines		View
Storage Infrastructure	Connect Cancel	R Help
Storage Repositories	Create Storage Repository	ľ
Virtual Machine Templates	Create Storage Profile	
	Create Virtual Machine Template	
Site Recovery	Common tasks	
Jobs	Create Virtual Machine(s)	
Administration		
P	۱ا	

3. Add the Hypervisor hosts. Use the name or IP address of the XenServer resource pool master and the XenServer root credentials. (Note: if you receive a networking error during this step, you may need to temporarily remove NIC bonds from your XenServer host(s). The bonds can be recreated once the hosts have been added to the StorageLink Manager.)

S Citrix StorageLink Manager - [Console Root\Citrix	StorageLink M	lanager : [10.204.132.20]]			
File Action View Help					
Hypervisor Hosts «	🚑 Нуре	visor Hosts	▲ ▼	Ac	tions
	Home			Cit	trix StorageLink Manager : [10.204.13 🔺
					Connect
				1	Change password
S 5	torageLink Ma	nager - Add Hypervisor Host	×	🔻	Set License Server Location
	~			1	Refresh
	Add the s	ecified hypervisor host to the services:		8	Rescan
	-			1	Create Virtual Machine(s)
н	ostname:	10.204.132.15			Create Storage Repository
н	ypervisor type:	Citrix XenServer	•		Alerts (9)
	cer name:	root			Alert Options
	ser numer				Save Log As
P	assword:	•••••		1	About
Virtual Machines	Enable Site Re	covery for this Host		_	View •
C Storage Infrastructure				?	Help
Storage Repositories			Cancel	Ну	rpervisor Hosts
Virtual Machine Templates	Creat	e Storage Profile		4	Add Hypervisor Host
	Crea	e Virtual Machine Template		1	Rescan Hypervisor Hosts
Site Recovery				?	Help
Jobs	Commo	e Virtual Machine(s)			
Administration					
,					

4. Once all of the XenServer hosts have been enumerated, your screen should look something like this:

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Citrix XenServer and NetApp Storage Best Practices

S Citrix StorageLink Manager - [Console Root\Citrix Sto	prageLink Manager : [10	.204.132.33]]							_ 🗆 ×
File Action View Help									
Hypervisor Hosts «	🚑 Hypervisor H	losts				• •	Actions		
	Home General						Cit	rix StorageLink Manager : [10.	204.13 🔺
Resource Pool A 210 1 (10 204 122 15)	Name	Hypervisor Type	OS Type	OS Version	Memory Size	CPUs	1	Connect	
□₩ Initiators	r-310-1 (10.204.132.15)	Citrix XenServer	Xen		8182 MB	8	1	Change password	
□ 100 00 1b 32 82 8f 75	r-310-2 (10.204.132.16)	Citrix XenServer	Xen		8182 MB	8	1	License Manager	
□-18 20-00-00-1b-32-85-08-28						_	8	Refresh	
21-00-00-1b-32-85-08-28							8	Rescan	
iqn.2010-12.com.example:6263a3cc								Create Virtual Machine(s)	
Virtual Machines								Create Storage Repository	
E Demo Linux VM (2)							0	Alerts (1)	
🖻 🐁 r-310-2 (10.204.132.16)							1	Alert Options	
Initiators Virtual Machines								Save Log As	
🗄 - 💪 Demo Linux VM (1)								About	
								View	•
	4					Þ	?	Help	
							Hv	pervisor Hosts	
	Identification							Add Hypervisor Host	
Hypervisor Hosts	Name:	r-310-1 (10.204.132.15)					Rescan Hypervisor Hosts	
Virtual Machines	Hypervisor type:	Citrix XenServer					2	Help	
(The Storage Infrastructure	OS type:	Xen						hop	
	OS version:								
Storage Repositories	Memory size:	8182 MB							
Virtual Machine Templates	CPU cores:	8							
Site Recovery	State:	Online							
	StorageLink license:	Platinum (required for S	ite Recovery)						
100s	License state:	Licensed							
Administration									
							,		

5. Next, add the NetApp storage active-active controller configuration. Select the "Storage Infrastructure" tab and then "Add Storage System."

Citrix StorageLink Manager - [Console Root\Citr	ix StorageLink Manage	er : [10.204.132.33]]		
File Action View Help				
Storage Infrastructure	« 👖 Storage S	ystems 🔺 🔻	Ac	tions
	Home		Cit	rix StorageLink Manager : [10.204.13 🔺
Fabrics	🐧 StorageLink Manag	er - Add Storage Adapter Credentials	1	Connect
	-			Change password
	Select a storag	e adapter and define the storage credentials:	🙎	License Manager
			2	Refresh
	Storage adapter:	Netapp / IBM N Series Storage Adapter	8	Rescan
	Name:	NetApp		Create Virtual Machine(s)
	CIMOM namespace:			Create Storage Repository
	Hasterne (10 address)	10.204.1.100		Alerts (1)
Itypervisor Hosts	Hostilame/IP address:	10.207,1,100		Alert Options
Virtual Machines	Port number:			Save Log As
201 Storage Infractiusture	User name:	root	∥≞	About
	Password:	•••••		
Storage Repositories	1 domonal			пер
Virtual Machine Templates		OK Cancel	Sto	orage Systems 🔺
Site Recovery		de Frome		Add Storage Adapter Credentials
	Create Virtua	al Machine Template		Rescan Storage Systems
J005	_		2	Help
Administration	Common tasks	5: 		
	Create Virtua	ai Machine(s)		

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- 6. After the storage system has been discovered, your screen should look similar to this. You will see the any aggregates on the NetApp active-active controller configuration within the StorageLink Manager console (in this case XS1 and Vol0)
- 7. Create the Storage Repository. Click on the "Create Storage Repository" link in the middle pane.





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torage Infrastructure	« 🚳 vol0			A v	Actions	
Storage Infrastructure - The Storage Systems - The NetApp FAS3140 (ISV - Storage Pools	StorageLink Manager - Crea	te Storage Repositor e repository settin	v gs for use with the provisioning of new	storage volume	<u> </u>	ık Manager : [10.204.13. ord
KS1 Vol0 Storage Volumes Fabrics	Name and Storage System Settings Storage Volumes	Storage pool: Raid type: Provisioning type: Provisioning options: Protocol: Storage pool XS1	XS1 RAID6 Thin None Auto	Show All Show All CHAP		ier Machine(s) e Repository
Storage Infrastructure Storage Repositories Virtual Machine Templates Site Recovery Jobs Administration	CİTRİX .	eate Virtual Machine(s)	< Previous Next >	Einish	Cancel	

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8. After clicking "Finish" an SR named "StorageLink Gateway" (or whatever name you specified) will be visible within both the StorageLink Manager as well as XenCenter, similar to what is shown below.

🗴 XenCenter						<u>_ ×</u>
Ele View Pool Server VM Storage Templates Tools Win C Back • O Forward • Image: Add New Server Image: New Pool Image: NewPool	n dow <u>H</u>elp New Storage 🛅 New VM 🙆 Shut Down 🛞 F	Reboot 🕕 Suspend			System Ale	<u>erts: 12</u>
Show: Server View 🔎 🔹	XenCenter					
Source Pool Image: Source Pool Image:	Search Logs Overview					
StorageLink Gateway	Name	CPU Usage	Used Memory	Disks (avg / max KBs)	Network (avg / max KBs)	-
	- 🌇 Resource Pool	-	-	-	-	
□ (1) XS1		0% of 8 CPUs	820 of 8182 MB	-	1/2	1
StorageLink Gateway (StorageLink_Gatewayf4d5d7cb) 🚷 vol0	■ R-310-2 Default install of XenServer	0% of 8 CPUs	1079 of 8182 MB		2/3	1
	EQ Dell EqualLogic SR [10.204.208.44	•	-	-		
	NetApp Virtual diskstorage NetApp SR [10.204.151.15 (XS1)]	-	-	-		
	StorageLink Gateway NetApp					
	Haikel-Xen Default install of XenServer	2% of 4 CPUs	1978 of 4095 MB	-	1/4	1
	StorageLink (10.204.132.33)		-			
	= 📔 ISV3140	-				
	= 🛞 XS1		-			
	StorageLink Gateway	-			-	
	🛞 vol0	-			-	-
<u> </u>						

- 9. In addition, a new volume will be created on the NetApp aggregate selected in step 7. The name of this new volume will start with the name of the SR.
- 10. At this point, the StorageLink Manger console will not be required for regular administration activities. The StorageLink Gateway service does need to be running for many VM operations within XenCenter.



11. When new VMs are created on the storage repository, the StorageLink Gateway will automatically provision LUNs on the NetApp active-active controller configuration. For example, after using XenCenter to create a new Debian VM with two disks (one 4 GB and another 512 MB), the following two LUNs will be visible in NetApp FilerView or via NetApp System Manager:

NetApp System Manager										
Eile Action View Help										
🗢 🔿 🖄 🖬 🚺 🖬										
NetApp System Manager Imit ISV3140.magic.local Storage	LUN Management Initiator Groups	LUN Management Intiator Groups								
Volumes		1								
🗉 🚔 Shared Folders	Name	Container Path	Status	Size	Туре					
juli LUNs	volu	/vol/SPORE_ISCSI_1	Online	299.04 GB	Xen					
Quotas		/vol/SPORE_ISCSI_2	Online	299.04 GB	Xen					
Disks	6324b479_744t_4655_81t4_9tbd55388	/vol/StorageLink_Gatewayf4d5d/cb	Online	512.00 MB	Linux					
Aggregates	31210984_2ecd_4638_b963_01f07039	/vol/StorageLink_Gatewayf4d5d/cb	Online	4.00 GB	Linux					
🕀 🔧 Configuration	vol0	/vol/UCS_FCoE_2	Offline	7.00 GB	Xen					
+ Z Diagnostics	vol0	/vol/UCSTemp1	Online	98.00 GB	Xen					
	f61bf64d-1904-4c0b-b468-3822490c576f	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	512.00 MB						
	e0e9e8b9-da34-4d45-ad0b-9b1440c7bd	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	4.00 GB						
	292b393c+f63c-42d0-a306-db5a881de616	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	10.00 GB						
	dd620e83-09cf-4549-b9a7-e633cd5c01d1	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	512.00 MB						
	251d91d6-5073-4f80-af57-26c9c7502dde	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	4.00 GB						
	ab58c2df-8e5b-4e2f-90f2-c47388dabb9b	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	4.00 GB						
	7da4e227-83b4-48fc-9934-432979cf2c38	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	512.00 MB						
	5e691437-9b4e-4b40-b7da-cb140d91b7	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	4.00 GB						
	6a061e38-e8d2-4cec-b6b8-96ee910e16	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec22	Online	512.00 MB						
	LUN properties									
	Multiple LUNs are selected. A singl	e LUN must be selected to see its detail properties.								
J					J					

12. If a virtual machine snapshot is performed from XenCenter, additional LUNs will be visible in FilerView or NetApp System Manager with a "snapXX" appended to the name, similar to below:

NetApp System Manager						_ 🗆 ×					
<u>File Action View H</u> elp											
🗢 🔿 🖄 📷 🚺 🖬											
NetApp System Manager Imm ISV3140.magic.local Storage Volumes	LUN Management Initiator Groups Create Edit X Delete Status Image Snapshot Refresh										
Shared Folders	vol0	/vol/SPORE iSCSL 2	Online	299.04 GB	Xen						
Image: Graph of the second	vol0 6324b379_744f_4655_81f4_9fbd55388bda_snap01 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4638_b963_01f07039071b 31210984_2ecd_4655_8144_9fbd5388bda vol0 vol0 vol0 vol0 302645588146616 3b58c2df-865-4e2f-90f2-c47388dab95b dd62De83-09d+4549-b9a7-66330d5c01d1 7da4e227-83b4446r-934-4329742c38 251d91d6-50734f80-af57-26c9c7502dde 5a601e33e-8824-4cec-b68-96ee910e1659 5e691437-9b4e-4b40-b7da-cb140d91b7d9 LUN properties Multiple LUNs are selected. A single LUN must	 /vol/SPORE_ISCS12 /vol/StorageLink_Gateway_14d5d7cb /vol/StorageLink_Gateway_14d5d7cb /vol/StorageLink_Gateway_14d5d7cb /vol/XorageLink_Gateway_14d5d7cb /vol/XorageLink_Gateway_14d5d7cb /vol/XorageLink_Gateway_14d5d7cb /vol/XorageLink_Gateway_14d5d7cb /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 /vol/XenStorage_78ba35b0_1aff_4867_90b3_19 	Online Online Online Online Online Online Online Online Online Online Online Online Online Online	299.04 GB 512.00 MB 4.00 GB 512.00 MB 7.00 GB 98.00 GB 4.00 GB 512.00 MB 10.00 GB 512.00 MB 512.00 MB 512.00 MB 512.00 MB 4.00 GB 512.00 MB	Xen Unux Unux Unux Unux Xen Xen Xen						



Shared Storage using the direct StorageLink Adapter for NetApp

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

The direct StorageLink adapter for NetApp was first introduced in XenServer 4.1. While it is still available in XenServer 5.5, XenServer 5.6, and now on XenServer 5.6 Feature Pack 1, it is primarily intended to maintain backward compatibility with pre-5.5, 5.6 and 5.6 FP1 deployments. For the new XenServer 5.6 FP 1 deployments, it is recommended to use the StorageLink Gateway.

The direct StorageLink-NetApp storage repository uses NetApp Data ONTAP for its control path, with in-band configuration and management of the data path via the host software initiator. The only backend NetApp storage configuration required is to create an aggregate that will house the FlexVols used by this storage repository type. See Appendix B for information for security considerations to allow XenServer administrators to have root access to the device to be able to provision FlexVols and generate Snapshots on the device.

