

Create a 2 node virtual SQL Server 2005 Cluster Configuration

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DOCUMENT

This document explains how to create a virtual 2 node SQL Server cluster using VMWare Server 2.0.1 (you could also use Microsoft Virtual Server 2005 R2 SP1), Windows 2003 Enterprise 32bit and SQL Server 2005 Enterprise 32 bit (you may 64 bit if desired). For the purposes of this document the following apply;

Fail-Over	A Microsoft Cluster implementation method
SSMS	SQL Server Management Studio
T-SQL	Transact_SQL (the native SQL Server command language)
MSCS	Microsoft Cluster Services. The underlying technology for SQL Server Fail-Over clustering
NIC	Network interface card
Virtual Server Name	A unique computer name in the domain. During fail-over this computername is passed from one node to another
Virtual IP Address	A unique IP Address in the network. During fail-over this IP Address is passed from one node to another
OS	Operating System
Node	A host which participates in a cluster
Quorum	The centralised repository used by MSCS
Heartbeat	A segregated private network for communication detection between nodes
Active\Passive	A cluster configuration which involves an active node and a passive node. The passive node becomes active on Fail-Over.

1.1 AUDIENCE

The document is intended for administrators wishing to simulate a SQL Server cluster environment for testing or as a tool when expressing a wish to learn more about Windows\SQL Server clustering. It is not expected that the reader is familiar with the Windows operating system and MSCS.

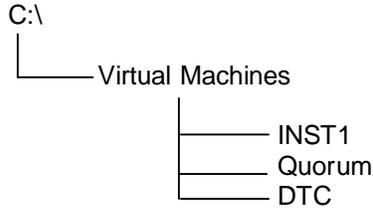
2 CLUSTERING BRIEF OVERVIEW

MSCS involves 2 or more computers (they don't have to be physical you can use virtual machines too) configured into a cluster relationship. This technology requires a central, shared storage (it cannot exist on the machine itself). Clusters use Virtual Server Names and Virtual IP Addresses to create a reference for the network connection to the clustered application. For example SQL Node 1 has a computername of SQLCLNODE01 and IP Address of 10.10.10.120. SQL Server instance INST1 has a computername of SQLCL01 and IP Address of 10.10.10.126. All network calls to the SQL Server instance 1 are made through the virtual server name and IP address, not the Nodes actual name or IP Address. During fail-over this virtual name and IP address are passed to the partner Node like a ticket, re directing network calls to the new Node.

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SQL SERVER CLUSTER

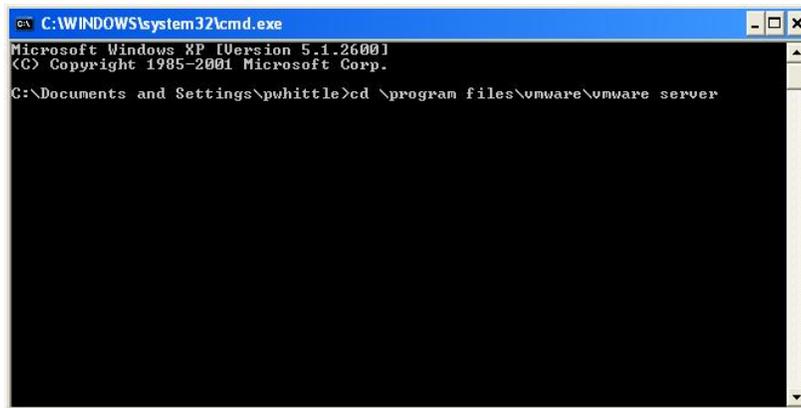
Install VMware Server 2.0.1 and then create the following folder structure locally



Use the commands listed below to create the virtual disks required. The **vmware-
vdiskmanager.exe** resides in the following folder if a default installation of VMware Server was used;

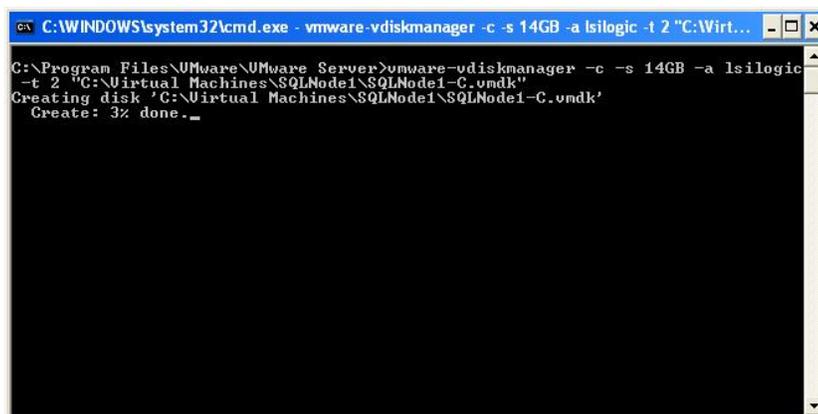
C:\Program Files\VMware\VMware Server

Open a command prompt and paste the commands, in turn, into the shell window (ensure you set the directory path first as shown in the screenshot below).



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\pwhittle>cd \program files\vmware\vmware server
```

Create the drives as shown below



