Building a Microsoft SQL Server Failover Cluster on the Interoute Virtual Data Centre

User Guide
This document is intended as an illustration of how a Microsoft Failover Cluster might be created for Microsoft SQL Server on the Interoute Virtual Data Centre (VDC) platform.

The illustration focuses on basic procedures for accomplishing the creation of a simple two-node cluster, the aim being that these procedures can then be modified and adapted by the reader to create a cluster suitable for their own requirements.

This illustration should not be taken as a guide for the creation of a production-ready cluster fit for any particular purpose, since every aspect of what is created here should be tailored to the requirements of the reader’s own applications and services.
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Pre-requisites

Familiarity with the VDC Control Centre, Windows Active Directory and Microsoft SQL Server is assumed.

Components

VDC & Hypervisor

It is recommended that failover clusters are only created on the ESXi-type of VDC; however, this procedure will also work on a KVM VDC.

Storage

Creating a cluster requires shared block storage, which can be provided via the Interoute Scalable Storage Dedicated NetApp product.

Network

The following networks will be used for this illustration:

- **Storage network:**
  - ISS Dedicated NetApp SVM is provided as a reserved IP address on a dedicated network (of the type ‘external’ in VDC) – referred to in this illustration as the Storage network.
  - Each cluster node requires an interface on the Storage network.

- **Heartbeat network:**
  - A private network is required for the cluster heartbeat (i.e. the isAlive check that runs every 60 seconds).
  - Each cluster node requires an interface on the Heartbeat network.

- **Application network:**
  - This is the network on which the SQL Server instance will be accessible.
  - Active Directory also needs to be available on this network.
  - Each cluster node requires two interfaces on the Application network:
    - One interface for the node itself.
    - The other interface will be used to reserve an IP address that will become a shared cluster IP address. This interface will actually be disabled during the Windows configuration. In effect, it serves as a place-holder in VDC for the additional IP address.

Virtual Machines

A minimum of three virtual machines are required:

- Two Microsoft SQL Server 2008 R2 (SP2) appliances, the Failover Cluster nodes.
- One Windows Server 2008 R2 (SP1) appliance, configured to be a Domain Controller to provide an Active Directory (AD) domain into which the cluster nodes will be joined [configuration of the Domain Controller is not covered in this illustration].

Additional Software

The following additional software was obtained and used for this illustration:

- Recommended Microsoft Failover Cluster Hotfix KB2550866 [the transient communication failure hotfix]. This hotfix will be installed on each cluster node later on in this illustration.
- Plink.exe: an SSH tool for interaction with the ISS Dedicated NetApp [see APPENDIX I for details]. Copy this executable to a local folder on each of the SQL Server appliances.
**Installation**

**Preparation**
In a VDC zone where an ISS Dedicated NetApp SVM has been provided and in an ESXi VDC:

- Ensure the networks detailed above are available and, if possible, name them according to their function.
- Find the details that have been provided with your SVM, particularly the:
  - SVM address
  - SVM admin account credentials
- Check that the appliances detailed above are available to be deployed. These can be purchased via cloudstore.interoute.com if necessary.

For optimum convenience, connections to the appliances, once deployed should be made via a Remote Desktop (RDP) connection. The figure below shows an overview of the setup created for this illustration, which uses a NAT’d public IP address to access a Jump Host via RDP:
ISS Dedicated NetApp Shared Storage Configuration

The ISS Dedicated NetApp is used to provide shared block storage to the cluster, served as iSCSI LUNs on the Storage network – connected to the cluster nodes by in-guest software iSCSI initiators. By default, an ISS Dedicated NetApp SVM in VDC is usually provided with a single volume and with the iSCSI service running.

For this illustration, 3 LUNs were created on the SVM:

- LUN 0, size 1 GB, to be used by the cluster for Quorum.
- LUN 1, size 100 GB, to provide cluster storage for the Microsoft SQL Server system databases and logs.
- LUN 2, size 100 GB, to provide cluster storage for the Microsoft SQL user databases and logs.

Each LUN was mapped to the same igroup (igroup1) created on the SVM, to which the in-guest software iSCSI initiators of the cluster nodes were also joined.

See APPENDIX I for details of the ISS Dedicated NetApp SVM commands and how they were used to create the igroup and LUNs.