1. For using NetApp Data ONTAP to create the storage repository, in XenCenter, choose *New Storage*. Select *Advanced StorageLink technology*. Select *NetApp*

📚 New Storage Repository - Reso	ource Pool	<u> </u>
Enter the name, desc	cription and storage system for the new storage repository	•
Type Location	Select a name and optional description for your new storage, then select the type of storage system you would lik add.	e to
- Name and Storage System - Settings	Name: NetApp Virtual disk storage	
	Storage system: NetApp Citrix StorageLink Gateway is a storage management technology which enables automated disco and one-click access to native storage services using any of the leading storage architectures ar protocols, including DAS, NAS, SAN, ISCSI and Fibre Channel. Configure the Citrix StorageLink Gateway Server connection	vvery nd
CİTRIX	< <u>P</u> revious <u>N</u> ext > ⊟nish Ca	ncel



2. Provide the name of the device (or its IP address), and authentication credentials. If CHAP is required, then select *Use CHAP* and provide the username and password. CHAP is only required if there is a security requirement between the NetApp storage and the XenServer.

New Storage Repository - Re	source Pool		
Enter the NetApp fil	er details		?
Type Location	Provide the address w	here your storage is located and the credentials required to access the storage.	
Name and Storage System	NetApp filer address:	10.204.0.1	
- NetApp filer	Userna <u>m</u> e:	root	
-i	CHAP User:	ntication	
CITRIX			
		< Previous Next > Einish	Cancel

Note, the device manages CHAP authentication credentials per host IQN. This must be managed and configured directly on the device if required.

3. The NetApp Data ONTAP adapter will poll the device for existing aggregates. Choose the aggregate to create the storage repository in. If thin provisioning is required, then check the box entitled *Use NetApp thin provisioning*. With thin provisioning, it is also possible to make enable deduplication on the backend.

Thin provisioning is a very useful space conserving mechanism for Virtual Machine disk storage, since many Virtual Machines are likely to significantly under-utilize all the virtual disk space allocated. Furthermore, NetApp deduplication can be very effective where many VMs contain the same, or similar, Operating System, and there is likely to be a significant amount of duplication of data across disks. Selecting *Use NetApp thin provisioning* with *Enable FAS deduplication* can significantly reduce the amount of space required on disk. Note, however that there are no space guarantees when operating in thin provisioning mode, so it is quite feasible to over-provision the amount of allocated space. If an over-provisioned aggregate runs out of space, a LUN will be forcibly set offline when any data writes are received which may cause a Virtual Machine to crash. Management of space usage can be greatly improved by utilizing the NetApp Data ONTAP alert mechanisms. Alternatively, Virtual Machine disk space can be guaranteed by disabling thin provisioning.

Deduplication is enabled on a volume, and the amount of data deduplication realized is based on the commonality of the data stored in a deduplication-enabled volume. For the largest storage savings, NetApp recommends grouping similar operating systems and similar applications into one volume. For deduplication best practices, including scheduling and performance considerations, see TR 3505 NetApp FAS Dedupe: Data Deduplication Deployment and Implementation Guide.

When we consider how many volumes we create, we need to consider the total VM number, backup strategy and space saving. The more same OS VMs in one volume, the more deduplication storage saving. NetApp recommends grouping VMs with similar backup requirement in other words VMs with the same snapshot schedule in one volume.



For example, a 1000 virtual desktops environment, we can put the 250 VMs in one volume and have 4 volumes to host the 1000 VMs. And use SnapMirror to backup gold image volume to disaster recovery site storage. Another example, we can use one volume to host 100 VMs if all the VMs have same snapshot backup requirement.

😵 New Storage Repository - Res	source Po	ol					_ 🗆 🗙
Enter the NetApp fik	er detaik	s					7
Туре	OB	eattach one of th	e existing SRs on t	he filer:			
Location Name and Storage System		SR NetApp Virtual	disk storage on Re	esource Pool			
- Reattach SR/New SR	© <u>c</u>	reate a new SR o	n the following agg	regate:			
	[Aggregate	Size	Disks	RAID type	A-SIS capable]
		XS1	2472.8 GB	9	raid_dp	Yes	
CİTRIX.		Number of Flex <u>V</u> o	Is to use: 8 P <u>o</u> rt: 80	Help me choose	V Use	NetApp <u>t</u> hin provisioning nable ONTAP <u>d</u> eduplicat	, ion
L				< Previ	ious Next >	Einish	Cancel

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4. Click *Finish* for the storage repository to be created using Data ONTAP for the control path.

NOTE: If multipathing is enabled, the NetApp SR in XenCenter will show multipathing as *Not Active*. The reason is that the NetApp SR type is a LUN-per-VDI model, and no LUNs or VDIs exist when the SR is created.



However, once a VM has been created with VDI's attached and is started up, XenCenter will show multipathing as *Active*. Henceforth, the SR will remain in multipath mode.

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🗴 XenCenter			×
<u>File View Pool Server VM Sto</u>	grage <u>T</u> emplates Too <u>l</u> s <u>V</u>	Mindow Help	
🕒 Back 👻 🕞 Forward 👻 📑 Add N	New Server 🏪 New Pool	🛅 New Storage 🛅 New VM 🔘 Shut Down 🛞 Reboot 🕕 Suspend 🛛 🗸 No System Alert	s
Show: Server View 🔎 🗸	NetApp Virtual disk	k storage Logged in as: Local root accour	it
E S XenCenter	General Storage Logs		
E Resource Pool	Storage General Prop	erties	
E Demo Linux VM (1)	j-		
DVD drives	Properties	Expand all Collapse all	
Local storage			
Removable storage	General		
	Name:	NetApp Virtual disk storage	
Demo Linux VM (4)	Description:	NetApp SR [10.204.151.15 (XS1)]	
Demo Linux VM (5)	Tags:	<none></none>	
Local storage	Folder:	<none></none>	
Removable storage	Type:	NetAnn	
Demo Linux VM (2)	Sino	1504 0 CP used of 2/172 0 CR total (28 CR allocated)	
NetApp Virtual disk storage	SIZE.		
StorageLink Gateway	SCSI ID:	W9n8czaeqyyd,W9n8czaeqygt,W9n8czazrBi8,W9n8czazrBis,w9n8czarjiwp,w9n8czaraup-,w9n8czarau-,w9n8czarau-,w9n8czar	
🕀 🔂 Haikel-Xen	UUID:	78ba35b0-1aff-4867-90b3-19d7ec223f05	
	Status		
	State:	ок	
	r-310-1:	Connected	
	R-310-2:	Connected	
	Multipathing		
	r-310-1:	Active	
	Demo Linux VM (1):	1 of 1 paths active (2 iSCSI sessions)	
	R-310-2:	Active	
	Demo Linux VM (3):	1 of 1 paths active (1 iSCSI sessions)	
	Demo Linux VM (4):	1 of 1 paths active (1 iSCSI sessions)	
			.:

Identifying XenServer objects on the NetApp active-active controller configuration

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

The NetApp SR is mapped to a FlexVol in the NetApp active-active controller configuration. Each VDI is represented as a LUN within a FlexVol, with VDI's of the same VM being within a single FlexVol.

When the NetApp SR is created in Direct StorageLink-NetApp Adapter, the FlexVols created on the NetApp active-active controller configuration follow a naming pattern:

XenStorage_UUID_FVn

where UUID is the UUID of the NetApp SR in XenServer, and n is the FlexVol number

The LUNs that are created within the FlexVol use as their name the UUID of the VDI that they represent.

When the NetApp SR is created in the StorageLink gateway, the FlexVol created on the NetApp active-active controller configuration follows a naming pattern: <CustomizedName>_UUID.



To view the FlexVols that correspond to the NetApp SR

1. In XenServer console, get the UUID of the NetApp SR using the xe sr-list command.

```
[root@r-310-1 ~]# xe sr-list type=netapp
uuid ( R0) : 78ba35b0-1aff-4867-90b3-19d7ec223f05
name-label ( RW): NetApp Virtual disk storage
name-description ( RW): NetApp SR [10.204.151.15 (XS1)]
host ( R0): <shared>
type ( R0): netapp
content-type ( R0):
```

2. On the NetApp System Manager, click on Volumes.

NetApp System Manager						
Eile Action View Help						
🗢 🧼 🖄 📰 🛛 🖬						
NetApp System ManagShow/Hide Action ISV3140.magic.loca	Pane eate 📄 Edit 🗙 Delete 🍣 Refresh 🖯 Status 🗸 🔊	Snapshot 👻 🔚 Res	ize 💝 Deduplicat	ion 👻		
🖃 👸 Storage	Name	Aggregate	Status	Available space	Used %	Total space
Volumes	StorageLink_Gatewayf4d5d7cb	XS1	online	4.78 GB	18	7.29 GB
Shared Folders	UCS_FCoE_2	XS1	online	1007.27 MB	88	8 GB
Quotas	UCS_NFS_1	XS1	online	149.98 GB	0	150 GB
© Otrees	UCS_NFS_2	XS1	online	8 GB	0	8 GB
Disks	UCSTemp1	XS1	online	1.8 GB	98	100 GB
Aggregates	vol0		online	367.99 GB	1	371.86 GB
Configuration	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV0	XS1	online	873.69 GB	65	2.41 TB
Diagnostics	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV1	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV2	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV3	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV4	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV5	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV6	XS1	online	873.69 GB	65	2.41 TB
	XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV7	XS1	online	873.69 GB	65	2.41 TB
						<u>-</u>
	Deduplica	ation properties	Last n	un details		
	Enabled:	(multiple values)	Start ti	me: (multiple va	alues)	
	Mode:	(multiple values)	End tir	ne: (multiple va	alues)	
	Status:	(multiple values)	Space	saved: (multiple va	alues)	
	Type:	(multiple values)	Space	saved (%): (multiple va	alues)	
	Graphies	end				
	Cirapiniog	data	Annalabla dat	NY C 1		
	Used	data space	Available data spa	ce 👷 Snapsnot	overnow	
	Since State	Snapshot space	Available Snapsho	t space		
	Details Space Snapshot Copies Deduplication					
]]					1	
1					1	J

In the NetApp System Manager above, XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV0 to XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV7 are the FlexVols that make up the NetApp SR which has UUID 78ba35b0-1aff-4867-90b3-19d7ec223f05.

On the NetApp active-active controller configuration, the FlexVol can also be displayed using the ONTAP CLI command.

vol status

ISV3140> vol status						
Volume State	Status	Options				
vol0 online	raid_dp, trad	root, nosnap=on				
XenStorage_78ba35b0_1aff_4867_	90b3_19d7ec223f05_1	FV0 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	90b3_19d7ec223f05_1	FV1 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	00b3_19d7ec223f05_1	FV2 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	90b3_19d7ec223f05_1	FV3 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	90b3_19d7ec223f05_1	FV4 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	0b3_19d7ec223f05_1	FV5 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	0b3_19d7ec223f05_1	FV6 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					
XenStorage_78ba35b0_1aff_4867_	0b3_19d7ec223f05_1	FV7 online	raid_dp,	flex	nosnap=on,	guarantee=none
	sis					



To view the LUNs associated with the VDIs in the NetApp SR

1. In XenServer console, get the UUID of VDIs created on the NetApp SR using the xe vdi-list command.

[root@r-310-1 ~]# xe vdi-list sr-name-label=NetAppN VirtualN diskN storage par s=uuid,is-a-snapshot uuid (RO)	am
s=uuid,is-a-snapshot uuid (RO) : ab58c2df-8e5b-4e2f-90f2-c47388dabb9b	
uuid (RO) : ab58c2df-8e5b-4e2f-90f2-c47388dabb9b	
is-a-snapshot (RU): false	
$1 + \frac{1}{2} = \frac{1}{2} + $	
is-a-snapshot (RU): false	
unid (BD) : 251d91d6-5073-4f80-af57-26c9c7502dde	
$i_{2-3-construct}$ ($R(1)$: false	
is-a-shapshot (ho). Taise	
uuid (RD) : dd620e83-09cf-4549-b9a7-e633cd5c01d1	
is-a-snanshot (BO): false	
uula (RU) : 7aa4e227-83b4-48fc-9934-432979cf2c38	
is-a-snapshot (RO): false	

2. In the NetApp System Manager, click on LUNs->Manage.

📊 NetApp System Manager					_	
<u>File Action View H</u> elp						
🗢 🔿 🖄 🖬 🔽 🖬						
NetApp System Manager ⊡ ISV3140.magic.local ⊟ E Storage Q Volumes	LUN Management Initiator Groups Create Edit X Delete Status Image Status	napshot 🛛 🕄 Refresh				
🕀 🔛 Shared Folders	Name	Container Path	Status S		lype	
Ouetre	31210384_2ecd_4638_0363_01f070390710_shap00	/voi/storageLink_Gateway_14dod/cb	Online 4.	00 GB	Linux	
Cuotas	63240479_744f_4655_81f4_9f0d553880da		Offline 7		Unux	
Disks	vol0	/vol/UCS_FC0E_2	Online 7.		Xen	
Aggregates	a0a9a9b9.da34.4445.ad0b.9b1440c7bd3a	/vol/VerStorage_79ba35b0_1aff_4867_90b3_19d7ec223f05_EV/0	Online Ju	00 GB	Zien	
🕀 🔧 Configuration	f61bf6/d,190/./c0b.b./68.3822/90c576f	/vol/XenStorage_78ba35b0_1alf_4867_90b3_19d7ec223r05_EV/0	Online 51	12.00 MB		
	292b393c463c-42d0-a306db5a881de616	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV2	Online 10	0.00 GB		
	ab58c2df-8e5b-4e2f-90f2-c47388dabb9b	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_EV4	Online 4	00 GB		
	dd620e83-09cf-4549-b9a7-e633cd5c01d1	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_EV4	Online 51	12.00 MB		
	7da4e227-83b4-48fc-9934-432979cf2c38	/vol/XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV4	Online 51	12.00 MB		
	251d91d6-5073-4f80-af57-26c9c7502dde	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV4	Online 4.	00 GB		
	6a061e38-e8d2-4cec-b6b8-96ee910e1659	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV5	Online 51	12.00 MB		
	5e691437-9b4e-4b40-b7da-cb140d91b7d9	/vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV5	Online 4.	00 GB		Ţ
	LUN properties Name: ab58c2df-8e5b-4e2f-90f2-c4738E Status: Initiators Status: Online Group : Steil nu Type: Mount p Container path: /vol/XenStorage_78ba35b0_1aff_4867_900 Description: SRC(2011-1-20:16:26:10	: iqn.2010-12.com.example:6263a3cc LUN ID: (XenStorage-iqn.2010-12.com.example:6263a3c umber: W9n8cZaZrBSX oint: b3_19d7ec223f05_FV4				
			J			

In the above example, /vol/XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV4 is the LUN that represents the VDI with UUID ab58c2df-8e5b-4e2f-90f2-c47388dabb9b.