```
C:\WINDOWS\system32\cmd.exe - vmware-vdiskmanager -c -s 14GB -a lsilogic -t 2 "C:\Virt...
C:\Program Files\VMware\VMware Server>vmware-vdiskmanager -c -s 14GB -a lsilogic
-t 2 "C:\Virtual Machines\SQLNode1\SQLNode1-C.vmdk"
Creating disk 'C:\Virtual Machines\SQLNode1\SQLNode1-C.vmdk'
Create: 3% done. _
```

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vmware-vdiskmanager -c -s 512MB -a lsilogic -t 2 "C:\Virtual Machines\Quorum\Quorum.vmdk"

Create the drives for the SQL Server clustered instance data, logs and DTC

vmware-vdiskmanager -c -s 5GB -a lsilogic -t 2 "C:\Virtual Machines\INST1\INST1_Data.vmdk"

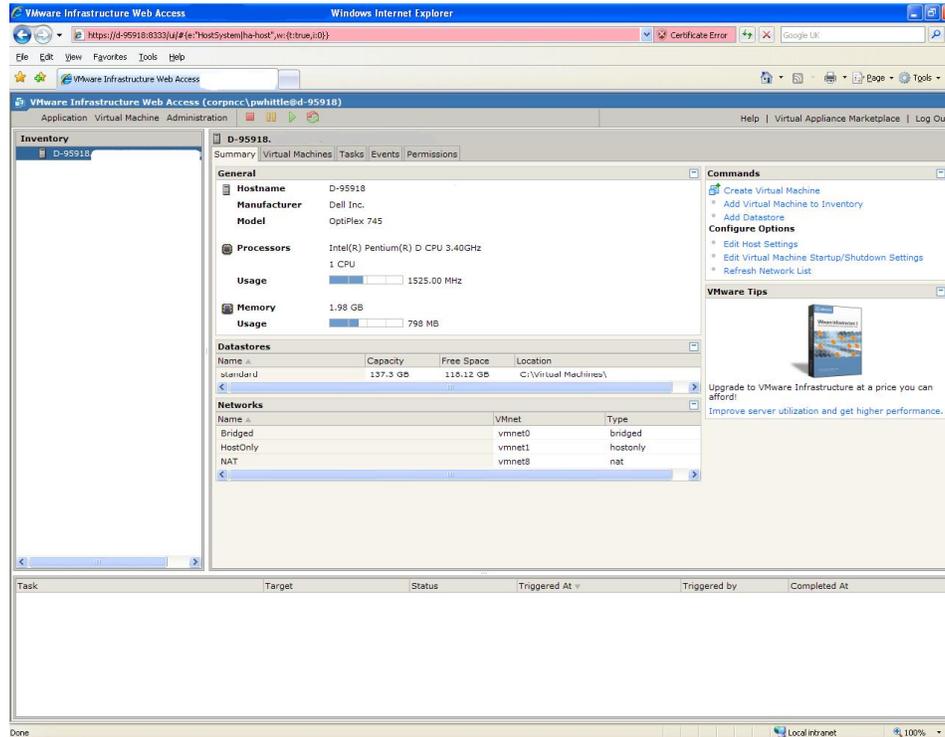
vmware-vdiskmanager -c -s 5GB -a lsilogic -t 2 "C:\Virtual Machines\INST1\INST1_Logs.vmdk"

vmware-vdiskmanager -c -s 2GB -a lsilogic -t 2 "C:\Virtual Machines\DTC\DTC_Data.vmdk"

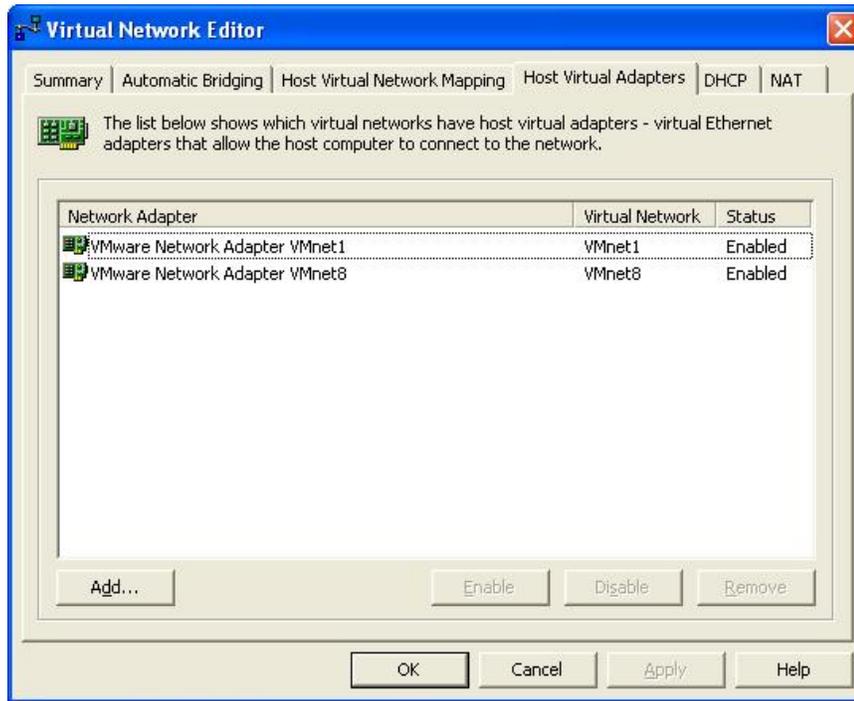
Ensure you add your Windows domain\local account to the following local group on your pc

__vmware__

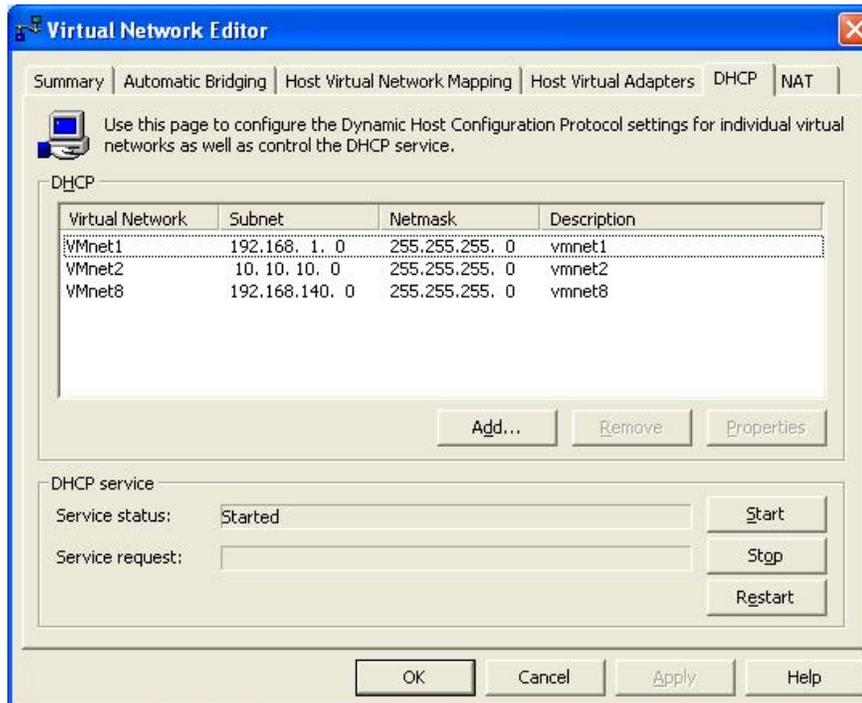
Log into the Vmware Server console supplying your Windows account and password and you will see the following;



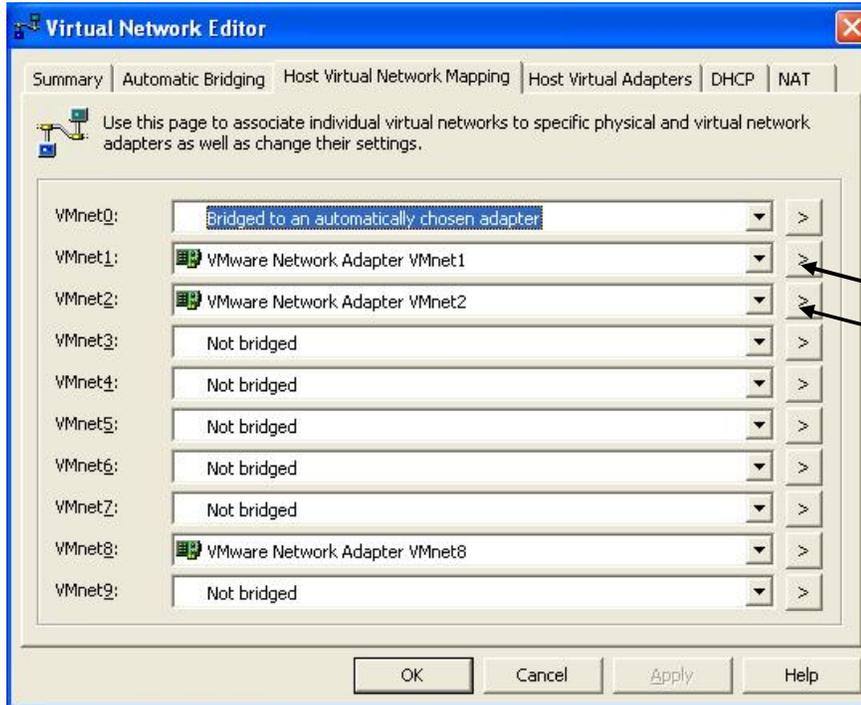
virtual networks+option from the Start menu. Go straight to the Host Virtual Adapters tab and add a new virtual adapter for VMnet2 and click



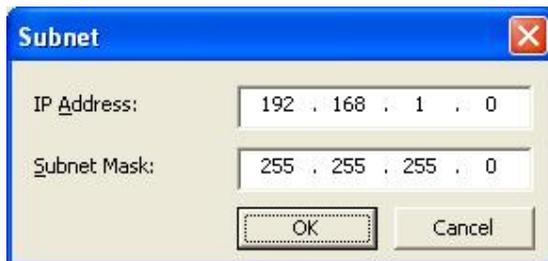
Now go to the DHCP tab and remove any DHCP assignments (click each item and remove) then click %Apply+.



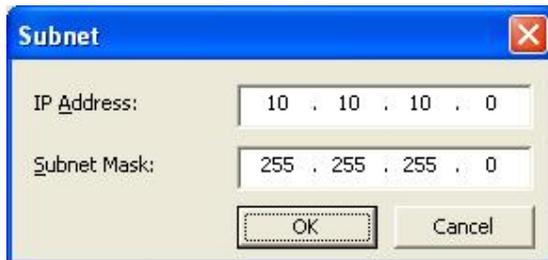
... mapping+option and change the subnets to be used clicking the arrow (indicated) and selecting %Subnet+from



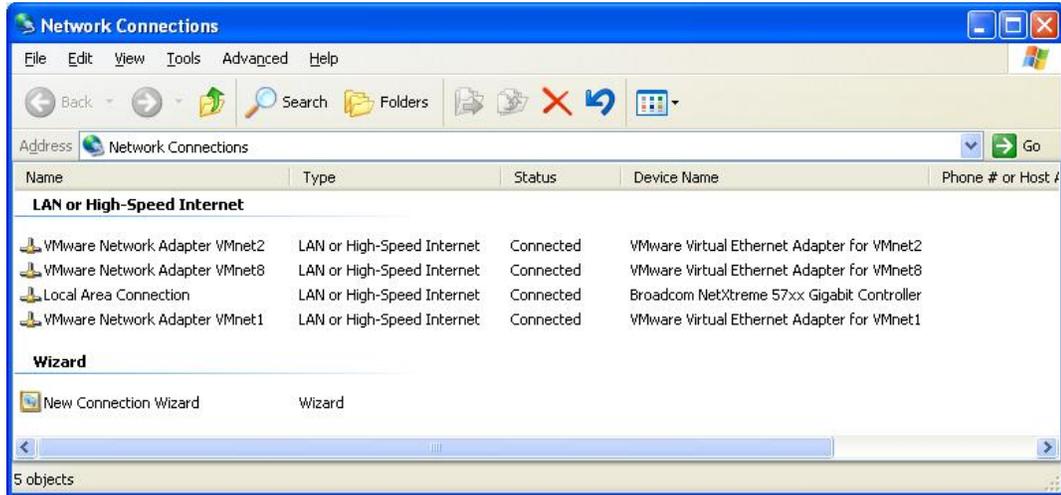
For VMnet1 set the IP address to 192.168.1.0



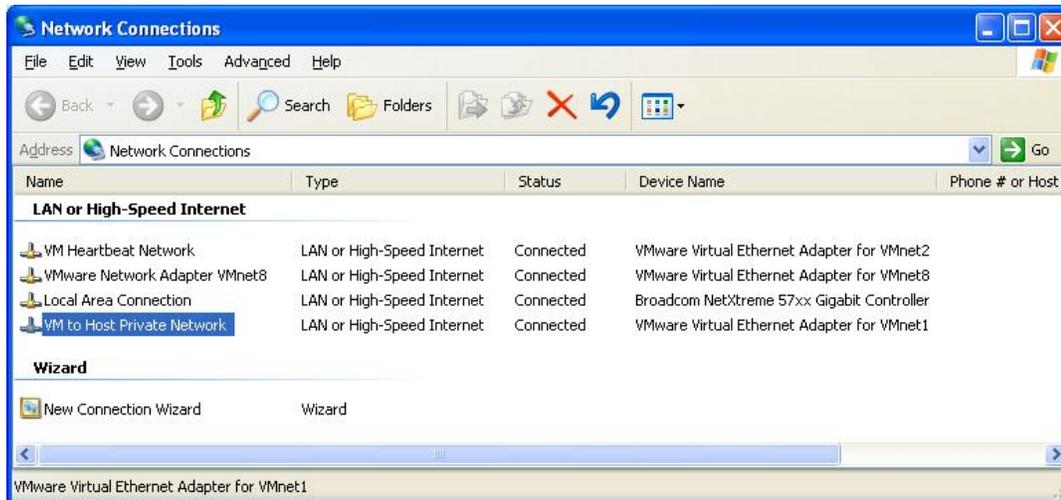
For VMnet2 set the IP address to 10.10.10.0



network editor. It's a good idea to open your host machine and rename the virtual LAN adapters to something a little more



Renamed to

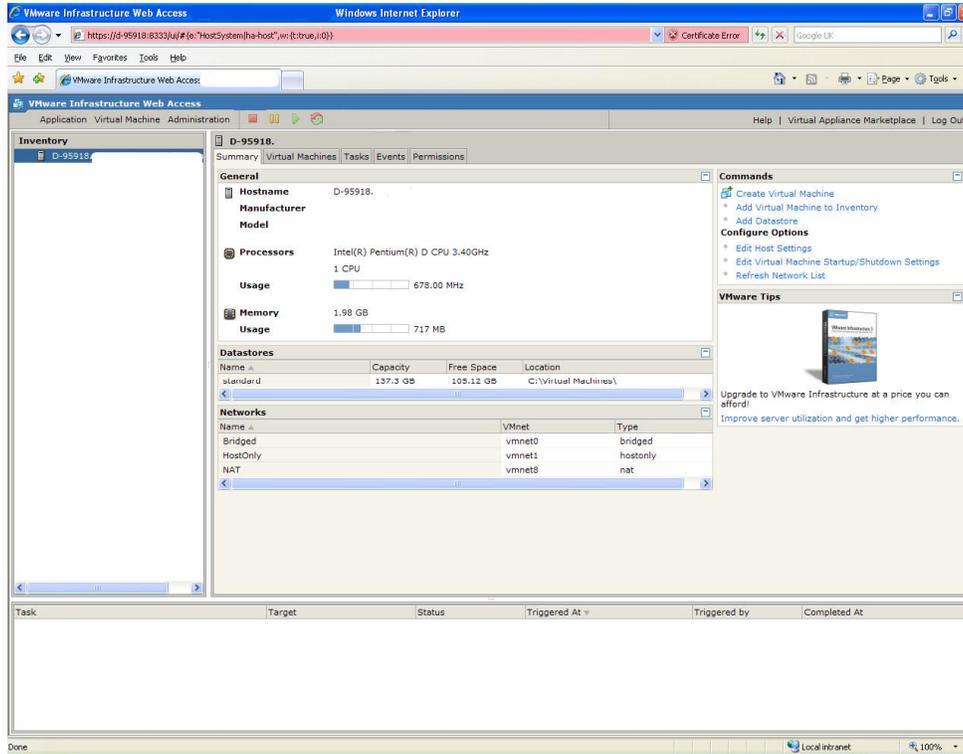


Click the refresh networks list option within the VMWare Server console to refresh the virtual networks.

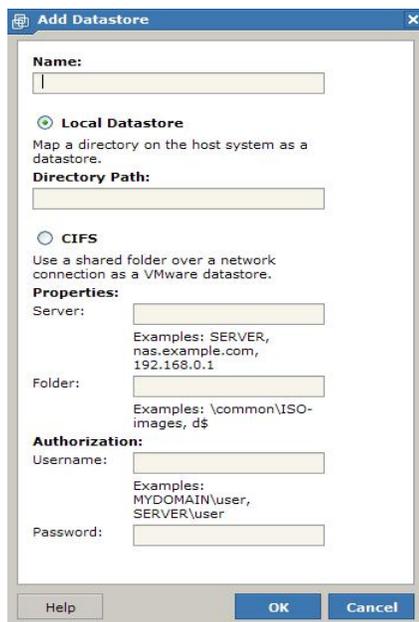
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ole installed and configured and the virtual networks
w time to create a datastore to hold all the ISO images

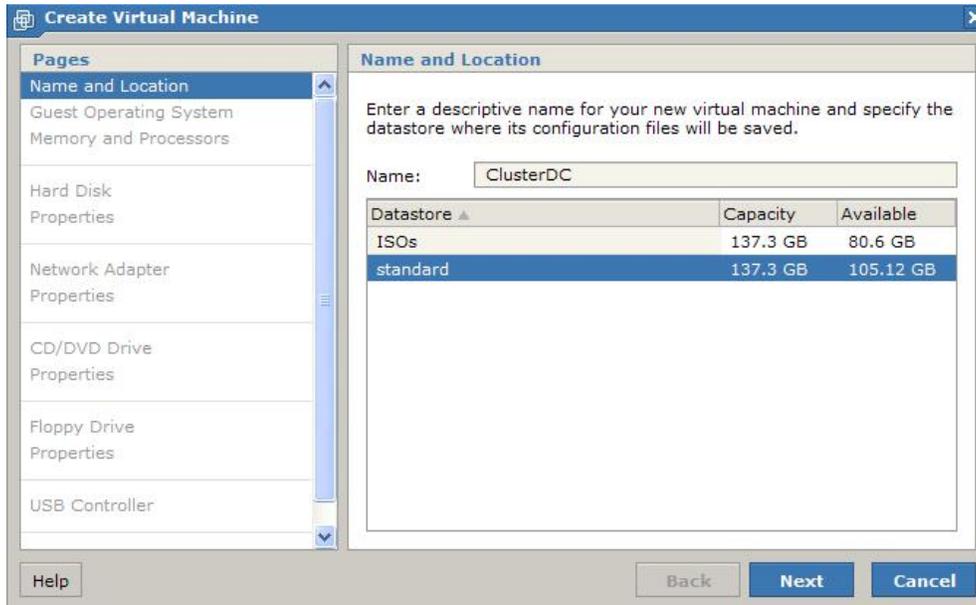
Select the host node in server console as shown below and under %Commands+click %Add datastore+;



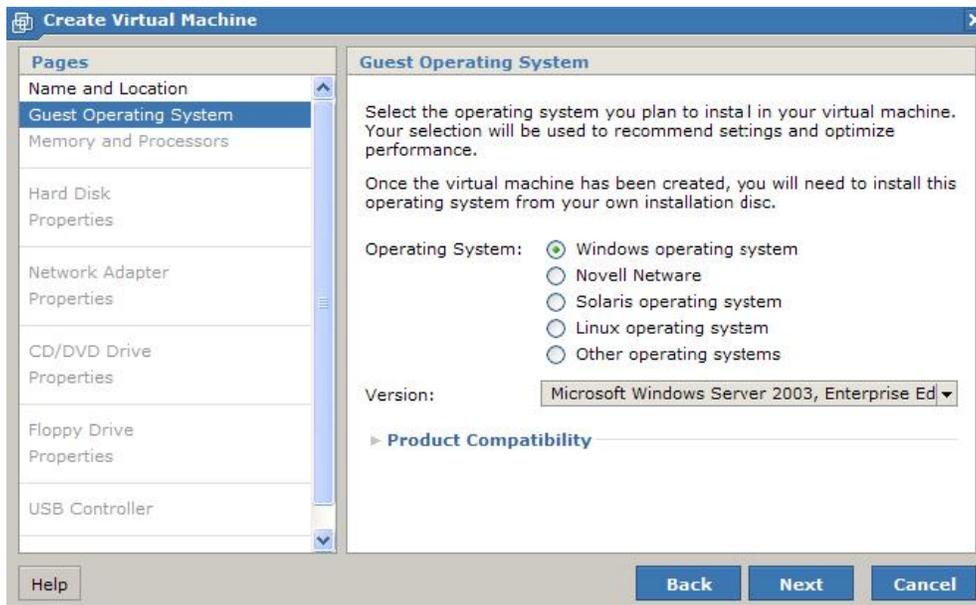
At the dialog supply a datastore name (ISOs) and a local path (C:\ISOs) then click %OK+;



ating the VMs. Under the %Commands+section, select for a Virtual machine name and select a datastore (this your local drive) then click %Next+;

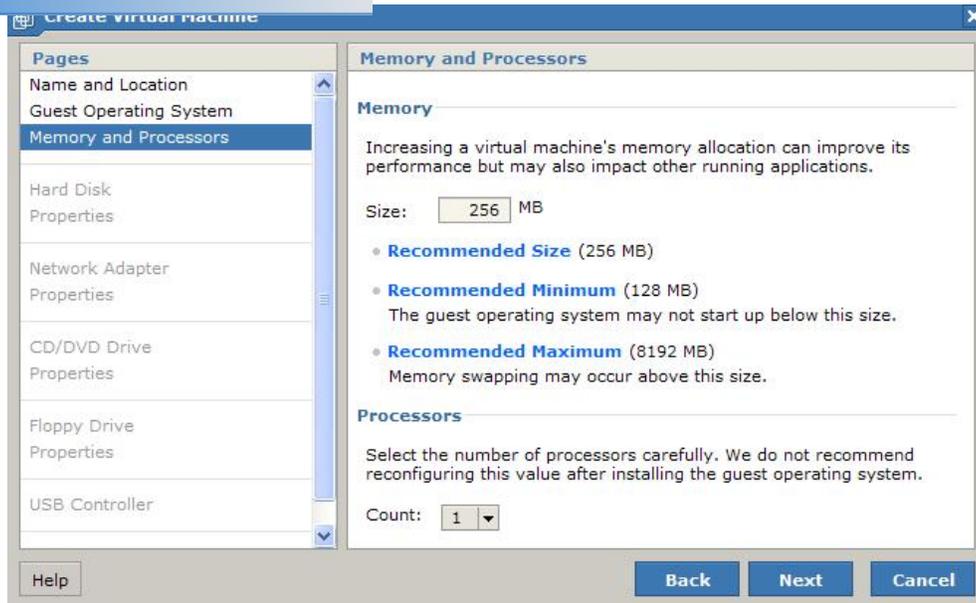


