STORAGECRAFT. SHADOWPROTECT 4

BEST PRACTICES GUIDE

Hardware Independent Restore

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POWERED BY STORAGECRAFT Technology Corporation

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Table of Contents

Synopsis

This Best Practices Guide will cover the methodology to adhere to when performing a Hardware Independent Restore (HIR) or a restore of any volume for that matter.

HIR is the process of recovering a system from one set of hardware to another set of hardware, or to a virtual environment. You can perform a HIR to affect a recovery from:

- Physical to Physical (P2P)
- Physical to Virtual (P2V)
- Virtual to Virtual (V2V)
- Virtual to Physical (V2P)

The process is processor independent and manufacturer independent as the chances are you will not be going back to similar hardware.

It is important to note that HIR is a recovery solution: it is not a deployment product.

Drivers, drivers, drivers

The majority of issues in a HIR revolve around the Mass Storage Controllers. Ensure that you have all the required (and correct) Mass Storage Controller driver(s) and Network Interface Card (NIC) driver(s) available before you start.

StorageCraft does not produce drivers. You get them from the manufacturer of the hardware you use. Note that in some situations you may need the 32-bit versions for the Recovery Environment (RE) and 64-bit versions for the operating system being recovered. And you will need the driver that matches the firmware of your device. Invariably every firmware change on a device requires a new driver update. That is why when you go to the manufacturers site, Model B SCSI adapter has 14 drivers listed – there have been 14 firmware changes since it was released.

Note: *Just because a driver loads in a running Windows system does not mean that the driver will be used in the RE. The RE is based on a Microsoft WinPE kernel and is a lot more strict on having well-formed driver INF conformity. Therein lies the issue - some of the drivers provided are badly written.*

What you must do!

When you deploy a new server, boot from the recovery CD into the RE and make sure that you can see the disks. Get the drivers now! Make sure that they load! Do it before you need it!

Recovery Environment

There are two REs that can be utilised. The first and the recommended RE to use is based on a Windows Server 2008 R2 kernel. This is a ‘clean’ baseline kernel with a minimal clean Microsoft driver set loaded. It has the very real advantage of being able to dynamically load drivers for the

Mass Storage Controllers and network adapters as well as being able to hot-plug USB devices whilst running.

Note: Some common physical and virtual third party storage and network drivers are provided in the `Additional_Drivers` folder found in the root of the recovery CD.

The second RE is a legacy environment based on a Windows Server 2003 kernel. If you need to load RAID drivers for this RE, you can only do this at boot time using the F6 option and you will require a floppy disk drive with a 3.5" 1.44 MB diskette containing the drivers. You cannot load network drivers in this RE at all.

The recovery environment that you choose is not dependent on the operating system that you are recovering. A Windows Server 2003 or Windows 2000 Server system can be recovered using the Windows Server 2008 R2 RE – this is the recommended RE and should be tried first in all cases.

The legacy RE is available for those cases where no drivers are available to see the disks in the RE, in machines where less than 1 GB of memory is available, or where the system BIOS does not support Windows Server 2008 R2 kernel levels.

Where to obtain the recovery CD

If you purchased a media kit with the software, this CD is the recovery CD. Please note that with each major release of the software, this recovery CD will be updated. An ISO image of the recovery CD is also available online. This can be obtained by raising a case with Support through the web portal at http://forum.storagecraft.com/Community/web2case/.

Pre-recovery considerations

To HIR or not to HIR

The recovery CD will only perform a HIR if the source machine that is being recovered had ShadowProtect installed and depending on the version, activated. This is an anti-piracy measure and designed to ensure that the recovery is in line with the products intended use.

Note: The ShadowProtect IT Edition does not have this limitation. It will perform a HIR regardless of whether ShadowProtect was installed or not on the source machine.

Windows licensing

The HIR process is not intended to bypass any Microsoft licensing terms and conditions. Specifically you should be aware that Windows OEM licenses are not allowed to be transferred from one machine to another machine. This may have a serious impact on your ability to recover the system concerned.

If you have any concerns with this, you should contact your Microsoft licensing organisation to discuss.

500 GiB into 320 GiB does not go

You may be faced with the situation where the source disks are larger than the destination disks available. What are your options apart from the obvious of ”get bigger disks”?

Shrink it. From within the RE (or on another running system with ShadowProtect installed) you can use the shrink facility. This technology is provided by the Microsoft WinPE (or the Microsoft operating system), but there are limitations.

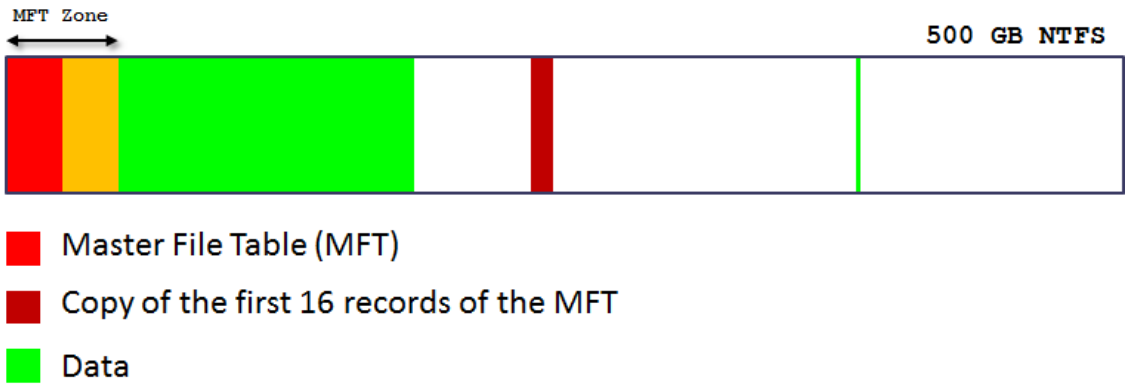

Figure 1: NTFS partition layout

The first limitation is that the shrink facility is only available in Windows Vista/Windows Server 2008 and later kernels.

Secondly, where the data in the partition physically resides will determine how far you can shrink the disk. Referring to Figure 1, there is data situated at approximately the 78% mark in the partition. Therefore, this partition can only be shrunk to after the end of this data – so approximately it can be shrunk by 100 GiB.

If this data did not exist, then by how much could this partition be shrunk? If the image came from a server where the kernel was earlier than Windows Server 2008 R2/Windows 7, then it will shrink to just after the copy of the MFT at the 50% point in the partition. If the kernel is Windows Server 2008 R2/Windows 7 then better shrinking may be obtained.

Note: *Refer to Knowledge Base article 00000166 How to remove free space from an image for details on the procedure.*

Domain Controllers RIP

There is a particular aspect of Domain Controllers that will dictate whether you will be able to recover a Domain Controller. This is the tombstone date which with Active Directory on Windows Server 2003 and later is set at 60 days. If the images you are attempting to recover are outside the tombstone date you will have these options:

You have a current System State Backup

You will be able to recover the server. After performing step 21 and before performing step 22, you will then need to boot into **Directory Services Restore Mode** and restore Active Directory. This procedure is outside the scope of this document but can be found in the Microsoft Knowledge Base.

You have only a single Domain Controller

And you do not have a System State Backup. You will need to contact Support who will be able to advise you on an unsupported procedure for recovering the server.

You have two or more Domain Controllers

And you do not have a System State Backup. Basically as a Domain Controller this server is now RIP - you will not be able to recover it. You will need to rebuild it as a new Domain Controller.

Dynamic disks

ShadowProtect will quite happily back up dynamic disks. However when you recover the disks, they will be recovered as basic disks only and cannot be converted back to dynamic disks.

The procedure step by step

For this procedure we will be recovering a physical Windows Server 2008 R2 application server that had IIS 7.5, PHP 5.3.3 and Microsoft SQL Server 2008 R2 Express installed. The original machine was an IBM System x3200 M2 with 4 GB of memory, two 250 GB SAS drives in a RAID-1 configuration with three disk partitions defined as:

- System Reserved (100 MiB)
- C: system volume (40 GiB)
- D: data volume (191.8 GiB)

The recovery will be performed to a virtualised guest within Oracle VM VirtualBox with a single 320 GiB disk allocated.

Step 1: Boot from the recovery CD

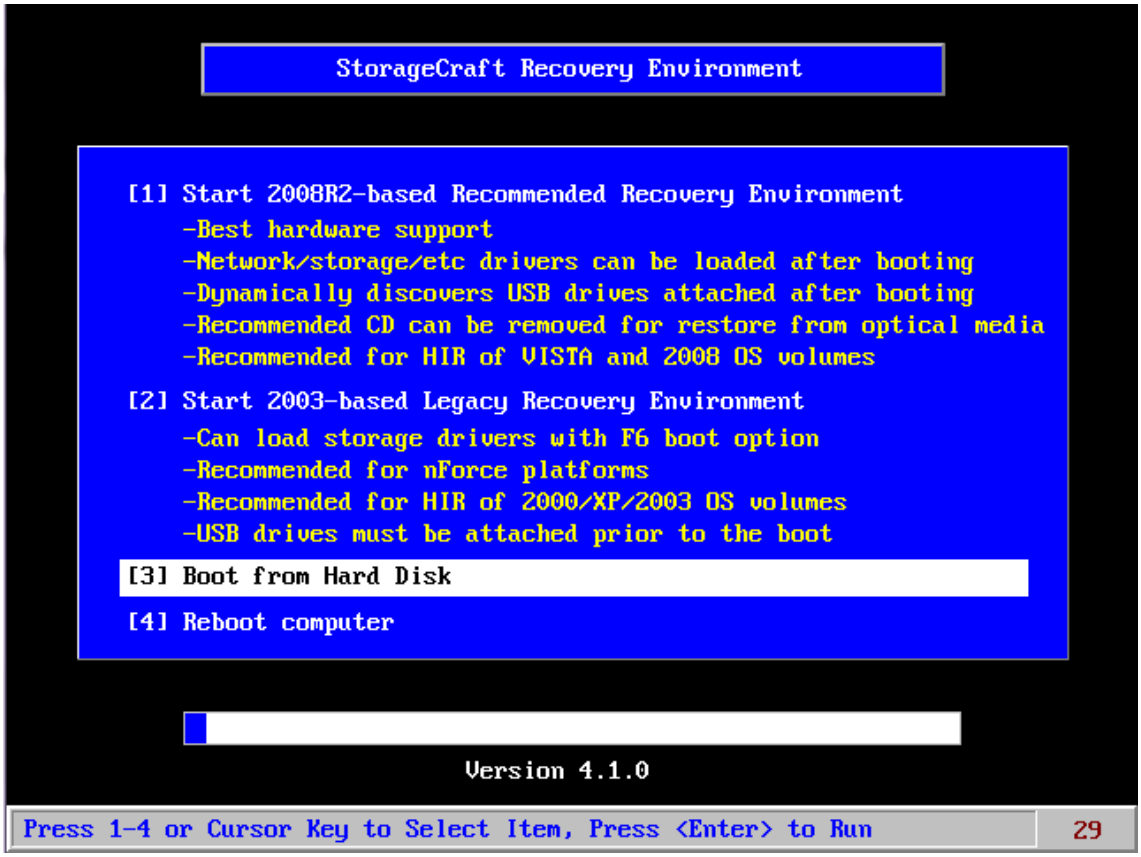

Figure 2: StorageCraft Recovery Environment

Select option 1 to start the preferred Windows Server 2008 R2 RE.

Note: If at this stage you have no keyboard or mouse input, it means that the BIOS does not support the keyboard or mouse attached in the current 16-bit mode environment. Try another keyboard or mouse.