On the NetApp active-active controller configuration, the LUNs can also be displayed via ONTAP CLI command.

lun show

ISV3140>	lun show														
	/vol/XenStorage	78ba35b0	_1aff_48	67_90b3_	19d7ec223f05	_FV0/e	0e9e8b9-0	da34-4d4	5-ad0b-	9b1440c7bd3e	4g	(4294967296)	(r/w,	online,	mapped)
	/vol/XenStorage	78ba35b0	1aff 48	67 90b3	19d7ec223f05	FV0/f	61bf64d-1	1904-4c0	b-b468-	3822490c576f	512m	(536870912)	(r/w,	online,	mapped)
	/vol/XenStorage	78ba35b0	laff 48	67 90b3	19d7ec223f05	FV2/2	92b393c-1	E63c-42d	0-a306-	db5a881de616	10g	(10737418240)	(r/w,	online)	
	/vol/XenStorage	78ba35b0	1aff 48	67 90b3	19d7ec223f05	FV4/2	51d91d6-5	5073-4f8	0-af57-	26c9c7502dde	4g	(4294967296)	(r/w,	online)	
	/vol/XenStorage	78ba35b0	laff 48	67 90b3	19d7ec223f05	FV4/7	da4e227-8	33b4-48f	c-9934-	432979cf2c38	512m	(536870912)	(r/w,	online)	
	/vol/XenStorage	78ba35b0	1aff 48	67 90b3	19d7ec223f05	FV4/a	b58c2df-8	Be5b-4e2:	f-90f2-	c47388dabb9b	4g	(4294967296)	(r/w,	online,	mapped)
	/vol/XenStorage	78ba35b0	laff 48	67 90b3	19d7ec223f05	FV4/d	d620e83-()9cf-454	9-b9a7-	e633cd5c01d1	512m	(536870912)	(r/w,	online,	mapped)
	/vol/XenStorage	78ba35b0	1aff 48	67 90b3	19d7ec223f05	FV5/5	e691437-9	9b4e-4b4	0-b7da-	cb140d91b7d9	4g	(4294967296)	(r/w,	online,	mapped)
	/vol/XenStorage	78ba35b0	1aff 48	67 90b3	19d7ec223f05	FV5/6	a061e38-e	e8d2-4ce	c-b6b8-	96ee910e1659	512m	(536870912)	(r/w,	online,	mapped)

Configuration Shared NAS using NFS

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

To use the NetApp active-active controller configuration as a shared NAS storage option using NFS, it is recommended that a separate volume be created for VDI storage. To do so:

- 1. Open the NetApp System Manager and discover the NetApp Filer.
- 2. Click on Volumes, and then Create to open the Volume Wizard.
- 3. Click *Next* and select the volume type as *Flexible*.
- 4. It is recommended to give a name that the NetApp storage server's automatic support system can identify as specific to XenServer storage, for example, a name such as "XenServer_NFS_Storage" would be appropriate.
- 5. Select NAS for Storage type and choose the appropriate aggregate.
- 6. Set the size required for the NFS SR. If snapshots are not required, you can set 0% snapshot reserve to save space

File Action View Help
Image: Storage Create Volume Image: Storage: Storage Image: Storage <



7. Under the Space settings tab, for storage saving, you can select "None" for Space Guarantee



8. Click *Create* to create the FlexVol.

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📊 NetApp System Manager							_ D ×
File Action View Help							
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NetApp System Manager	📑 Create 🛛 🔡 Edit	🗙 Delete 🏾 😋 Refresh 🖯 Status	🕶 💽 Snapshot 👻	🖓 Resize 🛛 🐎 D	eduplication 👻		
ISV3140.magic.local Storage Yolumes	Name	· · ·	Aggregate	Status	Available space	Used %	Total space
🕀 🔛 Shared Folders	UCS_NFS_2		XS1	online	8 GB	0	8 GB
👰 LUNs	UCSTemp1		XS1	online	1.8 GB	98	100 GB
Quotas	vol0			online	367.99 GB	1	371.86 GB
Disks	XenServer_NFS_St	orage	XS1	online	1023.89 MB	0	1 GB
Aggregates	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
🕀 🔍 Configuration	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
🕀 🚾 Diagnostics	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	XenStorage_78ba3	5b0_1aff_4867_90b3_19d7ec223f05_F	. XS1	online	873.6 GB	65	2.41 TB
	Name:	XenServer_NFS_Storage	Guarantee:	none			
	Status:	😔 online	Maximum files:	31,122			
	Type:	Flexible	Current files:	96			
	Root:	No	Character encoding	: en (English)			
	Clone parent:	NA	Create unicode:	Yes			
	Clone children:	NA	Convert unicode:	Yes			
	Deduplication:	Disabled					
	Details Space	Snapshot Copies Deduplication					
, , , , , , , , , , , , , , , , , , ,							

9. To create an NFS export on the above volume, select *Shared Folder->Shares/Exports*. Click on *Create*.



10. Click browse to choose from a list of Shares/Exports.

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NetApp System Manager					_ [] ×
File Action View Help					
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NetApp System Manager	Create 🕅	Edit 🦳 Browse 🔘 Stop Sharing 🛛 🖏 Refi	esh		
ISV3140.magic.local Storage	Chara anna	Channel anth	Description	Masterio	Cashing
Volumes		Shared pain	Remote Administration	Maximum users	Caching
🖃 📓 Shared Folders	ETCs Cre	ate Share and Export Wizard		×	
Shares/Exports	HOME	Shared Folder Leastian			
Sessions		Specify the folder you want to share			1
Quotas				NetApp	
Qtrees					
Disks		System name: ISV3140.magic.local			
Aggregates					
E Se Local Users and Groups		Folder to share:		Browse	
🗉 🍯 Network					
Protocols Sequrity	Create				
E System Tools	Export par			E E	
E Diagnostics	/vol/NES			ľ	
CIFS	/vol/SPOF				
	/vol/UCS_				
	/vol/UCS_				
	/vol/UCS1				
	/vol/vol0		< Back Next >	Cancel	
	/vol/vol0/				
	/vol/XenServer	_NFS_Storage /vol/Xe	enServer_NFS_Storage		
<u> </u>					

11. Select the "XenServer_NFS_Storage" export created in step8 and click ok and click Next.

NetApp System Manager				
File Action View Help				
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File Action View Help Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage Image: Storage I	Image: Start start Image: Start start Share name A Share name A Share name A Share name A Share name A Share name A Share name A Share name // Cs // ETCS Browse For Folder HOME Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder you want to share Image: Select the folder SPORE_ISCSI_1 Image: Select the folder StorageIntk_Gateway_f Image: Select the folder UCS_NFS_1 Image: Select the folder Vol CS_NFS_2 Image: Select the folder Yeol Yeo<	Refresh Description Remote Administration 4d5d7cb aff 4867 90b3 19d7ec223f05 EV0	Maximum users	Caching
	/vol/U Make new folder	OK Car		
	/vol/vol0	/vol/vol0	0	
		/vol/volu/home		
	/vol/XenServer_NFS_Storage	/vol/XenServer_NFS_Storage		
1]			

12. Select the NFS check box and give it a new export name, in this case "/vol/XenServer_NFS_Storage1" and click Next.

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rie Action view neip	
🔽 NetApp System Manager	
Im ISV3140.magic.loca	
Storage Solar Cleate Share and Export wizard Solar Cleate Share and Export wizard Solar Cleate Share and Export wizard Solar Cleate Share and Export wizard	
Shared Folders CS Share Protocols	
Shares/Exports LCS Select each protocol over which users will access this shared folder.	
Sessions HUM	
© Otress	
Disks Share name: XenServer_NFS_Storage	
Aggregates Share path: \\ISV3140.magic.local\XenServer_NFS_Storage	
Comparation	
Eleased of 1/23/2011	
F Protocols	
Security INFS	
Experimental system loois Experimental Exper	
/vol/ Mount path: ISV3140.magic.local:/vol/XenServer_NFS_Storage1	
/vol/	
/vol/	
<pre>//voi/ cal/</pre>	
Vol volo	
/ vol/Xen/Server NES_Storage	

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13. For the XenServer host to be able to create SRs on the exported NFS target, the host's IPAddress or subnet mask needs to be granted *Root Access*. Select the appropriate root access and click Next to finalize the export creation..

For the *Root Hosts* page, click *Add*.... If all hosts on a particular subnet should be given access to the NFS storage repository, then enter the subnet. Else, enter the individual host names (or IP addresses) separated by a comma.

NetApp System Manager			
File Action View Help			
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File Action View Help Image: Strate Image: Strate Image: Strate Volumes	Create Create Case Content of the second se		I ers Caching
		/vol/volU	0
	Aval /Von Soniar NES, Starpag	/vol/Vol0/home	
	/voi/xenserver_NFS_storage	7Voi/Aenserver_NFS_storage	
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NetApp System Manager					
File Action View Help					
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Image: Configuration Image: Configuration <	Create Create Charteners Content of Content	Refresh Arright Provide the second	NetApp ancel	ers nonymous user ID	Caching
	<u>]</u> [





14. In XenCenter, connect to the XenServer host, and choose New Storage. Select NFS.





15. Give the NFS share a name, and set the path to the NFS export point from the device and click Finish.

XenCenter				_ O ×
<u>File View Pool S</u> erver	V <u>M</u> St <u>o</u> rage <u>T</u> emplates Too	o <u>ls W</u> indow <u>H</u> elp		
Back • 🕞 Forward •	Add New Server 🛄 New	Pool New Storage 🕈 Resource Pool	🗏 New VM 🗆 🧥 Shut Down 🙉 Reboot 🎧 Suspend	No System Alerts
Show: Server View				ınt
XenCenter Resource Pool	Enter a name and	l path for the new NFS	storage	2
= 🔽 r-310-1				
Demo Linux VM ((Туре	Select a name for y	our new SR and provide the name of the share where it is located, optionally specifyii	ng advanced
Local storage	Location	options. Indicate w	nether you wish to create a new SR or reattach an existing SR before proceeding.	-
Removable stora	a	Name:	NFS virtual disk storage	
Demo Linux VM (c	Share Name:	10.204.151.14:/vol/XenServer_NFS_Storage	<u>S</u> can
Demo Linux VM (Example: server:/path	
DVD drives		Advanced Options:		
Removable stora	a			
Demo Linux VM (2)		<u>C</u> reate a new SF	L	
NetApp Virtual disk s	3	C Reattach an exis	sting SR:	
StorageLink Gatewa	1			
Haikel-Xen Storagel ink (10,204,13)	2			
	CITRIX.			
			< Previous Einish	Cancel
<u></u>				

By default, the VDI that is created in the NFS SR is thin-provisioned.



Creating a Fully Provisioned VDI in the NFS SR

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

1. In XenCenter, click on the newly created NFS SR in the Resources pane, and click the Storage tab.



2. Click on *Add Disk*... button, and enter details for the size of VDI you want. Make sure the newly created NFS SR is highlighted, and click *Add*.

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🗴 Add Virtual Disk				
Enter a name VM the disk b	, description and size for your virtual disk. The size of your disk and the home server set elongs to will affect which storage locations are available.	ting of any		
<u>N</u> ame:	New virtual disk (2)			
Description:	Thin Provisioned virtual disk			
<u>S</u> ize:				
<u>L</u> ocation:	EQ 4006.4 GB free of 4817.9 GB Local storage on r-310-1 141 GB free of 141 GB Local storage on R-310-2 549.7 GB free of 549.7 GB NetApp Virtual disk storage 876 GB free of 2472.8 GB NFS virtual disk storage 1023.8 MB free of 1 GB StorageLink Gateway 876.1 GB free of 876.1 GB			
	<u>A</u> dd	Cancel		

3. From a XenServer console, find the mount point for the newly created NFS SR using the *mount* command.

```
[root@r-310-1 ~]# mount
/dev/sda1 on / type ext3 (rw)
none on /proc type proc (rw)
none on /sys type sysfs (rw)
none on /dev/pts type devpts (rw)
none on /dev/shm type tmpfs (rw)
/opt/xensource/packages/iso/XenCenter.iso on /var/xen/xc-install type iso9660
(ro,loop=/dev/loop0)
none on /proc/sys/fs/binfmt_misc type binfmt_misc (rw)
sunrpc on /var/lib/nfs/rpc_pipefs type rpc_pipefs (rw)
10.204.151.15:/vol/XenServer_NFS_Storage/e5f7e999-f067-25b4-aa93-23025aad13bb on /var/run/sr-
mount/e5f7e999-f067-25b4-aa93-23025aad13bb type nfs
(rw,soft,timeo=133,retrans=2147483647,tcp,noac,addr=10.204.151.15)
```

In the example above, /var/run/sr-mount/e5f7e999-f067-25b4-aa93-23025aad13bb is the mount point.

4. Change directory to the mount point, and run the *vhd-util* command to write zeroes into the .vhd file that represents the newly created VDI that needs to be fully provisioned

[root@r-310-1 ~]# vhd-util

```
usage: vhd-util COMMAND [OPTIONS]
COMMAND := { create | snapshot | query | read | set | repair | resize | fill | coalesce | modify | scan | check |
revert }
```

In the example VDI above, the command is

[root@r-310-1 e5f7e999-f067-25b4-aa93-23025aad13bb]# vhd-util fill -n e5f7e999-f067-25b4-aa93-23025aad13bb.vhd You can now attach the VDI to a virtual machine as a fully provisioned virtual disk.



Configuring iSCSI Storage

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

To set up the NetApp active-active controller configuration for an iSCSI SR from XenServer, NetApp System Manager will be used. The first step is to create an Initiator Group and then assign the XenServer IQN initiators to that group.