Appliance Deployment

Using the VDC Control Centre:

- Active Directory must be present on the Application network. This was done first, using a Windows Server 2008 R2 (SP1) appliance, deployed into a virtual appliance in a VDC that had been prepared as above.
- Two Microsoft SQL Server 2008 R2 (SP2) appliances [that will become the Cluster Nodes] should be deployed as Persistent Virtual Machine Templates into a virtual appliance in a VDC that has been prepared as above:
  - In the virtual appliance, turn to the Persistent Virtual Machine Templates tab, click the ‘+’ button and select a Microsoft SQL Server 2008 R2 (SP2) template.
  - Click the ‘clone’ button, ensure that both are selected and click the ‘Start Conversion’ button.
- When the conversion is complete, drag the persistent templates into the virtual appliance and click save, but do not deploy yet. First make the following configuration changes to the appliances:
  - On the appliance’s Network tab,
    - The following IP addresses should be present:
      - NIC 0 Application network
      - NIC 1 Application network
      - NIC 2 Heartbeat network
      - NIC 3 Storage network
    - Click Save. The Default gateway can be on the Application network.
  - Make a note of the IP address assigned to NIC 1 on each appliance. These will be used later as shared IP addresses for the cluster:

<table>
<thead>
<tr>
<th>Server</th>
<th>NIC1 IP Address</th>
<th>Cluster Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>sqlnode1</td>
<td>192.168.0.20</td>
<td>sqlcluster1</td>
</tr>
<tr>
<td>sqlnode2</td>
<td>192.168.0.21</td>
<td>sqlclustersrv1</td>
</tr>
</tbody>
</table>

- On the appliance’s General Information tab, change the name to something descriptive, e.g. sqlnode1 and sqlnode2.
- Deploy the virtual appliance (or click ‘update running appliance’ if adding to an existing virtual appliance).
- As outlined earlier, it is at this stage assumed that the SVM is available on the Storage network and that an Active Directory is available on the Application network.
Operating System Configuration

The following configuration changes were made to sqlnode1 and sqlnode2 for the purposes of this illustration:

Name
- The computername was changed to sqlnode1 and sqlnode2.
- Each node was joined to the Active Directory domain as a member. In this illustration, an Active Directory domain was created called ‘sqlad.local’.

Networking
- Windows firewall: Firewall appliances were used to secure the networking where needed, so the Windows firewall was disabled.
- Network Interface re-naming: For clarity, the network connections were re-named to:
  - App
  - App1 (this was then disabled)
  - Heartbeat
  - Storage
- Static IP Addressing: Although the VMs can obtain all their IP addresses by DHCP, for clustering it is recommended that the addresses are set statically. Gateway and DNS IP addresses are not needed on the Storage and Heartbeat networks.
- Protocols: De-select un-wanted protocols:
  - On the Storage network, leave only TCP/IPv4 selected.
  - On the Heartbeat network, three protocols can be de-selected:
Network Binding Order: In the Network Connections window, go to Advanced -> Advanced Settings:

Ensure that the Application network appears first in the binding order:

iSCSI Storage

Connecting Windows To The iSCSI LUNs

By this stage, the 3 required LUNs must have been created on the SVM and mapped to an igroup [see APPENDIX I for further details].

Initially, connecting to the iSCSI LUNs and formatting them for use with Windows will need to be done from one of the cluster nodes; for simplicity, it is recommended that the other node is shut down whilst the following procedure is carried out. Shut down sqlnode1 and configure sqlnode2 first:
iSCSI Configuration

- As a preliminary, check that the SVM is reachable: Open a command-prompt and ping the SVMs IP address.
- Configure the iSCSI Initiator Service:
  - Go to Start -> Administrative Tools -> iSCSI Initiator to open the iSCSI Initiator Properties window (which will also start the iSCSI initiator service and configure it to start automatically with Windows).
  - Starting the iSCSI initiator service will have created an iSCSI initiator ID for the server – this ID will need to be added to the igroup on the SVM in order for the server to be able to connect to the SVMs storage.
  - Obtain the Initiator ID from the Configuration tab [shown as Initiator Name]:

![iSCSI Initiator Properties](image)

- Add the initiator ID to the same igroup on the SVM to which the LUNs have also been mapped; see APPENDIX I - Adding an iSCSI initiator to an igroup for an example of the command that was used to do for this illustration.
• On the Targets tab (back in the iSCSI Initiator Properties window), type in the IP address of the SVM and click Quick Connect:
• On the Connect To Target pop-up window, click OK to accept the default action to 'Add this connection to the list of Favorite Targets'.