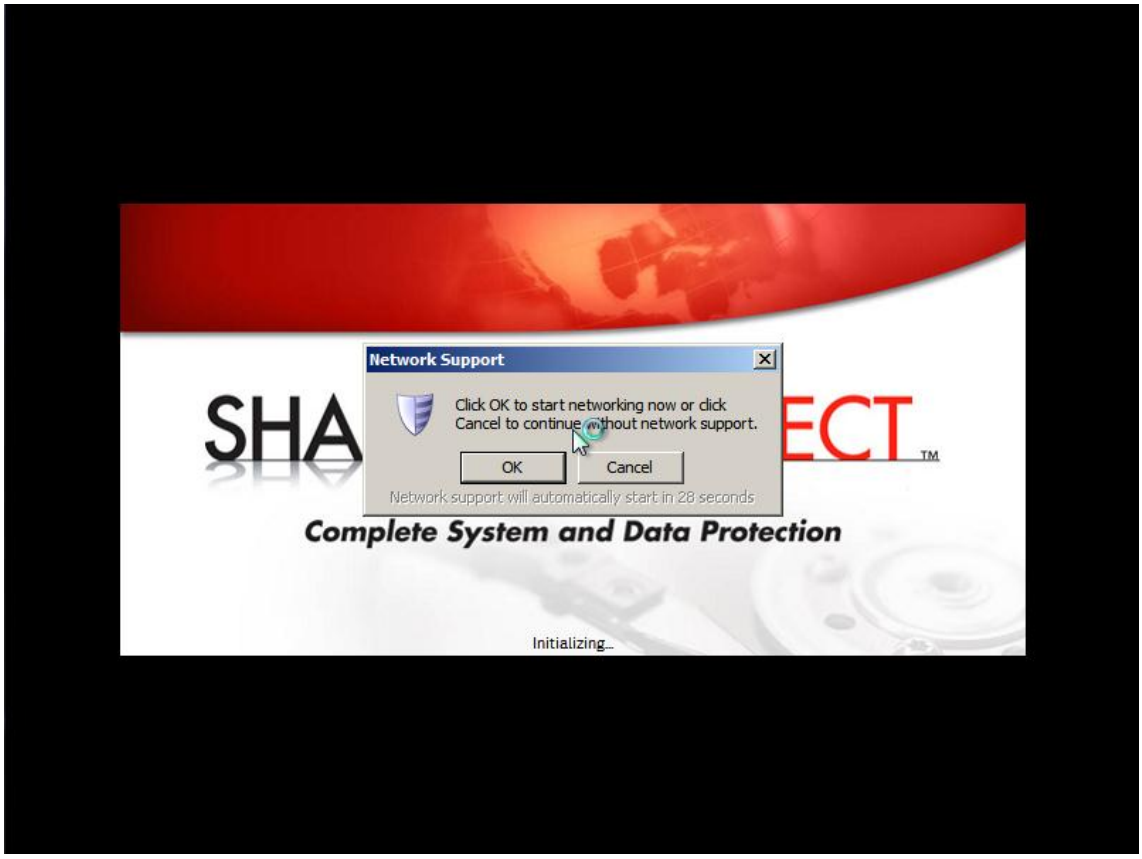

Figure 3: Network Support

You will be prompted whether to start networking. If you do not need networking or you will need to load a network driver, select **Cancel**.

Step 2: Set the time zone

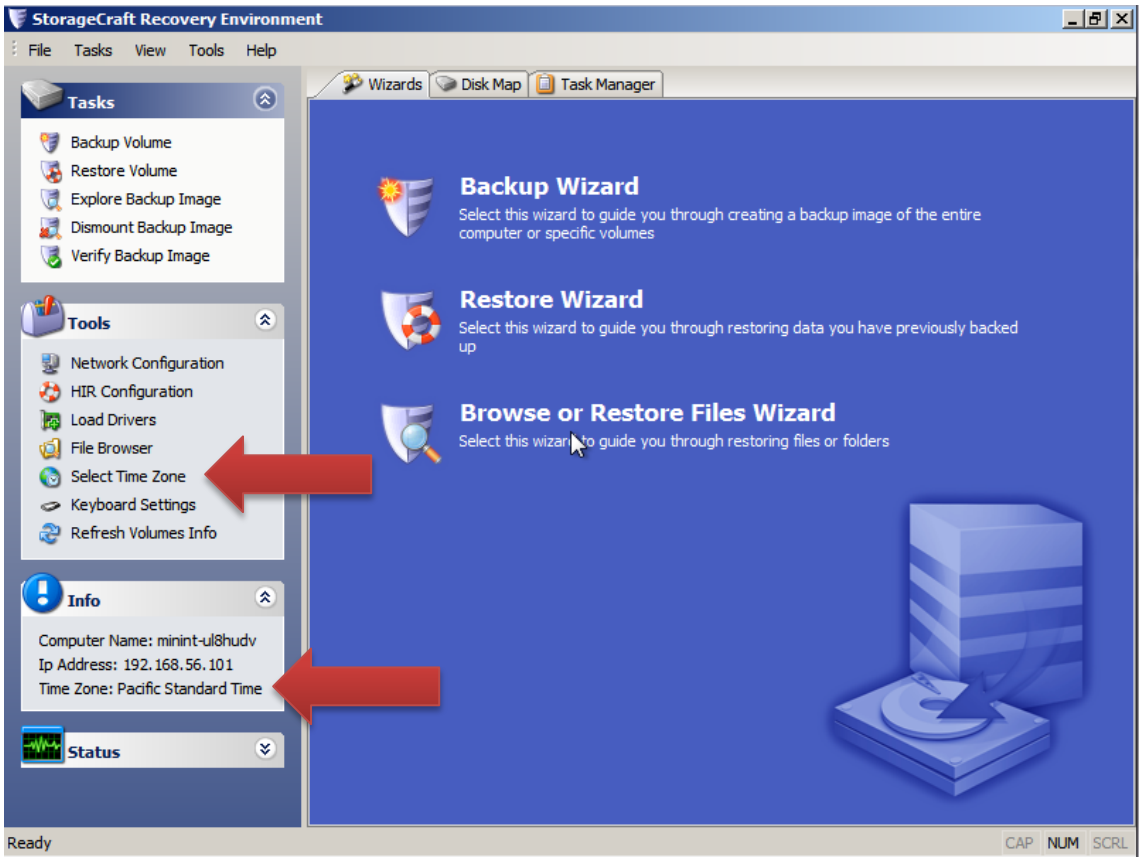

Figure 4: Recovery Environment

Notice that by default the time zone is set to Pacific Standard Time (UTC-08:00). Change it to reflect your time zone using the **Select Time Zone** option in the **Tools** panel. This is crucial if the server is a Domain Controller!

Step 3: Check and load drivers

If you need to load network drivers, load the appropriate drivers using the **Load Drivers** option in the **Tools** panel and set the IP address using the **Network Configuration** option in the **Tools** panel.

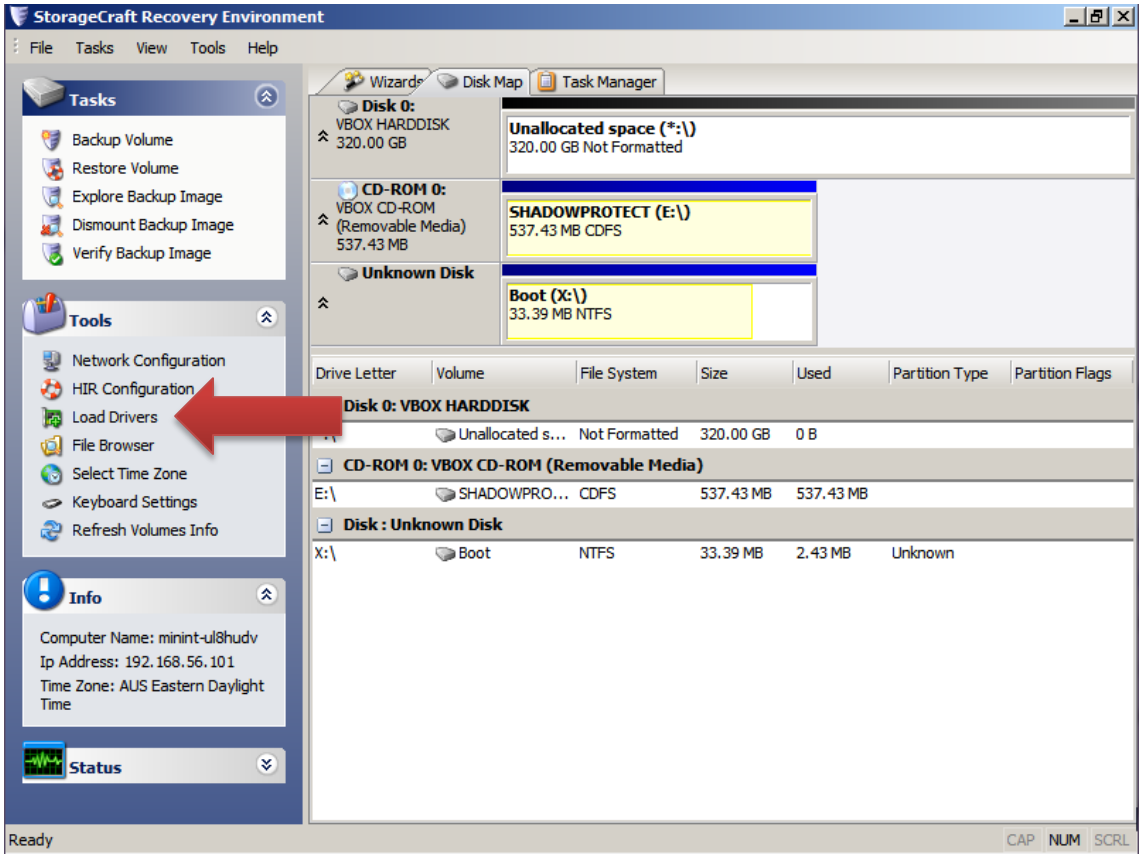

Figure 5: Disk Map

Select the **Disk Map** tab and ensure that you can see the destination disk(s). If you cannot see the disks, load the appropriate drivers using the **Load Drivers** option in the **Tools** panel.

Step 4: Map a network drive (optional)

If you need to map a network drive that contains your backup images, this can be done from within the **Network Configuration** option in the **Tools** panel.

Step 5: Delete any existing partitions

If any existing partition(s) exist on the destination disk, then delete them. This disk should now look like Disk 0 in *Figure 5*.

Step 6: Set the partition policy

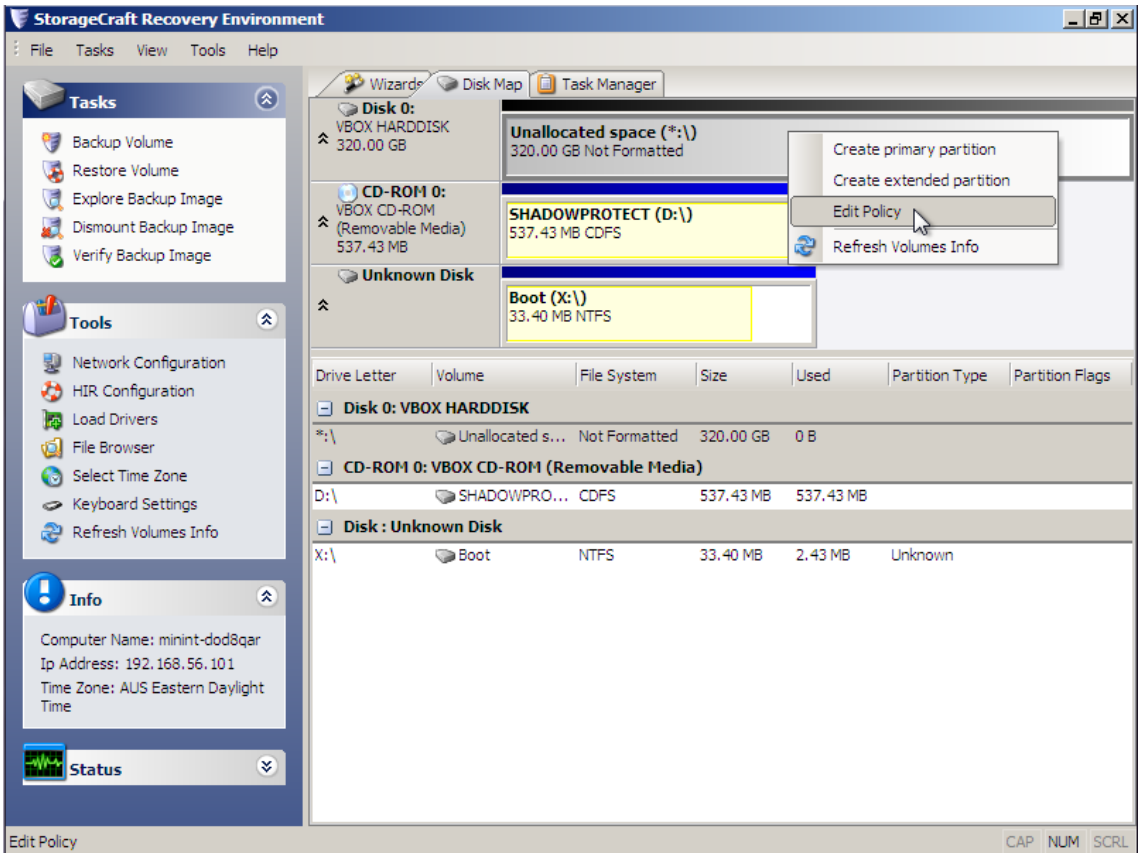

Figure 6: Disk Map

Select the destination disk, right-click and select **Edit Policy**.