1. Select LUNs under the Storage option, click on the Initiator Groups tab and click Add.

LUN Management	Initiator Groups
Initiator Groups:	
🗟 Add 📝 Edit	🗙 Delete

2. Give a name that uniquely identifies the igroup to be used by XenServer hosts in the data center. Select the initiator group type as *iSCSI*, the operating system as *Xen* and click Add.

Add Initiator Group				
Group Name:	XenServer_iSCSI_SR_TestDC			
Group Type:	iscsi 🔽			
Operating System:	Xen 🔽			
ALUA (Asymmetric Logical Unit Access) features enabled				
	Add Cancel			

3. Click Add on the screen below to assign the XenServer initiators to the newly created Initiator Group.



4. The Add Initiator ID box will appear. Select iSCSI for the Group Type, the Initiator Group that was created in step 2 for Group Name and the IQN initiator from XenServer in Initiator Name. Click Add.

Add Initiator ID			
Group Type:	iscsi		
Group Name:	XenServer_iSCSI_SR_TestDC		
Initiator Name:	iqn.2010-10.com.example:f8e18696		
	Add Cancel		



The IQN of a XenServer host can be seen from the *General* tab for the host in XenCenter (in the screen shot below, the IQN for XenServerTest host is "iqn.2008-01.com.example:44b80d2a"). To change the IQN to a more recognizable name, click on the *Properties* button at the top right of the *General* tab, and modify the *iSCSI IQN* field (see the screen shot below where IQN is changed to iqn.2008-01.com.example:testdc).

'R-3	10-2' Properties		? ×
-	General R-310-2	🖪 General	
	Custom Fields <none></none>	XenCenter provides and tags you can qu	several methods for labelling and organizing your resources. By using features such as folders ickly group and manage resources across your connected servers.
	Alerts None defined Multipathing	Na <u>m</u> e:	R-310-2
0	Active Power On	Description:	Default install of XenServer
	Log Destination	Folder: Tags:	<pre></pre> Change
			<mark>⊡</mark> ∞ <u>Edit taqs</u>
		iSCSI IQN:	iqn.2008-01.com.example:testdc
			Example: iqn.2007-11.com.example.my:optional-string
			OK Cancel

5. Repeat Step 4 for all of the XenServer hosts in the pool.

After the Initiator Group has been created and all of the initiator IQNs added, the LUN can be created using the Create LUN Wizard. The wizard gives the ability to use previously created volumes or create both the volume and LUN in a single wizard. In the example below System Manager will create both the LUN and Volume.

Note: SAN Volumes have a 0% Snap Reserve. For further information please refer to the Data ONTAP Block Access Management Guide for iSCSI and FC.

6. Select LUNs under the Storage option, click on the LUN Management tab and click on Create.

LUN Manag	Initiator Groups	
🙀 Create	📝 Edi	it 🗙 Delete (

7. Under General Properties, add the name of the LUN, which in this example will also be the name of the Volume, the description of the LUN, the size and select Xen as the type. Click Next to continue.

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Create LUN Wizard 🛛 🛛 🔀					
General You ca LUN th	General Properties You can specify the name, the size, the type and an optional description properties for the LUN that you would like to create.				
The maximum space available for your LUN creation is 347.90 GB in the containing aggregate 'aggr1' on storage system 'KC3140-1.rtp.netapp.com'. Make sure that your LUN size is smaller than the maximum space available. You can enter a valid name for the LUN, and an optional short description.					
	Name:	XenServer_iSCSI_Storage			
	Description:	XenServer iSCSI SR	(optional)		
	You can spec Size: Type: <u>What is the Li</u>	ify the size of the LUN. Storage will be optimized according to the I 80 GB V Xen V JN size and type?	type selected.		
		< <u>B</u> ack <u>N</u> ext >	Cancel		

8. Under LUN Container, choose Automatically create a new volume.

Create LUN Wizard	×
LUN Container You can let the wizard create a volume on an aggregate with the most available space, or you can choose an existing aggregate as the container.	NetApp
 Automatically create a new volume. Create a new flexible volume XenServer_iSCSI_Storage in the following aggregate: KC3140-1.rtp.netapp.com:/aggr1 What is a LUN container? Choose an existing container for this LUN. Select an existing aggregate, volume or qtree for the LUN. 	
<pre></pre>	ancel



9. Under Initiator Mapping, select the Initiator Group that was created in step 2 and click on the right arrow to add the Initiator Group to Hosts to connect.

Create LUN Wizard		×
Initiator Mapping You can connect your LUN to the initia left and moving them to the hosts list or	ator hosts by selecting from the known hosts list on the n the right.	NetApp
Known initiator hosts:	Hosts to connect:	
xen	XenServer_iSCSI_SR_TestDC	
Add Initiator Host		
	<pre>Back Next > C</pre>	ancel

- 10. Review the selections and click Next to create the Volume and LUN.
- 11. Click on Finish to close the Create LUN Wizard.



Creating an iSCSI SR Using the iSCSI Software Initiator

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

1. To create the storage repository, in XenCenter, choose New Storage. Select iSCSI.

🗴 New Storage Repository -	Resource Pool	
Choose the type	of new storage	0
Type Location	Virtual disk storage NFS VHD Software ISCSI Hardware HBA Advanced StorageLink technology ISO library Windows File Sharing (CIFS) NFS ISO	Shared Logical Volume Manager (LVM) support is available using either ISCSI or Fibre Channel access to a shared LUN. Using the LVM-based shared SR provides the same performance benefits as unshared LVM for local disk storage, however in the shared context, ISCSI or Fibre Channel-based SRs enable VM anglity — VMs may be started on any server in a pool and migrated between them.
		< Previous Next > Enish Cancel

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2. Enter the *Target Host* as the hostname or IP address of the NetApp active-active controller configuration in which the LUN was set up in steps 1-9. If *CHAP Authentication* was set up for iSCSI security on the device, then enter the *CHAP User* and *CHAP Secret*. It is recommended to have the same CHAP username/password for initiators in the same igroup (as is the case with a pool of XenServer hosts connecting to the same igroup). Most of the time, customers typically do not enable security for iSCSI unless there is a security requirement. If you are required to enable security for the iSCSI connection, then we recommend that you utilize the CHAP option. Click on *Discover IQNs* to get the list of *Target IQNs* on the NetApp active-active controller configuration. Select the relevant *Target IQN* and click on *Discover LUNs* to get a list of LUNs associated with the mapped igroup and LUNs in it. From the initial steps, the LUN that was created should show up in this list. Select the LUN, and click *Finish*.

New Storage Repository - Re	source Pool		×
Enter a name and pa	ath for the new iS	CSI storage)
Type Location	Select a name and before proceeding	provide a target host for your new ISCSI storage, indicating your target IQN and your target LUN .	
	Na <u>m</u> e: Target <u>H</u> ost:	SCSI virtual disk storage 10.204.151.15 1 3260	
	Use CHAP		
	Target <u>I</u> QN: Target <u>L</u> UN:	iqn. 1992-08.com.netapp:sn. 151699572 (10.204. 151. 16:3260)	
citrix.			
		< Previous Einish Cancel	

3. The new LUN will be overlaid with LVM, and XenCenter will ask the LUN to be formatted as such. Click *Yes* on the pop-up for the LUN to be formatted with LVM.





Creating an iSCSI SR Using an iSCSI HBA

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

For using an iSCSI HBA to create the iSCSI SR, the CLI from the control domain needs to be used. Depending on what HBA is being used; the initiator IQN for the HBA needs to be configured. Given the type of HBA used, the documentation for that HBA should be consulted to configure the IQN.

Once the IQN has been configured for the HBA, use the NetApp FilerView to create a new LUN as in steps 1-9 at the beginning of this section that covers LUN creation. However, instead of using the XenServer's IQN, specify the IQN of the various ports of the HBA. Do this for every XenServer host in the pool.

Two HBA CLI's are included in the XenServer host to configure the HBA:

Emulex: /usr/sbin/hbaanyware

QLogic iSCSI: /opt/QLogic_Corporation/SANsurferiCLI/iscli

For the purposes of an example, this guide illustrates how the QLogic iSCSI HBA CLI iseli can be used.

1. Get the IQN of the ports of the iSCSI HBA from the output of *iseli* command.

```
root@Haikel-Xen:/opt/QLogic_Corporation/SANsurferiCLI
                                                                               _ 🗆 🗵
Current HBA/Port Information: HBA Alias:
HBA: 0 Port: 0 HBA Port Index: 1 HBA Model: QLA4052C
IP Address: 192.168.0.200 Link: Up
Port iSCSI Name: iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.1
Port iSCSI Alias:
1. Display Program Version Information
 2. Host Level Info & Operations
3. HBA Level Info & Operations
4. Port Level Info & Operations
 5. List All QLogic iSCSI HBA Ports detected
 6. Help
 7. Select HBA Port
 8. Refresh
9. Exit
enter selection: 5
1. HBA: 0 Port: 0 HBA Port Index: 1 HBA Model: QLA4052C
    HBA Serial Number: (GS10649A26116) FW Version: 2.0.0.45 Type: Copper
    IP Address: 192.168.0.200
    Alias:
    iSCSI Name: iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.1
 2. HBA: 0 Port: 1 HBA Port Index: 2 HBA Model: QLA4052C
    HBA Serial Number: (GS10649A26116) FW Version: 2.0.0.45 Type: Copper
    IP Address: 192.168.0.201
    Alias:
    iSCSI Name: iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.2
Press the Enter key to continue.
```

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Refresh
 Exit

enter selection: 2

IP_Address [10.204.151.65] : IP_Subnet_Mask [255.255.255.0] : IP_Gateway [10.204.151.1] : Port Network Settings Menu

DHCP to obtain TCP Information: [off] :

2. Set the IP address for the HBA. In the control domain, use the *iseli* CLI to do so. Choose option 4, then option 2 to enter *Port Network Settings Menu*. Enter option 4 to *Select HBA Port* and then option 2 to *Configure IP Settings*.

root@Haikel-Xen:/opt/QLogic_Corporation/SANsurferiCLI main Interactive Menu Program Version: 1.2.00.29 Driver Version: 5.02.03.00.05.07-c2 IC: 2 FW Version: 2.0.0.45 Type: Copper Current HBA/Port Information: HBA Alias: HBA: 0 Port: 0 HBA Port Index: 1 HBA Model: QLA4052C IP Address: 192.168.0.200 Link: Up Port iSCSI Name: iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.1 Port iSCSI Alias: 1. Display Program Version Information 2. Host Level Info & Operations 3. HBA Level Info & Operations 4. Port Level Info & Operations 5. List All QLogic iSCSI HBA Ports detected 6. Help 7. Select HBA Port 8. Refresh 9. Exit enter selection: 4 root@Haikel-Xen:/opt/QLogic_Corporation/SANsurferiCLI iSNS Port Number * iSNS Server Conn Status : closed Press the Enter key to continue. Port Network Settings Menu Program Version: 1.2.00.29 Driver Version: 5.02.03.00.05.07-c2 IC: 2 FW Version: 2.0.0.45 Type: Copper Current HBA/Port Information: HBA Alias: HBA: 0 Port: 0 HBA Port Index: 1 HBA Model: QLA4052C IP Address: 10.204.151.65 Link: Up Port iSCSI Name: iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.1 Port iSCSI Alias: 1. Display Network Settings 2. Configure IP Settings 3. iSNS Settings 4. Select HBA Port 5. Save changes and reset HBA (if necessary)



- 3. Create an Initiator Group and then assign the IQNs of the HBA to that group.
- 4. From the NetApp System Manager, select LUNs under the Storage option, click on the Initiator Groups tab and click on Add.

LUN Management	Initiator Groups	
Initiator Groups:		
🙀 Add 🛛 📝 Edit	🗙 Delete	

5. Give a name that uniquely identifies the Group to be used by XenServer hosts in the data center. Select the initiator group type as *iSCSI*, the operating system as *Linux* and click Add.

oup Type:	iscsi 👻
perating System:	Linux 🐱

6. Click Add on the screen below to assign the iSCSI HBA IQN to the newly created Initiator Group.

Initiator IDs:				
🙀 Add 🛛 📄 Edit	🗙 Delete			

7. The Add Initiator ID box will appear. Select iSCSI for the Group Type, the Initiator Group that was created in step 5 for Group Name and the IQN from iSCSI in Initiator Name. Click Add.

Add Initiator ID		×
Group Type:	iSCSI	
Group Name:	XenServer_iSCSI-HBA_SR_TestDC	
Initiator Name:	iqn.2000-04.com.qlogic:qla4052c.gs10649a26116.1	
	<u>A</u> dd <u>C</u> ancel	


8. After the Initiator Group has been created and all of the IQNs added, the LUN can be created using the Create LUN Wizard. The wizard gives the ability to use previously created volumes or create both the volume and LUN in a single wizard. In the example below System Manager will create both the LUN and Volume.

Note: SAN Volumes have a 0% Snap Reserve. For further information please refer to the Data ONTAP Block Access Management Guide for iSCSI and FC.

9. Select LUNs under the Storage option, click on the LUN Management tab and click on Create.

LUN Management		Initiator Group	s
🙀 Create	📝 Edi	it 🗙 Delete	(

10. Under General Properties, add the name of the LUN, which in this example will also be the name of the Volume, the description of the LUN, the size and select Linux as the type. Click Next to continue

Gene	ral Propertie	S	
You LUN	can specify the n I that you would li	ame, the size, the type and an optional description properties for the ke to create.	NetAp
The stor Mał	maximum space age system 'fas31 ke sure that your L	available for your LUN creation is 2.14 TB in the containing aggregate ' 70-10'. .UN size is smaller than the maximum space available.	'aggr1' on
6	You can ente	er a valid name for the LUN, and an optional short description.	
	Name:		
	Description:	XenServer iSCSI-HBA SR (c	optional)
	You can spe Size: Type:	cify the size of the LUN. Storage will be optimized according to the type 80 GB V Linux	e selected.