Select the Operating System type (Enterprise Edition for clustering. We will be using 32bit OS) and click %Next+;

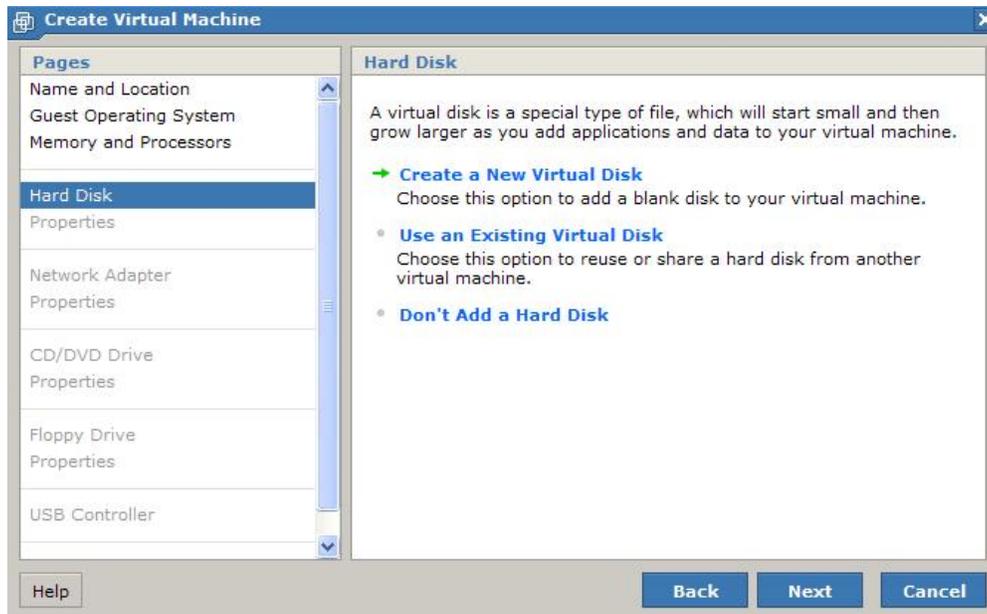


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2GB and 400MB for each cluster node) and CPU (1 each)

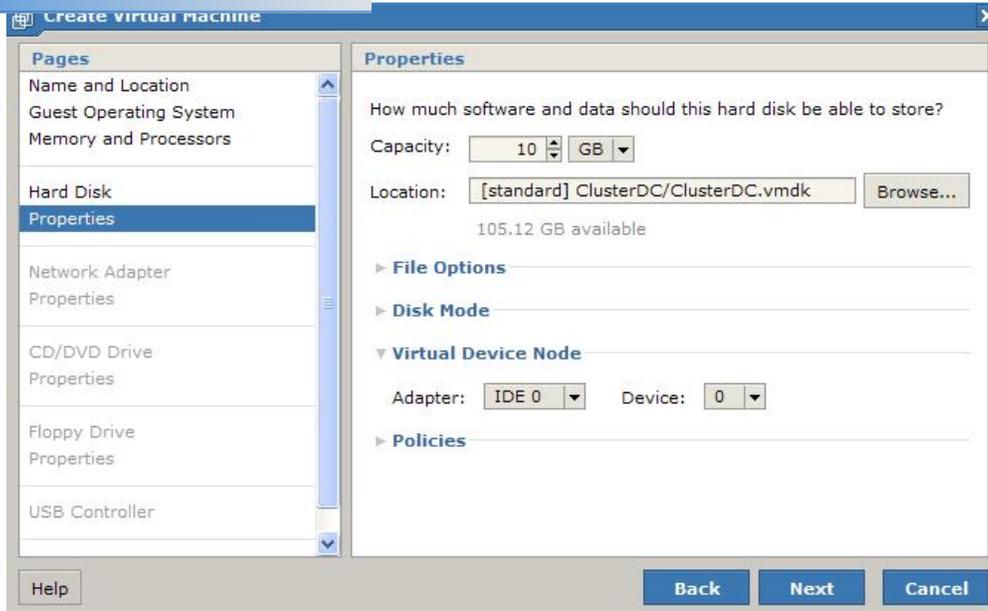


Select to create a new virtual disk;

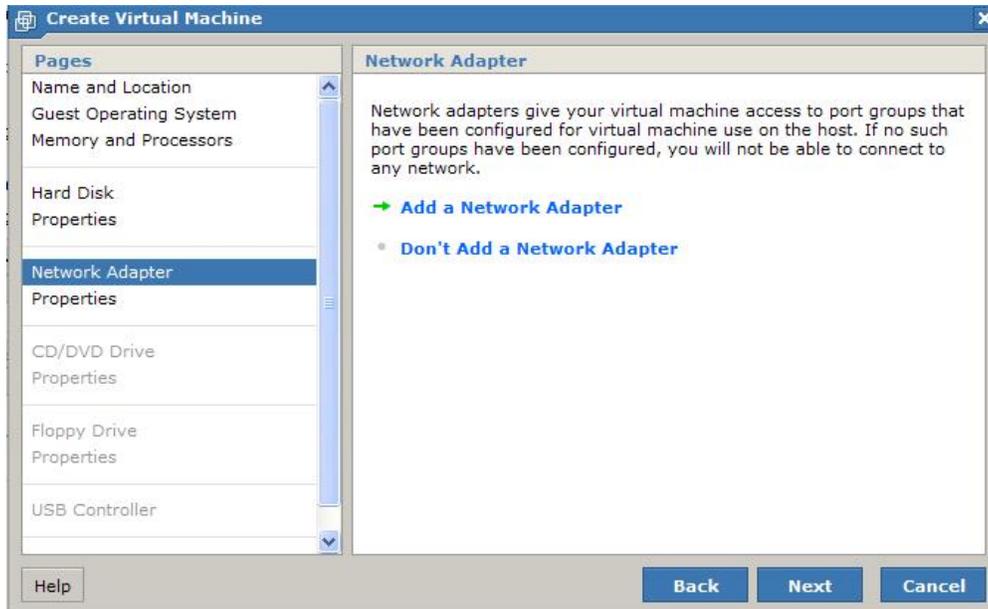


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Click and select SCSI bus (SCSI ID 0 for the VM boot disk)
Next;

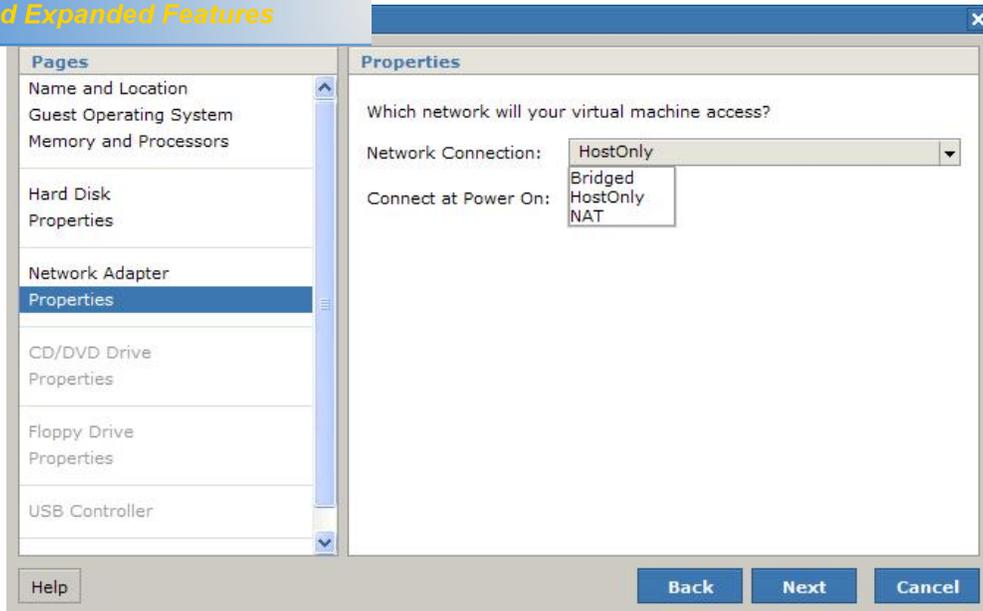


Select 'Add a network adapter' and the network selection browse opens

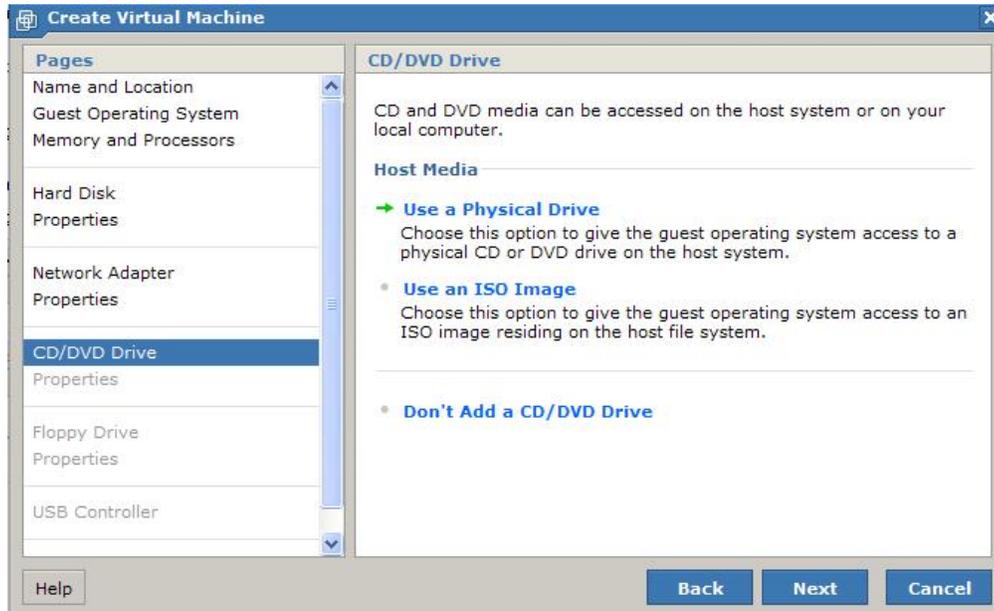


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and click **Next**;

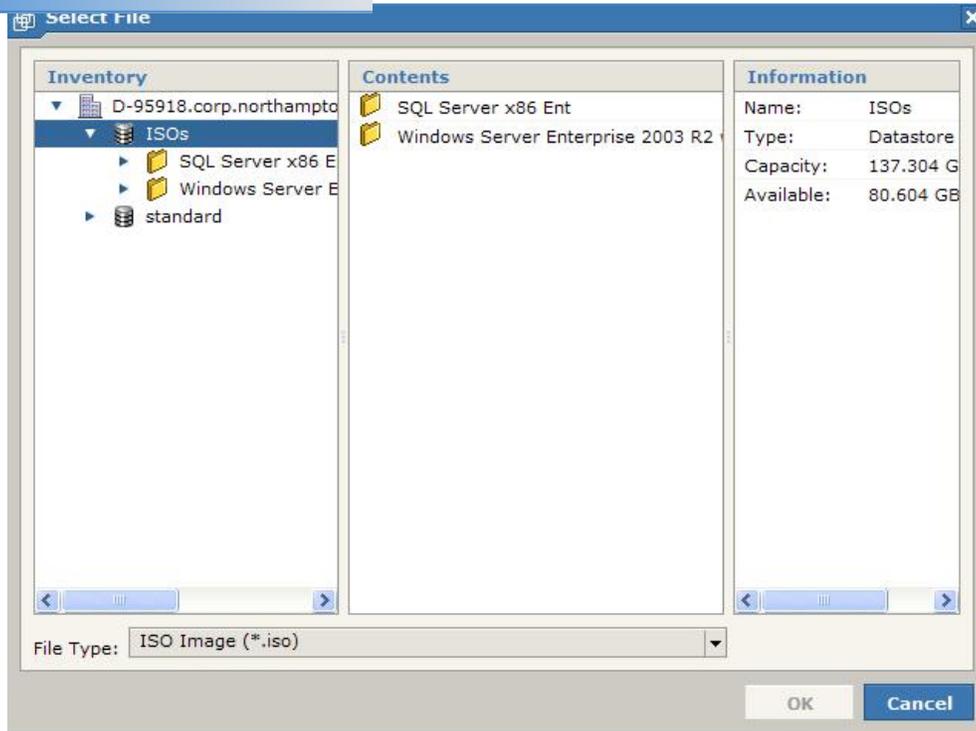


Select to use an ISO image for the vCD drive and click the browse button,

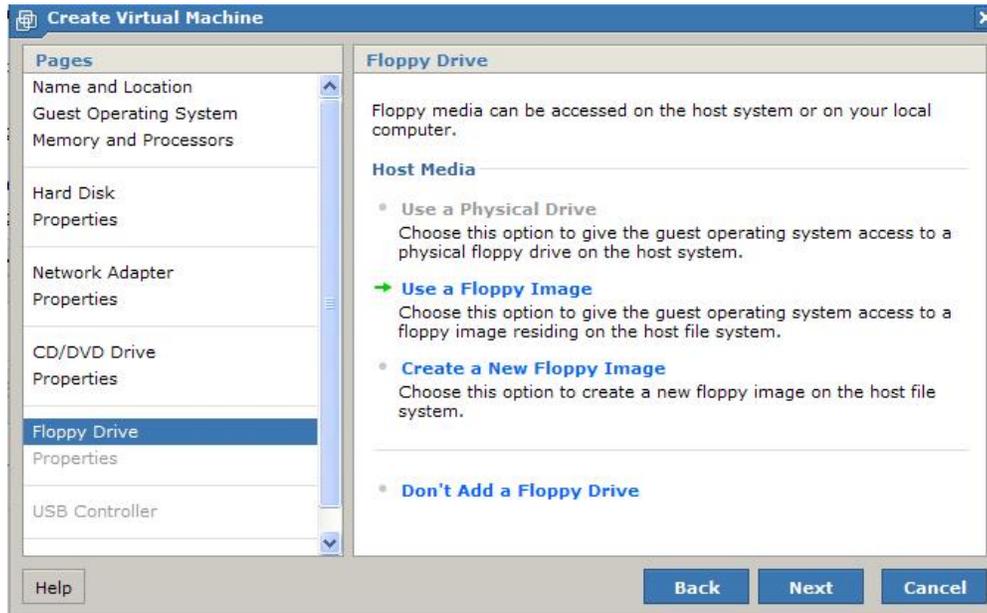


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drill down and select the Windows 2003 R2 Enterprise
create virtual machine window+click %N>next+;

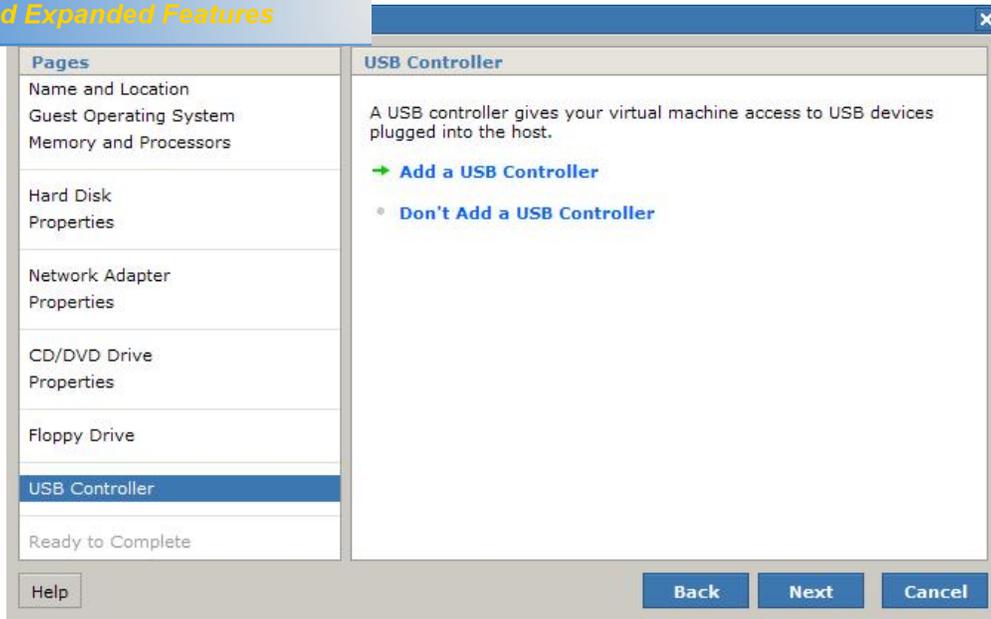


At the next screen do not add a floppy drive and click %N>next+;

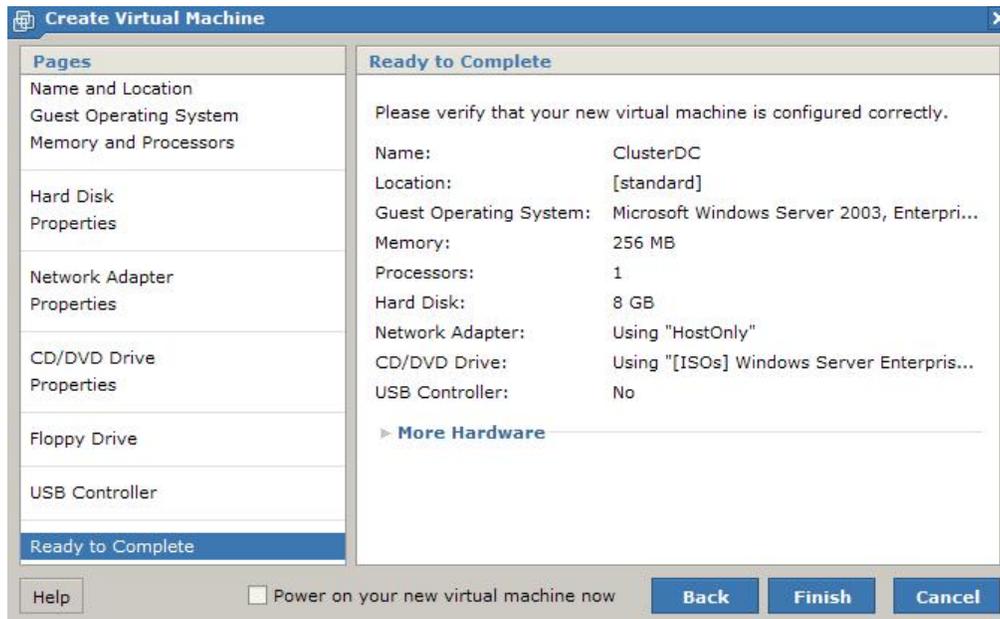


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and click **Next**;



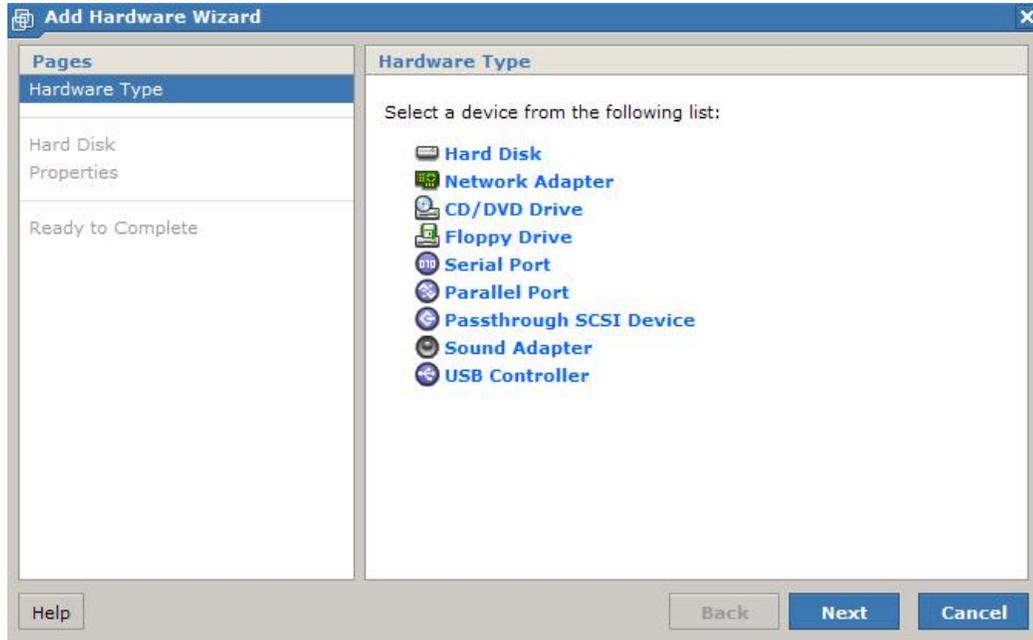
At the last screen click **Finish** to complete the VM



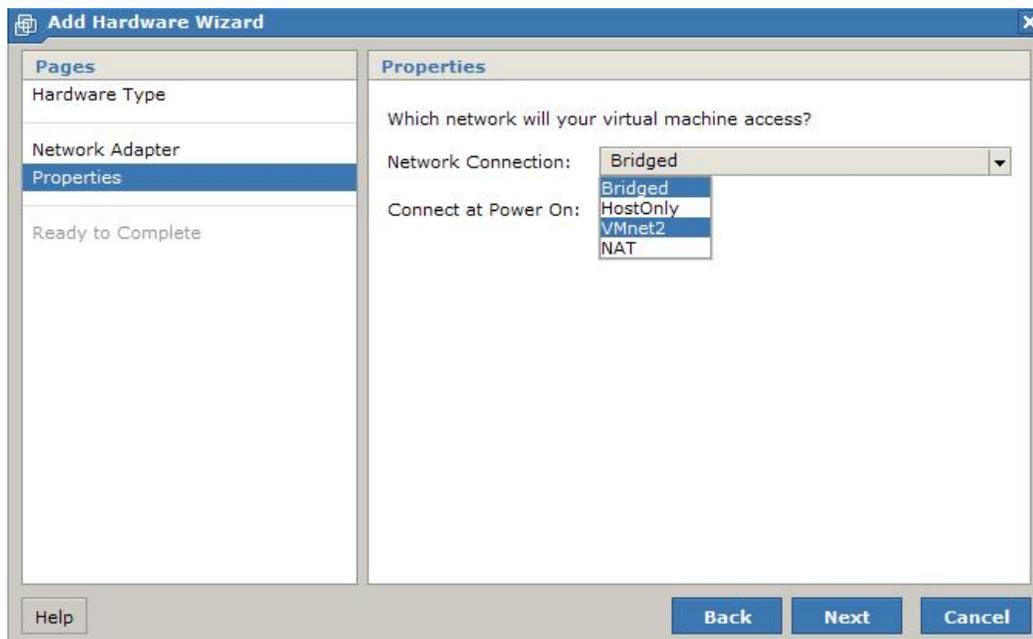
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node 1 and node 2). For each of the cluster nodes add a network adapter for the Heartbeat network. This is done as follows;

Select the first node and under the **Command+** section click **Add hardware+**, the following screen appears. Click **Network adapter+** and the vNIC properties appear;



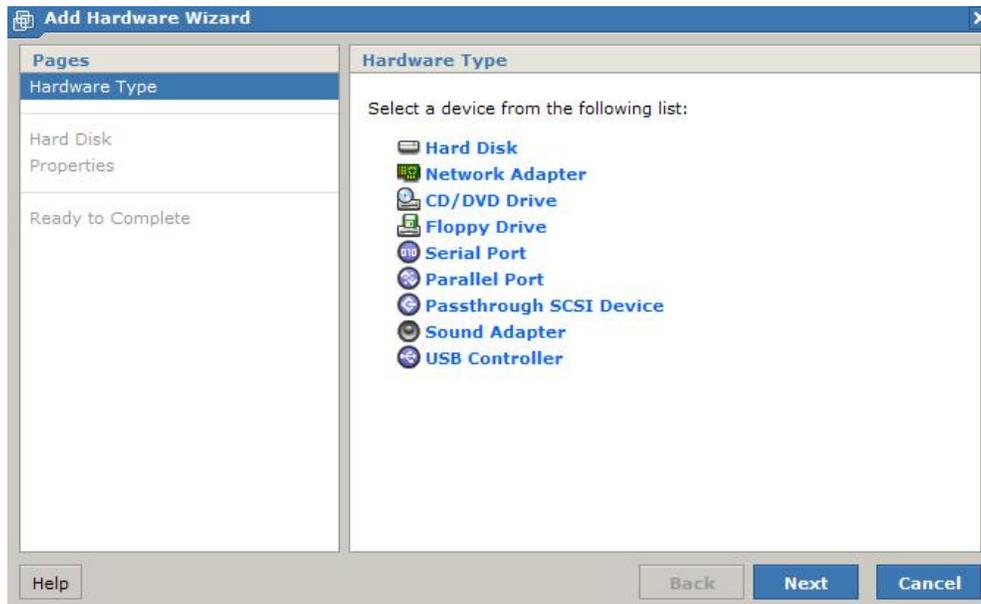
Select the **VMnet2+** option from the drop down list and click **Next+**, then click **Finish+** to complete. Do this for the second cluster node too.



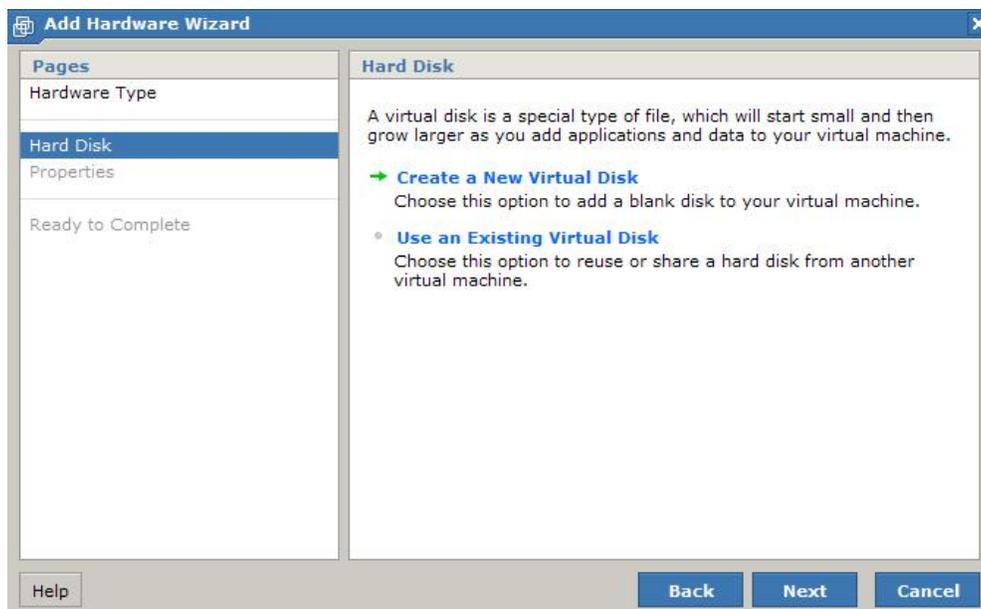
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systems on each VM and create a domain controller (DC). Configure networking (Public and Heartbeat) on the 2 nodes to the domain. Once this is done you may proceed with the rest of the instructions in this document.

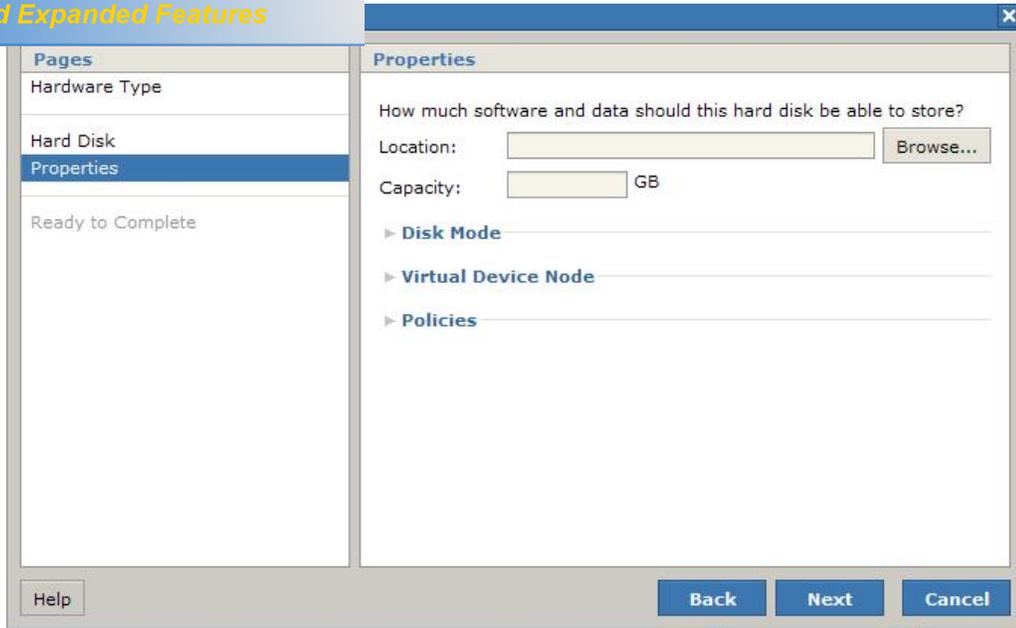
Once the cluster nodes have been created we need to shut the VMs down and attach the pre created virtual disks to each cluster node this involves also manually editing the VM configuration file (*.vmx). With the VMs powered off start as follows. Select node 1 and click **Add hardware**. Click **Hard disk**;



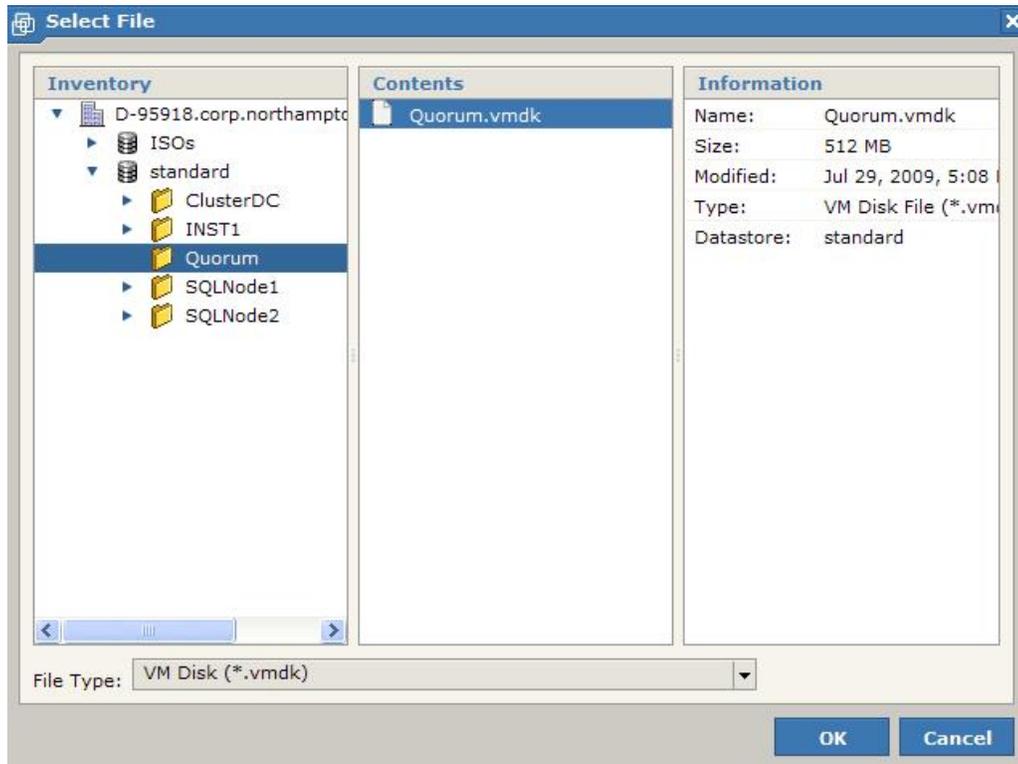
Use existing hard disk;