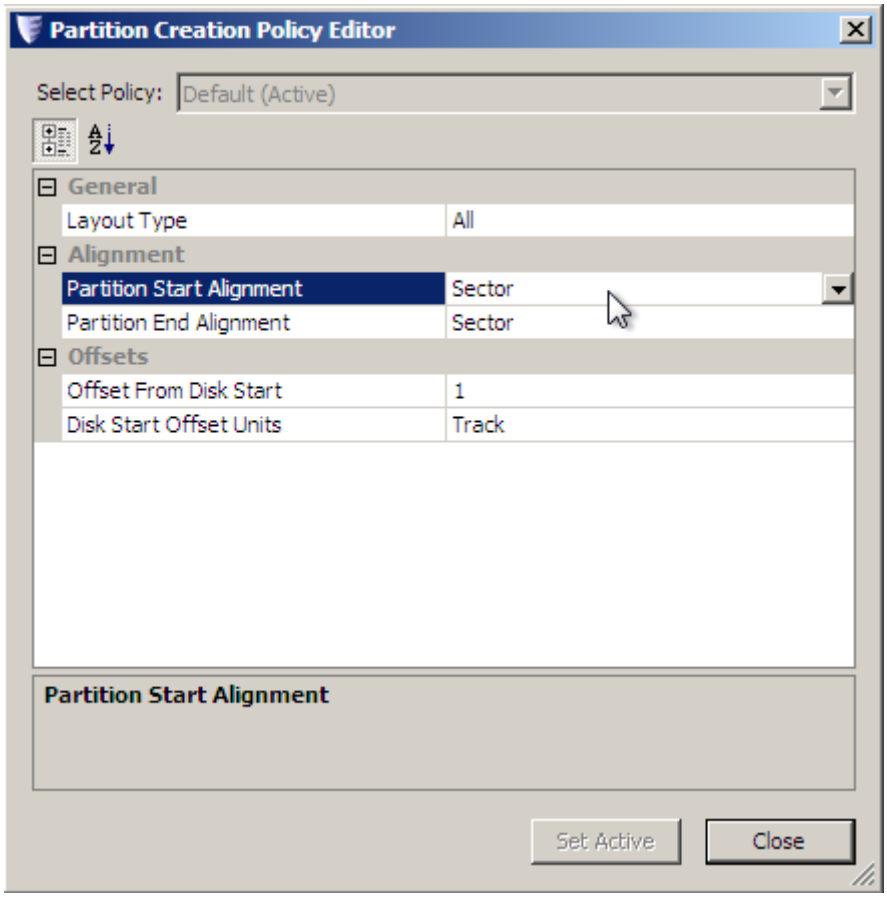

Figure 7: Partition Creation Policy Editor

Ensure that the **Partition Start Alignment** and **Partition End Alignment** are both set to **Sector**. Select **Close**.

Step 7: Begin the restore of volumes

Select the **Restore Volume** option in the **Tasks** panel. Alternatively, from the **Wizards** tab, select the **Restore Wizard** option.

This will start the restore wizard. Select **Next** on the **Welcome to the Restore Wizard!** Page.

Step 8: Select the restore type

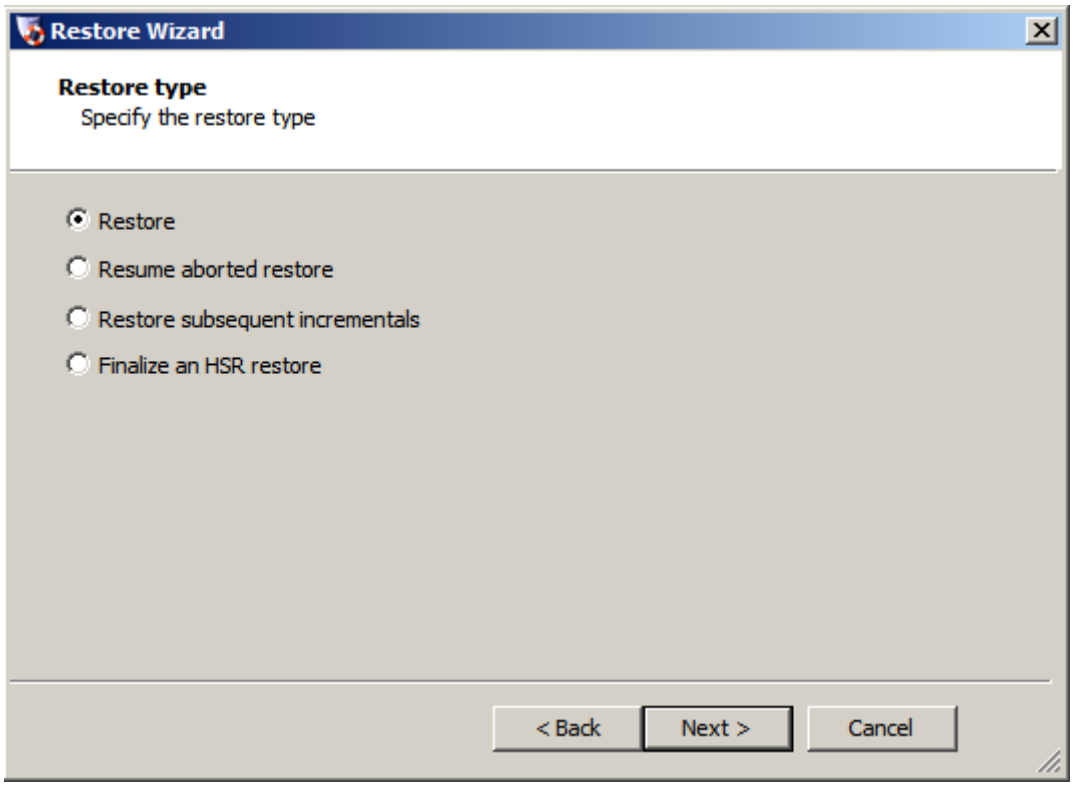

Figure 8: Restore type

Select the **Restore** radio button and select **Next**.

Note: The other restore options are described in Knowledge Base article 00000227 ShadowProtect 4.0.1 Recovery CD Restore Wizard Options.

Step 9: Select the system volume image

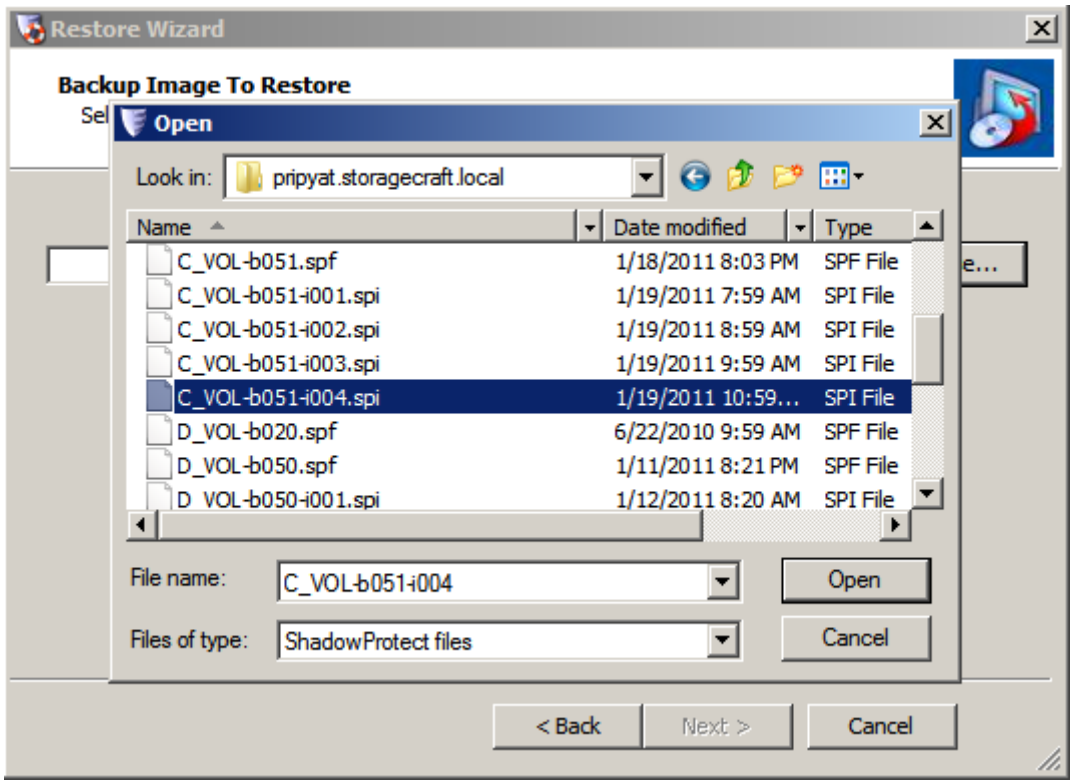

Figure 9: Browse images

Select the **Browse…** button and navigate to where your backup images are located. Highlight the system volume image at the required Point in Time to recover to and select **Open**.

Note: *The original machine had a 100 MiB System Reserved partition at the beginning of the drive created by Windows Server 2008 R2 setup. We have never backed this partition up and we will not restore it. It is not required and pointless to attempt to recover it. You should note the existence of this partition on the original disk as it will influence the options you use to create partitions on the new source disk.*

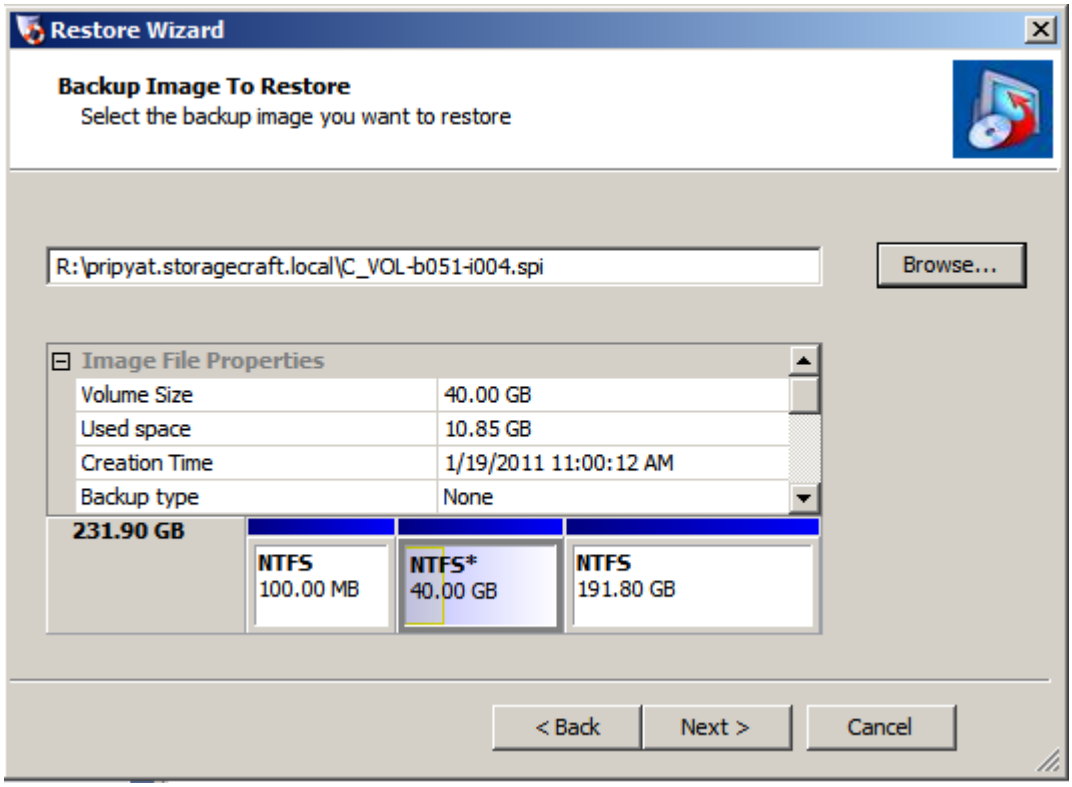

Figure 10: Backup Image to Restore

The image file properties are displayed. Notice that the complete source disk details including any other partitions that existed are listed in the graphic. Review the details and select **Next**.