![Connect To Target Window]

• If the SVM has been configured correctly, the LUNs should now be visible to the server: Verify by clicking the Devices button to see a list:

(Note: If LUNs were created on the SVM whilst an iSCSI connection had already been established from the server, it may be necessary to disconnect, then connect again from the Targets tab in order for them to be visible).

![Devices Window]

<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk 1</td>
<td>Port 3: Bus 0: Target 0: LUN 0</td>
</tr>
<tr>
<td>Disk 2</td>
<td>Port 3: Bus 0: Target 0: LUN 1</td>
</tr>
<tr>
<td>Disk 3</td>
<td>Port 3: Bus 0: Target 0: LUN 2</td>
</tr>
</tbody>
</table>
Go to the Volumes and Devices tab and click Auto Configure to ensure that the LUNs are connected to and available in the same way between re-boots of the server:

The iSCSI Initiator Properties window can now be closed.

**Disk Initialisation**

- Open disk manager. If the LUNs have been newly created, they will require initialising before Windows can use them:

- Depending on the LUN size, choose MBR or GPT.
Volume Creation

- Each newly-created LUN will now appear as an 'Unallocated' disk; a primary partition will need to be created on each and formatted with NTFS.

This can be done by a right-click -> New Simple Volume on each disk:
Follow the New Simple Volume wizard for each disk and assign drive letters as follows:

<table>
<thead>
<tr>
<th>Disk</th>
<th>Size (GB)</th>
<th>Drive Letter</th>
<th>Volume Name</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Q</td>
<td>Quorum</td>
<td>Quorum Disk</td>
</tr>
<tr>
<td>1</td>
<td>100</td>
<td>S</td>
<td>sql_system</td>
<td>SQL Server system db's &amp; logs</td>
</tr>
<tr>
<td>3</td>
<td>100</td>
<td>U</td>
<td>sql_user</td>
<td>SQL Server user db's &amp; logs</td>
</tr>
</tbody>
</table>

**New Simple Volume Wizard**

**Assign Drive Letter or Path**

For easier access, you can assign a drive letter or drive path to your partition.

- Assign the following drive letter: Q
- Mount in the following empty NTFS folder: Browse...
- Do not assign a drive letter or drive path

The default formatting options should be used (NTFS, quick), as shown here:

**New Simple Volume Wizard**

**Format Partition**

To store data on this partition, you must format it first.

- Do not format this volume
- Format this volume with the following settings:
  - File system: NTFS
  - Allocation unit size: Default
  - Volume label: Quorum
- Perform a quick format
- Enable file and folder compression

< Back   Next >   Cancel
Repeat for the other two LUNs to end up with three drives as follows:

This completes the storage configuration on sqlnode2. Shut down sqlnode2 and, when it has powered off, start up sqlnode1.

---

**Sqlnode1**

**iSCSI Configuration**

These steps are to be performed with sqlnode2 shut down (after having configured the iSCSI storage).

- As was done for sqlnode2, configure the iSCSI service on sqlnode1. The iSCSI initiator ID will need to be added to the same igroup, on the SVM before a connection to the LUNs can be made.
- When the LUNs have been connected, use disk manager to bring them online.
- The disks will not need to be initialised or formatted, but assign them the same drive letters as were assigned for sqlnode2.

When the storage has been configured on sqlnode1, sqlnode 2 can be powered on again (but do not attempt to access the disks on sqlnode2 – these will remain in the possession of sqlnode1).

**Active Directory User Accounts**

Prior to installing the cluster services, the following user accounts and group were created in Active Directory:

- User: clusteradmin
  - Member of: Domain Admins
  - Properties: Administrator permissions on each sqlnode VM
  - Purpose: Installation tasks on each sqlnode VM
- **User:** sqlsvrdb
  - Member of: Domain Users
  - Properties: Password set to never expire
  - Purpose: Account under which the SQL Server service will run on each sqlnode VM

- **User:** sqlsvragnt
  - Member of: Domain Users
  - Properties: Password set to never expire
  - Purpose: Account under which the SQL Server Agent service will run on each sqlnode

- **Group:** sqladmin
  - Purpose: Easily grant users administrative permissions on the SQL server by adding them to this group.