11. Under LUN Container, choose Automatically create a new volume.

Create LUN Wizard	×	
LUN Container You can let the wizard create a volume on an aggregate with the most available space, or you can choose an existing aggregate as the container.	NetApp ⁻	
 Automatically create a new volume. Create a new flexible volume XenServer_iSCSI_HBA_SR_TestDC in the following aggregate: ISV3140.magic.local:/Xen 		
What is a LUN container?		
C Choose an existing container for this LUN.		
Select an existing aggregate, volume or qtree for the LUN.		
< <u>B</u> ack Ca	incel	

12. Under Initiator Mapping, select the Initiator Group that was created in step 2 and click on the right arrow to add the Initiator Group to Hosts to connect.

Create LUN Wizard		×
You can connect your LUN to the initiator left and moving them to the hosts list on the	hosts by selecting from the known hosts list on the e right.	NetApp
Known initiator hosts: x3500 x3400 UCS_B250_M2-1 HS12 HS22 HX5	Hosts to connect: XenServer_iSCSI-HBA_SR_TestDC <	
Add Initiator <u>H</u> ost What are initiator hosts?		
	< Back Next > C	ancel

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- 13. Review the selections and click Next to create the Volume and LUN.
- 14. Click on Finish to close the Create LUN Wizard.
- 15. The newly created LUN now needs to be zoned in to the XenServer host and will appear as a SCSI device. The command to force a scan of HBAs installed on the system and detect the new LUN zoned to the host. It will return the list of properties for each LUN found. One of these properties will be *<path>* which is the global device path of the HBA LUN. Specify the host-uuid of the system from where the *xe sr-probe* command is run.

```
xe sr-probe type=lvmohba host-uuid=<UUID of host>
```

16. Now add a persistent target to the HBA. The target iSCSI IQN can be retrieved from the NetApp FilerView by clicking *Configuration->Protocols->iSCSI->Service*.

/opt/QLogic_Corporation/SANsurferiCLI/iscli -pa 0 <iSCSI_target_iP_address>



Note that the above command was run for 2 ports of the iSCSI HBA, each port connecting to a different subnet (as indicated in the multipathing configuration at the beginning of the XenServer Storage Configuration section). This command will assign the port the specified iSCSI IP address and specific target IQN.

17. Use the *xe sr-probe* command to force a scan of iSCSI HBAs installed on the system and detect the new LUN zoned to the host. It will return the list of properties for each LUN found. One of these properties will be *<path>* which is the global device path of the HBA LUN. Specify the host-uuid of the system from where the *xe sr-probe* command is run.

xe sr-probe type=lvmohba host-uuid=<UUID of host>



To validate that the device path is for the newly created LUN on the device, match the serial number from the *<serial>* field of the *xe sr-probe* output with the serial number of the LUN in FilerView. Note that there are 2 paths to the LUN indicating that multipathing is active.

To determine the LUN serial number from the NetApp FilerView, click *LUNs->Manage* and click on the newly created LUN. Then note the *Serial Number* field.

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NetApp System Manager					<u>_ 0 ×</u>
Eile Action View Help					
🗢 🔿 🔰 🖬 🔽 🖬					
Image: Image	LUN Management Initiator Create E Edit X I Name Isosi-HBA1 v1 vol0 vol0 Vol0 LUN properties Name: isosi-H Status: O C Size: 10.000 Type: Xen Container path: /vol/iso	r Groups Delete Container Path Vrol/iscsi_HBA1 /vol/UCS1 /vol/SPORE_ISCSI_1 /vol/SPORE_ISCSI_2 BA1 Initiat BA1 Initiat GB Seria Moun csi_HBA1	e Snapshot Status Online Online Online Online Online Online	ssh Size 10.00 GB 498.02 GB 298.03 GB 298.03 GB 298.03 GB 298.03 GB	Type Xen Xen Xen Zen Zc.gs1064(

- 18. Repeat the above steps for all hosts in the pool.
- 19. To create the iSCSI SR over HBA on this LUN, in XenCenter click *New Storage* and select *Hardware HBA* option. Click *Next*.

New Storage Repository - H	aikel-Xen	
Choose the type o	f new storage	0
Type Location	Virtual disk storage NFS VHD Software IgCSI Hardware HBA Advanced StorageLink technology ISO library Windows File Sharing (CIFS) NFS ISO	XenServer hosts support Fibre Channel (FC), Fibre Channel over Ethernet (FCoE) and shared Serial Attached SCSI (SAS) storage area networks (SANs) using host bus adapters (HBAs). All configuration required to expose a LUN to the host must be completed manually, including storage devices, network devices, and the HBA within the XenServer host. Once all configuration is complete the HBA will expose a SCSI device backed by the LUN to the host. The SCSI device can then be used to access the LUN as if it were a locally attached SCSI device.
		<pre></pre>

There is short delay while XenServer probes for available LUNs.



20. Select the appropriate LUN. Give the SR an appropriate Name and click Finish.

🗴 New Storage Repository - Ha	New Storage Repository - Haikel-Xen		
Select the LUN to re	eattach or create a new SR on	0	
Type Location	Provide a name for your new SR and select the LUN you would like to reattach or create the SR on.		
	Name: SCSI HBA SR on NetApp		
	Dell 147.1 GB 3600508e0000000041ada12c39aa7a0d 0:1:0:0 NETAPP 10 GB W9n8c2b49r45 360a9800057396e38635a623439723435 3:0:64:0		
CITRIX [.]			
	< Previous Einish Einish	Cancel	

21. A warning is displayed that the LUN will be formatted and any data present will be destroyed. Click *Yes* to format the disk.



Note that multipathing is active by clicking on the newly created SR in the Resources pane, and then the General tab.

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XenCenter				
<u>File View Pool S</u> erver V <u>M</u> S	t <u>o</u> rage <u>T</u> emplates Too <u>l</u> s	<u>W</u> indow <u>H</u> elp		
🕒 Back 👻 💽 Forward 👻 l 📴 Add	l New Server 🏪 New Pool	🛅 New Storage 🛅 New VM 🕴 🕘 Shut Down 🛞 Reboot 🕕	Suspend 🗸 N	lo System Alerts
Show: Server View 🔎 🔹	iscsI HBA SR on Net	Арр	Logged in as: Log	cal root account
🖂 😣 XenCenter	General Storage Logs			
Resource Pool Haikel-Xen RHEL 5 (64-bit) (Dev)	Storage General Prope	rties		
🔀 W2K3 (1) 🕞 WinServe2K3 (64-bit) (Licens	Properties		Expand all	Collapse all
CIFS ISO library	General			
iSCSI HBA SR on NetApp	Name:	iSCSI HBA SR on NetApp		
Local storage	Description:	Hardware HBA SR. [NETAPP - /dev/sdb [sdc]]		
Removable storage	Tags:	<none></none>		
	Folder:	<none></none>		
	Type:	Hardware HBA		
	Size:	4 MB used of 10 GB total (0 B allocated)		
	SCSI ID:	360a9800057396e38635a623439723435		
	UUID:	a458877b-ba48-e93f-55a3-67d8ccf6ea6d		
	Status			
	State:	ОК		
	Haikel-Xen:	Connected		
	Multipathing			
	Haikel-Xen:	2 of 2 paths active		
				.::



Configuring Fibre Channel Storage

To set up the NetApp active-active controller configuration to be used for an FCP SR from XenServer, NetApp System Manager will be used. The first step is to create an Initiator Group and then assign the XenServer World Wide Port Names (WWPNs) to that group.

1. Select LUNs under the Storage option, click on the Initiator Groups tab and click on Add.

LUN Management	Initiator Groups	
Initiator Groups:		
🙀 Add 🛛 📝 Edit	🗙 Delete	

2. Give a name that uniquely identifies the igroup to be used by XenServer hosts in the data center. Select the initiator group type as *FCP*, the operating system as *Linux* and click Add. Note: Do not use Operating system as "Xen" in FCP, see NetApp burt ID **479889**.

A	dd Initiator Gro	ир	X
	Group Name:	XenServer_FCP_SR_TestDC	
	Group Type:	FCP	
	Operating System:	Linux	
	ALUA (Asymme	tric Logical Unit Access) features enabled	
		Add Cancel	

3. Click Add on the screen below to assign the XenServer WWPNs to the newly created Initiator Group.



4. The Add Initiator ID box will appear. Select FCP for the Group Type, the Initiator Group that was created in step 2 for Group Name and the WWPN from XenServer in Initiator Name. Click Add.

Add Initiator ID		
Group Type:	FCP	
Group Name:	XenServer_FCP_SR_TestDC	
Initiator Name:	21:00:00:e0:8b:1c:20:6e	
	Add Cancel	



The WWPN for the HBAs in the XenServer hosts can be found by running a tool such as SANsurfer. Since different *FC ven*dors have *specific and d*ifferent configuration requirements, *it is recommended that the* documentation for the specific HBA be consulted for configuration settings.

This guide will assume a QLogic 2342 HBA, and as such use the /opt/QLogic_Corporation/SANsurferCLI/scli to get configuration information. Run /opt/QLogic_Corporation/SANsurferCLI/scli in the control domain, and enter 5 from the main menu. The screen shot below shows the WWPN for the ports highlighted..



5. Repeat Step 4 for all of the XenServer hosts in the pool.

After the Initiator Group has been created and all of the WWPNs added, the LUN can be created using the Create LUN Wizard. The wizard gives the ability to use previously created volumes or create both the volume and LUN in a single wizard. In the example below System Manager will create both the LUN and Volume.

Note: The snapshot reserve of the newly created Volume will be 0% and snapshots will not be scheduled. If a reserve of greater than 0% is required, right click on the Volume after its creation and select Snapshot > Configure.



6. Select LUNs under the Storage option, click on the LUN Management tab and click on Create.

LUN Management		Initiator Groups
🙀 Create	📝 Edi	t 🗙 Delete (

7. Under General Properties, add the name of the LUN, which in this example will also be the name of the Volume, the description of the LUN, the size and select Linux as the type. Click Next to continue.

Create LUN	Wizard		×
Genera You ca LUN th	I Propertie In specify the n Iat you would lil	S ame, the size, the type and an optional description properties for the ce to create.	NetApp
The master storage Make :	aximum space e system 'fas31 sure that your L You can ente	available for your LUN creation is 2.14 TB in the containing aggregate 'a 70-10'. UN size is smaller than the maximum space available. ar a valid name for the LUN, and an optional short description.	aggr1'on
<u>6</u>	Name:	XenServer_FCP_SR_TestDC	
	Description:	XenServer FCP SR (o	ptional)
	You can spec Size: Type: <u>What is the L</u>	Cify the size of the LUN. Storage will be optimized according to the type B0 GB Linux V	selected.
2		<pre></pre>	Cancel

8. Under LUN Container, choose Automatically create a new volume.

Create LUN Wizard	×
LUN Container You can let the wizard create a volume on an aggregate with the most available space, or you can choose an existing aggregate as the container.	etApp ⁻
 Automatically create a new volume. Create a new flexible volume XenServer_FCP_Storage in the following aggregate: f31.vgibu.eng.netapp.com:/aggr0 What is a LUN container? Choose an existing container for this LUN. Select an existing aggregate, volume or qtree for the LUN. 	
< Back Next > Canc	el



9. Under Initiator Mapping, select the Initiator Group that was created in step 2 and click on the right arrow to add the Initiator Group to Hosts to connect.

Create LUN Wizard		×
Initiator Mapping You can connect your LUN to the initiator h left and moving them to the hosts list on the	iosts by selecting from the known hosts list on the right.	NetApp [.]
Known initiator hosts:	Hosts to connect: XenServer_FCP_SR_TestDC <	
What are initiator hosts?		
	< Back Next >	Cancel

- 10. Review the selections and click Next to create the Volume and LUN.
- 11. Click on Finish to close the Create LUN Wizard.
- 16. The newly created LUN now needs to be zoned in to the XenServer host and will appear as a SCSI device. For this, use the *xe sr-probe* command similar to the usage as when creating an iSCSI HBA SR. The command to force a scan of HBAs installed on the system and detect the new LUN zoned to the host. It will return the list of properties for each LUN found. One of these properties will be *<path> ath>* which is the global device path of the HBA LUN. Specify the host-uuid of the system from where the *xe sr-probe* command is run.

	,			1	6	1
xe	sr-probe	type= <sr< td=""><td>type></td><td>host-uuid=<uuid< td=""><td>ΟÍ</td><td>host></td></uuid<></td></sr<>	type>	host-uuid= <uuid< td=""><td>ΟÍ</td><td>host></td></uuid<>	ΟÍ	host>

[root@TestXenServerHost ~]# xe sr-probe type=lvmohba host-uuid=0e8ff?2c-d00d-4?df-860b-0aac1d05b6?5 Error code: SR_BACKEND_FAILURE_90
Error code: SR_BACKEND_FAILURE_90
Chevices , the request is missing the device parameter, ((xml dersion==1.8 ?) (BlockBeuice) (path) /dev/disk/by-id/scsi-360a98000686f64616b4a483466363972 (vendor) WETAPP (/vendor) (serial) hodakJH4f69r (size) 5368709120 (size) (calapter) (channel) (id) 0 (/id) (un) 0 (/lun)
(hba) qla2xxx

12. To validate that the device path is for the newly created zoned in LUN on the device, match the serial number from the *<serial>* field of the *xe sr-probe* output with the serial number of the LUN in System Manager. To determine the LUN serial number from System Manager click *LUNs* and select LUN Management. Click on the newly created LUN. The serial number is available towards the bottom of the window.

📊 NetApp System Manager						_ 🗆 🗡
<u>File Action View H</u> elp						
🗢 🔿 🖄 🖬 🛛 🖬						
 NetApp System Manager ISV3140.magic.local Storage Volumes Shared Folders LUNs Quotas Qtrees Disks Aggregates Configuration Diagnostics 	LUN Management	Initiator Groups dit ★ Delete ⑦ Status ▼ A Container Path /vol/vol0 /vol/vol0	Manage Snapshot Status Online Online	Size 10.00 GB 1.00 GB	Type Xen Xen	
	LUN properties - Name: Status: Size: Type: Container path: Description:	FC_LUN Online 10.00 GB Xen /vol/vol0 Fiber Channel LUN	Initiators: Group : LUN ID: Serial number: Mount point:	21:00:00:1b:32:82:8f:75;21: (r-310-1 : 0) W9n8cZaid19a	00:00:1b:32:8	

- 17. Repeat the above steps for all hosts in the pool.
- 18. To create the FC SR over HBA on this LUN, follow the same steps used to create the iSCSI SR over HBA.