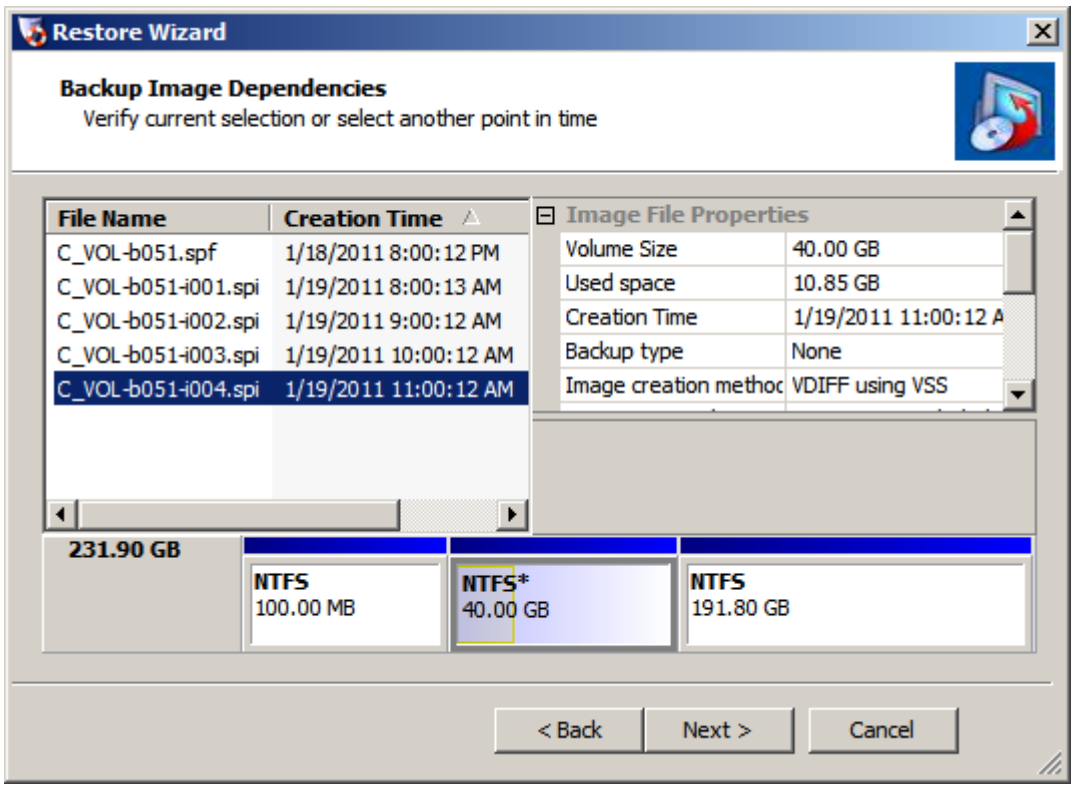

Figure 11: Backup Image Dependencies

At this page you will see the complete image chain associated with the image you selected. Once you are satisfied with the image you require, select **Next**.

Step 10: Create the partition

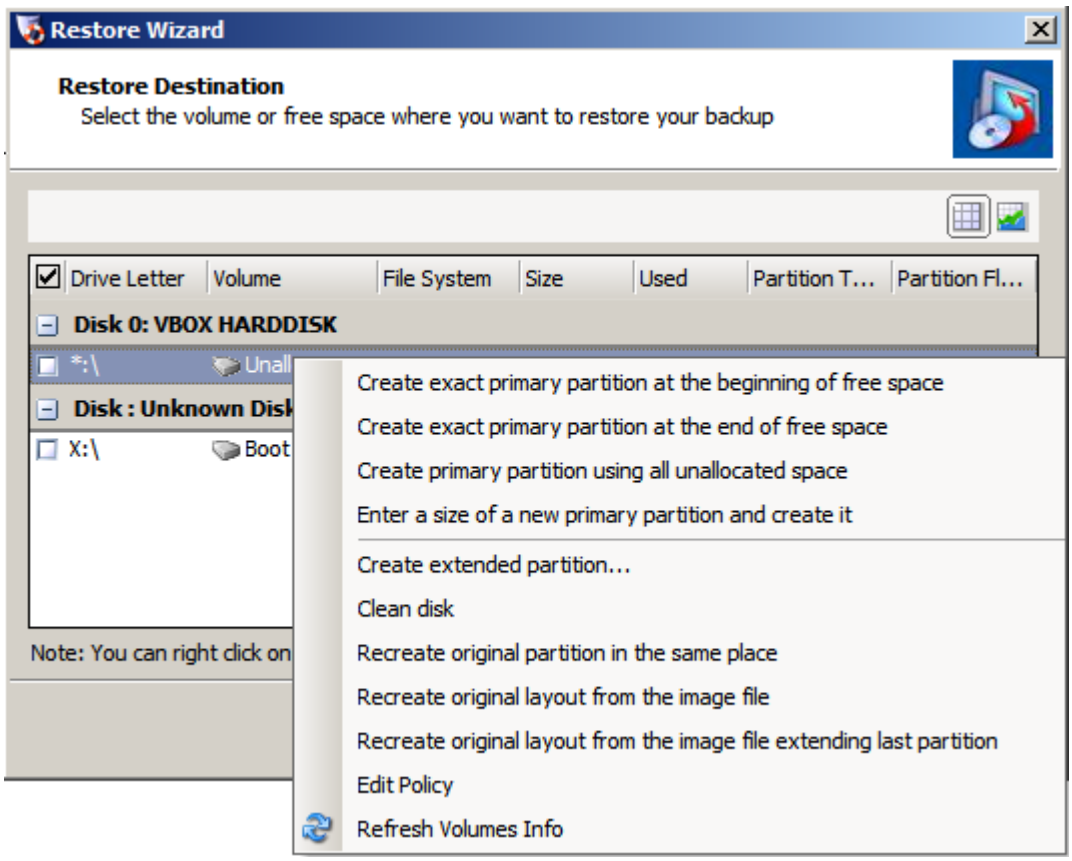

Figure 12: Restore Destination

Highlight the destination and right-click to create the partition.

As you can see from *Figure 12*, there are a number of options to select from. In the majority of cases, the first option **Create exact primary partition at the beginning of free space** will be selected for the system volume. For the restore of our data volume later we will select the third option **Create primary partition using all unallocated space**. The drive we are restoring to is larger than the original source disk and the data volume will therefore 'fill' the remainder of the drive.

Note: The options in the second half of this list ignore the disk policy set in step 6.

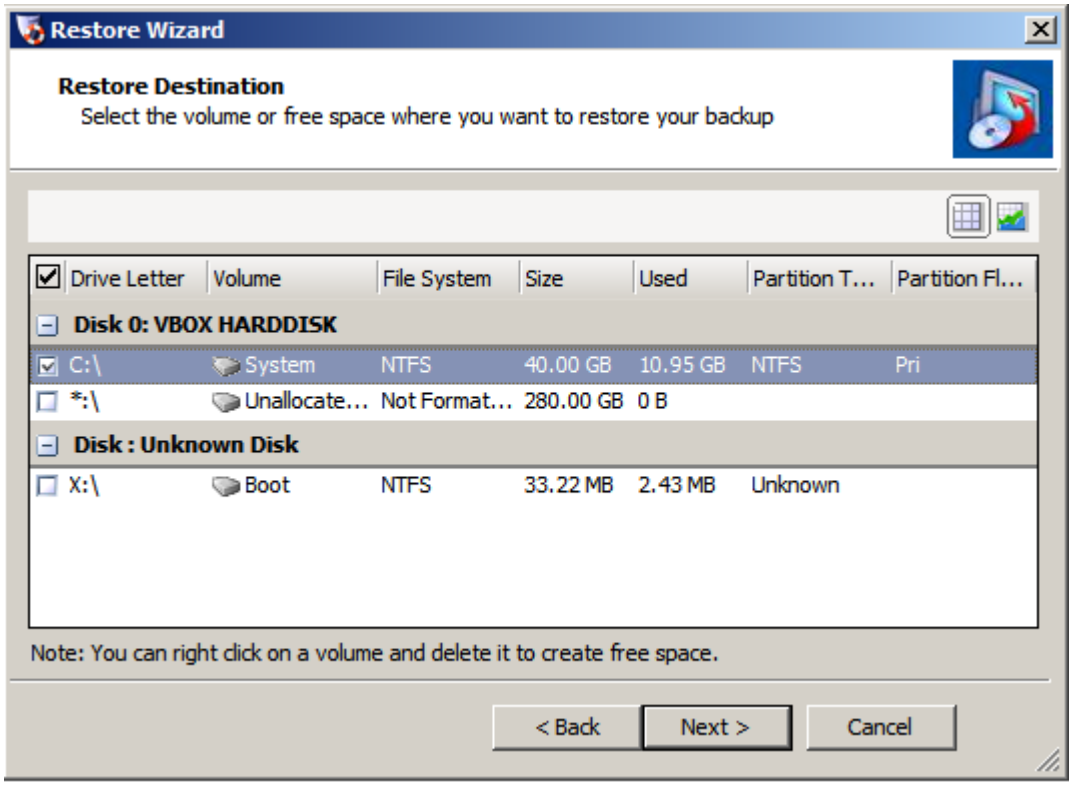

Figure 13: Select the partition

Select the partition just created and select **Next**.

Step 11: Finalise the volume

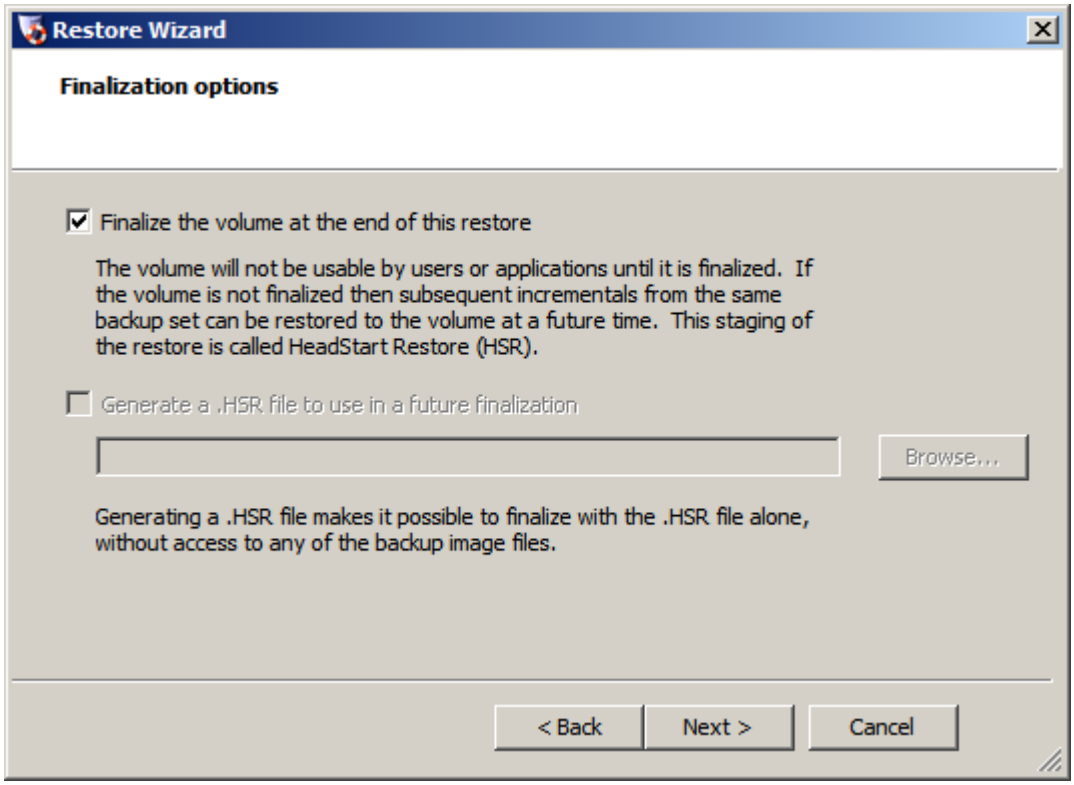

Figure 14: Finalization (sic) options

Select **Finalize the volume at the end of this restore** and select **Next**.

