



Technical Report

Integrating Lotus Domino 8.5 for Windows 2008 with a NetApp Storage System

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March 2010 | TR-3588

EXECUTIVE SUMMARY

The tight integration of SnapDrive® with Windows® and NetApp® storage systems offers the ease of storage management and high data availability required for Lotus Domino environments. A NetApp storage system in conjunction with SnapDrive offers an enterprise-class solution for Lotus Domino. This document describes steps necessary to integrate a NetApp storage system with an IBM Lotus Domino server for Windows 2008 using SnapDrive over an iSCSI connect to the storage connection.

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1 PURPOSE AND SCOPE

This document describes the steps necessary to integrate SnapDrive with IBM Lotus Domino 8.5 for the Windows 2008 Enterprise Edition using iSCSI connections to a NetApp storage system. The main topics covered in this document are:

- Preparing the NetApp storage system for Lotus Domino
- Configuring Windows server and installing Lotus Domino software
- Migrating Lotus Domino server from local disks to LUNs on a NetApp storage system

The process steps and methods described in this paper are completely applicable to the IBM N series product line.

2 ASSUMPTIONS

For the information contained in this report to be useful to the reader, we assume the reader has knowledge of the following products and technologies:

- Windows 2008 enterprise server
- Lotus Domino 8.5
- NetApp storage system, Data ONTAP, FilerView®, NetApp System Manager
- SnapDrive software

3 INFRASTRUCTURE OVERVIEW

In order to produce this paper we used the following infrastructure to set up Lotus Domino over Gigabit Ethernet to a storage system:

- The name of the NetApp storage system is **iceman**.
- The name of the server hosting the Lotus Domino server is **fuji15**.
- The location of the Lotus Domino binaries on the Windows 2008 system is **C:\Program Files\IBM\Lotus\Domino**.
- The target volumes on the storage system for the Domino data and transaction logs are **dominodata** and **dominologs**, respectively.
- The name of CIFS shares created for flexible volumes named **dominodata** and **dominologs** are **lddata** and **ldlogs**, respectively.
- The virtual disk **dominodata** is mounted at J:\.
- The virtual disk **dominologs** is mounted at K:\.

The other components of the environment are:

- X86 server running the Windows 2008 enterprise server with:
 - On-board Gigabit Ethernet connection
 - NetApp SnapDrive 6.2 software
 - Microsoft iSCSI initiator included with Windows 2008 server
- NetApp storage system running Data ONTAP 8.0 7-Mode with:
 - On-board 10/100/1000 Ethernet connection
 - Gigabit Ethernet adapter

In production environments, NetApp recommends multiple switches and VIFS for scalability and network redundancy.

Figure 1 illustrates the main infrastructure components of a Lotus Domino on NetApp storage system environment.

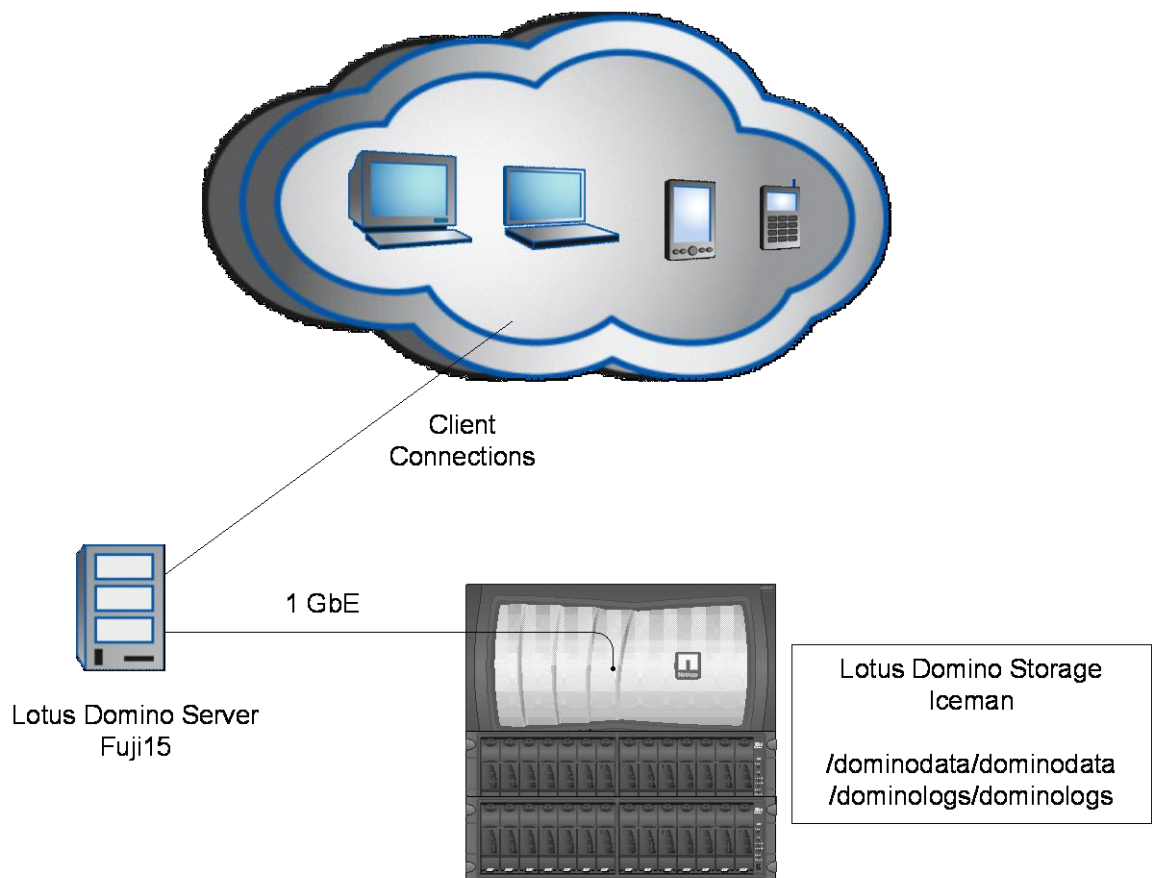


Figure 1) Lotus Domino on NetApp storage system infrastructure.

3.1 WINDOWS 2008 ENTERPRISE SERVER

For this technical report, we used Lotus Domino 8.5.1 enterprise server for Windows 2008. NetApp supports Lotus Domino v7.0 and above on Microsoft® Windows, UNIX®, and Linux®. NetApp also supports Domino partitioning and Domino clustering for high availability and disaster recovery.

Ensure that the server meets the minimum requirements for running Lotus Domino and that the server hardware is on the Windows catalog. For customers who plan to install Lotus Domino on a NetApp storage system cluster, Lotus Domino clustering must be implemented for failover. In cluster implementation, separate volumes are required for each Domino data directory.

3.2 MICROSOFT ISCSI SOFTWARE INITIATOR

For MS Windows 2008 servers, NetApp supports both software and hardware initiators when using the iSCSI protocol. For details on the supported initiators, refer to the “[NetApp iSCSI Solutions Support Matrixes](#)” page on the [NOW™](#) (NetApp on the Web) site. Windows 2008 includes Microsoft’s iSCSI initiator software by default. If you use another version of Windows and you desire to use a software iSCSI initiator to access the storage, you need to download and install the MS software initiator for Windows from the Microsoft Web site¹.

¹ Microsoft Storage Technologies - iSCSI:
<http://www.microsoft.com/windowsserver2003/technologies/storage/iscsi/default.mspx>

3.3 NETAPP SNAPDRIVE SOFTWARE

NetApp SnapDrive software allows you to reduce the cost and complexity of managing storage by enabling flexible and efficient utilization of storage resources to improve data and application availability. Some of the key features of SnapDrive are described in Table 1.

Table 1) SnapDrive Features

Feature	Descriptions
Advanced Storage Virtualization	By complementing native NTFS volume management with virtualization capabilities, SnapDrive allows administrators to easily create LUNs from pools of storage. Such server-based virtualization optimizes storage utilization and provides IT organizations the ability to respond easily to rapidly changing storage needs.
Dynamic Storage Management	Your business does not have to stop every time the IT organization has to add more storage. With SnapDrive you can increase size, add, delete, map, unmap, and mirror LUNs online. You can expand capacity on the fly with no impact on application or system performance.
Cluster Aware	For mission-critical applications in which information uptime is paramount, SnapDrive provides the greatest level of reliability by seamlessly integrating with an OS-specific cluster manager. In the Microsoft Windows environment, management of cluster resources, LUNs, and Snapshot [™] copies is greatly simplified, making failover completely transparent. Additionally, SnapDrive enables the use of a LUN as a quorum device.
Back Up and Restore in Seconds	SnapDrive integrates Snapshot technology to provide near-instantaneous point-in-time images of application and user data. These point-in-time images require minimal disk space and cause no disruption to service. SnapDrive enables access to Snapshot copies by mounting them as LUNs.
Seamless Online Replication	SnapDrive, when configured with NetApp SnapMirror [®] software, enables seamless online replication, providing enterprises global data availability and protection against disasters or application failures. Your entire storage environment, including LUNs and Snapshot copies, can be mirrored to one or more NetApp storage systems. Continual updates of mirrors enable data to be kept current and available. The online replication technology performs intelligent resynchronization and transfers only the modified data to the target system.

For more information on SnapDrive, please reference the “SnapDrive for Windows Installation and Administration Guide” on the [NetApp Storage System Client Software Information Library](#) Web page on the NetApp Web site.