Fixing Misaligned Windows Guest Operating System

Disks use geometry to identify themselves and their characteristics to the upper layer operating system. The upper layer operating system uses the disk geometry information to calculate the size of the disk and partition the disk into predetermined addressable blocks. Just as with physical disks, logical disks (LUNs) report disk geometry to the host so that it can calculate space and partition the LUN into addressable blocks.

NetApp uses 4KB blocks (4 x 1,024 = 4,096 bytes) as its basic storage building block. Writes can consume no less than a single 4KB block and can consume many 4KB blocks depending on the size of the write operation. Files that are smaller than 4KB are actually stored in the inode that contains their metadata. When a LUN is created in Data ONTAP, a certain amount of space is carved out of the disk in the form of 4KB blocks. These are then reported to the host OS with a specified geometry, depending on the LUN type selected. The host OS then takes the presented LUN and partitions it appropriately.

The problem of misaligned LUN I/O occurs when the partitioning scheme used by the host OS does not match the block boundaries inside the LUN.

Note: This problem is not peculiar to NetApp. All SAN vendors have the potential to experience misalignment issues. Misalignment issues can be caused because the partition size of the blocks in the host OS use something other than 4KB blocks. Misalignment issues can be caused if the host OS imposes an offset that has not been compensated for. NetApp compensates for offsets by identifying the OS and then adjusting the offset. This is done during LUN creation when the user enters the LUN type.

For a deeper discussion of disk geometry, consider attending the NGS SAN Fundamentals class or reading ntapcs7976: "FCP SCSI Geometry FAQs."



Figure 9 Properly aligned and unaligned I/O.

When aligning the partitions of virtual disks for use with NetApp active-active controller configuration, the starting partition offset must be divisible by 4,096. The recommended starting offset value for Windows 2000, 2003, and XP operating systems is 32,768. Windows 2008 and Vista default at 1,048,576 and do not require any adjustments.

To verify this value, we need to run msinfo32.exe from the Windows command console. And you will typically find that the VM is running with a default starting offset value of 32,256. To run msinfor32, you select start > All Programs > Accessories > System Tools > System Information. Notice the partition starting offset is 32,256 bytes in Figure 10. This indicates disk misalignment.

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Citrix XenServer and NetApp Storage Best Practices

System Summary	Item	Value	
Hardware Resources Components Multimedia CD-ROM Sound Device Display Infrared Input Modem Network Ports Storage Drives Disks SCSI IDE Printing Problem Devices USB Software Environment Internet Settings Office 2003 Applications	Item Description Manufacturer Model Bytes/Sector Media Loaded Media Type Partitions SCSI Bus SCSI Logical Unit SCSI Port SCSI Target ID Sectors/Track Size Total Cylinders Total Sectors Total Sectors Total Sectors Total Tracks Tracks/Cylinder Partition Partition Size Partition Starting Offset	Value Disk drive (Standard disk drives) HTS541040G9AT00 512 Yes Fixed hard disk media 1 0 1,240,320 240 Disk #0, Partition #0 37.25 GB (39,999,988,224 bytes) 32,256 bytes	

Figure 10 Using system information to identify the starting partition offset.



Resolution

Virtual disks can be formatted with the correct offset at the time of creation by simply booting the VM before installing an operating system and manually setting the partition offset. For Windows guest operating systems, consider using the Windows Preinstall Environment boot CD or alternative tools such as Bart's PE CD. To set up the starting offset, follow these steps:

1.	Boot the VM with the WinPE CD.
2.	Select Start > Run and enter DISKPART
3.	Enter Select Disk0.
4.	Enter Create Partition Primary Align=32.
5.	Reboot the VM with WinPE CD.
6.	Install the operating system as normal.

Command Prompt - diskpart

 C:\>diskpart

 Microsoft DiskPart version 5.1.3565

 Copyright (C) 1999-2003 Microsoft Corporation.

 On computer: VSTEWART01-LXP

 DISKPART> select disk 0

 Disk 0 is now the selected disk.

 DISKPART> create partition primary align=32_

Figure 11 Running diskpart to set a proper starting partition offset.

Before running *diskpart.exe* for Windows guests using the NFS SR, run the v*hd-util* to fully provision the VHD VDI, as detailed in the section describing the configuration of the NFS SR.

For more information on misalignment, read Best Practice for File System Alignment in Virtual Environment.

Backup and Recovery

There are various elements for backup and recovery:

- Snapshot the virtual machines time to time,
- Backup VM metadata
- Backup the snapshots and metadata, and
- Recover data/virtual machines from snapshots and metadata when needed.

Snapshot for Virtual Machines on NetApp Data ONTAP and NFS Storage Repositories

Creating VM snapshots for those VMs whose VDIs are resident on the NetApp Data ONTAP SR utilizes the NetApp activeactive controller configuration Snapshot technology directly by invoking the Snapshot at the device level. This results in minimal resource usage on the XenServer host in terms of CPU and memory during the snapshot process.

The snapshot process for VMs using the standard NFS, iSCSI, and Hardware HBA SRs, however, do not invoke any NetApp active-active controller configuration capability. It uses the VHD capability for its VDIs to allow chaining for the original and snapshot VDI to share common data. The original VDI proceeds to make its own changes in an isolated copy-on-write version, with the snapshot VDI being Read Only.

XenServer 5 provides a convenient snapshot mechanism that can take a snapshot of a VM's storage and metadata at a given time. Where necessary, IO is temporarily halted while the snapshot is being taken to ensure that a self consistent disk image can be captured.

Snapshot operations result in a snapshot VM that is similar to a template. The VM snapshot contains all the storage information and VM configuration, including attached VIFs, allowing them to be exported and restored for backup purposes.

The snapshot operation is a 2 step process:

- Capturing metadata as a template.
- Issuing a VM snapshot.

Two types of VM snapshots are supported: regular and quiesced.



Regular Snapshots

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

Regular snapshots are crash consistent and can be performed on all VM and Storage Repository types, including Linux VMs.

1. Within XenCenter, select the VM in the left-hand pane and then the "Snapshot" tab. VMs snapshots can be created for both running and powered down VMs.



2. After clicking "Take Snapshot" and providing a name, the snapshot will appear in XenCenter





3. Snapshots can be used to restore a VM. Right click the snapshot and select "Create new VM from Snapshot." Note that the MAC address (es) will need to be manually changed to make the new VM identical to the original. Snapshots can also be used to create templates, either for creating new VMs or for backup.





Quiesced Snapshots

Quiesced snapshots are a special case that take advantage of the Windows Volume Snapshot Service (VSS) for services that support it, so that a supported application (for example Microsoft Exchange or SQLServer) can flush data to disk and prepare for the snapshot before it is taken.

Quiesced snapshots are therefore safer to restore, but can have a greater performance impact on a system while they are being taken. They may also fail under load so more than one attempt to take the snapshot may be required.

It is essential to install the Xen VSS provider in the Windows guest in order to support VSS. This is done via the *install-XenProvider.cmd* script provided with the Windows PV drivers.

1. In the Windows VM that needs to be snapshot in quiesced mode, open a command window and change directory to where the Citrix XenTools are installed (this is by default in %ProgramFiles%\Citrix\XenTools. Run the *install*-*Provider.cmd*.



2. Open a console session to the XenServer master and run the xe vm-snapshot-with-quiesce command to snapshot the VM.

xe vm-snapshot-with-quiesce vm=<vm name> new-name-label=<vm snapshot name>





3. Once a quiesced snapshot has been created, it will appear in the VM's "snapshot" tab within XenCenter.

Backing up VM Metadata Information on NetApp active-active controller configuration

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

1. Open an *xsconsole* session to the XenServer master from XenCenter (if in a shell prompt, type *xsconsole* and press <*Enter*>).



2. Scroll to the *Backup*, *Restore and Update* option and hit *Enter*. Choose the *Backup Virtual Machine Metadata* option and press <*Enter>*.



- 3. Enter the login credentials for the XenServer host if prompted.
- 4. Select the NetApp SR, and press *<Enter>*.



There will be a short delay while the VM metadata is backed up to the NetApp active-active controller configuration

5. A success dialog box shows up indicating that the backup of the metadata was successful



Backing up Storage Repositories on NetApp active-active controller configuration

Utilize NetApp's SnapMirror® technology to backup the FlexVols that make up the SR. For more information on use of SnapMirror, please refer to the SnapMirror Administration guide at http://now.netapp.com

Some considerations when using SnapMirror:

- 1. For SnapMirror volume replication, the destination storage system must use a version of Data ONTAP that is the same as or later than that of the SnapMirror source storage system. For volume SnapMirror to support replication for the purpose of disaster recovery, both the source and destination storage systems must use the same version of Data ONTAP.
- 2. For SnapMirror volume replication, the capacity of the destination volume must be greater than or equal to the capacity of the source volume
- 3. To optimize performance, stagger Snapshot copy update schedules so that SnapMirror activity does not begin or end at the exact minute a *snap sched* command operation attempts to create a Snapshot copy. If the SnapMirror feature is scheduled to perform Snapshot management at the same time as a snap sched activity, then the Snapshot management operations scheduled using the *snap sched* command might fail with syslog messages: *Skipping creation of hourly snapshot* and *Snapshot already exists*.
- 4. For optimum SnapMirror volume replication performance, ensure that the SnapMirror source volume and destination volume contain disks of the same size.



5. To achieve maximum space savings on the destination volume, scan the entire file system to recreate the deduplication metadata for the destination volume. Use the *sis start -s* command to do so. **Note:** The destination volume is accessible for read-write operations when the deduplication scan is in progress. The *sis* start command, without the *-s* option, has the potential for space savings on the destination volume is reduced because only the new data written to the volume will be scanned for deduplication.

Note: Starting with Data ONTAP 8.0.1 7-Mode, FlexClone volumes can be replicated using volume SnapMirror without the need for additional capacity on the destination system as long as the parent of the FlexClone volume is also replicated. Please consult TR-3446: SnapMirror Async Overview and Best Practices Guide available at http://www.netapp.com.

6. For Firewall setting, allow a range of TCP ports from 10565 to 10569.

It is recommended to use the below diagram configuration as a guide to setup replication between the primary and DR site.



Figure 12 Graphical representation of replication setup



Creating the SnapMirror Relationship

(For purposes of illustration, the NetApp SR type is used for the backup and recovery steps. The same steps can be used for other SR types given the FlexVol)

- Determine the SR UUID from XenServer host console (as indicated in previous sections). For NFS/iSCSI/LVMoHBA SR on the NetApp active-active controller configuration, the FlexVol is the name determined when creating the FlexVol from the FilerView FlexVol creation wizard.
- 2. Open a console session to the NetApp active-active controller configuration on the primary site. Convert the FlexVols in the NetApp SR to use ucode using the *vol options* command

vol options <vol-name> <option-name> <option-val>

ISV3140> vol options XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV0 create_ucode on ISV3140> vol options XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV0 convert ucode on

- 3. Repeat the above step for all FlexVols that make up the NetApp SR
- 4. Ensure SnapMirror is turned on using the options snapmirror.enable command

ISV3140> options snapmirror.enable snapmirror.enable on

If not enabled, turn snapmirror on using the same command with on option

options snapmirror.enable on

5. Authorize DR site host to replicate the primary site storage using the options snapmirror.access command options snapmirror.access host=<IP address or DNS name of DR site device>

ISV3140> options snapmirror.access host=10.204.132.16



6. On the primary site NetApp SR, disable any system Snapshots that may be on by default. In FilerView, click *Volumes-Snapshots->Configure* and select the FlexVols that make up the NetApp SR. Click *Unselect All*, and set the *Number of Scheduled snapshots to Keep* to 0. Ensure that *Scheduled Snapshots* is unselected as well. Click *Apply*

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NetApp	Search At	iout
 ISV3140 ? Filer ? Volumes ? Add 	Configure Snapshots ⑦ Volumes → Snapshots → Configure	
Manage • Qtrees ???	Volume: Select the volume for which snapshots will be configured. Only online volumes are displayed.	
Snapshots ⑦ Add	Snapshot Reserve: Enter the size of volume's snapshot reserve, a percentage between 0 and 100.	
Configure Manage	Snapshot Directory Visible: If Directory Select to make the .snapshot directory visible.	
 Aggregates <a>? Storage ? 	Scheduled Snapshots: Select to enable scheduled snapshots.	
Operations Manager ⑦ SnapMirror ⑦ CIFS ⑦ NFS ⑦	Number of Scheduled Snapshots to Keep: Enter the number of scheduled weekly, nightly, and hourly snapshots to keep. These snapshots are created only if Scheduled Snapshots is selected. 0 Weekly [®] 0 Nightly 0 Nightly	
HTTP ⑦ LUNs ⑦	Hourly Snapshot Schedule: ⑦ Select the times at which hourly snapshots will occur.	
Security ⑦ Secure Admin ⑦ NDMP ②		
SNMP ⑦ Real Time Status ⑦	$\square 9 AM 3 \square \square 9 PM 3 \square$	
• Wizards ⑦		
	Select All - Unselect All	
	Apply	•
	🛛 👘 Internet Protected Mode: Off	• //

7. Open the NetApp FilerView for the NetApp active-active controller configuration at the DR site, and create an aggregate that is larger than the aggregate on the primary site that has the NetApp SR FlexVols. The aggregate can be created using steps outlined in the NetApp active-active controller configuration configuration section.



8. Create FlexVols within the aggregate created in the previous step, such that the FlexVols have the same name as the FlexVols that make up the NetApp SR at the primary site. FlexVols can be created using the steps outlined earlier in the document. Ensure that the space guarantee for the FlexVol is set to *none* and the size if at least 5% greater than the FlexVol in the NetApp SR at the primary site. Also set the *Snapshot Reserve* to 0%.