Step 12: Specify the MBR and HIR options

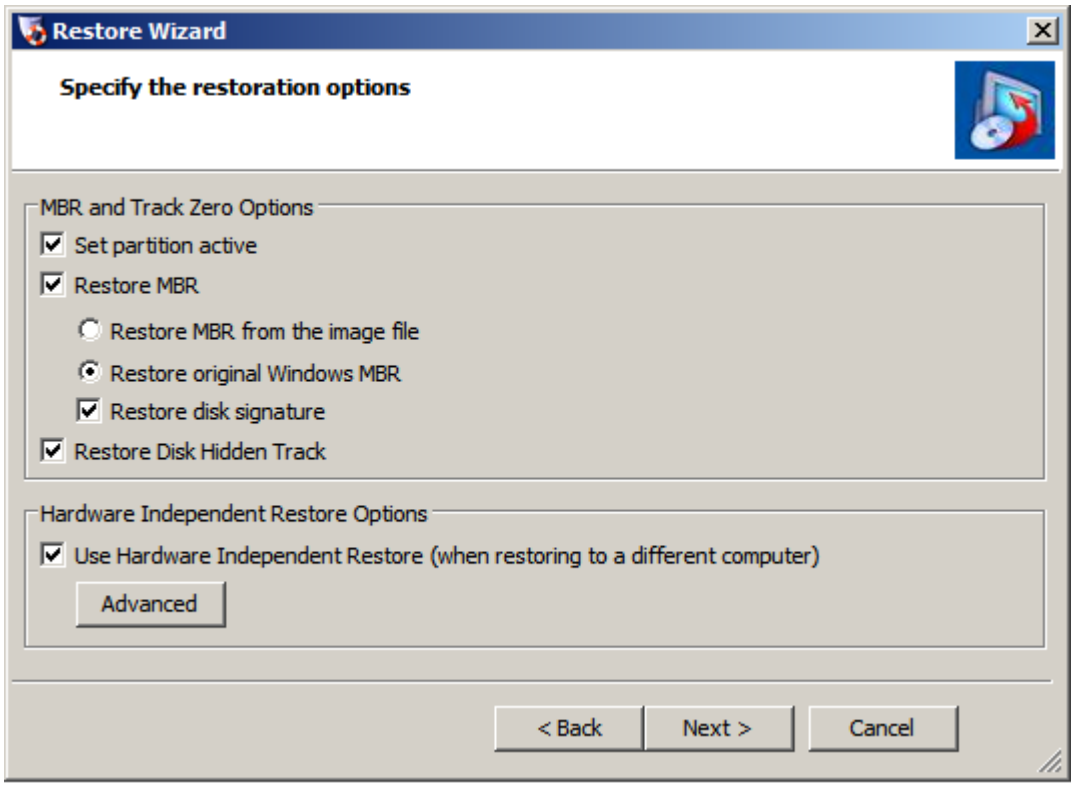

Figure 15: Specify the restoration options

For the restore of a system volume, the options checked/selected in *Figure 15* are correct.

Note: *If the server being recovered is a Hyper-V host, then note that when the BCD is written, it will not have the required entry to run the Hyper-V Hypervisor layer service. You will need to use the command line bcdedit.exe tool (which is located in the %WINDIR%\System32 folder within the RE) to add the entry.*

Note: *Refer back to the To HIR or not to HIR section discussion earlier.*

If you are recovering a data volume, then check/select the options as detailed in *Figure 16*.

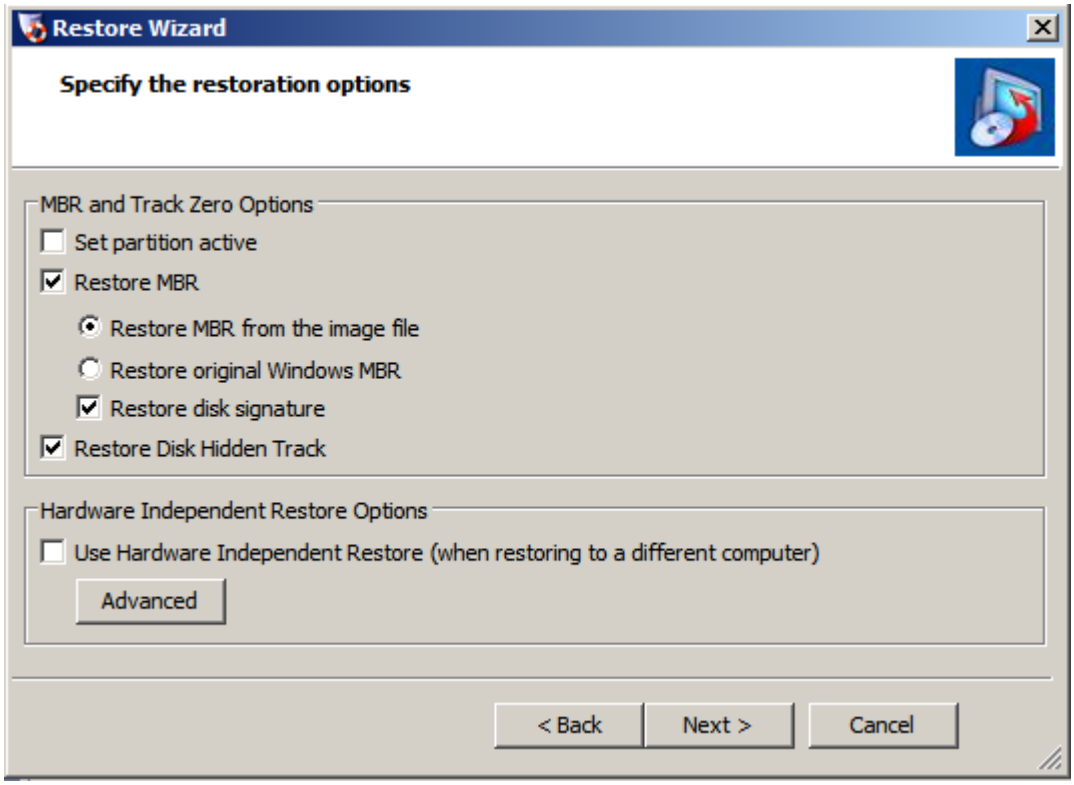

Figure 16: Restoration options for a data volume

Step 13: Specify the advanced options (optional)

If you need to inject Mass Storage Controllers during the HIR process, select the **Advanced** button on the **Specify the restoration options** page.

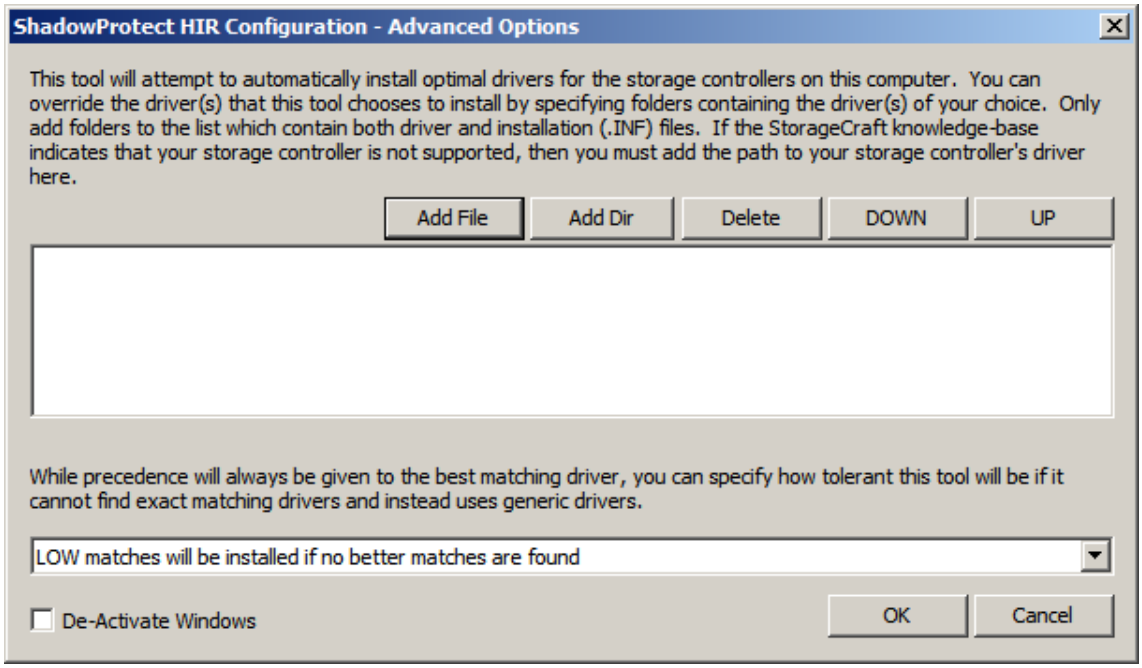

Figure 17: Advanced Options

Here is where you specify the driver location to use. In relation to Mass Storage Controllers, if you specify a particular driver, it will be forced in regardless of the precedence level, whereas if you specify a folder, the precedence level may override your choice.

Optionally, you can specify to deactivate Windows. Generally this option should only be selected if you are recovering an OEM licensed copy of Windows. This will then give you a very limited period of time for this server to run before activation is required.

Note: With some OEM licenses immediate activation may be required regardless of whether this setting has been used.

Select **OK** and the select **Next**.

Step 14: Check the job details and complete

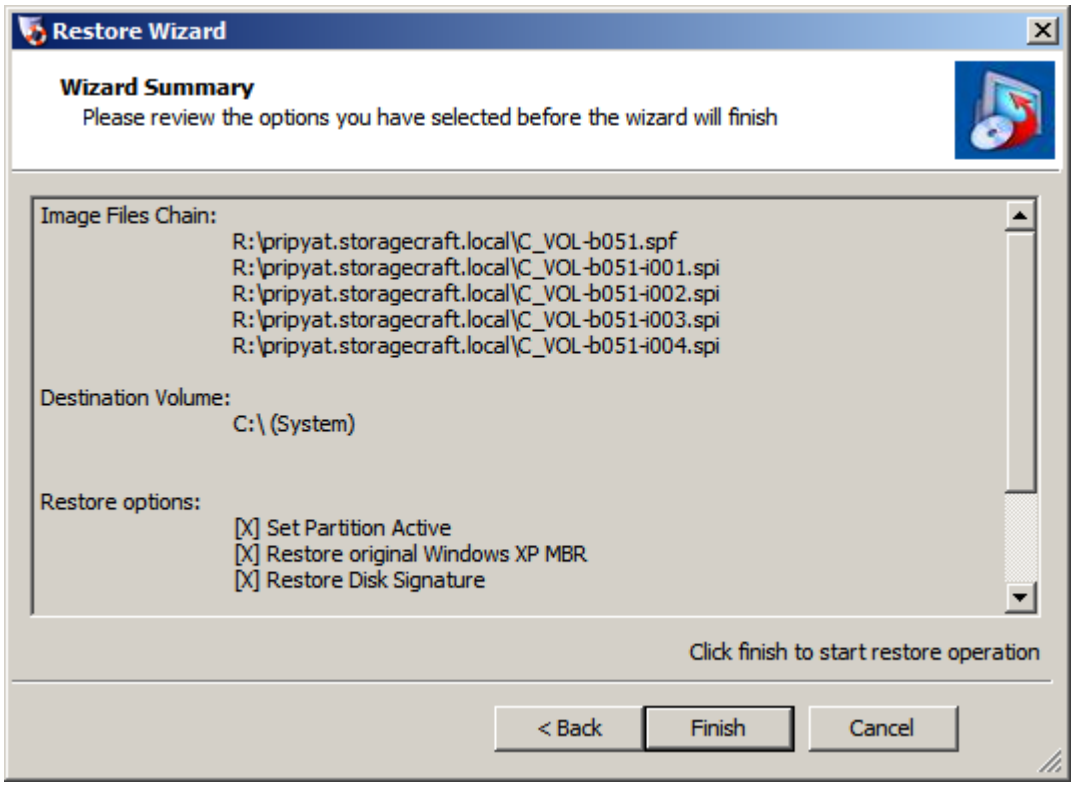

Figure 18: Wizard Summary

Details for the restore job will be summarised. Check them and if satisfied select **Finish**.