3.4 NETWORK

For I/O traffic from the Windows server hosting the Domino binaries and the storage system housing the Lotus Domino databases and transaction logs, a private LAN or VLAN is mandatory. IBM will not support Domino I/O traffic over a public network. This can be accomplished using a crossover cable in a simple networking topology or network switch, with VLANs dedicated to Lotus Domino and auxiliary traffic for antivirus, etc., and NetApp storage system workloads. This can also be thought of as an IP SAN, since the Domino server(s) will be connected to the storage system over a private network and no other machines will have access to LUNs on the storage system. A gigabit IP SAN between the Lotus Domino server machine and the NetApp storage system is required for the following reasons:

- Eliminates issues of contention or latency
- Minimizes security issues and hacking threats
- Provides storage capacity scalability

NetApp strongly recommends that Gigabit Ethernet be used to support your Lotus Domino database environment on the NetApp storage system.

3.5 NETAPP STORAGE SYSTEM

A NetApp storage system running Data ONTAP 8.0 in 7-Mode configuration supports virtual storage layers called flexible volumes, hereafter known as FlexVol[®] volumes. A FlexVol volume is created

within an aggregate and is loosely coupled with its containing aggregate. The FlexVol volume provides greater performance than traditional volumes and can grow and shrink as needed by executing one simple command. Data ONTAP makes it easy to control the placement of related Domino file systems on a FlexVol volume. For more information on creating and managing FlexVol volumes, refer to the `vol` command in the appropriate NetApp documentation available online on the NetApp [NOW](#) site.

A key to easily using and managing a Domino server housed on a NetApp storage system is the notion that the entire Domino environment can be stored on one or more flexible volumes. This configuration requires minimal attention by Domino administrators and system administrators—allowing the storage system to manage the physical data storage provides high performance and availability. However, there are a few storage system physical design factors that need to be taken into consideration so that these benefits are not compromised:

- The root volume should be its own volume. The root volume can be a traditional volume or a FlexVol volume. For extra reliability and flexibility, NetApp recommends having a mirrored root volume. The root volume usually contains data that does not change much over time; a low change rate on the root volume would imply that it does not need to be backed up as often. And, should a data volume fail, having a separate, still functioning root volume will save valuable time in the recovery process.
- NetApp strongly recommends that all the Domino files be stored on a volume on the NetApp storage system that is not the root volume.
- NetApp strongly recommends that a large aggregate be used whenever possible for performance reasons. Multiple FlexVol volumes required for a Domino environment can be created within a single large aggregate.
- Domino transaction log files should be kept on a different LUN from the LUN housing the Domino data directory. Also, Domino data and transaction logs should reside on separate flexible volumes. If database and transaction logs are housed in the LUNs on the same flexible volume, the recovery of the LUNs will return the logs to the same state they were in at the time the Snapshot copy was created. As a result, log data generated after creation of the Snapshot copy will be lost, thus making roll-forward recovery for Domino impossible, since log file data needed would no longer be available.
- If NDMP is used to back up Domino residing on the NetApp storage system, multiple backup tasks can be spawned. It is simpler and more efficient to create a volume, define your LUNs in the root of the volume, and let the storage system manage the storage.

Any currently supported NetApp storage system that can run Data ONTAP 7.0 or higher can be used to store Lotus Domino data and transaction logs. In addition to running the appropriate Data ONTAP version, the FCP or iSCSI license must be activated on the storage system. The iSCSI and FCP licenses supplied with SnapDrive enable all the CIFS functionality necessary for using SnapDrive, including CIFS share creation. If you also want full-featured, direct CIFS access to a particular storage system, you must install a separate CIFS license on that storage system.

4 USING LOTUS DOMINO WITH NETAPP STORAGE

There are several advantages to storing Lotus Domino data and transaction logs on a NetApp storage system. This section examines some of those advantages and explores some steps that must be taken to enable overall Domino performance.

4.1 ADVANTAGES OF NETAPP STORAGE SYSTEMS

Running Domino with databases and transaction log files stored on a NetApp storage system has several advantages:

- **Extremely Fast Backup:** Snapshot copies can be created in a matter of seconds, regardless of the size of the Domino database or the level of activity on the NetApp storage system used. This reduces the Domino backup window from hours to seconds and allows Domino administrators to take frequent full backups without having to take the Domino server offline.
- **Quick Recovery:** Using the Data ONTAP SnapRestore® command, an entire Domino environment can be restored in a matter of seconds. Since there is no data copying involved, an

incredible amount of time is saved as the file system is put back to the original state it was in at the time the Snapshot copy was created. Data ONTAP 8.0 7-Mode supports 255 Snapshot copies per WAFL[®] volume. The ability to store a large number of low-impact, frequently created Snapshot copies brings the time needed to perform a roll-forward recovery operation down to minutes or seconds. In many circumstances it allows the Domino administrator to restore the Domino server immediately without having to restore from tape.

- **High Availability:** The need for 24x7 availability is fast becoming a reality for organizations of all sizes. Organizations cannot tolerate scheduled downtime nor can they afford extended periods of slow system response caused by traditional Domino server backup methods. NetApp Snapshot technology that can create a Domino server backup in a matter of seconds without bringing the server down can be used as complementary technology to enable higher system uptime.
- **High Reliability:** The RAID architecture used for NetApp storage systems is unique and provides greater reliability than many traditional RAID implementations. If a disk in a NetApp RAID group fails, it is reconstructed automatically without any user intervention. Additionally, NetApp supports RAID-DP[®] architecture. RAID-DP is considered approximately 4,000 times more reliable than traditional RAID. For more details on RAID-DP please read [NetApp Data Protection: Double Parity RAID for Enhanced Data Protection with RAID-DP](#).
- **No Impact on System Response Time During Backup:** A Snapshot copy is simply a picture of the file system at a specific point in time. Therefore, creating a Domino server backup using Snapshot doesn't involve actual data movement (data I/O); the backup process has virtually no performance impact on system response time.
- **Minimum Storage Requirement:** Two Snapshot copies created in sequence differ from each other by the blocks added or changed in the time interval between their creation times. This block-incremental behavior limits associated storage capacity consumption.
- **Load Balance:** Many of the tasks associated with load balancing between multiple Domino directories can be eliminated. Because of the high performance of the NetApp storage system, only one volume needs to be defined for each directory used.
- **Compaction of Domino Databases:** Compaction does not need to be performed as often, because of the way that WAFL manages the space on the storage system volume.

4.2 LOTUS DOMINO TRANSACTION LOGGING

Lotus Domino supports transaction logging. With this feature enabled, the system captures database changes and writes them to the transaction log. Then if a system or media failure occurs, you can use the transaction log and a previously created backup to recover your Domino databases.

Transaction logging provides three main benefits:

- **No fix-up required:** In most cases, you no longer need to run the fix-up task to recover databases following a system failure, which results in faster server restarts. Fix-up must check every document in each database, while transaction log recovery applies or undoes only those transactions not written to disk at the time of the system failure.
- **Superior performance:** Transaction logging saves processing time because it allows Domino to defer database updates to disk during periods of high server activity. Transactions are recorded sequentially in the log files, which is much quicker than database updates to random, nonsequential parts of a disk. Because the transactions are already recorded, Domino can safely defer database updates until a period of low server activity.
- **Simplified backup process:** Using transaction logging simplifies your daily backup procedure. You can use Snapshot to perform daily incremental backups of the transaction logs, rather than perform full database backups.

Lotus Domino's serialized log writes play to one of the strengths of the NetApp storage system. WAFL is very efficient at writing data to a storage system volume. The storage system's NVRAM cache effectively groups incoming data and writes it out to disk in an efficient manner.

Lotus Domino supports three types of transaction logging as described in Table 2.

Table 2) Transaction Logging Styles

Style	Descriptions
Circular	Circular logging is the default transaction logging type. It uses one transaction log file of a predefined size (192MB to 4GB). The transaction log size is defined in the server document. The circular logging overwrites the old data once the defined size is reached with the new transaction. Domino writes the old transaction log data to the disk before it is overwritten. This method helps in server crash recovery but limits the Domino administrator's ability to perform roll-forward recovery because the old logs are overwritten. Circular logging does not support incremental backups.
Linear	Similar to circular logging but allows a log space larger than 4GB.
Archival	The method of transaction logging doesn't overwrite the transaction log file. After a file has reached its defined size, Domino creates a new transaction log file. After all the data is committed to the database, the old transaction log file becomes available for archiving. For archiving the transaction log file you can use a third-party tool such as Tivoli or your custom scripts. Archive logging will enable rollback, media recovery, and point-in-time recovery.

NetApp requires that data and transaction logs be stored on separate LUNs.

5 CONFIGURE THE DOMINO ENVIRONMENT

5.1 CONFIGURING THE STORAGE SYSTEM

Before you create a Domino database on a NetApp storage system, you need to configure the storage system. You can use command line, NetApp FilerView, or NetApp System Manager for this purpose. In this document we used command line to configure the storage, but most of the task can also be completed using NetApp FilerView or System Manager. NetApp FilerView is a Web-based interface and NetApp System Manager is a Windows/MMC 3.0 application that offers comprehensive storage management capability for one of more systems via a simple, easy-to-use, intuitive GUI. We configured the storage system by completing the following simple configuration steps:

1. Set up and install Data ONTAP 8.0 7-Mode (or other supported version of Data ONTAP).

Install Data ONTAP 8.0 7-Mode on your storage system if it is not already installed. For Data ONTAP installation and setup instructions please refer to the [Software Setup Guide](#) on the [NOW](#) Web site.

2. Activate the license and start the appropriate services.

On the NetApp or IBM N series storage system, file access protocols FCP and iSCSI are licensed services. You need to enable the following services by activating license keys for the protocol you intend to use.