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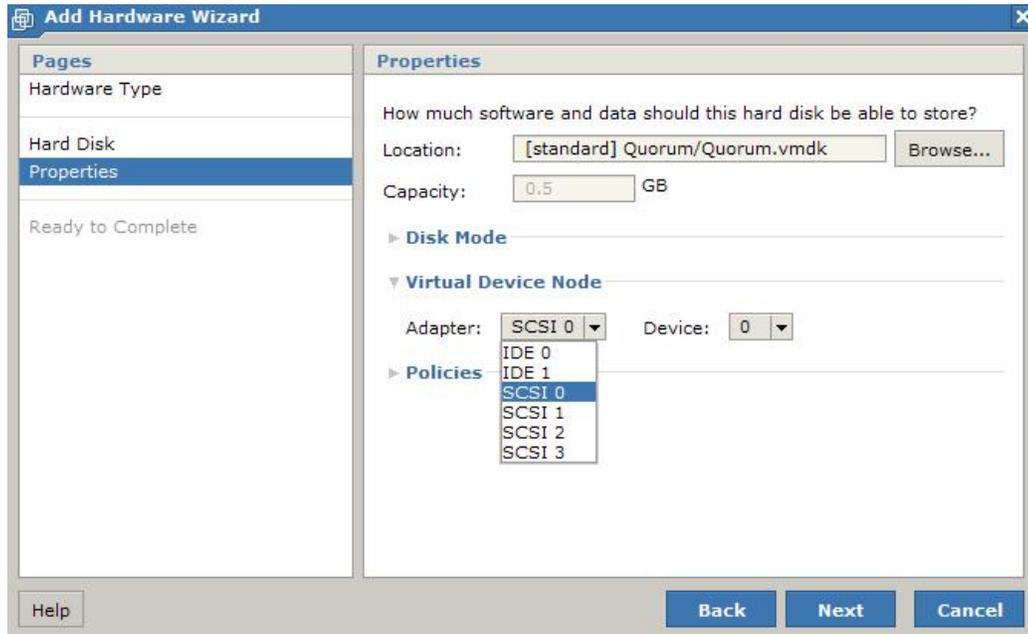


The datastore browser opens. Select the first disk Quorum and click OK;

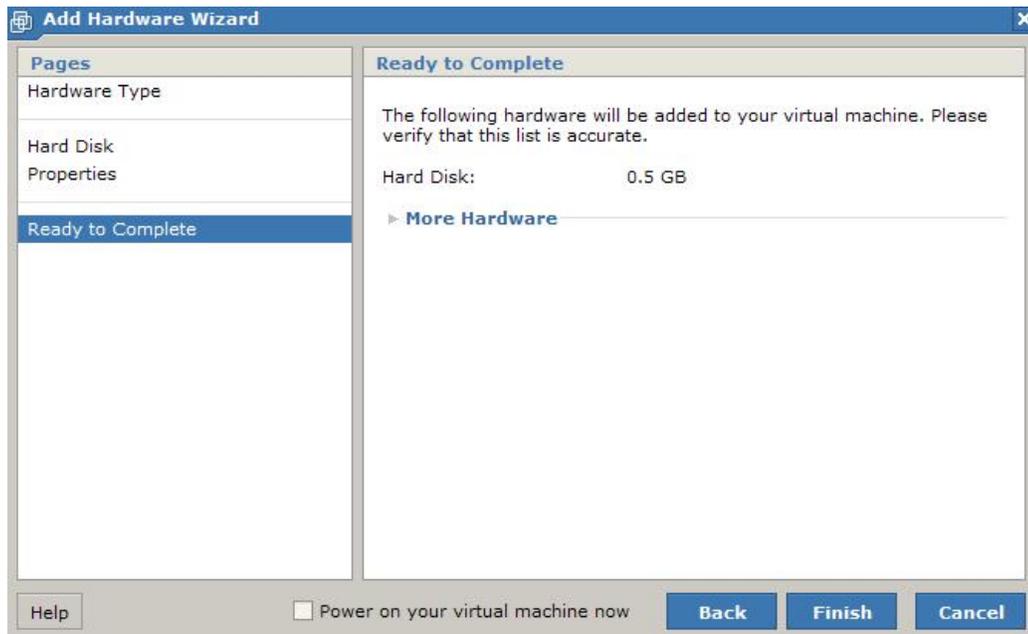


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...settings accept the default assignment for node1 if you chose a SCSI bus boot drive change the adapter ext;

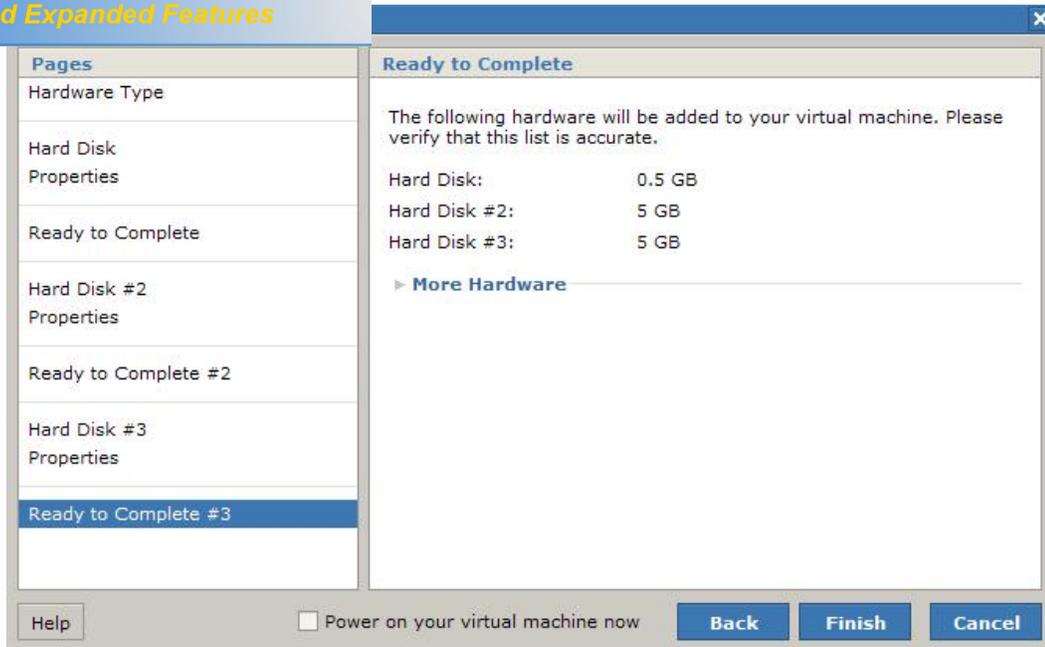


At the next screen select the **More hardware** option to add the 2 remaining SCSI disks.



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Finish+ to complete the configuration;



Now do the same for Node 2.

Once the disks have been added to both VMs it is important that only 1 machine is booted at any one time until the Windows cluster is installed and configured on the first node otherwise disk corruption will occur. The final step remaining is to ensure that the virtual SCSI bus on each VM is set to share and disk locking is disabled. Edit the .VMX file for each node by clicking the virtual machine and then under commands click Configure VM. On the advanced tab click into the Configuration Parameters section and then click Add New Entry using the following;

Name = disk.locking
Value = false

Click %Apply+ and %OK+ to finish configuring the VM. Do the same for the second node. Next locate the VM configuration (search for *.VMX) file for each node, open in NOTEPAD and find the following section;

scsiX.sharedBus = "none" where X is the SCSI bus number the shared disks are attached too (1 in our case).

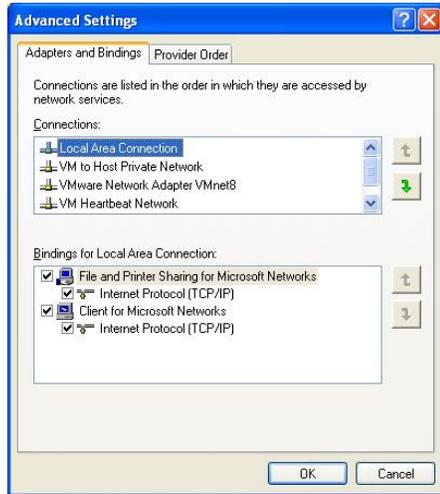
Change the text to;

scsiX.sharedBus = "virtual"

Close the file and save it.

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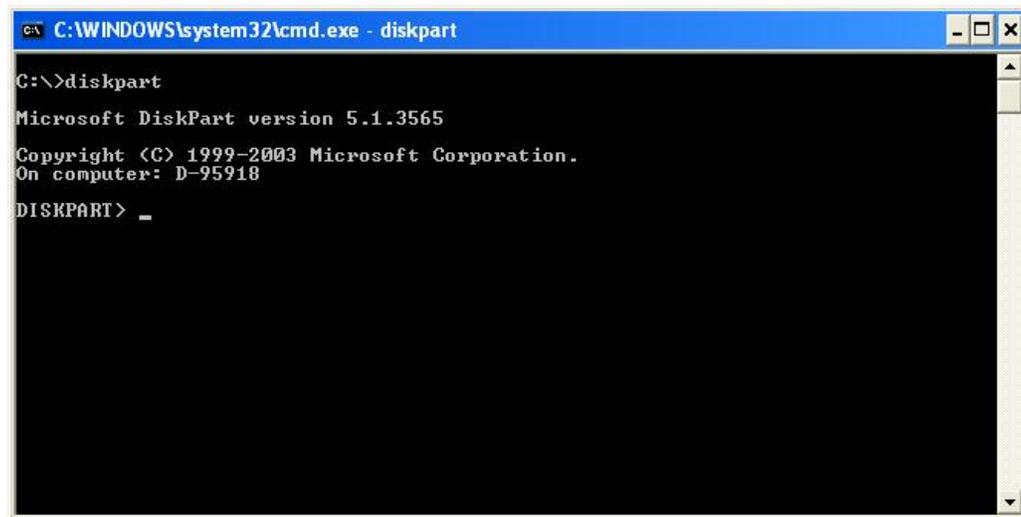
on both nodes, we need to power on the first node and create the NTFS partitions on each of the 3 disks. Also configure the disk only on the heartbeat NIC. Select TCP/IP advanced properties and on the DNS tab clear the checkbox **Register this connections address in DNS**. In network connections explorer change the adapter order to Public first then Private\Heartbeat.



Highlight the connection and click the up or down arrow to move. Ensure the Public connection is topmost

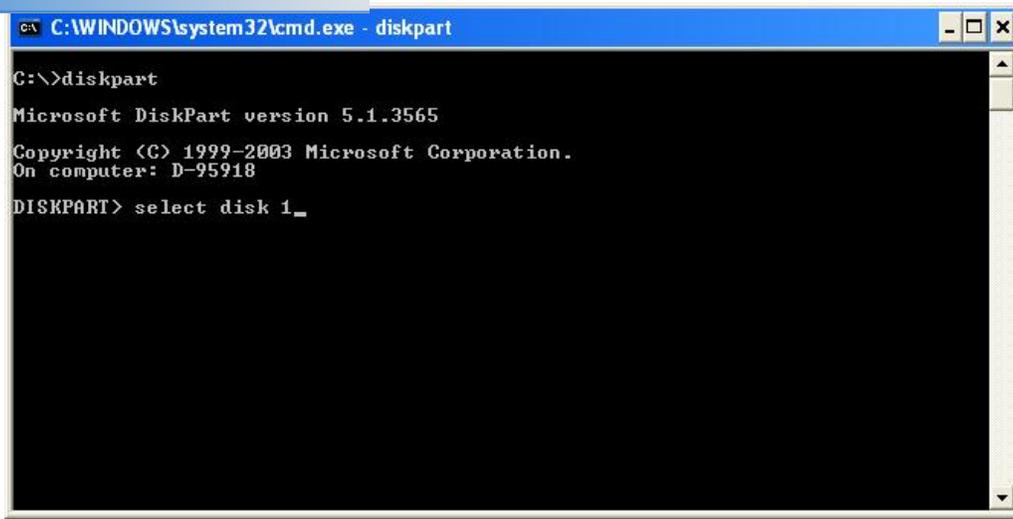
Boot the first node and create 3 NTFS partitions on the 3 new drives, use drive letters Q (Quorum), S (SQL Data) and T (SQL Logs). Although not necessary on your virtual machines the following instructions are used to create aligned partitions for use with SQL Server.

Open a command prompt and type diskpart followed by return as shown below



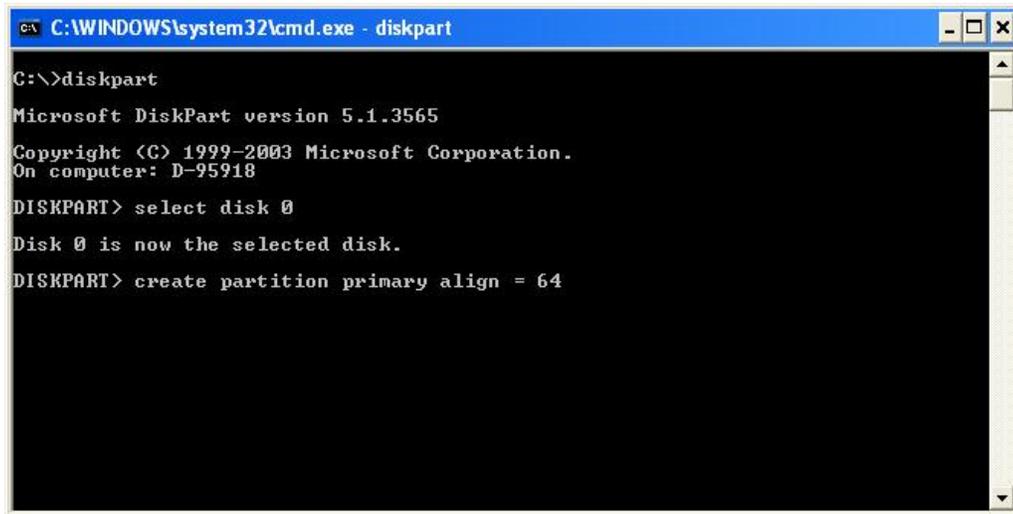
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number (you may get these from disk management),