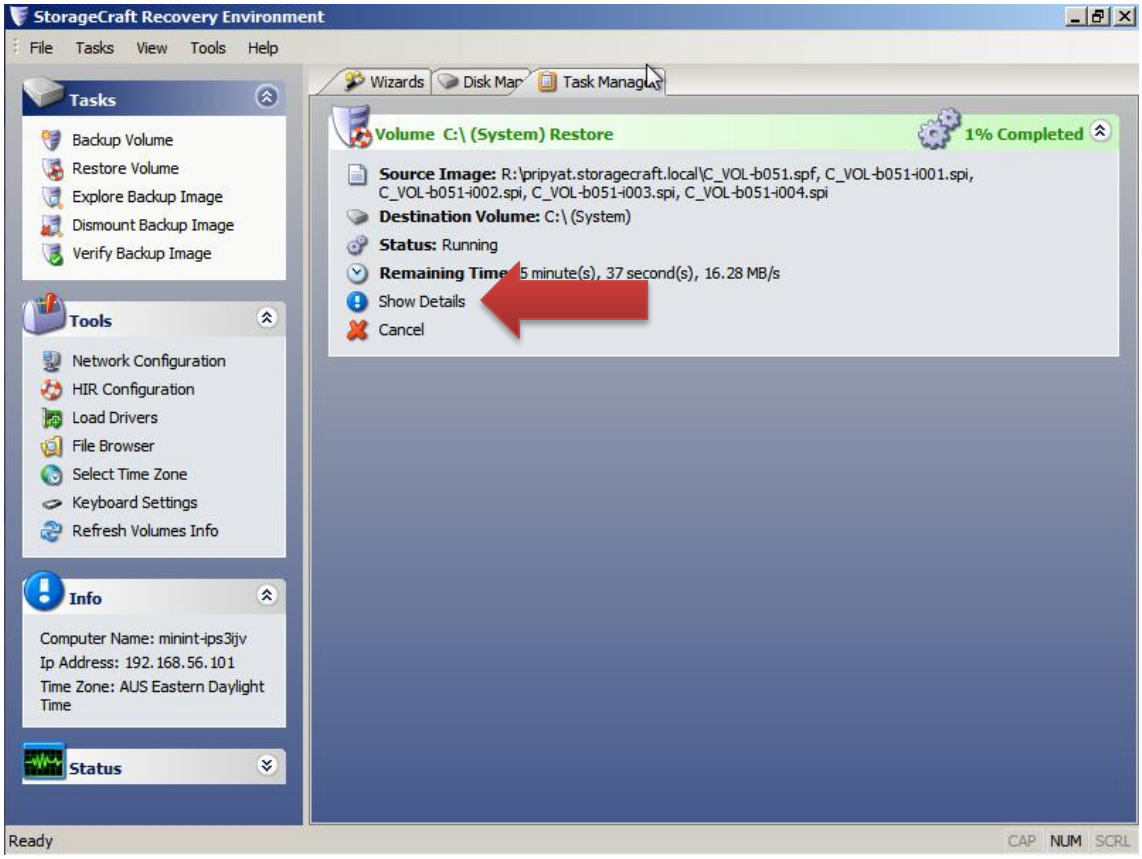

Figure 19: Task Manager

The job will commence and the summary will be displayed in the **Task Manager** tab. Select the **Show Details** option to display the full job details.

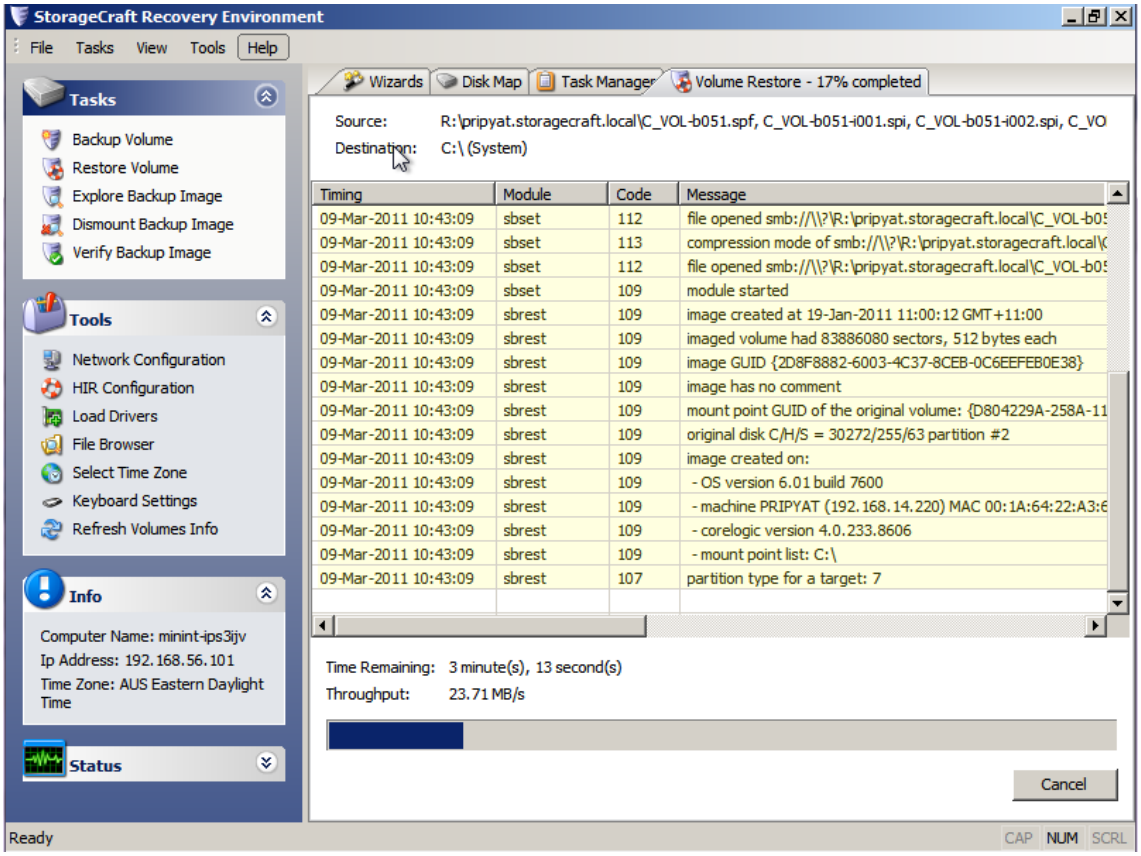

Figure 20: Volume restore job details

Step 15: Restore the other volumes required

If you have additional volumes to restore, such as a data volume(s), repeat steps 7 to 14 for each volume.

Step 16: Check the results!!!

Once the restore has completed, check the complete job details for each volume to ensure all completed without issues.

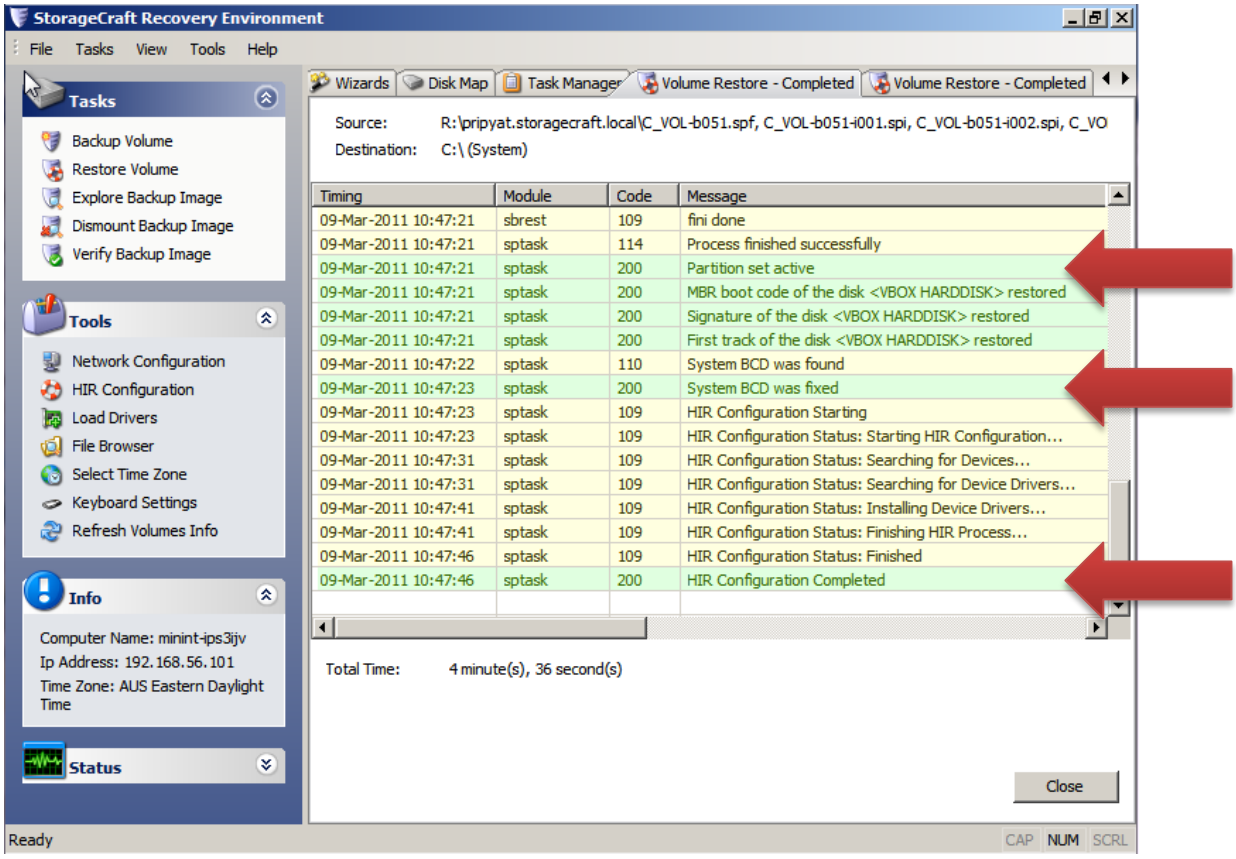

Figure 21: Completed job details for the system volume

For the system volume, check the highlighted areas. This has confirmed that partition was set active, the MBR was created and that the HIR ran and completed.

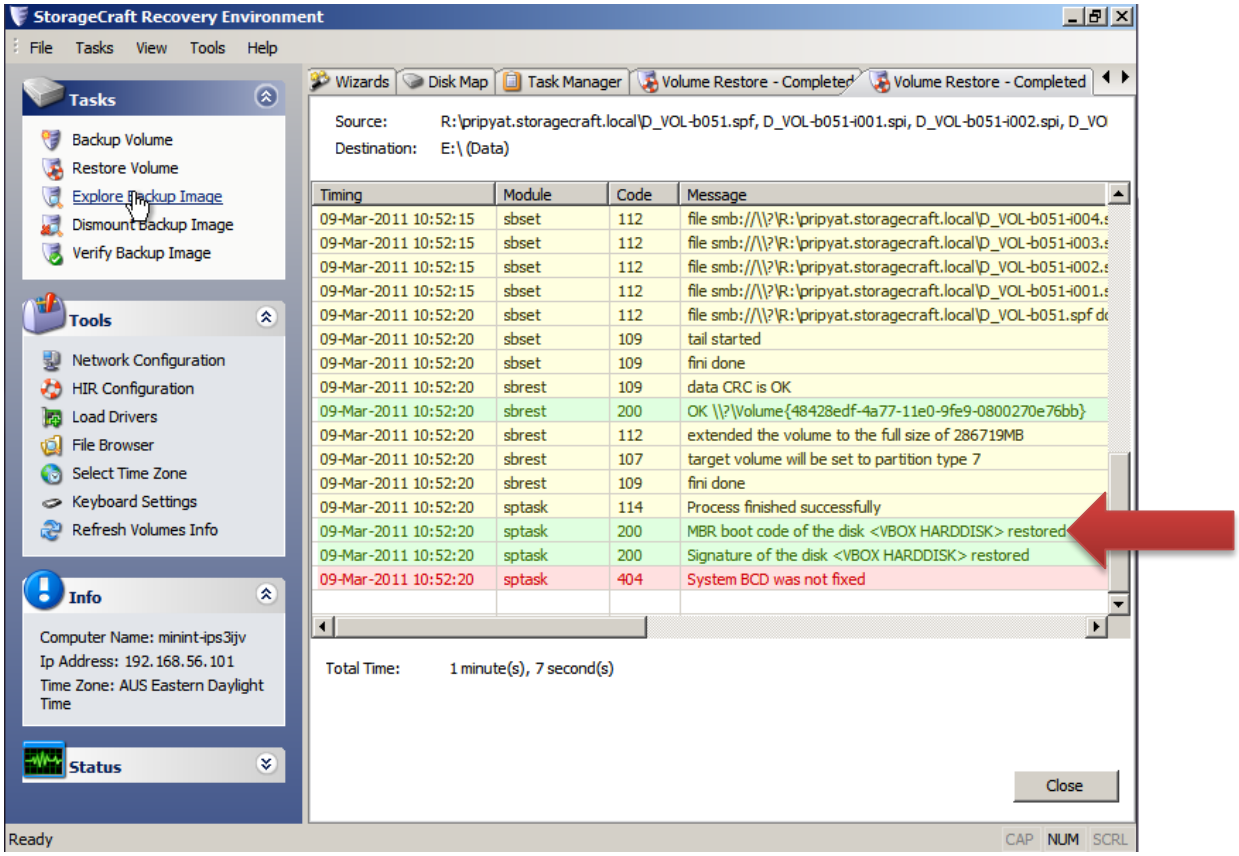

Figure 22: Completed job details for the data volume

For the data volume(s) check the highlighted areas. The 404 error is expected in this instance.