- iSCSI, if you plan to use iSCSI-accessed virtual disks
- FCP, if you plan to use FCP-accessed virtual disks
- SnapRestore, which is required for restoring virtual disks from Snapshot copies

The license keys can be activated by executing the following command on the NetApp storage system:

```
license add [LicenseCode]
```

Where

- `LicenseCode` identifies the necessary license key for the service/product.

NOTE: Parameters or options shown in square brackets ([]) are required and must be provided; parameters shown in angle brackets (< >) are optional; a comma followed by ellipses (...) indicates that the preceding parameter can be repeated multiple times.

For example, to activate the license code for iSCSI, you would execute the following command on the storage system:


```
license add 123XYZABCD
```

After activating the license key you need to start the service by executing the following command:

```
[fcp | iscsi] start
```

3. Update the `/etc/host` file on the storage system.

The storage system must be able to communicate with the Windows server and vice versa. The storage system can communicate with the Windows server if there is an entry in its `/etc/hosts` file for it or, alternatively, if it uses some other host name resolution techniques like NIS or DNS. By default, the `/etc/hosts` file is checked first for host name resolution. The easiest way to update the `/etc/hosts` file on the storage system is by using FilerView. Entries made in the `/etc/hosts` file should have the following format:

```
[LDServerIP] [LDServerName]
```

Where

- `LDServerIP` identifies the IP address assigned to the Windows server.
- `LDServerName` identifies the name assigned to the Windows server.

For example, to add an entry for a Windows server named `ldsrv01` that has the IP address `172.17.32.112`, you would add the following line to the `/etc/hosts` file on the NetApp storage system:

```
172.17.32.112      ldsrv01
```

4. Enable rsh access.

In order to use rsh (remote shell) from a Windows server, you must enable rsh by turning the rsh option on and editing the `/etc/hosts.equiv` file. You can turn the rsh option on by executing the following command on the storage system:

```
options rsh.enable on
```

Edit the `/etc/hosts.equiv` file and add an entry for each user on the Windows server that can issue the `rsh` command. Each entry should have the following format:

```
[LDServerName] [UserName]
```

Where

- `LDServerName` identifies the name assigned to the Windows server.
- `UserName` identifies the name assigned to the user on the Windows server.

For example, to enable rsh for a user named `ldadmin` on the Windows server named `ldsrv01`, you would add the following entry to the `/etc/hosts.equiv` file on the storage system:

```
ldsrv01 ldadmin
```

If a user is a domain user then the entry should follow a format that looks similar to the following:

```
[LDServerName] [DomainName]\[UserName]
```

Where

- `LDServerName` identifies the name assigned to the Windows server.
- `DomainName` identifies the domain name the user belongs to.
- `UserName` identifies the name assigned to the user on the Windows server.

For example, to enable rsh from a Windows server named `ldsrv01` for a user named `ldadmin`, who belongs to a domain named `corp`, you would add the following entry to the `/etc/hosts.equiv` file:

```
ldsrv1 corp\ldadmin
```

5. Create an aggregate and volumes.

In order to create a Domino database on the storage system, you need to create aggregates and flexible volumes. An aggregate is a physical pool of storage, comprised of one or more RAID groups, and is created using the following command:

```
aggr create [AggrName] -r [RaidSize] [NDisks]@[DiskSize] -t [raid-dp|raid4]
```

Where

- `AggrName` identifies the name assigned to the aggregate.
- `RaidSize` identifies the raid group size for the aggregate.
- `NDisks` identifies the number of disks used for the aggregate.
- `DiskSize` identifies the disk size for the disks that are used for the aggregate.

For example, to create an aggregate named `aggr01` that has eight 146GB disks in it and that uses RAID-DP, you would execute the following command on the storage system:

```
aggr create aggr01 -r 8 -t raid_dp 8@146g
```

A FlexVol volume is a logical storage container inside an aggregate. A FlexVol volume can be as small as a few megabytes and as large as the aggregate itself. FlexVol volumes can be created using the following command:

```
vol create [VolName] [AggrName] [VolSize]
```

Where

- `VolName` identifies the name assigned to the new volume.
- `AggrName` identifies the name assigned to the aggregate.
- `VolSize` identifies the size of the new volume in kilobytes (KB), megabytes (MB), gigabytes (GB), or terabytes (TB).

In order to create a virtual disk using SnapDrive, you need to create dedicated FlexVol volumes for each virtual disk used.

For example, to create a flexible volume named `dominodata` that is 200GB in size and that resides in the aggregate named `aggr01`, you would execute the following command on the NetApp storage system:

```
vol create dominodata aggr01 200GB
```

You should create at least two dedicated volumes, one for the Domino database and one for the transaction logs.

Note: The volume must be more than twice the combined size of all the virtual disks on the volume if a Snapshot copy of the volume will be created. This enables the volume to hold the virtual disks and a special reserved space, so that no matter how much the contents of the virtual disks change between Snapshot copies, the entire contents of the disks can be written to the volume.

6. Specify the volume security settings to use.

You must ensure that the volume(s) on the storage system that are to be used to house a Domino database support either the NTFS or the Mixed security style. The security setting of a volume can be set using the following command:

```
qtree security [VolName] [ Unix | NTFS | mixed ]
```

Where

- `VolName` identifies the name assigned to the new volume.

For example, to change the security style of a volume named `dominodata` to NTFS, you would execute the following command on the storage system:

```
qtree security /vol/dominodata NTFS
```

Repeat this step and change the security style for all the volumes to be used for the database.

7. Create CIFS shares for the volumes.

Next, you need to create CIFS shares for each volume that you created in the previous step. A CIFS share can be created by executing the following command on the storage system:

```
cifs shares -add [ShareName] [VolPath]<-comment [ShareDescription]>
```

Where

- **ShareName** identifies the name assigned to the CIFS share created for the Domino data volume.
- **VolPath** identifies the path assigned to the volume.
- **ShareDescription** identifies the description for the CIFS share.

For example, to create a share named `lddata` for a FlexVol volume named `dominodata`, you would execute the following command on the storage system:

```
cifs shares -add lddata /vol/dominodata -comment "Domino data"
```

Repeat this step and create CIFS shares for all the volumes to be used by the database.

8. Disable the automatic Snapshot feature.

Normally, a Domino database is backed up based on a user-defined schedule. Therefore, NetApp recommends that you turn off the automatic Snapshot feature for all volumes that are used for the database and its transaction log files. The automatic Snapshot feature can be turned off by executing the following command on the storage system:

```
vol options [VolName] nosnap on
```

Where

- **VolName** identifies the name assigned to the new volume.

For example, to turn the automatic Snapshot feature off for a volume named `dominodata`, you would execute the following command on the storage system:

```
vol options dominodata nosnap on
```

Repeat this step and turn the automatic Snapshot feature off for all the volumes that are used by the database.

9. Setting the snap reserve option for the volume.

By default, Data ONTAP sets the snap reserve option for new volumes to 20%. You should reset the snap reserve option to 0% on all volumes holding SnapDrive virtual disks. To reset the snap reserve option, you would execute the following command on the storage system:

```
snap reserve -V [VolName] [Percent]
```

Where

- **VolName** identifies the name assigned to the new volume.
- **Percent** identifies the volume space reserved for the Snapshot copies. A valid value is between 0 and 100.

For example, to set snap reserve to 0% for a flexible volume named `dominodata`, you would execute the following command on the storage system:

```
snap reserve -V dominodata 0
```

10. Obtain a node name for the storage system.

Target NetApp or IBM N series storage systems are identified by a unique node name that is used for creating persistent binding for the storage devices on the host. You can find out the node name by executing the following command:

```
[ fcp | iscsi ] nodename
```

For example, to find the node name assigned to an iSCSI target, you would execute the following command on the NetApp storage system:

```
iscsi nodename
```

The output from the above command should look similar to the following:

```
iSCSI target nodename: iqn.1992-08.com.netapp:sn.101171898
```

Make a note of the node name returned by this command; you will need it later when configuring the HBA on the Windows server.

11. Create a user with administrator privileges.

Create a user that belongs to the local administrator group by entering the following command on the storage system:

```
useradmin useradd [UserName] -g [AdminGroup]
```

Where

- `UserName` identifies the name assigned to the user.
- `AdminGroup` identifies the name assigned to the local administrator group.

For example, to create a user named `ldadmin` that belongs to the local administrator group named `administrator`, you would execute the following command on the storage system:

```
useradmin useradd ldadmin -g administrator
```

Enter a password when prompted to do so for the user account you are creating. (You will be prompted twice to enter a password.)

5.2 CONFIGURING THE WINDOWS SERVER

1. Installing SnapDrive for Windows

In order to simplify storage management, you need to install SnapDrive on your Windows server that will house the Domino software. SnapDrive for Windows is a licensed product and can be downloaded from the NetApp Web site or IBM Web site. The detailed installation steps are described in Appendix A. For the purposes of this document we use SnapDrive 6.2.

2. Configuring the Microsoft iSCSI software initiator

You need to download and install the Microsoft iSCSI software initiator by completing the following steps:

- I. Windows 2008 comes with a version of Microsoft iSCSI initiator installed by default. Older versions of Windows will require you to download the Microsoft iSCSI software initiator from the Microsoft Web site and install the initiator using the downloaded file.
- II. Next, configure the initiator. To do this, open the initiator property panel by navigating to Start -> Control Panel -> iSCSI initiator.
- III. Select the General tab and check the initiator name. The initiator's name must adhere to the following naming format:

```
iqn.[yyyy-mm].[BackwardNamingAuthority]:UniqueDeviceName
```

Where

- `yyyy-mm` is the month and year in which the naming authority acquired the domain name.
- `BackwardNamingAuthority` identifies the reserved domain name (backward) of the authority responsible for naming this device.