**Failover Cluster Installation**

To create the cluster, an Active Directory domain account that has administrative permissions on the cluster member servers, sqlnode1 and sqlnode2 is required.

From this point on, in this illustration, all steps were performed whilst logged on as the 'clusteradmin' user (which, for convenience, was a member of the Domain Admins group).

**Failover Cluster Feature Installation**

- For each of sqlnode1 & 2 use Server Manager -> Features -> Add Features -> Failover Clustering to install the feature.
- Download and install the recommended Microsoft Failover Cluster Hotfix KB2550866 (the transient communication failure hotfix ) on sqlnode 1 & 2.

**Failover Cluster Validation**

- On sqlnode1 (logged in as clusteradmin), open Failover Cluster Manager.
- To start the Validate a Configuration Wizard, click the link to Validate a Configuration:
• Click the Browse button to select sqlnode1 & 2 from Active Directory:

![Select Servers or a Cluster](image1)

![Testing Options](image2)

• Leave the default to Run all tests:
• Wait for the tests to complete. When finished, a Summary will show that the configuration is suitable for clustering:

![Validate a Configuration Wizard](image1)

Click View Report to verify that each category has been given a Success status:

![Failover Cluster Validation Report](image2)

• Close the report.

**Failover Cluster Setup**

• Start the Create Cluster Wizard: Back on the Summary window, click the link to ‘Create the cluster now using the validated nodes’ (alternatively, click Create a cluster in the Failover Cluster Manager).

• Provide a Cluster Name [e.g. sqlcluster1] and one of the reserved IP addresses [recorded earlier in the Appliance Deployment section from the disabled NICs].
- Confirm the details entered:
- Click Next to go ahead and create the cluster. When complete, a summary window will show some details of the successfully created cluster (click View Report for an more in-depth description):
• Click finish to exit the Cluster Wizard and return to the Failover Cluster Manager.
• Verify that the first disk (Q) has been selected as the ‘Disk Witness in Quorum’:

• Configure the cluster networks: Use the Failover Cluster manager to give the cluster networks useful names and to specify the cluster services permitted:
  • Expand the Networks, select a network and then expand the Network Connections for sqlnode1 &2 to show which of the network interfaces [Application, Heartbeat or Storage] is forming the selected cluster network.
  • Right-click the cluster network and choose properties:
    • re-name it accordingly [i.e. Application, Heartbeat or Storage]:

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Once the cluster networks have been re-named, go back to the properties of each and configure the following:

- Application Network properties:
  - Select ‘Allow cluster network communication on this network’
  - Tick ‘Allow clients to connect through this network’

- Heartbeat Network properties:
  - Select ‘Allow cluster network communication on this network’
  - Un-tick ‘Allow clients to connect through this network’

- Storage Network properties:
  - Select ‘Do not allow cluster network communication on this network’

**Clustered SQL Server Installation**

- Whilst logged on to sqlnode1 as clusteradmin, locate the shortcut to ‘SQL Server Installation Center [64-bit]’ – e.g. the shortcut on the desktop:
• Launch the Installation Center and, under Installation section, click the ‘New SQL Server failover cluster installation’ link:

• When prompted for the Installation Media, browse C:\mssql:
Continue through the setup tests and select the required features to install:

- Database Engine Services
- SQL Server Replication
- Full-Text Search
- Client Tools Connectivity
- Management Tools – Basic
- Management Tools – Complete

In the Instance Configuration section of the wizard, provide the ‘SQL Server Network Name’ – this will be the clustered SQL Server name – to go with the second of the reserved IP addresses recorded earlier in the Appliance Deployment section [e.g. sqlclustersrv1]:

Also specify a name for the clustered instance [e.g. INSTANCE1]:

E.g. only basic features were chosen for this illustration, including:

- Database Engine Services
- SQL Server Replication
- Full-Text Search
- Client Tools Connectivity
- Management Tools – Basic
- Management Tools – Complete
• On the next screen click Next to accept the default cluster resource group name:
• Next ensure that both Cluster disk 2 and 3 are selected as resources for the cluster:

• For Cluster Network Configuration, un-tick DHCP and specify the address reserved for ‘sqlclustersrv1’, as recorded in the Appliance Deployment section earlier:
• For Cluster Security Policy, accept the default of ‘Use service SIDs’:

<table>
<thead>
<tr>
<th>Service</th>
<th>Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Server Agent</td>
<td>sqlsvrgnt</td>
</tr>
<tr>
<td>SQL Server Database Engine</td>
<td>sqlsvrdb</td>
</tr>
</tbody>
</table>

• At Server Configuration, specify the Active Directory accounts created earlier as follows:

<table>
<thead>
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<th>Service</th>
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</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Microsoft recommends that you use a separate account for each SQL Server service.
For the Database Engine Configuration:
- On the Account Provisioning tab:
  - Select Mixed Mode
  - Provide a password for the Server Agent account
  - Click the ‘Add Current User’ button (to make the clusteradmin account an SQL Server administrator)
  - Click the Add button and select the ‘sqladmin’ group created earlier.

- On the Data Directories tab:
  - Set the Data root directory to the S:\ drive
  - Change the User database directory drive letter to U
  - Change the User database log directory drive letter to U
  - Change the Temp DB directory drive letter to S
  - Change the Temp DB log directory drive letter to S
  - Change the Backup directory drive letter to S
When the ‘Install a SQL Server Failover Cluster’ wizard has finished, the ‘SQL Server (INSTANCE 1)’ application should now be visible under ‘Services and applications’ in the Failover Cluster Manager:

Adding an SQL Server Failover Cluster Node

Sqlnode2 can now be added to the clustered SQL application:

- Logged on to sqlnode2 as clusteradmin, locate the shortcut to ‘SQL Server Installation Center (64-bit)’ – e.g. the shortcut on the desktop:

- Launch the Installation Center and, under the Installation section, click the ‘Add node to a SQL Server failover cluster’ link to start the wizard:
At Cluster Node Configuration, ensure the clustered instance (e.g. INSTANCE1) is selected:

For Service Accounts, ensure the correct Active Directory accounts are specified (to match sqlnode1) and enter their passwords:

<table>
<thead>
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<th>Account</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQL Server Agent</td>
<td>sqlsvrngt</td>
</tr>
<tr>
<td>SQL Server Database Engine</td>
<td>sqlsvrdb</td>
</tr>
</tbody>
</table>
Click through the rest of the wizard. At ‘Ready to Add Node’, click Next to start the installation:
• Click Close to exit the wizard when the installation has completed successfully:

This completes the basic setup of a 2 node SQL Server Failover Cluster. The following section demonstrates a failover and failback between the two nodes.
SQL Server Failover Testing

This section provides a few tests to demonstrate that the cluster will fail-over the SQL Server instance between cluster members sqlnode1 and sqlnode2. These tests should be run from a remote management server – i.e. one connected to the Application network (but which is not one of the cluster members); it should also be a domain-member server - e.g. the management server used in this illustration was the Domain Controller, using the clusteradmin account.

Remote Management Tools

- Install the Failover Cluster feature on the management server (using Server Manager -> Features -> Add Features -> Failover Clustering to install it).
  - Open Failover Cluster Manger and click ‘Manage a Cluster’; enter the computername given to the cluster [e.g. sqlcluster1].
- Install SQL Server client tools – to enable the management server to connect to the clustered SQL Server instance:
  - Connect to the admin share (c$) of one of the sqlnodes [e.g. \sqlnode1\c$] and run setup from the mssql folder:
    - Click Installation -> New installation …
    - Click thorough to SQL Server Feature Installation, choose Shared Features, Management Tools – Complete:

- Once installed, run SQL Server Management Studio [Start -> All Programs -> Microsoft SQL Server 2008 R2 -> SQL Server Management Studio):
  - Connect to SQLCLUSTERSRV1\INSTANCE1 using Windows Authentication: You will be connected to the active node in the cluster that has possession of the cluster resources.
Sample Data

To add the AdventureWorks2008R2 sample database:

- Download the zip file from codeplex (http://msftdbprodsamples.codeplex.com/downloads/get/478216#) and copy it to the U: drive of the active sqlnode. Extract the .mdf and .ldf files to U:\AdventureWorks2008R2.
- From the SQL Server Management Studio (either on the active sqlnode or on the management server), right-click on databases, choose Add and browse to the extracted .mdf file.
- Set the owner of the database to be the clusteradmin account.