Step 17: chkdsk the volumes!!!

We are not finished yet. We need to perform a `chkdsk` on each volume restored.

Firstly we need to enable access to the Command Shell. Type **CTRL – SHFT – F12**. You will now get a :) in the status bar. On the menu bar select **Tools – Command Shell**.

Perform the following command for each volume:

```
chkdsk /f <drive:>
```

Note: The drive letter allocated in the RE may not match the original source volume. This is not an issue as the drive letters in the RE are allocated only whilst the RE is running. Make sure you chkdsk the right volume(s)!

Close the Command Shell when completed.

Step 18: Check the partition table

Prior to rebooting, we need to confirm that the correct partition is active.

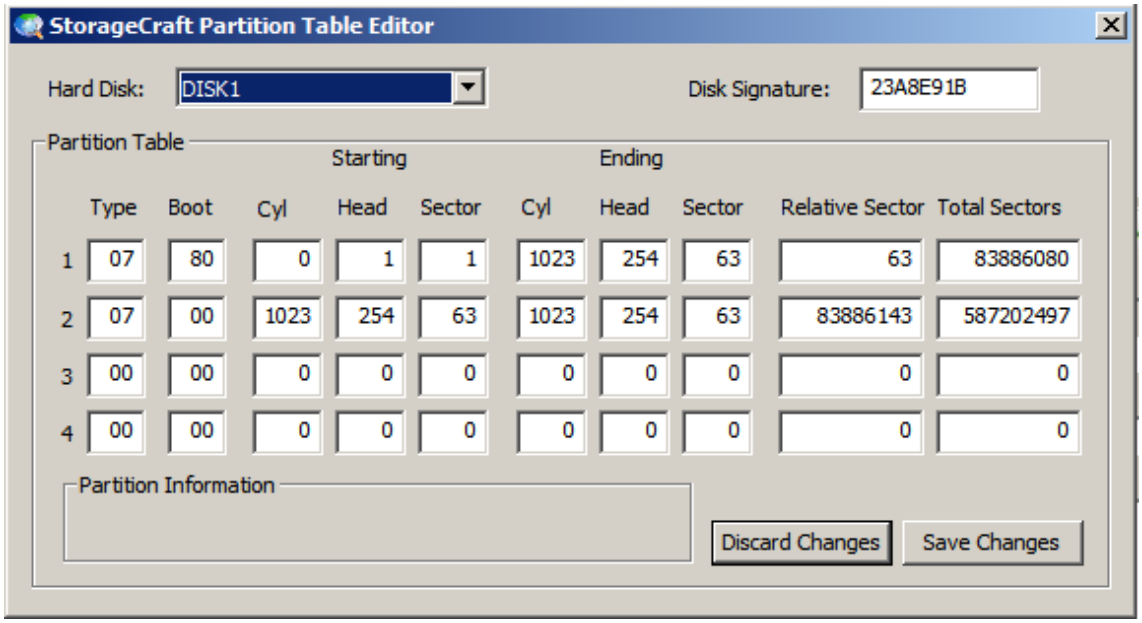

Figure 23: StorageCraft Partition Table Editor

On the menu bar select **Tools – Partition Table Editor**. Here we see in the Boot column that the first partition has code 80 indicating that it is the active partition. If the wrong partition is active or no partition is active, run the Boot Configuration Utility from **Tools – Boot Configuration Utility**, rather than change it here.

Step 19: Reboot

Time to reboot - almost. Ensure any USB devices used (such as USB hard drives) that contained drivers or backup images are disconnected. Then from the menu select **File – Exit**.

After BIOS POST, immediately hit the **F8** key. We want the Windows Advanced Boot Options

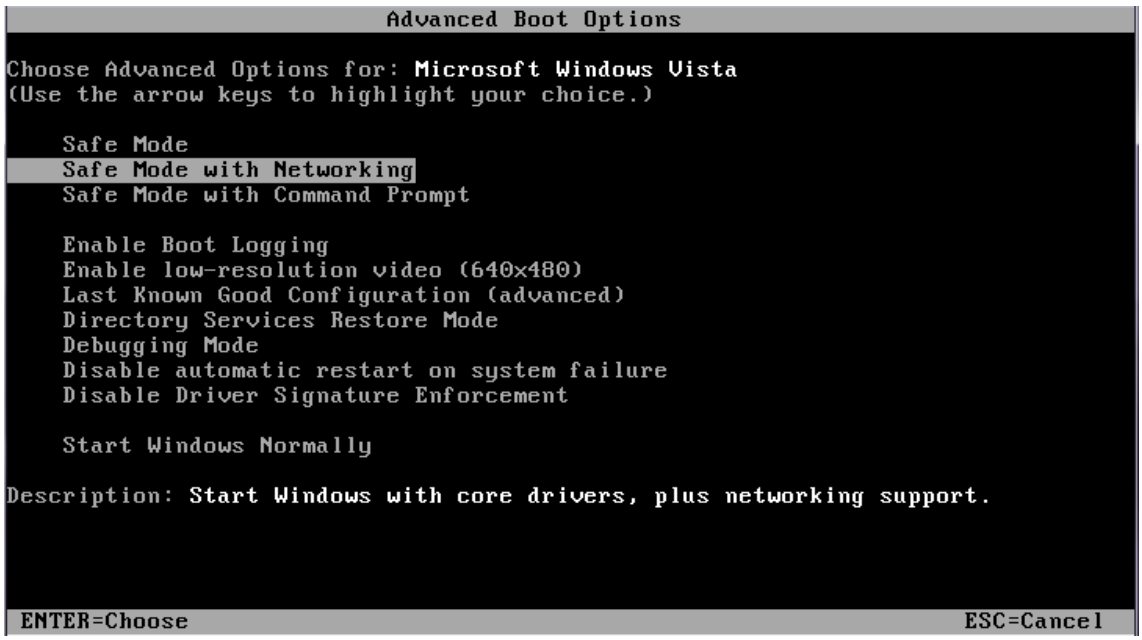

Figure 24: Windows Advanced Boot Options

For Windows Server 2008 and later, Windows Server 2003 and Windows Server 2003 R2, select **Safe Mode with Networking**. For Windows 2000 Servers that are Domain Controllers, select **Directory Services Restore Mode**.

Note: If you have missed hitting F8, start again from Step 1. If this was a Domain Controller or Microsoft SQL Server, it will now in all probability be broken and it will be faster to repeat the restore than repair the corruption.

Step 20: Fix networking

For Domain Controllers and Microsoft SQL Servers, we need to fix the networking and ensure that the new Network Interface Card (NIC) has the same IP address as it had previously. We need to perform this step quickly; if running in Safe Mode with Networking and this is a Domain Controller, Active Directory is running.

Note: A Windows Small Business Server 2011 / Windows Small Business Server 2008 / Windows Small Business Server 2003 host is a Domain Controller.

First we need to delete the old NIC to release the IP address. To do this we need to set a system environment variable. Select **Control Panel – System** and then **Advanced system settings**. Select the **Environment Variables…** button.

In the **System variables** group select **New…**

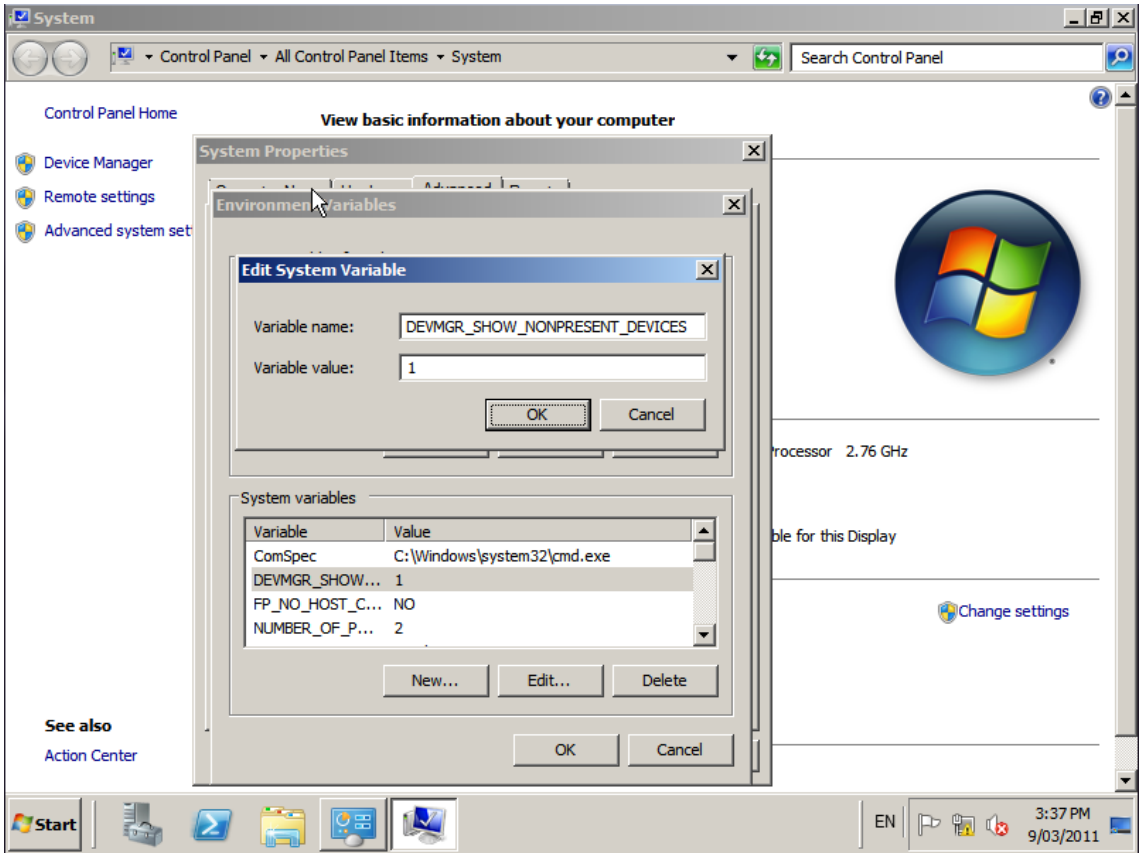

Figure 25: Add system environment variable

Add the variable as shown in *Figure 25* if it does not already exist.

Select **Control Panel – Device Manager**. From the menu select **View – Show hidden devices**.