- UniqueDeviceName identifies the unique name assigned to the host system.

For example, the initiator name should look similar to the one shown in Figure 2.

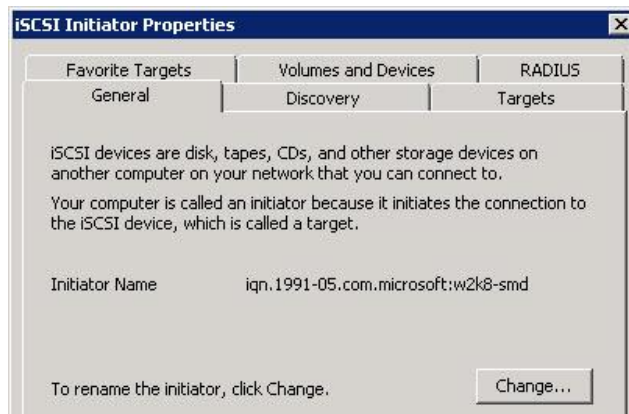


Figure 2) iSCSI software initiator name (iqn.1991-05.com.microsoft:fujfi15).

If the name is not in the required format, change it by clicking on the Change button and providing an appropriate name.

- IV. Next, select the Discovery tab and add a target by clicking on the Add button. Enter the storage system's IP address or DNS name as illustrated in Figure 3. The storage system port value is 3260 by default. If the port value is not 3260 in your environment then provide the appropriate port value.

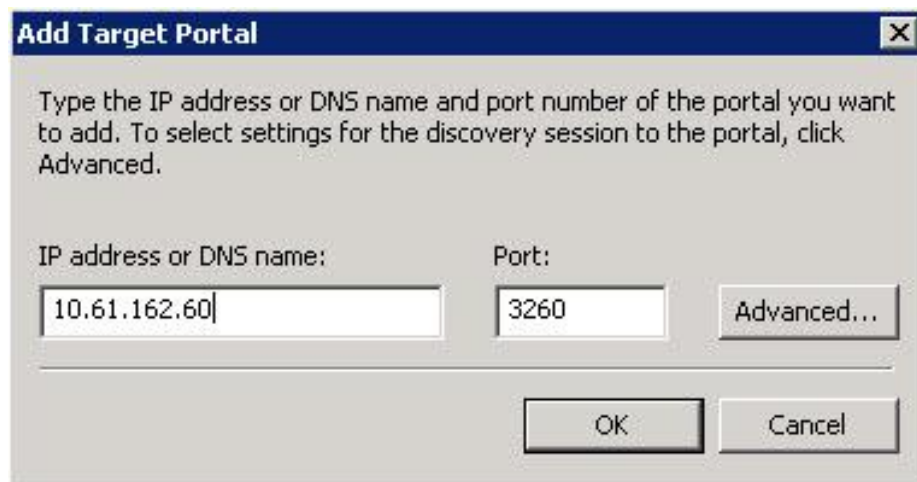


Figure 3) Target storage system details.

Next, click on the Targets tab and check the target name. This name should be the same as the one you obtained in step 10 of section 5.1. Figure 4 illustrates a target available for the initiator.

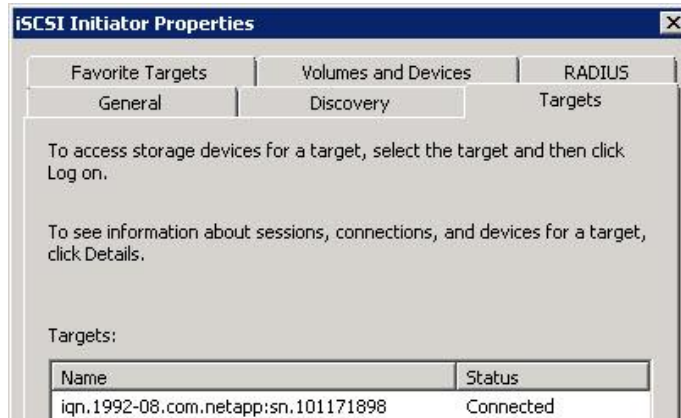


Figure 4) Available targets for the initiator.

After completing the above-mentioned steps the initiator is ready to be used.

- Configuring user authentication

The Windows server used for Lotus Domino needs to have proper authentication configured. You can configure with one of the following authentication methods:

1. Domain Name Service (DNS) – a domain controller is required
2. Network Information Server (NIS) – an NIS server is required
3. Pass-through authentication – no domain controller or NIS is required

You can use any of the authentication methods for your Domino environment. For the purposes of producing this document, we used pass-through authentication. In order to configure with pass-through authentication, you must complete the following steps:

- a) Create a local user account that has administrator privileges. Make sure that the user name and password for the local user account are the same as those you created on the storage system in step 11 of section 5.1.
- b) Open a Windows command prompt window and enter the following command:

```
rsh [StorageSystemName] version
```

Where

- `StorageSystemName` identifies the name assigned to the storage system.

For example, to check if rsh is enabled for a storage system named `netapp`, you would execute the following command in the command window on the database server:

```
rsh netapp version
```

NOTE: In order to develop this document we used the Microsoft iSCSI software initiator in our environment, though you can use Fibre Channel protocol to access the storage in your environment.

6 CREATING VIRTUAL DISKS ON A WINDOWS SERVER USING SNAPDRIVE

A virtual disk created on the Windows server is in fact a LUN on the NetApp storage system. You should not create LUNs using FilerView, System Manager, or the command line. Instead, you should use SnapDrive to create LUNs and virtual disks on the Windows server. In order to create virtual disks, complete the following steps:

1. To begin the LUN creation process, open the Microsoft Management Console (MMC). On the **Start Menu**, click **Run**, type `compmgmt.msc`, and then click **OK**. The Microsoft Computer Management wizard opens as illustrated in Figure 5.

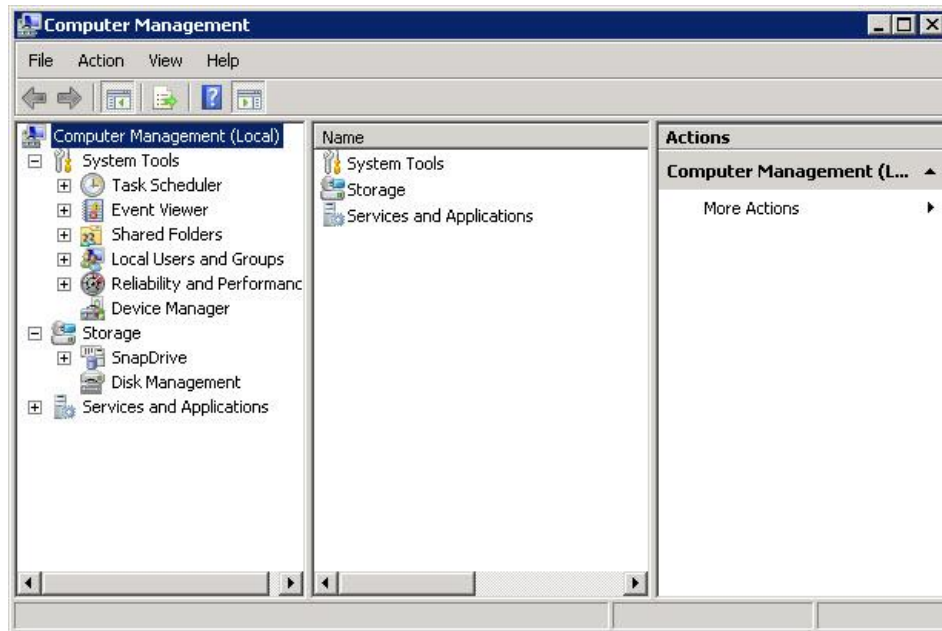


Figure 5) Computer management wizard.

2. Navigate the Storage -> SnapDrive -> Disks tree and right-click on the Disks node as illustrated in Figure 6.

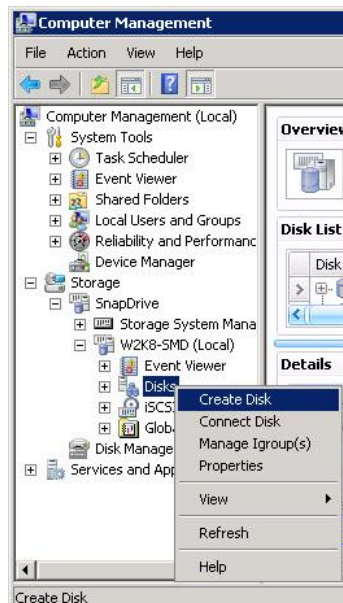


Figure 6) Create virtual disk menu.

3. Select Create Disk from the menu. This will activate the Create Disk Wizard as illustrated in Figure 7. When it is displayed, click the Next button.