Cluster Resource Configuration

To set up the cluster to failover quickly for the purposes of these tests, the following settings were configured on the cluster resources – all done from the Failover Cluster Manager on the management server:

- Select the clustered SQL service (e.g. SQL Server [INSTANCE 1]) under Services and applications:
  - Right-click and choose Properties:
• Under the General tab, check that both nodes are configured to be owners.
Under the Failover tab, adjust the settings to the tests, as shown:

With SQL Server [INSTANCE 1] selected, configure each of the component resources. Right-click each in turn and choose properties:
• On the Policies tab, adjust the settings to those shown here:

![Cluster Policies Settings](image-url)
• On the Advanced Polices tab, ensure that both sqlnode1 and 2 are selected as possible owners of the resource:

• Repeat the steps on the Policies and Advanced Policies tabs of the other resources:
  • IP Address
  • Cluster Disk 2 (Volume S)
  • Cluster Disk 3 (Volume U)
  • SQL Server
  • SQL Server Agent
• Finally, under Storage, locate Cluster Disk 1 (volume Q) and repeat the steps for the Policies and Advanced Policies tab.
**Failover test**

**Managed Failover**

The Failover Cluster Manager can be used to manually move the clustered SQL Server instance from one node to another. Whilst logged on to the management server as clusteradmin:

- Test the current connection to the SQL cluster:
  - Open a command prompt window and set a continuous ping to the cluster, e.g. type:
    ```
    ping –t sqlclustersrv1
    ```
  - Run a test query - e.g. to the AdventureWorks2008R2 database. Open another command prompt window and type the following:
    ```
    sqlcmd -S sqlclustersrv1\INSTANCE1 -d AdventureWorks2008R2 -Q "select * from production.product"
    ```
  
    If successful, 504 rows will be returned.

- Manually failover the SQL Server instance:
  - Select the clustered SQL service (e.g. SQL Server (INSTANCE 1)) under Services and applications):
  - Right-click and choose Move this service or application to another node. Click the node to move it to:

  ![Move service or application](image)

  - Confirm the action:

  ![Confirm action](image)

- The cluster will failover. Failover Cluster Manager will show the resources going offline as they are moved to the other node, and then being brought back online again. There will be a short loss of network connectivity to the cluster IP address, as seen in the ping command prompt window:
• Repeat the test query command: 504 rows should be returned again.
• If desired, repeat the process to ‘fail back’ the cluster to the original node.

**Automatic Failover (Simulated Node Failure)**

This test will power off the VM that is currently the active node for the cluster:

• On the management server, use the Failover Cluster Manager to identify the VM that is currently the active node for the clustered SQL Instance.
• If necessary test the current connection to the cluster (as described in the Managed Failover).
• Open an additional command prompt window and set a continuous ping going to the currently active node.
• From the VDC Control Centre, power-off the active node.
• The ping will start to time-out for both what was the active node and sqlclustersrv1, but sqlclustersrv1 will recover (as it is failed over to the remaining node).

• The Failover Cluster Manager will show one node as ‘down’ and all cluster resources will now be running on the other node:
• If desired, run a query against the clustered SQL instance [e.g. as detailed in the Managed Failover test].
• Power the ‘failed’ node back on again: When it has booted, it will automatically re-join the cluster and its state will change back to ‘Up’.
Further Reading

<table>
<thead>
<tr>
<th>Further Reading</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended hotfixes and updates for Windows Server 2008 R2 SP1 Failover Clusters</td>
<td><a href="http://support.microsoft.com/kb/2545685">http://support.microsoft.com/kb/2545685</a></td>
</tr>
</tbody>
</table>

APPENDIX I – ISS DEDICATED NETAPP SVM LUN CREATION

ISS Dedicated NetApp SVM can be managed from a command-line interface using non-interactive SSH sessions directed at the SVMs IP address. Indirect SSH means that a persistent SSH session is not established with the ISS Dedicated NetApp. Instead each command sent is prefixed with a login request, which lasts long enough to deliver the command and display the output from the SVM.

The examples below show how a SVM can be managed to provide iSCSI LUNs, for use as shared block storage for a Failover Cluster:

Sending Indirect SSH Commands

The simplest way is to use the command line interface of a VM deployed on the same network as the SVM:

- For Linux VMs, use the ssh command
- For Windows VMs an additional tool will be needed. It is recommended use the plink.exe tool [available from http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html]
  - Save plink.exe to a local folder, open a command prompt window and cd to that location, from where the command ‘plink’ can be used.