```
C:\WINDOWS\system32\cmd.exe - diskpart
C:\>diskpart
Microsoft DiskPart version 5.1.3565
Copyright (C) 1999-2003 Microsoft Corporation.
On computer: D-95918
DISKPART> select disk 1_
```

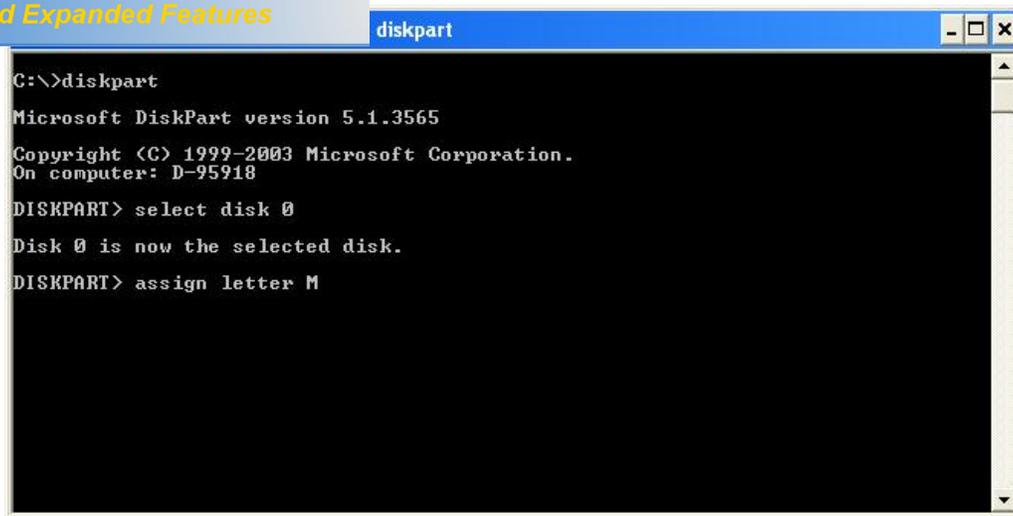
Now issue the command to create the partition shown below