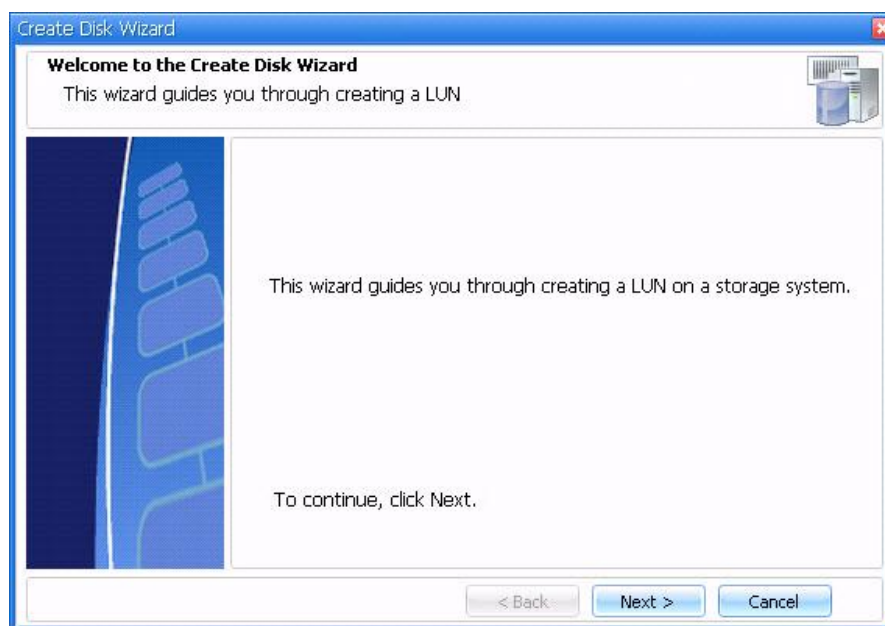


Figure 7) Create disk wizard.

4. (4) The next panel will prompt you to select your storage system, LUN path, and CIFS share name that you created in step 7 of section 5.2. Select the path and enter the CIFS share name as displayed in Figure 8 and click the Next button.

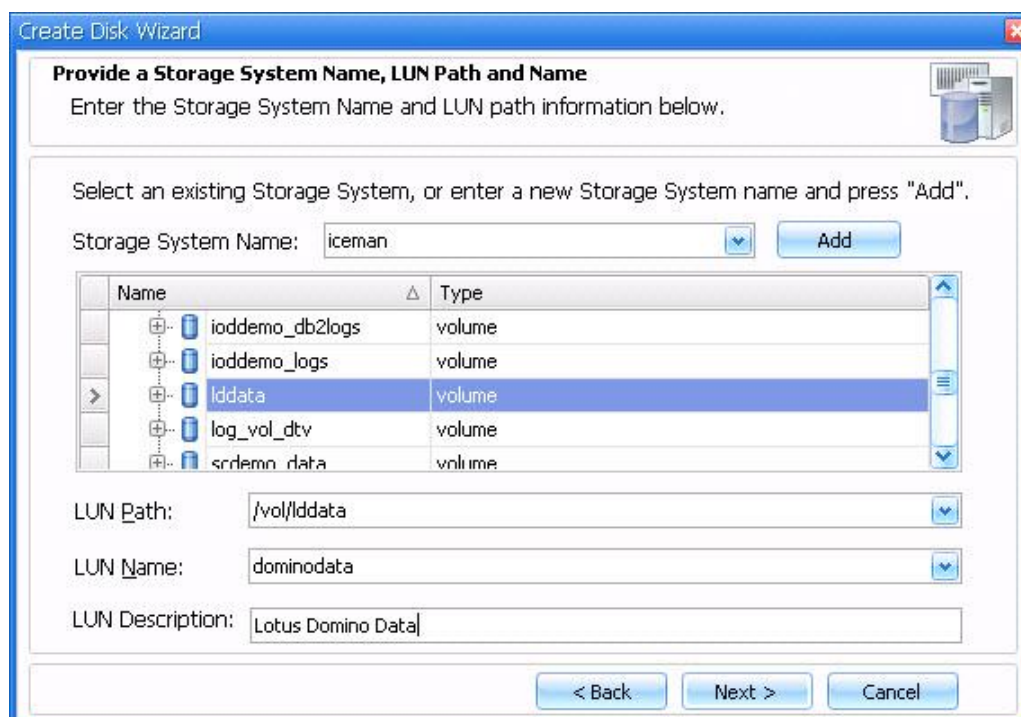


Figure 8) Virtual disk path and LUN name.

5. NetApp recommends using dedicated virtual disks for a Lotus Domino database. Therefore, specify the virtual disk being created as a dedicated disk by selecting the Dedicated radio button as illustrated in Figure 9. When this is done, click on the Next button.

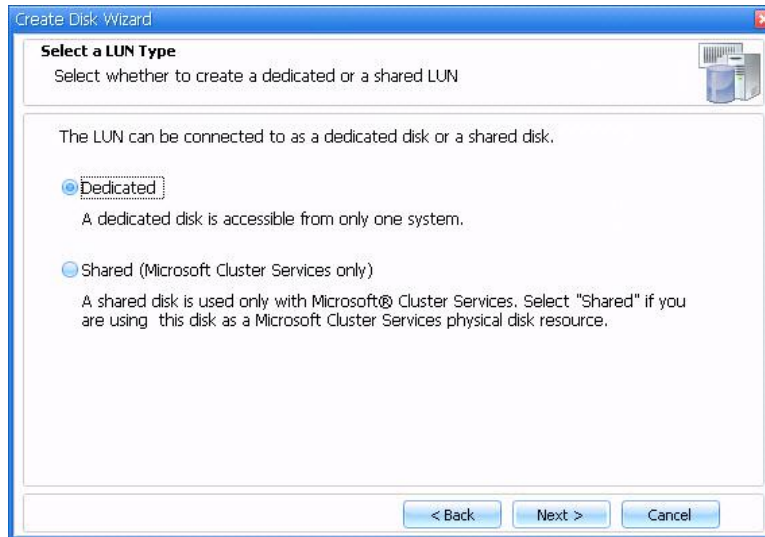


Figure 9) Create dedicated virtual disk.

6. By default, SnapDrive will select a Drive Letter and Size for the disk similar to the illustration in Figure 10. You can change the disk size by specifying the appropriate space available on your volume. After verifying the drive letter and entering the disk size, click the Next button.

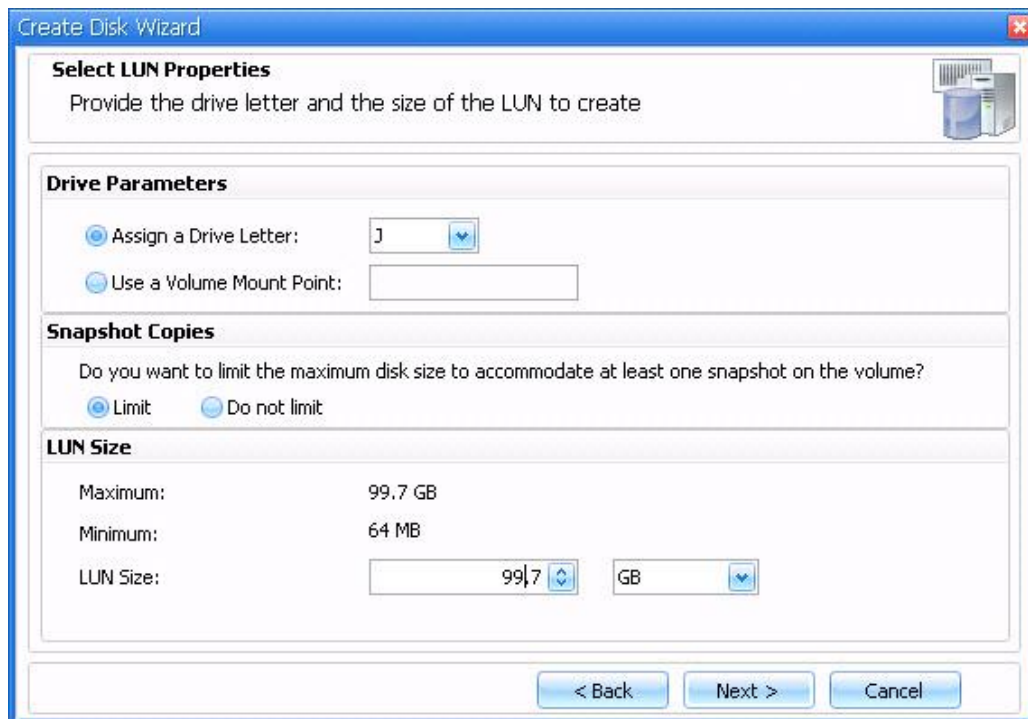


Figure 10) Disk size and drive letter.

7. The next panel should look similar to the one illustrated in Figure 11. It will inform you of some changes SnapDrive will make for the volume. After reviewing these changes, click the Next button.

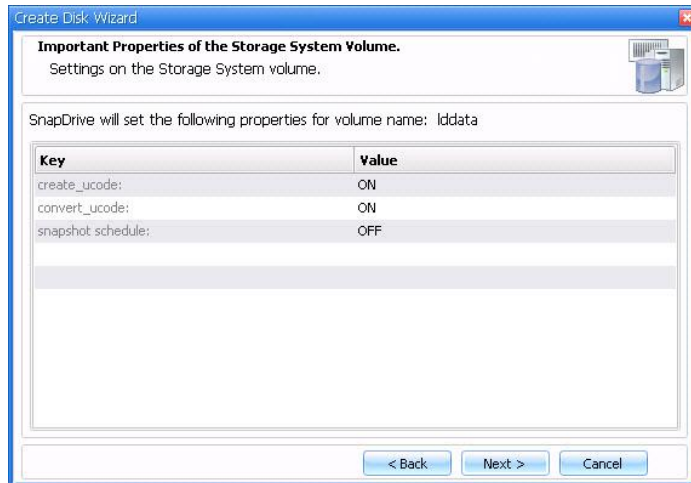


Figure 11) SnapDrive modification to the volume properties.