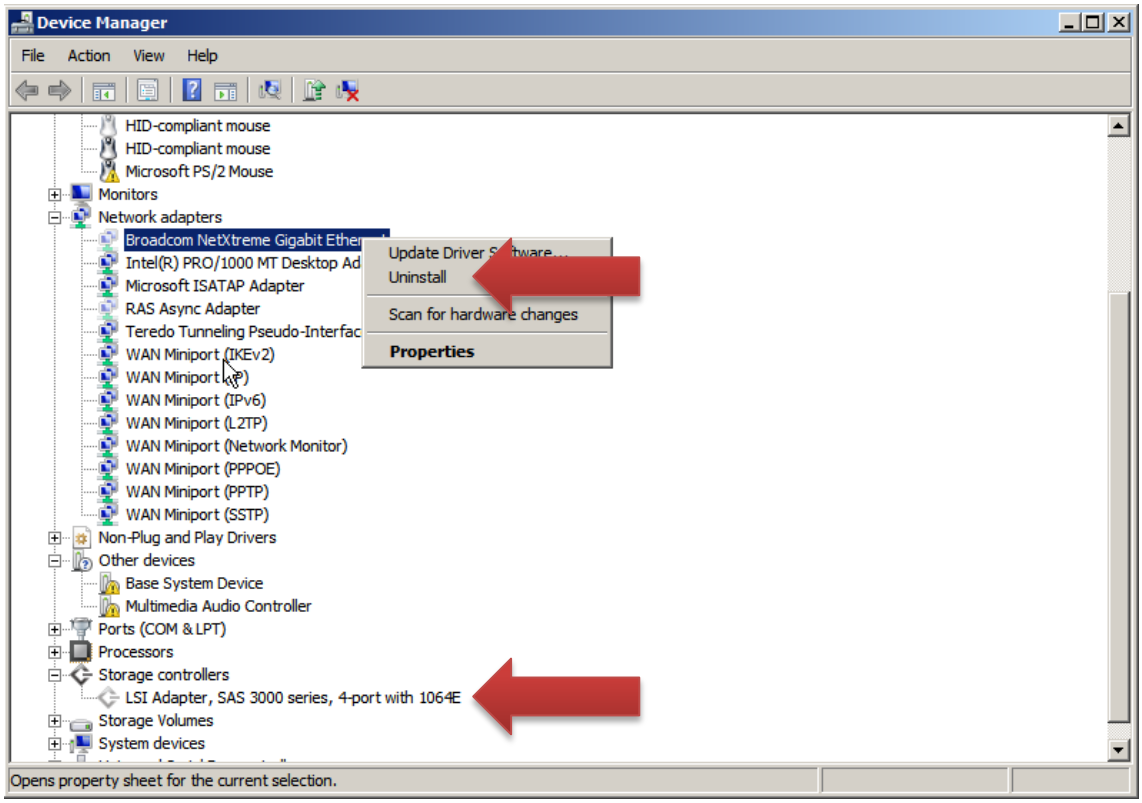

Figure 26: Device Manager

Expand out the **Network adapters** and uninstall the old NIC. While you are here, do the same for the old Mass Storage Controller. Close Device Manager.

Step 21: Set the original IP address

Select **Control Panel – Network and Sharing Center**. Select **Change adapter settings**. Select the new NIC, right-click and select **Properties**. Highlight the appropriate IP protocol and select **Properties**.

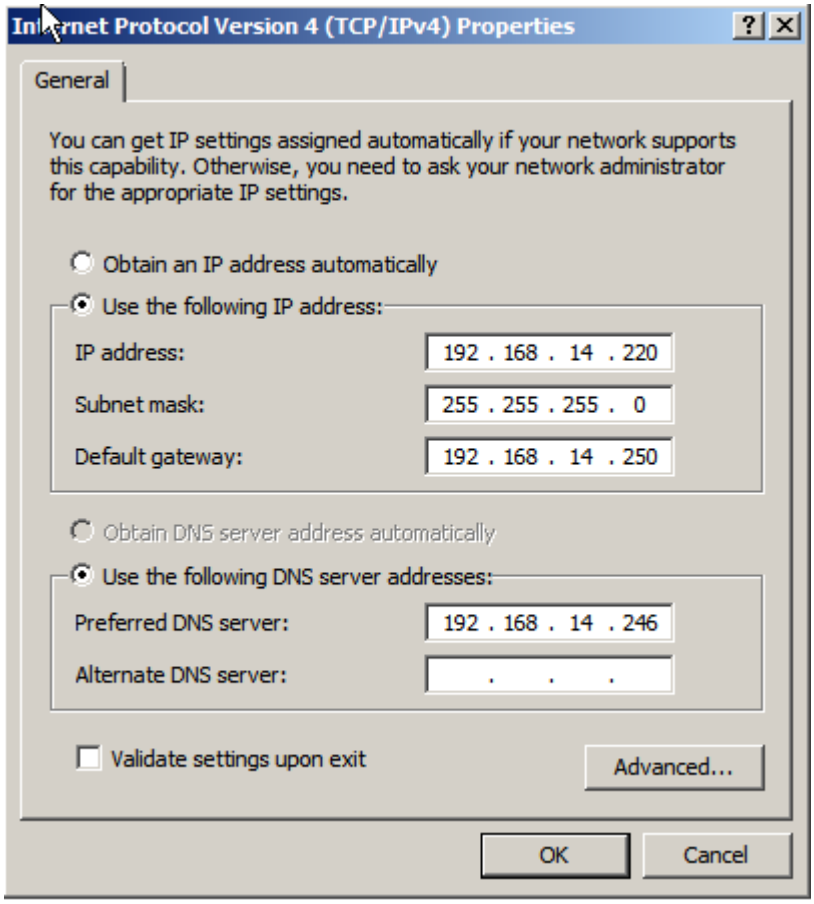

Figure 27: Edit the IP address

Change the IP address to the original IP address for the server. Select **OK**.

STAY IN SAFE MODE

Step 22: Disable OEM services

Go into the services applet (**Start – Run – services.msc**). Disable all OEM services (such as HP Networking, BackupEXEC); these will not be running and they are not required. If they are not disabled, this is the reason why you have to wait nearly an hour to log on. Some of these services are using all the CPU trying to do something with hardware that is no longer there.

Note: This step can be performed prior to starting the guest by booting into the ShadowProtect Recovery Environment, running the Boot Configuration Utility and disabling the services (Edit Services is available in the Advanced Options - Additional Boot Tools section, Registry Toolset group).

Step 23: Reboot into Windows

All is now complete. Restart and allow Windows to start normally.

Step 24: Windows Server 2008 and later

A final step if you are running Windows Server 2008 Service Pack 2 and later operating systems. The IP address set in step 21 will not have been retained.

So, log in and run a command prompt with Administrator privileges.

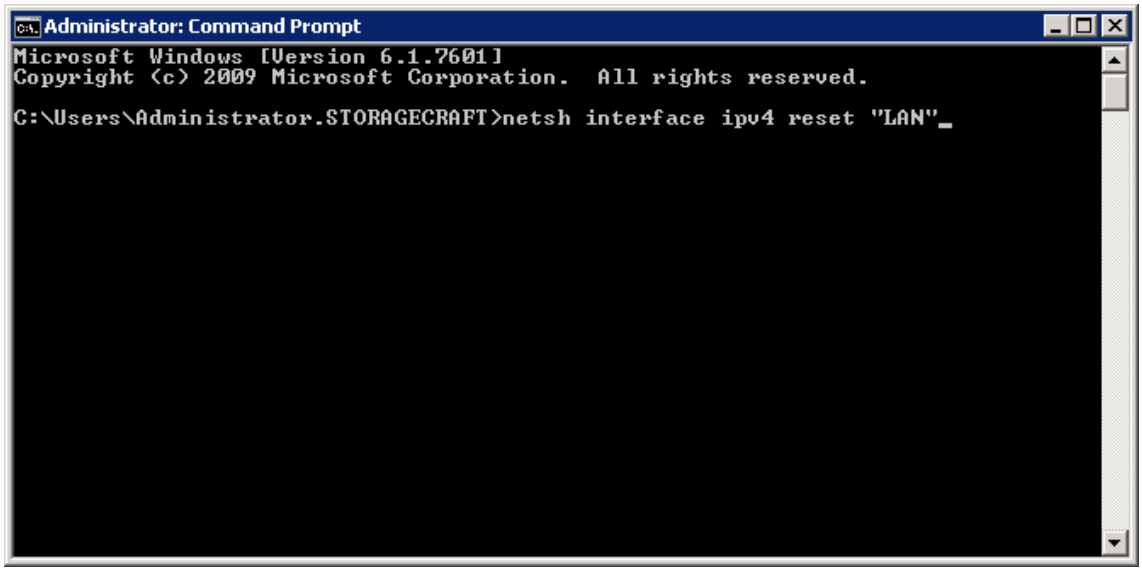

Figure 28: Command Prompt

Type the following command:

```
netsh interface ipv4 reset "<interface>"
```

The interface is the name assigned to the connection and should be enclosed in quotations especially if the name includes spaces.

Repeat step 21 to set the IP address again. Reboot.

Note: On Windows Small Business Server 2008 and Windows Small Business Server 2011, run the Connect to the Internet wizard in the Windows SBS Console instead.

Log in and verify that the IP address has been retained.

Finally, select **Control Panel – Network and Sharing Center**.

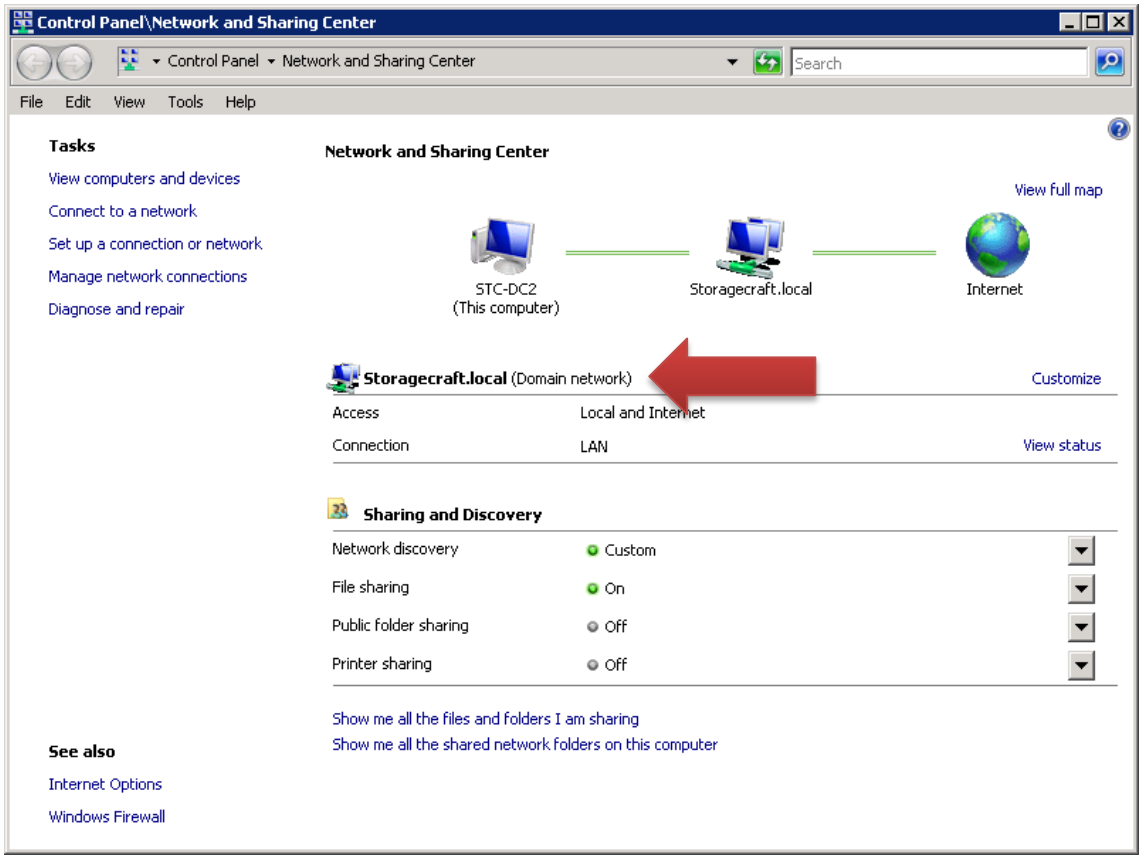

Figure 29: Network and Sharing Center

The network location must be set to Domain network to avoid issues such as clients not being able to connect and Active Directory not being able to talk to itself.

References

Products affected

- ShadowProtect Server
- ShadowProtect Small Business Server
- ShadowProtect Desktop
- ShadowProtect Virtual
- ShadowProtect IT Edition

Platforms affected

- All

Replaces article

00000184 HOW TO: Perform a Hardware Independent Restore (HIR), 12.12.2008

Supplemental articles

00000166 How to remove free space from an image

00000211 Boot Configuration Utility

00000227 ShadowProtect 4.0.1 Recovery CD Restore Wizard Options

NOTES:

2011/BP000005:6