```
C:\WINDOWS\system32\cmd.exe - diskpart
C:\>diskpart
Microsoft DiskPart version 5.1.3565
Copyright (C) 1999-2003 Microsoft Corporation.
On computer: D-95918
DISKPART> select disk 0
Disk 0 is now the selected disk.
DISKPART> create partition primary align = 64
```

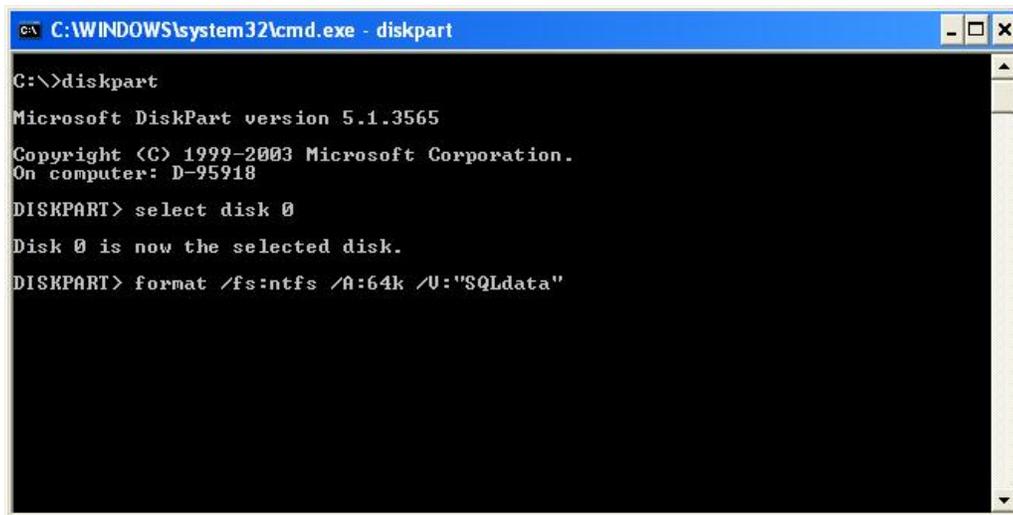
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created assign a drive letter using the following