8. Next, you need to specify the initiator that will be used to connect to the virtual disk. Select an appropriate initiator from the list of those available and move it to the selected list by clicking the arrow button as shown in Figure 12. After specifying the initiator, click the Next button.

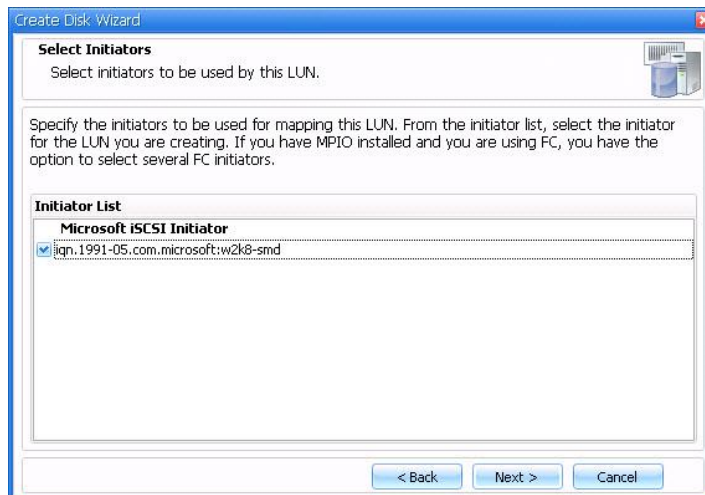


Figure 12) Select the appropriate initiator from the list of available initiators.

9. Next you need to select Initiator Group management. NetApp suggests that you take the default option of "Automatic" as shown in Figure 13. After specifying your choice, click the Next button.

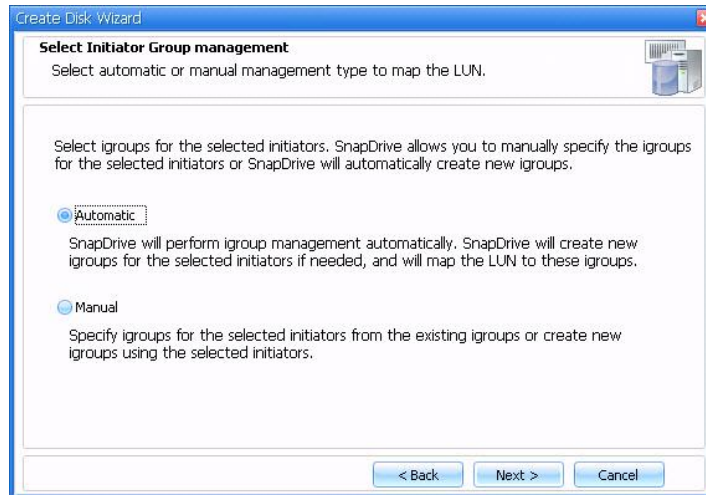


Figure 13) Select Initiator Group management.

10. The confirmation screen will provide you with summary information about the disk that is about to be created. When ready to proceed, click the Finish button and the system will create a virtual disk. It may take some time because the virtual disk is formatted in the NTFS format.

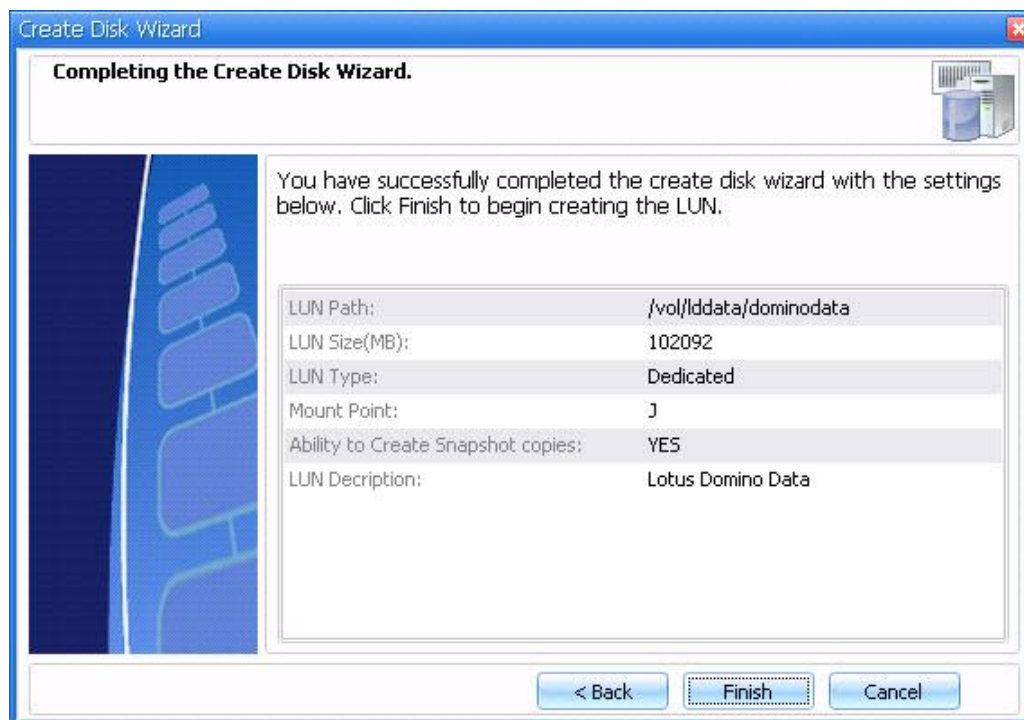


Figure 14) Create disk wizard.

11. After completing the steps above, as shown in Figure 15, you should see details of your new disk after all of the configuration steps have been completed.

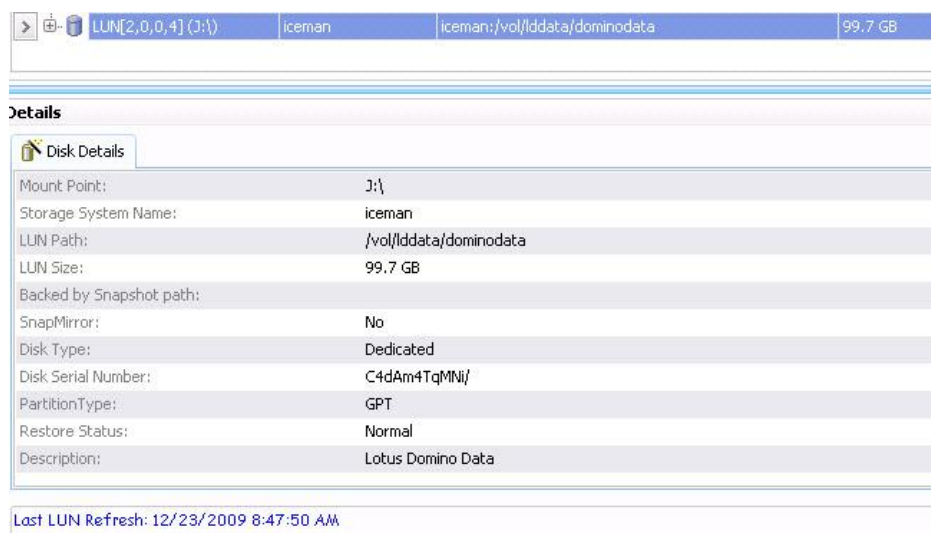


Figure 15) Virtual disk created successfully.

After you complete the above-mentioned steps, the SnapDrive will create a LUN named /vol/dominodata/dominodata.lun on the NetApp storage system. Repeat these steps and create additional virtual disks if needed for your Domino environment.

NOTE: When you create a virtual disk using SnapDrive, SnapDrive creates an igroup for the initiator. LUNs created for the initiator are mapped to this igroup.

7 INSTALLING AND CONFIGURING LOTUS DOMINO SERVER

The following steps are necessary to install and configure a Domino server that uses NetApp storage for its data and transaction logs:

1. Launch the Setup program for Lotus Domino server.
2. After accepting the license agreement, the next panel will prompt you to enter the program file location as illustrated in Figure 16. You can store the program file on the virtual disk or the local disk on the Windows server. For this write-up we installed the Domino program files on a local disk to the default location (C:\Program Files\IBM\Lotus\Domino).



Figure 16) Domino program file location.

3. The next panel will prompt you to enter the location for the Domino database data files as illustrated in Figure 17. You need to specify the network drive that corresponds to the virtual disk on the storage system for the Domino data folder (H:\lotus\domino\data).

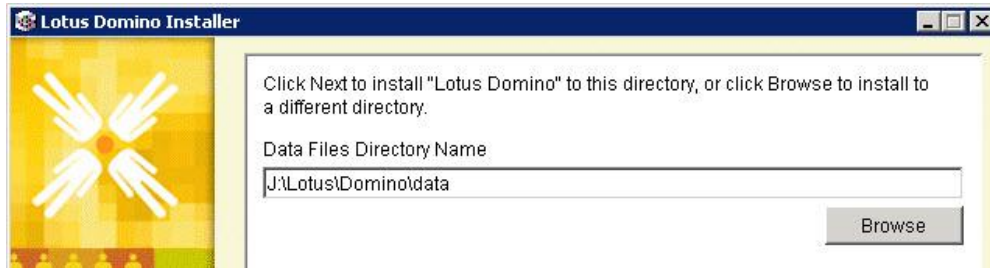


Figure 17) Domino data files location.

4. The next panel prompts you to select the install type. Select the "Domino Enterprise Server" as displayed in Figure 18 and click the Next button.



Figure 18) Domino install types.