ISS Dedicated NetApp SVM Commands

The following table documents a few (of the many available) SVM commands that were used in this illustration.

<table>
<thead>
<tr>
<th>Command</th>
<th>Options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>igroup</td>
<td>add &lt;igroup name&gt; &lt;iqn&gt;</td>
<td>Administrates igroups, to which initiators and LUNs can be added</td>
</tr>
<tr>
<td></td>
<td>create -i -t windows &lt;igroup name&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>show [-v]</td>
<td></td>
</tr>
<tr>
<td>iscsi</td>
<td>status</td>
<td>Administrates the iSCSI service</td>
</tr>
<tr>
<td>lun</td>
<td>create -s &lt;size&gt; -t windows_2008 &lt;vol&gt;</td>
<td>Administrates LUNs</td>
</tr>
<tr>
<td></td>
<td>show [-v</td>
<td>-m]</td>
</tr>
<tr>
<td></td>
<td>map &lt;lun path&gt; &lt;igroup name&gt; &lt;lun ID&gt;</td>
<td></td>
</tr>
<tr>
<td>vol</td>
<td>status [-v] [/vol/&lt;vol name&gt;]</td>
<td>Displays information about the volumes available in your ISS Dedicated NetApp SVM</td>
</tr>
</tbody>
</table>
All commands can be used as follows, where:

user is the administrative user created for you with your SVM

SVM IP is the IP address assigned to your SVM

- Using SSH (Linux):
  ssh user@<SVM IP><command>

- Using plink.exe (Windows):
  plink user@<SVM IP><command>

After entering a command, the SVM will prompt for the user password, after which the output, if any, from the SVM will be returned.

Help from the SVM can be requested for a command, for example:

```
plink user@10.15.0.2 vol help status
```

user@10.15.0.40’s password:

```
   - print the status of volume <vol-name> (or all volumes)
   (Only -v, -l, -b, and -? are available in an SVM context)
```

Example Command Usage - SVM iSCSI
To check that the iSCSI service is running:

```
plink user@10.15.0.2 iscsi status
```

user@10.15.0.2’s password:

```
iSCSI service is running
```

Example Command Usage - SVM Volumes
To show information about the volume(s) available in the SVM:

```
plink user@10.15.0.2 vol status
```

user@10.15.0.40’s password:

```
Volume State   Status                   Options
  testvol1     online       raid_dp, flex create_ucode=on,
sis           convert_ucode=on,
                  fractional_reserve=0
```
Include the volume’s name (prefixed by ‘/vol/’) to show further information on just that volume. E.g. to view the volume size:

```
plink user@10.15.0.2 vol status /vol/testvol -b
```

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>testvol1</td>
<td>4096</td>
<td>2684354560</td>
<td>2684354560</td>
</tr>
</tbody>
</table>

**Example Command Usage – SVM igroups**

An iSCSI initiator will be able to connect to a LUN if the initiator has been added to the same igroup to which the LUN has also been mapped.

To create an igroup:

```
plink user@10.15.0.2 igroup create -i -t windows igroup1
```

No output returned indicates success.

Adding an iSCSI initiator to an igroup:

```
plink user@10.15.0.2 igroup add igroup1 iqn.1991-05.com.microsoft:sqlnode1.sqlad.local
```

No output returned indicates success.

To view an igroup:

```
plink user@10.15.0.2 igroup show
```

```
igroup1 (iSCSI) [ostype: windows]:
```

**Example Command Usage – SVM LUNs**

To create a LUN:

```
plink user@10.15.0.2 Lun create -s 1g -t windows_2008 /vol/testvol1/testlun0
```

No output returned indicates success.
Mapping a LUN to an igroup:

```
plink user@10.15.0.2 lun map /vol/testvol1/testlun0 igroup1 0
user@10.15.0.2's password:
No output returned indicates success.
```

To view LUNs:

```
plink user@10.15.0.2 lun show
root@10.15.0.40's password:
/vol/testvol1/testlun0        1g [1073741824] [r/w, online]
```

To show LUN mappings:

```
plink user@10.15.0.2 lun show -m
root@10.15.0.40's password:

<table>
<thead>
<tr>
<th>LUN path</th>
<th>Mapped to</th>
<th>LUN ID</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>/vol/testvol1/testlun0</td>
<td>igroup1</td>
<td>0</td>
<td>iSCSI</td>
</tr>
</tbody>
</table>
```

Author

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