🖉 ISV3140: Volume Wizard - Windows Internet Explor	er julie j	
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Volume Wizard - Volume Type Sel	ection	
Volume Type Selection Select whether you want to create a traditional, flex	ible, or cache volume. C Traditional C Cache	?
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Volume Wizard - Volume Paramet	ers	
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UTF-8:		-
Select to make language of this volume UTF-8 enc	oded.	_
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- 9. Set the ucode options on the FlexVols.
- 10. Turn off Snapshot on the FlexVols using the vol options command.

```
vol options <flexvol name> nosnap on
```

11. If Data Deduplication is turned on at the primary site, turn on dedupe on the DR site FlexVols as well using the *sis on* command.

sis on <path>



- ISV3140: FilerView Windows Internet Explorer <u>- 🗆 ×</u> 😵 Certificate Error 10.204.151.15 FilerView® Search About -~ XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV0 online,raid_dp,sis <u>XS1</u> 745 GB 70% 2.41 TB 110 31.9 m ٠ 📼 ISV3140 🖷 ? $\mathbf{\nabla}$ XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV1 online,raid_dp,sis 745 GB 70% 2.41 TB 96 XS1 31.9 m • Filer 🖻 🕐 V XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV2 online.raid dp.sis XS1 745 GB 70% 2.41 TB 103 31.9 m -Volumes T ?? • XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV3 online,raid_dp,sis <u>XS1</u> 745 GB 70% 2.41 TB 96 31.9 m Add 7 XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV4 online,raid_dp,sis XS1 745 GB 70% 2.41 TB 124 31.9 m Manage • XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV5 online,raid_dp,sis <u>XS1</u> 745 GB 70% 2.41 TB 110 31.9 m • Qtrees 🖥 ?? 2 XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV6 online,raid_dp,sis 745 GB 70% 2.41 TB 96 31.9 m • Quotas 🛅 ? XS1 ⊽ XenStorage 78ba35b0 1aff 4867 90b3 19d7ec223f05 EV7 online.raid dp.sis 745 GB 70% 2.41 TB 96 31.9 m • Snapshots ? XS1 Add XenStorage DR 78ba35b0 1aff 4867 90b3 19d7ec223f05 FV0 online,raid_dp <u>XS1</u> 20 GB 0% 20 GB 96 623 k Configure Г Xen Lun online,raid_dp <u>XS1</u> 2.02 GB 83% 12 GB 103 375 k Manage lun2 online,raid_dp <u>XS1</u> 1.01 GB 83% 6.02 GB 103 187 k • Aggregates 둼 🕐 lun3 online,raid_dp <u>XS1</u> 2.02 GB 83% 12 GB 103 375 k Add Online Restrict Offline Destroy Select All - Unselect All Manage Storage ? Volumes: 1-33 of 33 Restrict Operations Manager (?) SnapMirror ? Refresh • 🖓 🔹 🔍 100% tapp.fv.volumes.manage.VolumeList 😜 Internet | Protected Mode: Off
- 12. Restrict the FlexVols by clicking on Volumes->Manage, selecting the FlexVols and then clicking the Restrict button.

13. Give access to the primary site NetApp active-active controller configuration to the DR site NetApp active-active controller configuration and vice-versa. From FilerView, click *SnapMirror->Remote Access->Add* and add the DNS name or IP address of the filer will request access.





- 14. Set up SnapMirror from FilerView by clicking SnapMirror->Add.
- 15. Select the first FlexVol and click Next.

SnapMirror Wizard https://10.204.151. SnapMirror V	d for ISV3140 - Windows Internet Explorer	or
Destination Filer: The destination filer for this mirror.	ISV3140 ⑦	
Destination Volume: The destination volume for this mirror.	XenStorage_DR_78ba35b0_1aff_4867_90b3_19d7ec223f05_FV0 🔽 🕐	
Destination Qtree: The destination qtree name, if desired.	•	
	Cancel Next >	

16. Enter the primary site NetApp active-active controller configuration name or IP address and FlexVol for the first FlexVol that needs to be replicated.

SnapMirror Wizard for ISV3140 - Windows Internet Explore	r	
https://10.204.151.15/servlets/netapp.fv.snapmirror.wizard.SnapM	irrorWizard	😵 Certificate Error
On an Minner Minnerk, October 1, a settion		
Snapmirror wizard: Source Location		
Source Filer: Enter the name of the source filer for the mirrored volume.	10.204.151.25	?
Source Location: Enter the name of the mirror source volume or full qtree path.	_90b3_19d7ec22	23f05_FV0 ⑦
< Back Cancel	Next >	•
Internet Protected Mode: (off 🛛 🖗	+ 🔍 100% +

- 17. Leave the *Restart Mode* and *Maximum Transfer* Rate as the default. The data transfer limit may be changed depending on the network and storage configuration at the deployment site.
 - a. Calculate a TCP window size that works well with the network, using the following formula:



Window Size = (Round Trip Delay) × (Desired Rate)
b. Adjust the TCP window size by entering the following command
options snapmirror.window_size rate
rate = the desired TCP window size.

- 18. Set the schedule for SnapMirror to occur as determined by the business needs. Having a small window will affect disk I/O on both the primary and DR sites, depending on the rate of change of the data blocks.
- 19. Commit the changes to create the new SnapMirror.



- 20. Click on SnapMirror->Manage and click Advanced for the SnapMirror just created.
- 21. Click on Initialize to setup the initial base line transfer.

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🖉 ISV3140: FilerView - Windows Internet Explorer						
Phtps://10.204.151.15/servlets/netapp.fv.servlets.FilerView						
NetApp	FilerView®	Search About				
ISV3140 ISV31	SnapMirror Properties ⑦ SnapMirror → Manage → Advanced 1 Success					
Quotas Quotas O Snapshots Aggregates O Storage	Manage Snapmirror Modify Delete Quiesce Initialize Update Break	Resume Interrupt Resync				
 Operations Manager ? SnapMirror ? Report Configure Manage Add Log ? Remote Access ? Enable/Disable CIFS ? NFS ? HTTP ? LUNs ~ ? 	Source (Filer:Location): ISV3140:XenStorage_78ba35b0_1aff_4867_90b3_19d7ec223105_FV0 Destination (Filer:Location): ISV3140:XenStorage_DR_78ba35b0_1aff_4867_90b3_19d7ec223105_FV0 Maximum Transfer Rate (kb/s): ISV3140:XenStorage_DR_78ba35b0_1aff_4867_90b3_19d7ec223105_FV0 Maximum Transfer Rate (kb/s): Schedule Priority Restart Mode: Schedule Priority Base Snapshot: Preset: Repeat Every Minute starting Always Base Snapshot: - Base Timestamp: - Lag Time (hh:murss): 00:00:00 Status: transferring State: unknown Content State: - Current Transfer Size (Kb): 0 Last Transfer Size (Kb): 0 Last Transfer Size (Kb): 0 Last Transfer Size (Kb): 0 Last Transfer Size (Kb): 0 Last Transfer Size (Kb): 0					
Network ⑦ Security ⑦ Secure Admin ⑦ Done	Last Transfer Type: - Back Refresh	Image: Image				

22. Once all FlexVols have been initialized, the SnapMirror *State* should show *snapmirrored*. To verify, in FilerView, click on *SnapMirror->Manage*.

2 ISV3140: FilerView - Windows Internet Explorer					
https://10.204.151.15/servlets/netapp.fv.servlets.FilerView					
NetApp		FilerView®		Search <u>About</u>	
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• SnapMirror ⑦ Report Configure Manage	Showing SnapMirrors: 1-2 of 2	Refresh		D	
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Configuring XenServer at DR site at time of disaster

The steps to restore a FlexVol that has been backed up using SnapMirror are:

- 1. Quiesce the SnapMirror relationship.
- 2. Break the SnapMirror relationship.
- 3. Once the SnapMirror relationship has been broken, the mirrored FlexVol is attached to the backup XenServer host at the DR site.

Quiesce the SnapMirror relationship

1. In FilerView, click on *SnapMirror->Manage*. Click *Advanced* for the FlexVol that needs to be quiesced.



2. Click *Quiesce* and then *OK* in the confirmation dialog box.



Break the SnapMirror Relationship

1. Once the mirror has quiesced, click *Break* and *OK* in the confirmation dialog box. The state of the mirror should show *broken-off.*



Repeat the quiesce and break-off process for each FlexVol that makes up the mirrored NetApp SR..


Attaching the mirror'ed SR to XenServer host at DR site

Please note that some images appear slightly different in XenServer 5.6 than XenServer 5.6 Feature Pack1

- 1. From XenCenter, connect to the XenServer host at the DR site..
- 2. Click on New Storage, and choose the Advanced StorageLink technology> NetApp option.
- 3. Enter the name/IP address of the NetApp active-active controller configuration at the DR site that has the mirror'ed FlexVols that make up the NetApp SR.
- 4. Click on Reattach on the existing SRs on the filer and choose the SR that was mirror'ed. Click Finish.

-							
Type	• <u>R</u> ea	attach one of th	e existing SRs on t	he filer:			
Location	0990abdd-18f8-8a46-a550-1f34f1663215 XS1						
Name and Storage System	71	ba35b0-1af	f-4867-90b3-1	9d7ec223f05 XS1			
etApp filer							
Reattach SR/New SR	O <u>C</u> re	ate a new SR o	n the following agg	regate:			
	A	ggregate	Size	Disks	RAID type	A-SIS capable	٦
	XS	1	2472.8 GB	9	raid_dp	Yes	
			ls to use:	Help me choose		area and the second stands	
	N	under of ElexVo	the same service of the service of t	- nup ne u louse	Use	iverapp min provisionin	g
	N	umber of Flex <u>V</u> o	10				
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- 5. Click Yes to confirm attaching the SR..
- 6. Open the xsconsole to the XenServer host at the DR site. Scroll to Backup, Restore and Update and press <Enter>.



7. Scroll to Restore Virtual Machine Metadata and press < Enter>.



- 8. If prompted, provide XenServer login credentials to perform the metadata restoration.
- 9. Select the attached NetApp SR from the previous steps and press *<Enter>*. There is a slight delay while XenServer looks for the backup VDI.
- 10. Once the backup VDI is found, select the appropriate metadata to restore from and press <*Enter*>.

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11. Select the Only VMs on this SR option to import all the VM metadata into the XenServer host at the DR site.

(enServer	5.6 FP1 16:5 Config	5:07 root@ uration ————	r-310-				
Backup,	Restore and Update	Restore Virtual Machine Metadata					
Schedu l Backup <mark>Restor</mark>	e Virtual Machine Metadata Virtual Machine Metadata ————————— Restore Backup from	Press <enter> to restore Virtual Machine metadata from a Storage 2011-01-28-13-42-32</enter>					
Select the set of VMs to restore from 2011-01-28-13-42-32							
	<mark>Only VMs on This SR</mark> All VM Metadata Only VMs on This SR (Dry Run) All VM Metadata (Dry Run)						
	<enter> Restore VMs <esc> Canc</esc></enter>	el					
<esc le<="" th=""><td>ft> Back <up down=""> Select</up></td><td>(Enter) Backup</td><td></td></esc>	ft> Back <up down=""> Select</up>	(Enter) Backup					

There is a slight delay while all metadata is imported.

Restoring SnapMirror relationship to bring primary site back up

Once the primary site has recovered from the disaster, use the below steps to restore information back to primary site.

To restore the SnapMirror relationship:

1. On primary site, destroy all data by re-initializing the primary NetApp active-active controller configuration



- 2. Set up a SnapMirror from the DR NetApp active-active controller configuration to the primary site NetApp active-active controller configuration:
 - a. Initialize a base line transfer
 - b. Quiesce the SnapMirror relationship
 - c. Break the SnapMirror relationship
 - d. Delete the SnapMirror configuration

This restores all the updated data from the DR site back to primary site.

- 3. Delete the SnapMirror configuration on the DR site NetApp active-active controller configuration
- 4. Repeat the steps in creating the SnapMirror relationship to set up replication between the primary site and DR site.

Summary

While other virtualization products consume valuable server resources to run proprietary management tools to manage storage services, Citrix XenServer enables each hardware component to do what it does best: NetApp storage systems can deliver optimal storage features and performance, and servers can direct their power to business-critical application workloads.

Above all, by incorporating the best practices for configuration, allocation and administration into the NetApp Data ONTAP Adapter, Citrix XenServer makes optimal management of storage in virtualized environment seamless – allowing organizations to unify virtualization management for increased agility and reduced management costs.



Appendix A

Script to perform Snapshot and Recovery of VMs

The script below is an example of how a virtual machine may be snapshot for backup and recovery.

Usage:

Copy/paste the script below to a file with .py extension. Copy the .py flie to your XenServer host, and execute it.