5. The next panel will present you with the install summary similar to the one in Figure 19. After reviewing the installation summary, click on the Next button.

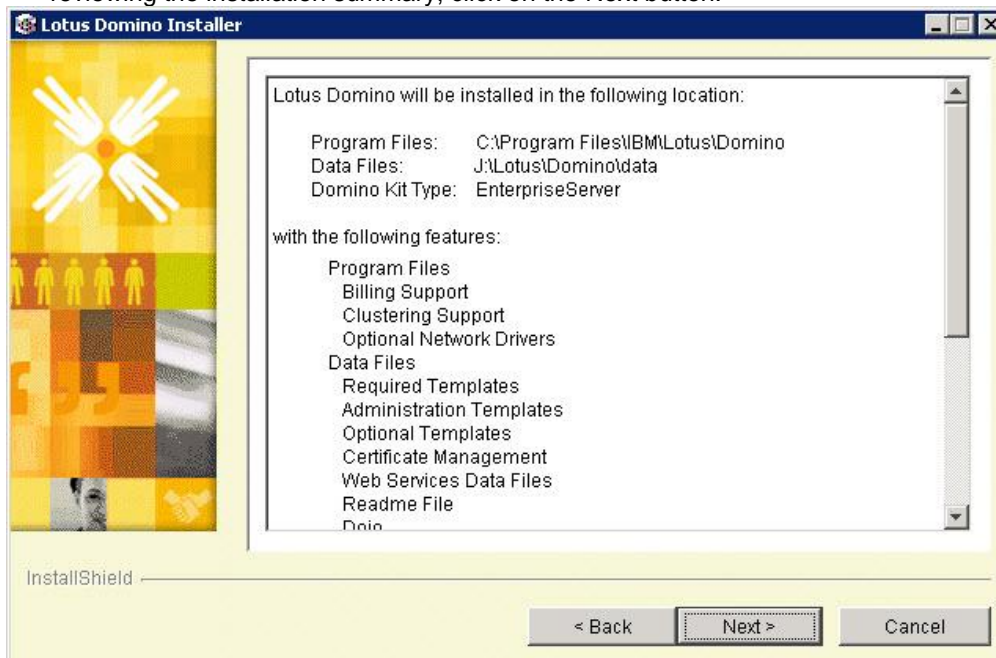


Figure 19) Domino installation.

6. When the Installation process is complete click the Finish button.
7. Next, start the Domino server setup process by double-clicking the desktop icon or by choosing:
Start-> All Programs -> Lotus Applications -> Lotus Domino Server
8. Click the Next button on the Welcome panel.
9. On the next panel select Set up the first server or a standalone server radio button and click OK.
10. On the next panel, specify the host details name and host description as illustrated in Figure 20 and click on the Next button.

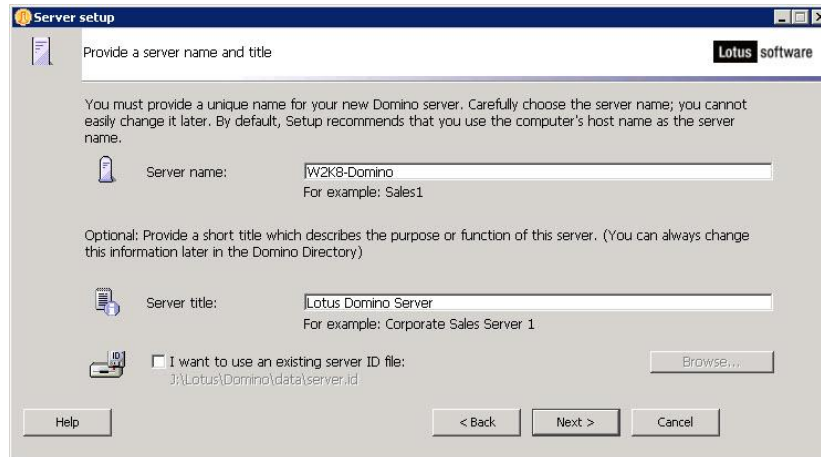


Figure 20) Domino first server configuration.

11. The next panel prompts you to specify the organization name and the certificate password. Enter the values for the organization name and the certificate password as illustrated in Figure 21 and click the Next button. If you desire to set up at the organization unit level, click on the Customize button and proceed with the configuration.

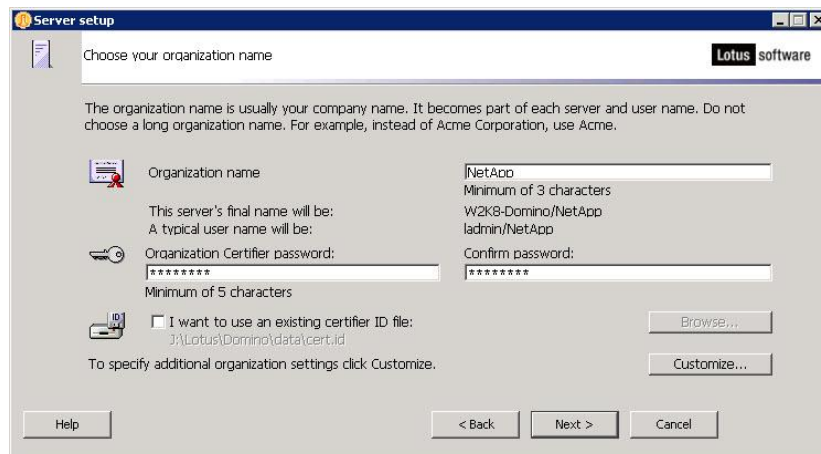


Figure 21) Domino first server configuration.

12. On the next panel enter the Domino domain name and click on the Next button.
13. On the next panel, specify the administration account details and click the Next button.
14. In the next step you need to configure the Internet services you desire for the Domino server. NetApp suggests that you click the Customize button and select only the services that you need on this server. In Figure 22 you will notice that all three boxes are checked, but using the "Customize" option not all services are selected.

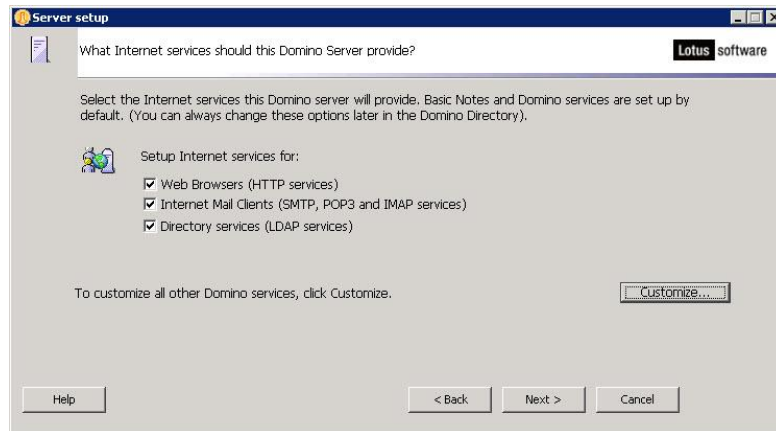


Figure 22) Internet service configuration.

15. By default the installation will configure multiple network settings. You can click on the Customize button and clear any ports that will not be used. At this time NetApp also suggests that you set the host name for the server. Figure 23 illustrates the settings selected.

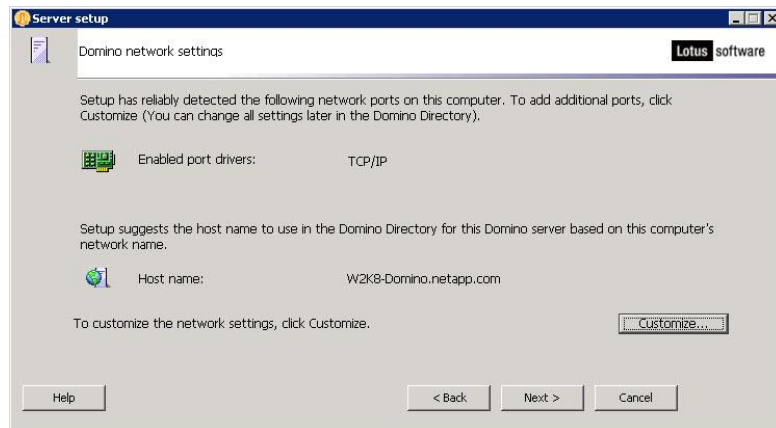


Figure 23) Configure network setting.

16. The next step covers security for the Domino server. NetApp suggests that you take the default options, and then click Next.
17. Review the configuration summary on the next panel and click the Setup button. When setup is complete, click the Finish button.

7.1 ENABLING LOTUS DOMINO TRANSACTION LOGGING

Transaction logging is an optional feature in Lotus Domino, but, based on integration work with Lotus Professional Services and close collaboration with Lotus Engineering, NetApp recommends the use of the transaction logging feature in Domino. Transaction logging has many benefits, including increased performance for high Domino workloads. However, the enhanced data availability associated with much shorter recovery (consistency check) times is the primary reason transaction logging should be seriously considered by all Domino server administrators. In order to enable transaction logging you need to complete the following steps:

1. From the Domino administrator select the Domino domain tab.
2. Select Server->Current Server Document from the tree and click the Configuration tab.
3. Click the Transactional Logging tab.
4. Complete these fields, and then save the document.