```
C:\>diskpart
Microsoft DiskPart version 5.1.3565
Copyright (C) 1999-2003 Microsoft Corporation.
On computer: D-95918
DISKPART> select disk 0
Disk 0 is now the selected disk.
DISKPART> assign letter M
```

Now type exit to quit diskpart and at the command prompt format the partition using



```
C:\WINDOWS\system32\cmd.exe - diskpart
C:\>diskpart
Microsoft DiskPart version 5.1.3565
Copyright (C) 1999-2003 Microsoft Corporation.
On computer: D-95918
DISKPART> select disk 0
Disk 0 is now the selected disk.
DISKPART> format /fs:ntfs /A:64k /U:"SQLdata"
```

The partition will be created using the label SQLData and NTFS file system with a cluster size of 64kb. (Note that NTFS disk compression will be disabled on this partition).

Create a simple text file on each drive. Shutdown the first node and boot the second node. Open disk management and assign the drive letters to the 3 raw disks. Check the text files exist, if they do then all is well. If you cannot view the files drive corruption has occurred and you should re create the virtual disks (remove them from the VMs first).

Configure the first node into the new cluster, shutdown
and open cluster administrator and select the option to

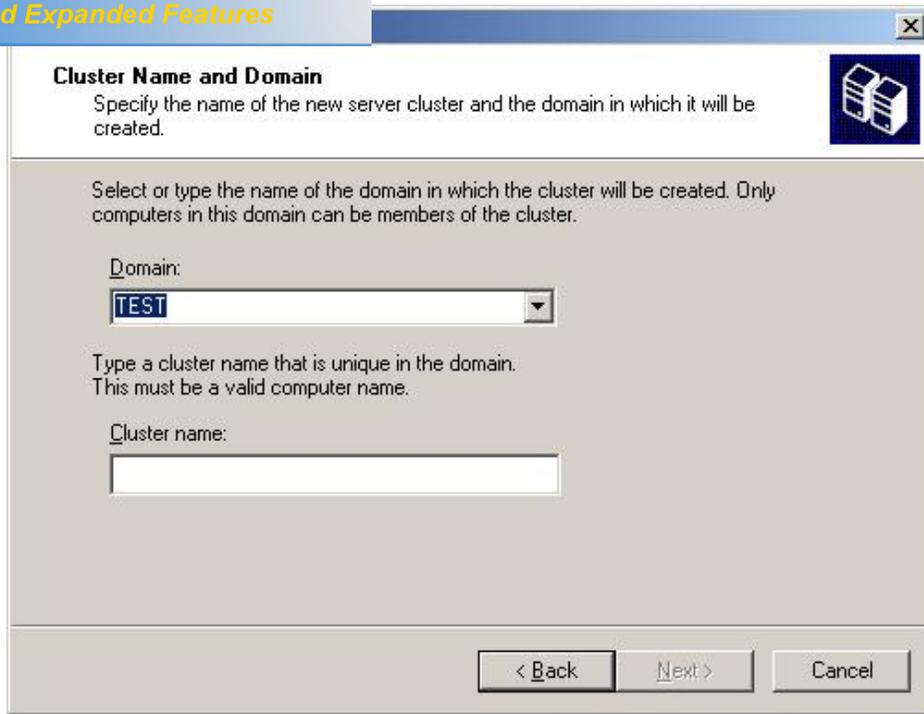


Click %Next+at the welcome screen;



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unique cluster name, then click **Next**;



Cluster Name and Domain

Specify the name of the new server cluster and the domain in which it will be created.

Select or type the name of the domain in which the cluster will be created. Only computers in this domain can be members of the cluster.

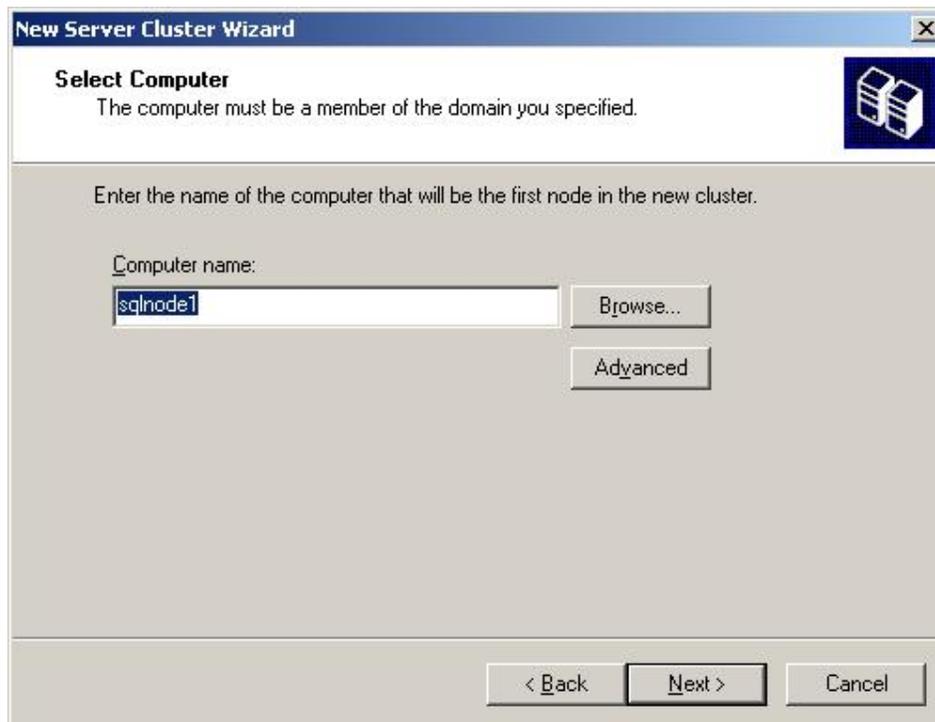
Domain:

Type a cluster name that is unique in the domain. This must be a valid computer name.

Cluster name:

< Back Next > Cancel

Confirm the node to add to the cluster and click **Next**;



New Server Cluster Wizard

Select Computer

The computer must be a member of the domain you specified.

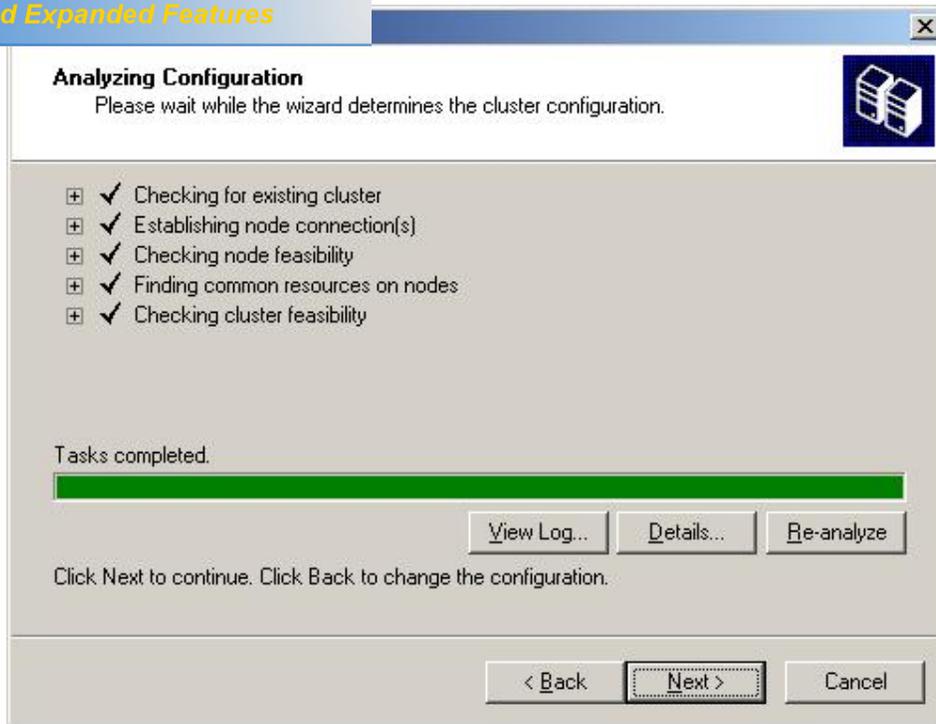
Enter the name of the computer that will be the first node in the new cluster.

Computer name:
 Browse... Advanced

< Back Next > Cancel

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Click Next from the analysis stage and click Next to proceed;

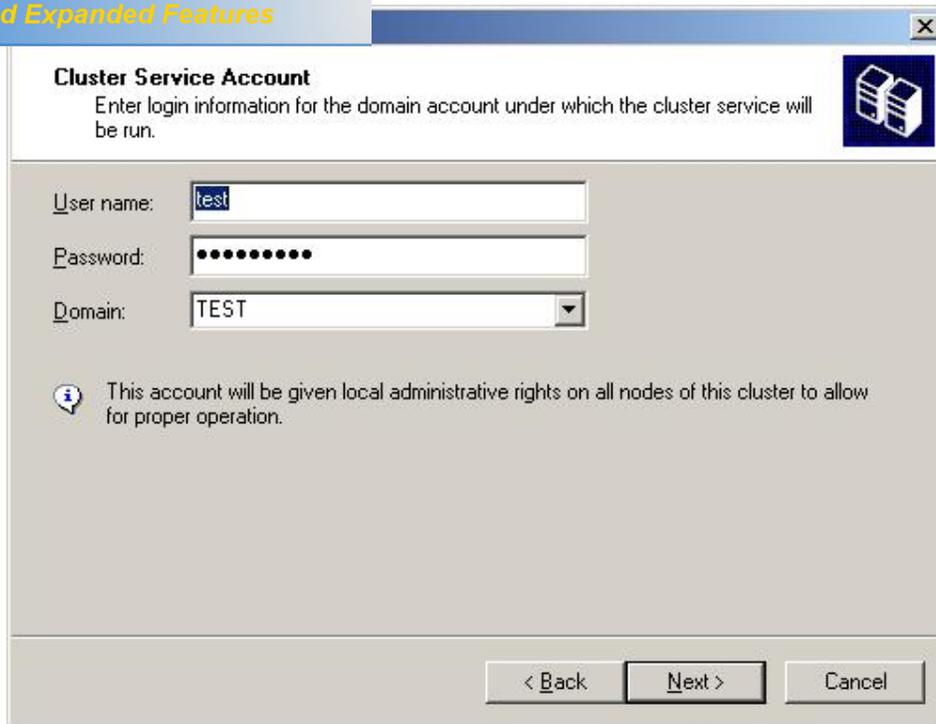


Enter a unique IP Address for the cluster and click Next;



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Enter the account credentials and click **Next**;



Cluster Service Account
Enter login information for the domain account under which the cluster service will be run.

User name:

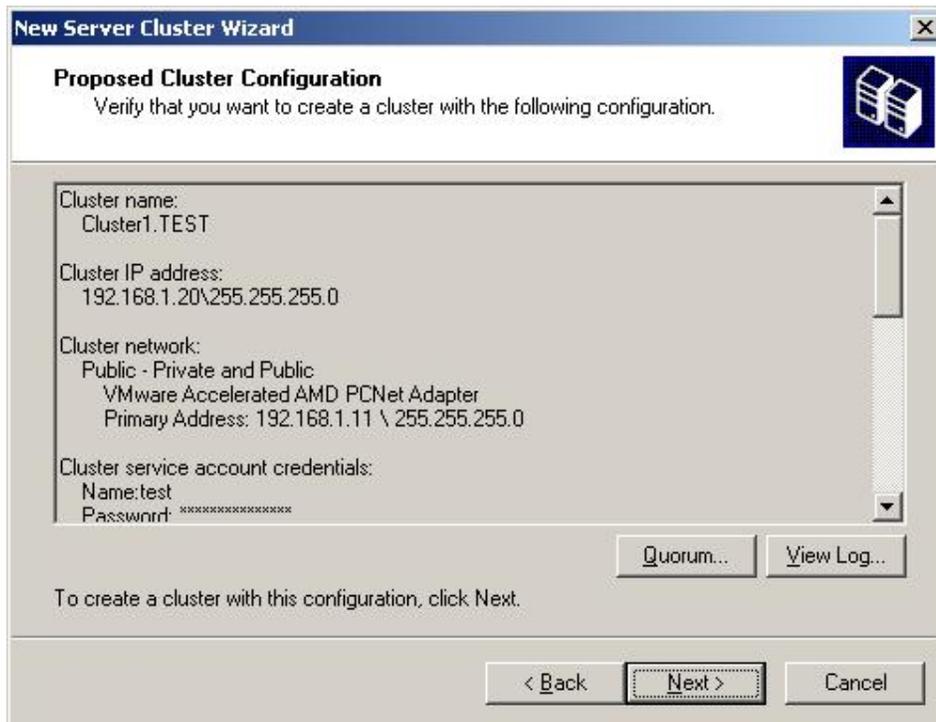
Password:

Domain:

 This account will be given local administrative rights on all nodes of this cluster to allow for proper operation.

< Back Next > Cancel

Review the proposed configuration and click **Next**;



New Server Cluster Wizard

Proposed Cluster Configuration
Verify that you want to create a cluster with the following configuration.

Cluster name:
Cluster1.TEST

Cluster IP address:
192.168.1.20\255.255.255.0

Cluster network:
Public - Private and Public
VMware Accelerated AMD PCNet Adapter
Primary Address: 192.168.1.11 \ 255.255.255.0

Cluster service account credentials:
Name: test
Password: *****

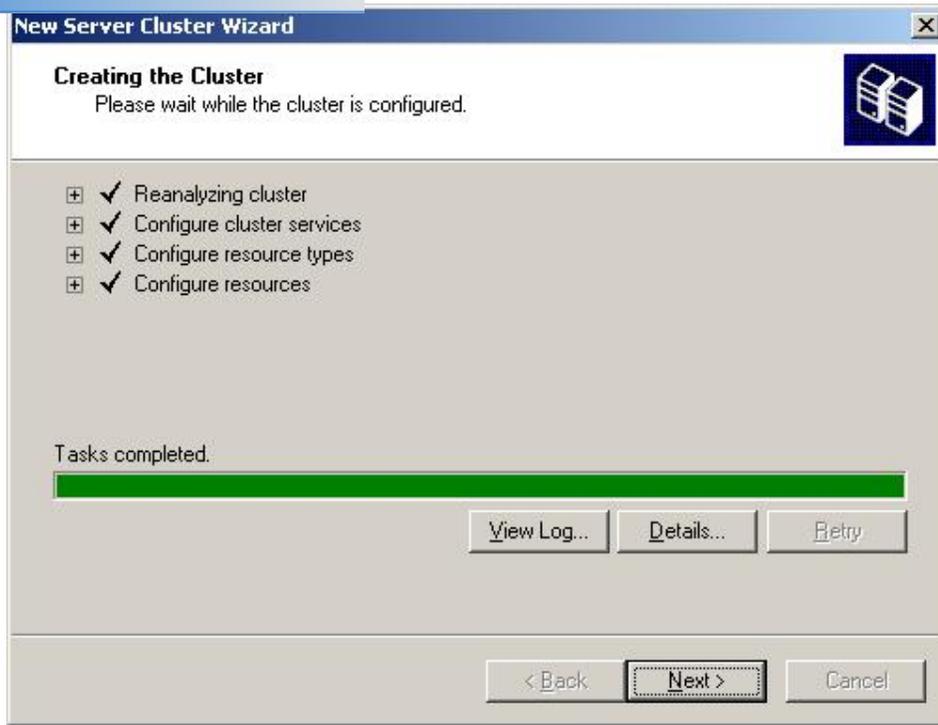
Quorum... View Log...

To create a cluster with this configuration, click Next.

< Back Next > Cancel

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configured review any errors or warnings and click %Next+