Sample run output:

python snapshot_restore.py

```
🚰 root@Haikel-Xen:~
                                                                              - 🗆 🗵
     [root@Haikel-Xen ~]# python snapshot_restore.py
            Citrix XenServer VM Snapshot/Restore Utility
            Copyright (c) 2008 Citrix Systems, Inc.
     VMs available:
            1. W2K3 (1)
            2. RHEL 5 (64-bit) (Dev)
            3. WinServe2K3 (64-bit) (LicenseServer)
     Please choose VM to snapshot or recover [1 - 3]: 1
     Do you want to snapshot|snapshot with quiesce (Windows guests only)|recover?
    (input "s" or "sq" or "r")
#!/usr/bin/env python
# Copyright (c) 2008 Citrix Systems, Inc.
# Permission to use, copy, modify, and distribute this software for any
# purpose with or without fee is hereby granted, provided that the above
# copyright notice and this permission notice appear in all copies.
# THE SOFTWARE IS PROVIDED "AS IS" AND THE AUTHOR DISCLAIMS ALL WARRANTIES
# WITH REGARD TO THIS SOFTWARE INCLUDING ALL IMPLIED WARRANTIES OF
# MERCHANTABILITY AND FITNESS. IN NO EVENT SHALL THE AUTHOR BE LIABLE FOR
# ANY SPECIAL, DIRECT, INDIRECT, OR CONSEQUENTIAL DAMAGES OR ANY DAMAGES
# WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN
# ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF
# OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.
import sys, time
import XenAPI
def snapshot vm(session, vm rec, snap choice):
        epoch = time.strftime("%Y%m%d-%H%M%S", time.localtime())
      vm snap name = "%s - %s" % (vm rec['name_label'], epoch)
      print "\nNow creating snapshot for VM %s..." % vm rec['name label']
       if snap choice == 'sq':
             vm snap = session.xenapi.VM.snapshot with quiesce(\
               session.xenapi.VM.get by uuid(vm rec['uuid']), \
               vm snap name)
      else:
```

```
vm snap = session.xenapi.VM.snapshot(\
               session.xenapi.VM.get by uuid(vm rec['uuid']), \
               vm snap name)
      print "VM snapshot created as : %s" % vm snap name
def recover vm(session, vm rec):
      snaps = vm rec['snapshots']
      if len(snaps) == 0:
             print "No snapshots available for VM %s" % vm rec['name label']
      else:
             snap_num = 0
             snap dict = {}
             print "List of snapshots available for VM %s:\n" % vm rec['name label']
             for snap in snaps:
                    snap rec = session.xenapi.VM.get record(snap)
                    snap num += 1
                    snap_dict[snap_num] = snap
                    print "\t%i. %s" % (snap num, snap rec['name label'])
             if (snap num == 1):
                    snap num choice = 1
                    raw input("\nPress Enter to restore from this snapshot")
             else:
                    snap num choice = 0
                    while (snap num choice == 0):
                          snap num choice s = raw input ('\nPlease choose a snapshot to
Restore to [1 - %i]: ' % snap num)
                           if (snap_num_choice s == ""):
                                 print "\nInvalid entry. Please try again...\n"
                                 continue
                           snap num choice = int(snap num choice s)
                           if (snap num choice > snap num):
                                 print ("\nInvalid entry. Please try again...\n")
                                  snap num choice = 0
                                 continue
             snap choice = snap dict[snap num choice]
             snap choice rec = session.xenapi.VM.get record(snap choice)
             # Steps to restore
             # 1. Force shutdown VM
             # 2. Destroy VBDs
             # 3. Clone VDI's of snapshot
             # 4. Sync state (VBD, VIF, VCPU, Memory, etc)
             # 5. Destroy subsequent snapshots
             print "\nCleanup VM..."
             vm name = vm rec['name label']
             vm power state = vm rec['power state']
             if not(vm_power_state == 'Halted'):
                    print "Halting VM..."
           session.xenapi.VM.hard shutdown(session.xenapi.VM.get by uuid(vm rec['uuid']))
             vbds = vm rec['VBDs']
             for vbd in vbds:
                    vbd rec = session.xenapi.VBD.get_record(vbd)
                    if vbd_rec['type'] == 'Disk':
                          _____vdi = vbd_rec['VDI']
                          session.xenapi.VDI.destroy(vdi)
             vifs = vm_rec['VIFs']
             for vif in vifs:
                    session.xenapi.VIF.destroy(vif)
```

```
print "Restoring VM..."
              # Restore VIFs
              snap vifs = snap choice rec['VIFs']
              for snap vif in snap vifs:
                     snap vif rec = session.xenapi.VIF.get record(snap vif)
                     restore vif = { 'device' : snap vif rec['device'],
                                    'network' : snap vif rec['network'],
                                    'VM' : session.xenapi.VM.get by uuid(vm rec['uuid']),
                                    'MAC' : snap_vif_rec['MAC'],
                                    'MTU' : snap_vif_rec['MTU'],
                                    "other_config" : snap_vif_rec['other_config'],
                                    "qos algorithm_type" : snap_vif_rec['qos_algorithm_type'],
                                    "qos algorithm params" :
snap vif rec['qos algorithm params'] }
                     session.xenapi.VIF.create(restore vif)
              # Restore VBDs
              snap vbds = snap choice rec['VBDs']
              for snap vbd in snap vbds:
                     snap vbd rec = session.xenapi.VBD.get record(snap vbd)
                     if snap vbd rec['type'] == 'Disk':
                            snap vdi = snap vbd rec['VDI']
                            restore vdi = session.xenapi.VDI.clone(snap vdi, {})
                            restore vbd = { 'VM' :
session.xenapi.VM.get by uuid(vm rec['uuid']),
                                           'VDI' : restore vdi,
                                           'userdevice' : snap vbd rec['userdevice'],
                                           'bootable' : snap_vbd_rec['bootable'],
                                           'mode' : snap_vbd_rec['mode'],
'type' : snap_vbd_rec['type'],
'unpluggable' : snap_vbd_rec['unpluggable'],
                                           'empty' : snap_vbd_rec['empty'],
'other_config' : snap_vbd_rec['other_config'],
                                           'qos algorithm type' :
snap vbd rec['qos algorithm type'],
                                           'qos algorithm params' :
snap vbd rec['qos algorithm params'] }
                            session.xenapi.VBD.create(restore vbd)
              # Restore config information
              vm rec['platform'] = snap choice rec['platform']
              vm rec['VCPUs max'] = snap choice rec['VCPUs max']
              vm_rec['recommendations'] = snap_choice_rec['recommendations']
              vm_rec['user_version'] = snap_choice_rec['user_version']
              vm rec['HVM shadow multiplier'] = snap choice rec['HVM shadow multiplier']
              vm rec['memory dynamic max'] = snap choice rec['memory dynamic max']
              vm_rec['HVM_boot_policy'] = snap_choice_rec['HVM_boot_policy']
vm_rec['PV_legacy_args'] = snap_choice_rec['PV_legacy_args']
              vm rec['actions after shutdown'] = snap choice rec['actions after shutdown']
              vm_rec['xenstore_data'] = snap_choice_rec['xenstore_data']
              vm rec['actions after crash'] = snap choice rec['actions after crash']
              vm rec['PCI bus'] = snap choice rec['PCI bus']
              vm rec['tags'] = snap choice rec['tags']
              vm rec['other config'] = snap choice rec['other config']
              vm rec['VCPUs at startup'] = snap choice rec['VCPUs at startup']
              vm_rec['actions_after_reboot'] = snap_choice_rec['actions_after_reboot']
              vm_rec['PV_bootloader'] = snap_choice_rec['PV_bootloader']
              vm_rec['resident_on'] = snap_choice_rec['resident_on']
              vm_rec['HVM_boot_params'] = snap_choice_rec['HVM_boot_params']
              vm rec['blocked operations'] = snap choice rec['blocked operations']
              vm rec['PV args'] = snap choice rec['PV args']
```

```
vm rec['affinity'] = snap choice_rec['affinity']
              vm_rec['PV_ramdisk'] = snap_choice_rec['PV_ramdisk']
vm_rec['memory_static_min'] = snap_choice_rec['memory_static_min']
vm_rec['PV_bootloader_args'] = snap_choice_rec['PV_bootloader_args']
              vm rec['PV kernel'] = snap choice rec['PV kernel']
              vm rec['memory dynamic min'] = snap choice rec['memory dynamic min']
              if not(vm power state == 'Halted'):
                     print "Powering up VM..."
                     session.xenapi.VM.start(session.xenapi.VM.get by uuid(vm rec['uuid']),
False, False)
              print "Destroying orphaned snapshots..."
              for snap in snaps:
                     snap rec = session.xenapi.VM.get record(snap)
                     if snap rec['snapshot time'] > snap choice rec['snapshot time']:
                             vbds = snap rec['VBDs']
                             for vbd in vbds:
                                    vbd rec = session.xenapi.VBD.get_record(vbd)
                                    if vbd rec['type'] == 'Disk':
                                           vdi = vbd rec['VDI']
                                           session.xenapi.VDI.destroy(vdi)
                             session.xenapi.VM.destroy(snap)
def snapshot recover vm(session, vm rec):
       while (True):
              choice = raw input ("Do you want to snapshot|snapshot with quiesce (Windows
guests only) | recover? \n (input \"s\" or \"sq\" or \"r\") ")
              if (choice == 's') or (choice == 'sq'):
                     snapshot_vm(session, vm_rec, choice)
                     break
              elif (choice == 'r'):
                     recover vm(session, vm rec)
                     break
              else:
                     print "\nInvalid choice. Please try again...\n"
                     continue
def main(session):
             vm records = session.xenapi.VM.get all records()
             vm num = 0
             vm dict = \{\}
             print "VMs available:\n"
             for vm record in vm records:
                 vm rec = vm records[vm record]
              if not(vm rec['is a template']) and not(vm rec['is control domain']):
                     vm num += 1
                     vm dict[vm num] = vm rec
                     print "\t%i. %s" % (vm num, vm rec['name label'])
            print ""
           if (vm num == 0):
              print ("No VMs available for snapshot/recover")
              return
           elif (vm num == 1):
              vm_num_choice = 1
           else:
              vm num choice = 0
              while (vm_num_choice == 0):
                     vm num choice s = raw input('Please choose VM to snapshot or recover [1 -
%i]: ' % vm num)
                     if (vm num choice s == ""):
                             print "\nInvalid entry. Please try again...\n"
```

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```
continue
                       vm num choice = int(vm num choice s)
                      if (vm num choice > vm num):
                             print "\nInvalid entry. Please try again...\n"
                             vm_num_choice = 0
                             continue
             vm_rec_choice = vm_dict[vm_num_choice]
             snapshot_recover_vm(session, vm_rec_choice)
           == "__main__":
if __name_
    print "\n\tCitrix XenServer VM Snapshot/Restore Utility"
    print "\tCopyright (c) 2008 Citrix Systems, Inc.\n"
    session = XenAPI.Session("http://_var_xapi_xapi", transport=XenAPI.UDSTransport())
session.xenapi.login_with_password("root", "xensource")
    try:
       main(session)
    except Exception, e:
        print str(e)
        raw_input ("\n\n--Press Enter to exit--")
        raise
    raw input ("\n\n--Press Enter to exit--")
```

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Appendix B

Security Considerations

To allow XenServer administrators to login into the device with root privileges and create the FlexVols for the NetApp Storage Repository, use the following guidelines.

Equating Windows 'Domain\Administrator' privileges to UNIX 'root' in a multi-protocol environment

1. To equate Windows 'Domain\Administrator' privileges to UNIX 'root' in a multi-protocol environment, on the device enter:

device> options wafl.nt_admin_priv_map_to_root on

2. Authorizing a Unix User Account to Login As Root on the Device

Data ONTAP uses the /etc/usermap.cfg file to map user names. In its simplest form, each /etc/usermap.cfg entry contains a pair of names: the Windows name and the UNIX name. Data ONTAP can translate the Windows name to the UNIX name or vice versa.

When a connection is started, if the /etc/usermap.cfg file is missing, a default file is created. It contains commented-out sample map entries that are useful for improving security. When Data ONTAP receives a connection request from a user, it searches the /etc/usermap.cfg file to see whether an entry matches the user's Windows domain name and user name. If an entry is found, Data ONTAP uses the UNIX name specified in the entry to look up the UID and GID from the UNIX password database. If the UNIX name is a null string, Data ONTAP denies access to the user.

If an entry is not found, Data ONTAP converts the Windows name to lowercase and considers the UNIX name to be the same as the Windows name. Data ONTAP uses this UNIX name to look up the UID and GID from the UNIX password database. Data ONTAP http://www.citrix.com/English/partners/partner.asp?partnerID=950197scans the file sequentially. It uses the first matching entry for mapping.

For information about character coding of the /etc/usermap.cfg file, see the information about the contents of the /etc directory in the Storage Management Guide.

Specify each entry using the following format:

[IP_qualifier:] Windows_name [direction] [IP_qualifier:] UNIX_name where

IP_qualifier field is an IP address that qualifies the user name by narrowing the match.

Windows_name field consists of a Windows domain name, which is optional, and a Windows user name.

Direction field indicates the direction of the mapping.

UNIX_name field is a UNIX name in the UNIX password database.

You can embed comments in the file by beginning the comment lines with #. Comments at the end of an entry are also allowed if preceded by #. Blank lines are ignored.

The way in which Data ONTAP interprets a domain name in the /etc/usermap.cfg file that contains a dot depends on whether storage system is in a Windows NT domain or a Windows Active Directory domain. Follow some guidelines to keep entries simple and easy to understand, and add several entries to the /etc/usermap.cfg file to prevent unauthorized users from accessing the storage system.

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Appendix C

Enhancements in Data ONTAP

Enhancements in Data ONTAP 7.3.1 affect the ability to do a LUN clone split when using NetApp's ZAPI. ONTAP has two ways (styles) to do the LUN clone split. Beginning with Data ONTAP 7.3.1, it will default to the new style. Citrix XenServer's NetApp Adapter will attempt to use the old style LUN clone split.

You will see the following error message if you are affected by this issue:

"Error parameters: General IO error [opterr=creating flexvol snapshot:Snapshot operation not allowed during LUN clone split. (13023)]"

If you are affected, the issue can be verified and fixed with the following commands.

```
> options lun.clone_restore
> options lun.clone_restore {off | on}
```

Setting to 'off' will mimic the old behavior; the system defaults to 'on'.

Data ONTAP 8.0 7-Mode introduces 64-bit aggregates which are no longer limited to 16TB. Consult TR-3786: A Thorough Introduction to 64-Bit Aggregates for complete details and sizing information, available at <u>http://www.netapp.com</u>.

Data ONTAP 8.0.1 7-Mode FlexClone volumes can be replicated using volume SnapMirror without the need for additional capacity on the destination system as long as the parent of the FlexClone volume is also replicated. Please consult TR-3446: SnapMirror Async Overview and Best Practices Guide available at http://www.netapp.com.



References

XenServer 5.6 Administration Guide: http://support.citrix.com/article/CTX124887

XenServer 5.6 Virtual Machine Installation Guide: http://support.citrix.com/article/CTX124888

XenServer 5.6 Feature Pack 1 Administration Guide: http://support.citrix.com/article/CTX127321

XenServer 5.6 Feature Pack 1 Virtual Machine Installation Guide: http://support.citrix.com/article/CTX127323

Citrix StorageLink 2.3 User Guide: http://support.citrix.com/article/CTX126304

Data ONTAP® 7.3 System Administration Guide: http://now.netapp.com/NOW/knowledge/docs/ontap/rel73/pdfs/ontap/sysadmin.pdf

Data ONTAP® 7.3 Data Protection Online Backup and Recovery Guide: http://now.netapp.com/NOW/knowledge/docs/ontap/rel73/pdfs/ontap/onlinebk.pdf

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