Field	Value
Transactional Logging	Choose Enabled. The default is Disabled.
Log path	Path name location of the transaction log. The default path name is \LOGDIR in the Domino data directory, although NetApp strongly recommends storing the log on a separate virtual disk residing on the NetApp storage system. The separate device should have at least 1GB of disk space for the transaction log.
Maximum log space	Default is 192MB. Maximum is 4096MB (4GB). Domino formats at least 3 and up to 64 log files, depending on the maximum log space allocated.
Use all available space on log device	Choose one: <ul style="list-style-type: none"> • Yes to use all available space on the device for the transaction log. This is recommended if you use a separate device dedicated to storing the log. If you choose Yes, you don't need to enter a value in the "Maximum log space" field. • No to use the default or specified value in the "Maximum log space" field.
Automatic fixup of corrupt databases	Choose one: <ul style="list-style-type: none"> • Enabled (default). If a database is corrupt and Domino cannot use the transaction log to recover it, Domino runs the Fix-up task, assigns a new DBIID, and notifies the administrator that a new database backup is required. • Disabled. Domino does not run the Fix-up task automatically and notifies the administrator to run the Fix-up task with the -J parameter on corrupt logged databases.
Runtime/Restart performance	This field controls how often Domino records a recovery checkpoint in the transaction log, which affects server performance. To record a recovery checkpoint, Domino evaluates each active logged database to determine how many transactions would be necessary to recover each database after a system failure. When Domino completes this evaluation, it: <p>Creates a recovery checkpoint record in the transaction log, listing each open database and the starting point transaction needed for recovery.</p> <p>Forces database changes to be saved to disk if they have not been saved already.</p> <p>Choose one:</p> <ul style="list-style-type: none"> • Standard (default and recommended). Checkpoints occur regularly. • Favor runtime. Domino records fewer checkpoints, which requires fewer system resources and improves server run time performance. • Favor restart recovery time. Domino records more checkpoints, which improves restart recovery time because fewer transactions are required for recovery.
Logging style	Choose one: <ul style="list-style-type: none"> • Circular (default) to continuously reuse the log files and overwrite old transactions. You are limited to restoring only the transactions stored in the transaction log. • Archive (recommended) to not reuse the log files until they are archived. A log file can be archived when it is inactive, which means that it does not contain any transactions necessary for a restart recovery.

7.2 MIGRATING AN EXISTING LOTUS DOMINO SERVER FROM LOCAL DISK TO A NETAPP STORAGE SYSTEM

A Domino administrator can migrate an existing Domino server from local disk to a NetApp storage system either by using NetApp SnapManager® for Domino or manually copying the Domino data directory and transaction log files to the virtual disks created on the storage system. This section describes the manual process to migrate the Domino server.

In order to migrate the Domino server to virtual disks residing on the NetApp storage system you need to complete the following steps.

1. Stop the Domino server that is being migrated.
2. Make a complete backup of the original Domino server.
3. Identify the location of the program directory by looking at the line "NotesProgram =" in the NOTES.INI file.

4. Create the \Lotus\domino\data and \Lotus\domino\logs directories on the virtual disks you create for the Domino server.
5. Move the old \Lotus\domino\data old directories (the location of the data directory can be identified from the line Directory= in the notes.ini) to the new directory \Lotus\domino\data on the virtual disk.
6. Move the old \Lotus\domino\logs old directories (the location of the data directory can be identified from the line Directory= in the notes.ini) to the new directory \Lotus\domino\logs on the virtual disk.
7. The notes.ini file should have references to the new data and transaction log file locations. Go to the Domino directory and update the following parameters in the notes.ini file.

Old Value	New Value
Directory=C:\Lotus\Domino\data	Directory=C:\Lotus\Domino\data
KeyFilename=C:\Lotus\Domino\data\server.id	KeyFilename=F:\Lotus\Domino\data\server.id
CertifierIDFile=C:\Lotus\Domino\data\cert.id	CertifierIDFile=F:\Lotus\Domino\data\cert.id
TRANSLOG_Path=C:\lotus\domino\logs	TRANSLOG_Path=G:\lotus\domino\logs
Previous_TRANSLOG_Path=C:\lotus\domino\logs\	Previous_TRANSLOG_Path=G:\lotus\domino\logs\

In the above example, the Lotus Domino data and transaction log files are moved from directories on a local disk to the directories on virtual disks H and G. Only storage is changed, not the Domino server, therefore the program files are not moved and kept in the same directory.

8. Start the Domino server to determine that it was migrated correctly and test migration by sending some e-mails from a Notes e-mail client. Also open a couple of the databases and make sure that there are no issues.

8 CONCLUSION

Based on a simple and elegant architecture, NetApp storage systems offer a unique balance of performance, scalability, and availability not found in any other storage solution. Using NetApp storage systems with a Lotus Domino server helps any organization meet increasingly stringent service-level agreements while maximizing performance and minimizing storage and Domino administration requirements.

9 CAVEATS

The information presented in this document has been tested by NetApp using only a limited set of hardware and software options. Therefore, your experience may differ from that presented here. If you have any problems with the techniques described in this technical report, please contact the author.

APPENDIX A: INSTALLING SNAPDRIVE FOR WINDOWS

You need to download SnapDrive 6.2 or higher from the NOW Web site and complete the following steps to install SnapDrive. Please note that you may be required to install some patches prior to a successful installation of SnapDrive. If these patches are required:

1. Execute the installation program. The installation wizard displays the Welcome panel. Click on the Next button.
2. The next panel presents you with the End User License Agreement as illustrated in Figure 24. Accept the license agreement and click on the Next button.

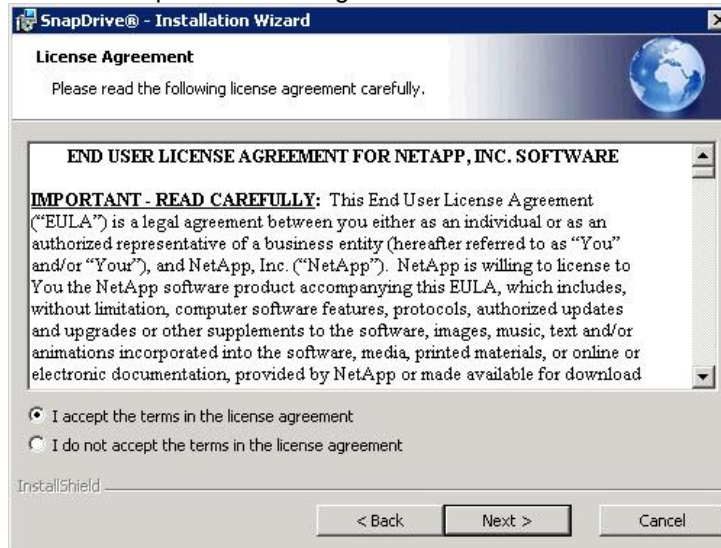


Figure 24) End user license agreement.

3. On the next panel enter the SnapDrive license key.
4. On the next panel enter the customer information and click on the Next button.
5. Confirm the destination folder for the SnapDrive product and click on the Next button.
6. On the next panel you need to specify the detail of the user who will be logging on to the SnapDrive service and performing the operations. Enter the user details and click the Next button.
7. On the next panel confirm the ports that will be used for SnapDrive communication. The default ports are:
 - SnapDrive Web Service TCP/IP Endpoint - Port 808
 - SnapDrive Web Service HTTP Endpoint - Port 4094
 - SnapDrive Web Service HTTPS Endpoint - Port 4095Change the default port numbers if desired, and then click Next.
8. On the next panel confirm the default protocol settings. The default setting is RPC, but you may also select HTTP or HTTPS. Make your selection and click Next.
9. On the next panel you can specify the DataFabric[®] Manager configuration setting for Protection Manager. Enter the information requested if you wish to connect to Protection Manager. Otherwise click Next to continue.
10. Once the wizard has collected the information it needs to perform the installation, it provides one last chance to go back and change information, install, or cancel out of the wizard. You can start installation by clicking on the Install button.
11. Once the wizard completes, click the Finish button to exit the wizard.

APPENDIX B: MIGRATION—ADDITIONAL CONSIDERATIONS

Before you start migrating your Lotus Domino server from local disks to virtual disks residing on a NetApp storage system, you should pay attention to the following additional migration.

1. Make sure the server document is updated if the Network Configuration section changes. Some customers may have a server IP address in the Net Address field. This must be updated if the new box being installed has a different IP address.
2. Check for Directory Links when performing an upgrade/move.
3. If the server name is to be changed, determine that all encrypted databases are decrypted before copying the files to the new server.
4. When moving servers between different operating system platforms, use FTP to relocate the databases or mail files. This will prevent the code pages from being corrupted. In some instances, using the OS copy has caused some database corruption.
5. If moving from one machine to another and the drive mapping is different (e.g., from C drive to D drive), change the following parameters in the NOTES.INI:

Directory=d:\Lotus\Domino\Data

NotesProgram=d:\Lotus\Domino

Perform a search in the server's NOTES.INI to determine that these parameters are changed appropriately. Additionally, perform a "find" (CTRL + F) on the old drive references and change appropriately.

NOTE: If the server's name is changed when it is moved to the new hardware, the administrator can send users a mail message with a button having LotusScript behind it to change their Location documents to reflect the new name of the server.

REVISION INFORMATION

Version 2.0: February 2010 - Updated TR-3588 to reflect Windows 2008, Domino 8.5.1, SnapDrive 6.2, and Data ONTAP® 8 7-Mode. Screenshots were updated as well as basic information that has changed since the original publishing. TR Refresh performed by John Spinks.

Version 1.1: December 2009 - TR updated with updated NetApp branding.

Version 1.0: June 2007 - Original TR published. Original TR referenced Windows 2003, Domino 7.0.2, SnapDrive 4.2, and Data ONTAP 7.2.

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