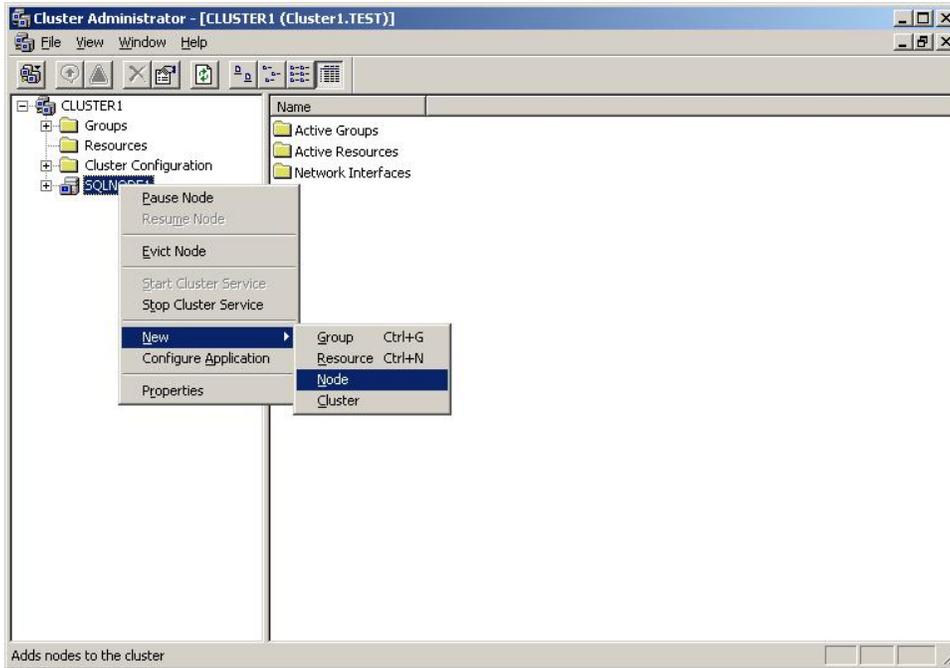


Finally click %Finish+to exit;

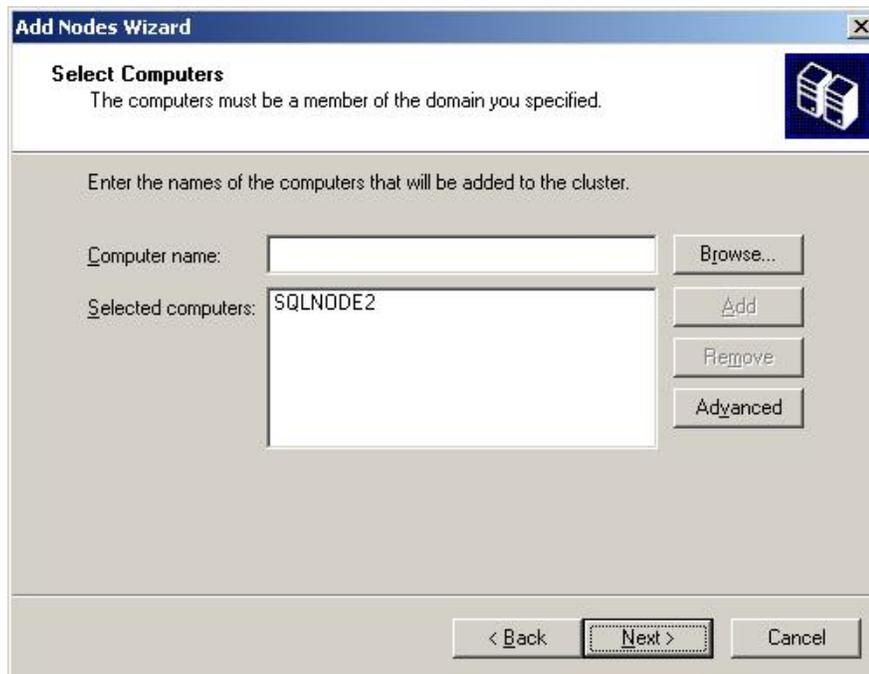


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active and managing the resources you may now boot the cluster administrator on SQLNode1, right click the node and the add node wizard will start.



Click **Next** through the welcome screen and you will be asked to provide the computer name of the node you wish to add. Browse for the computer name and select from the list returned. Click the **Add** button to confirm the node;

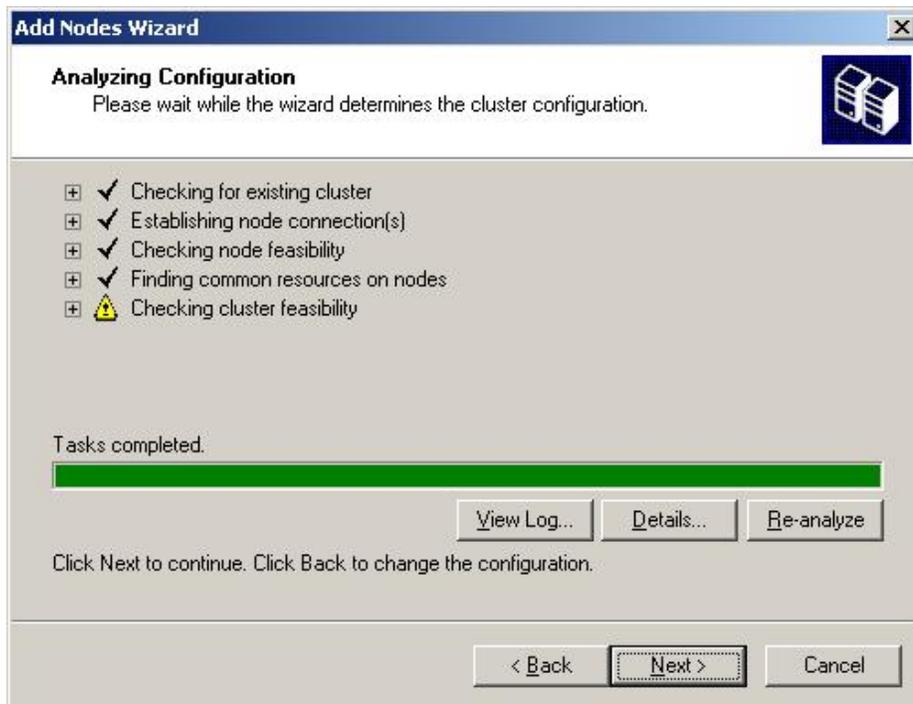


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minimal configuration by clicking the advanced button.

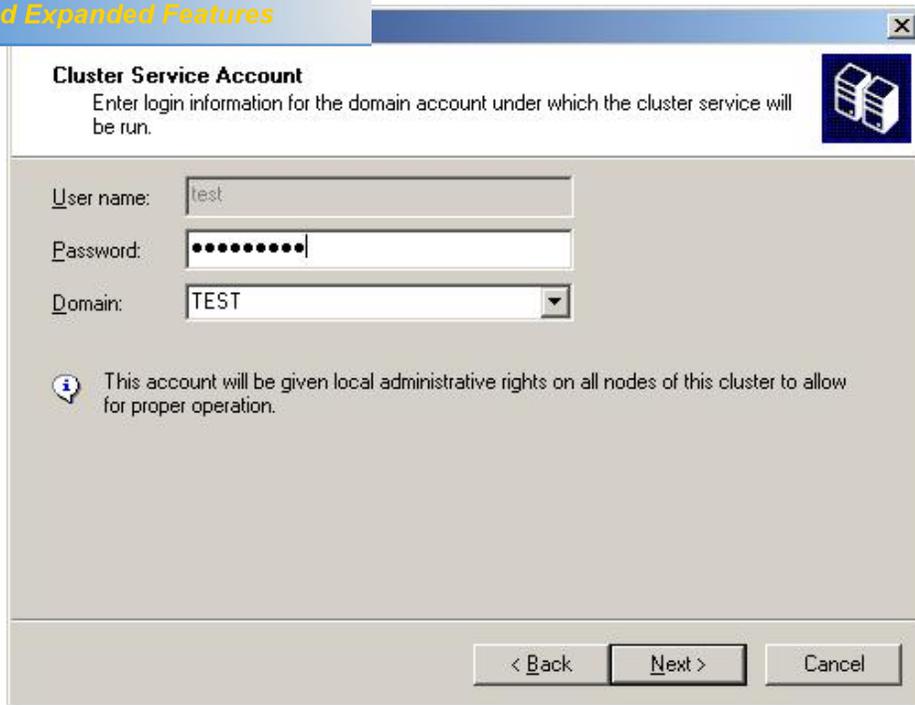


Cluster administrator analyses the configuration, review any errors or warnings.



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Account credentials



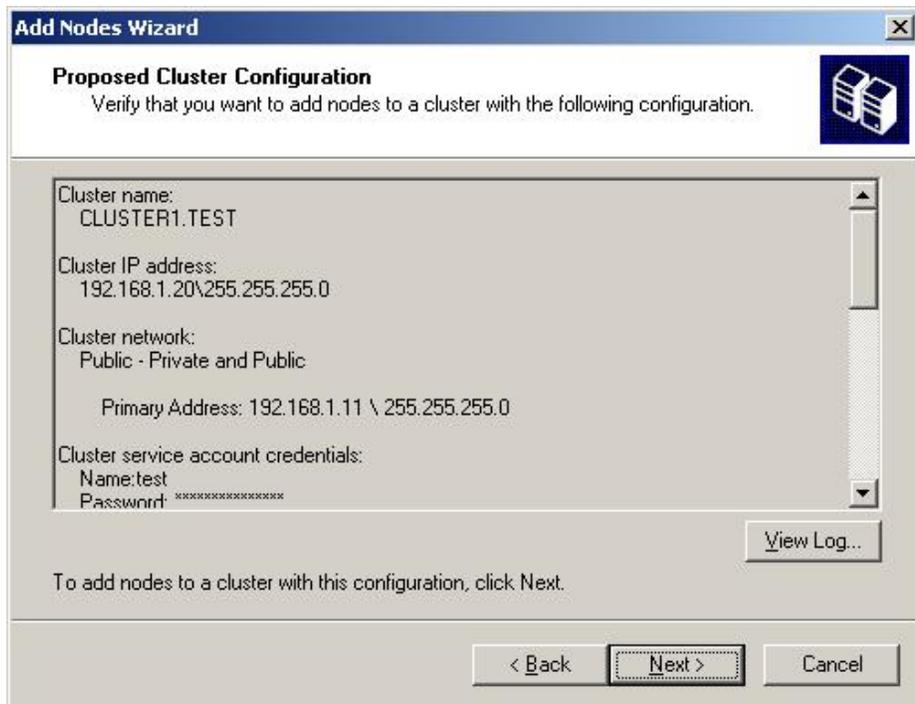
Cluster Service Account
Enter login information for the domain account under which the cluster service will be run.

User name: test
Password: ●●●●●●●●
Domain: TEST

i This account will be given local administrative rights on all nodes of this cluster to allow for proper operation.

< Back Next > Cancel

Review the proposed configuration and click **Next**.



Add Nodes Wizard

Proposed Cluster Configuration
Verify that you want to add nodes to a cluster with the following configuration.

Cluster name:
CLUSTER1.TEST

Cluster IP address:
192.168.1.20\255.255.255.0

Cluster network:
Public - Private and Public

Primary Address: 192.168.1.11 \ 255.255.255.0

Cluster service account credentials:
Name: test
Password: ●●●●●●●●

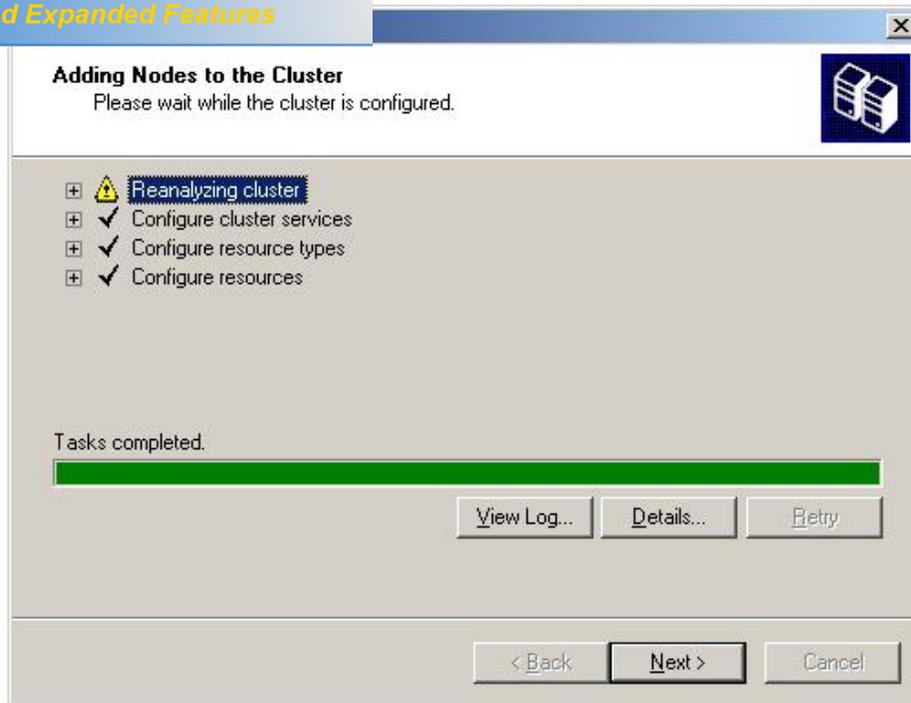
View Log...

To add nodes to a cluster with this configuration, click Next.

< Back Next > Cancel

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the cluster, again review any errors or warnings

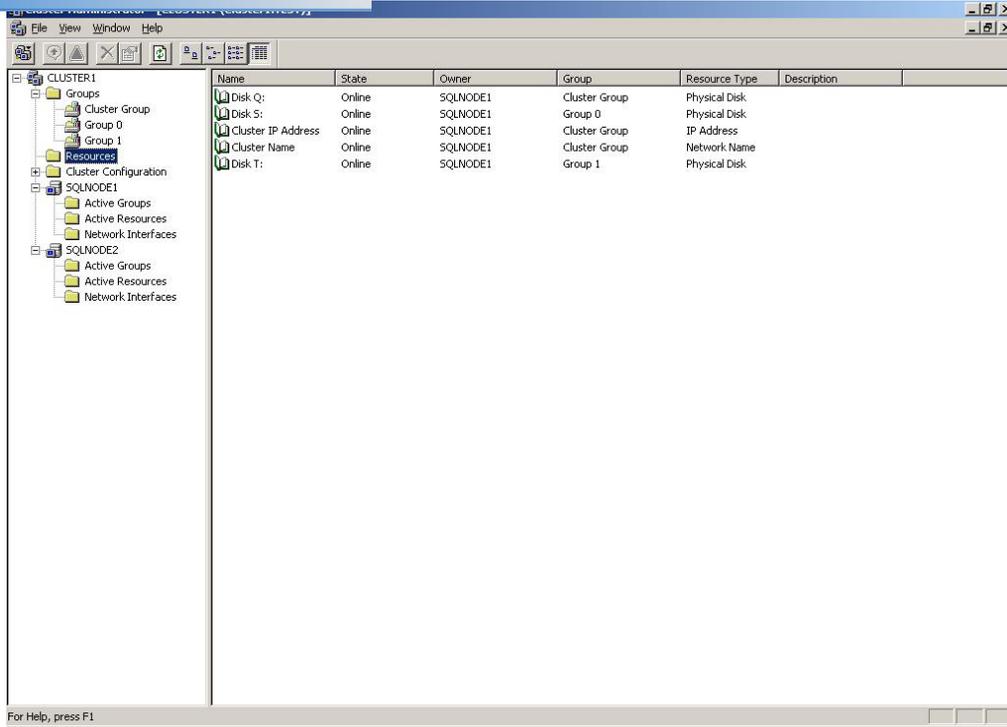


Finally click Finish when the wizard has completed;

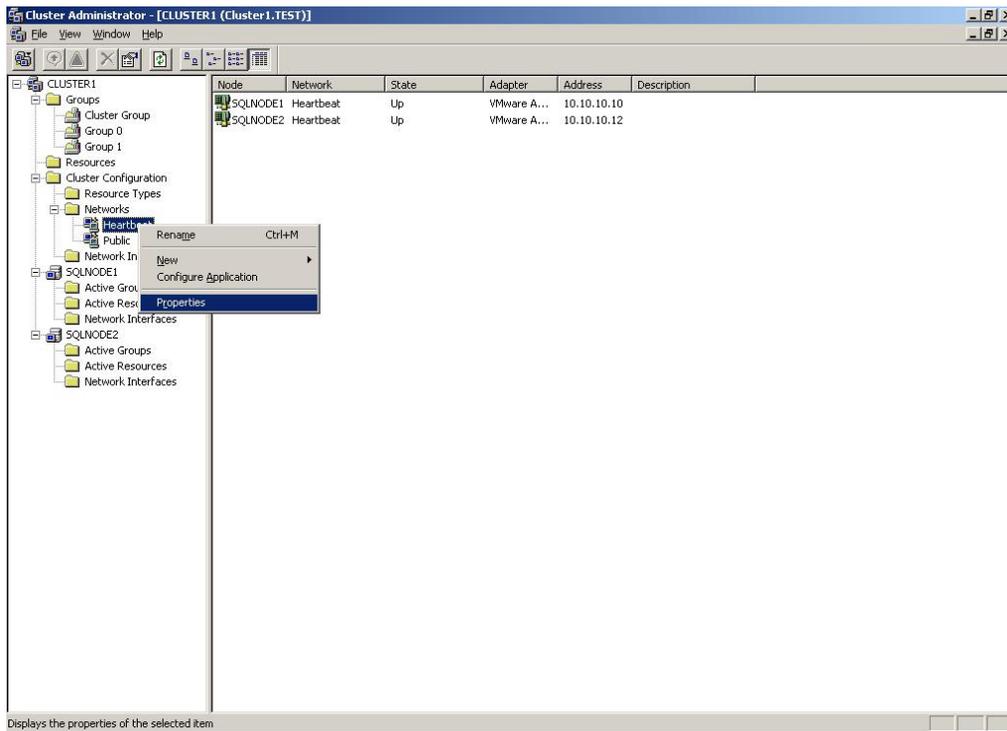


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Resources configured you should see the following in cluster resources owned by SQLNode1

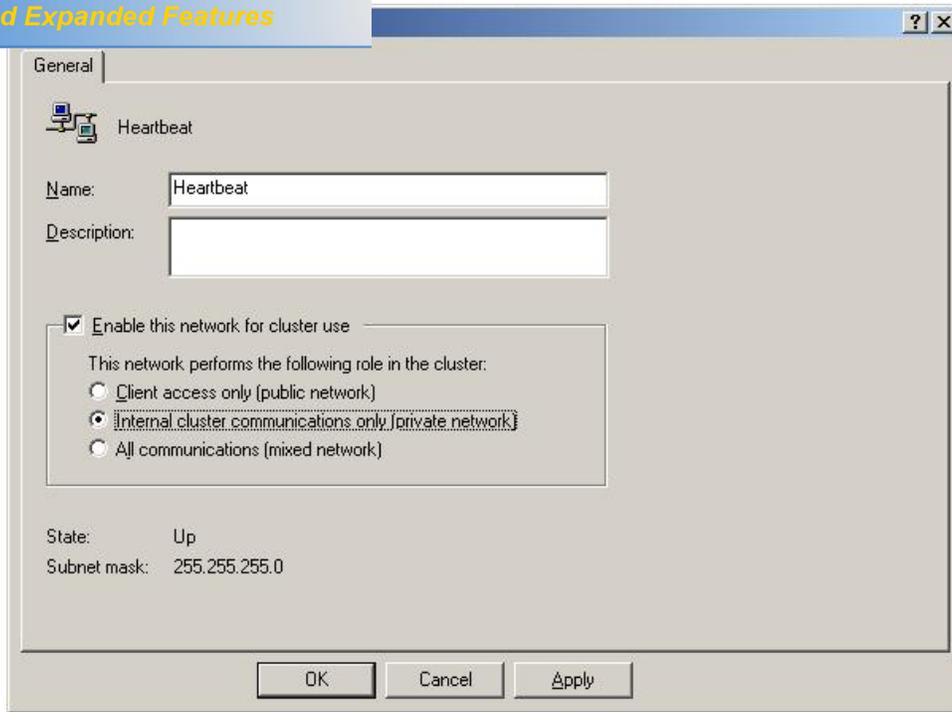


Open the networks information and set the properties for each item;

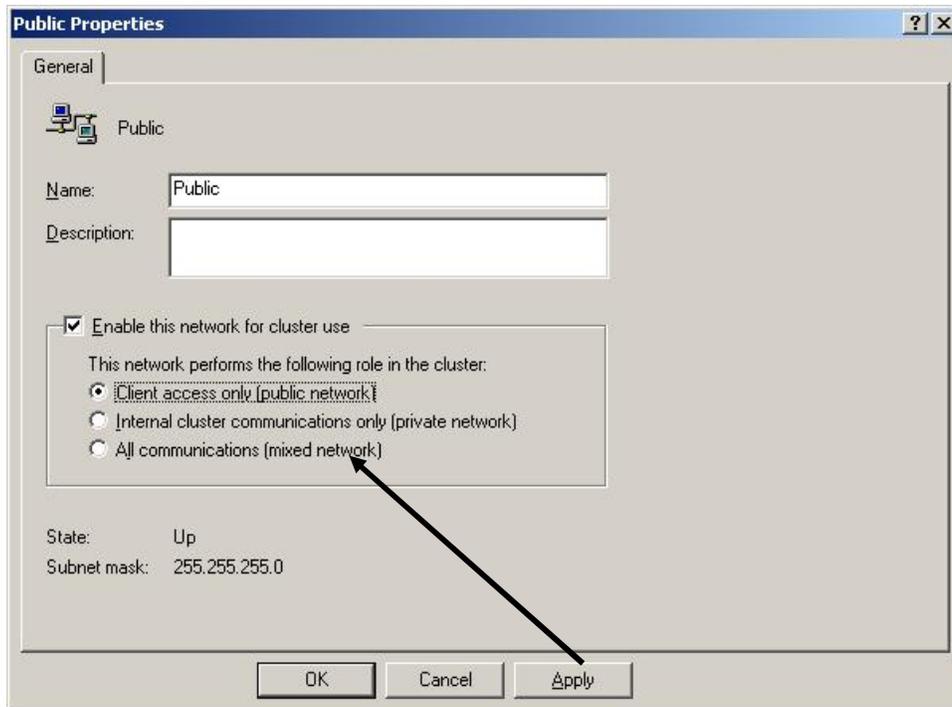


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nal access;

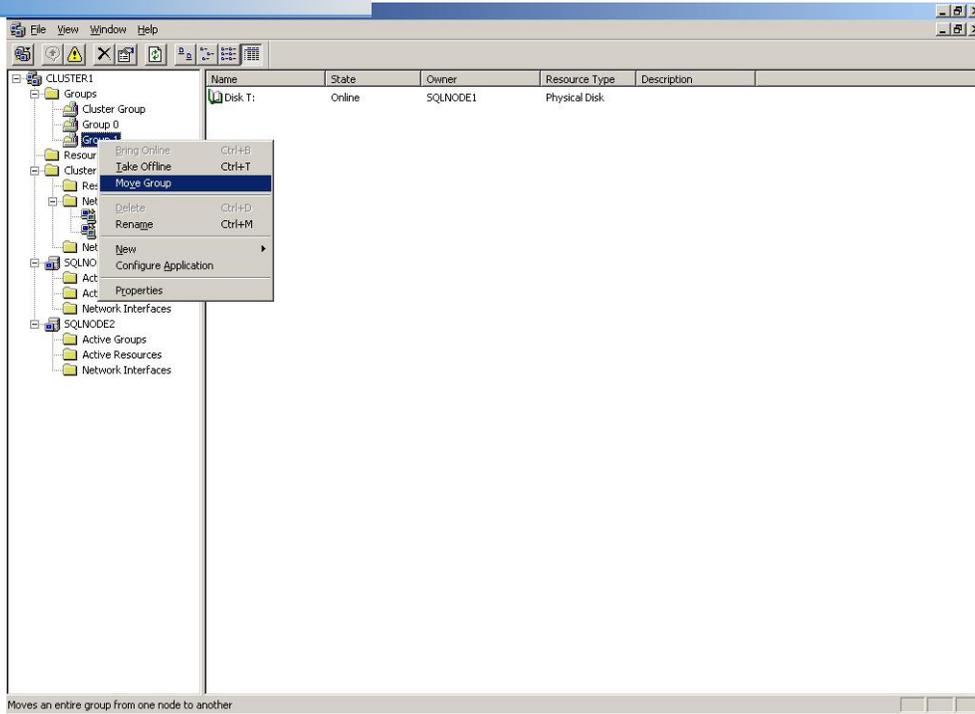


The Public should be set to Mixed Communication access;

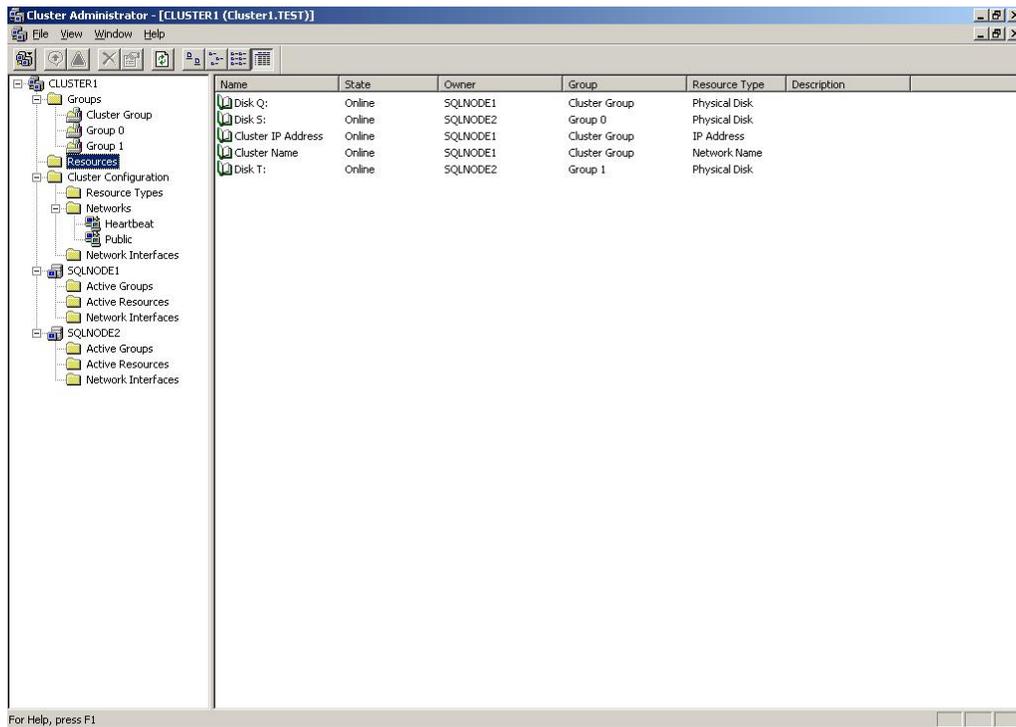


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by moving a cluster group from one node to another. Right group+. The resource will transfer to the partner node;



Groups 0 and 1 transferred to SQLNode2;



DISTRIBUTED TRANSACTION COORDINATOR

Next we need to create a cluster resource and group for the Distributed Transaction Coordinator service.

In Cluster Administrator right click **Groups** and select **New** > **Group**. Give the group a name and click **Next** then add available nodes and click **Finish**. Right click the newly created group and select **New** > **Resource**. Give the resource a name **INST1DTC IP** from **Resource Type** drop down list select **IP Address** and click **Next**. Select available nodes and click **Next**. Click **Next** through dependencies, enter an IP Address and mask for the public network (192.168.0.30 and 255.255.255.0) and click **Finish**.

Right click the group and select **New** > **Resource**. Give the resource a name **INST1DTC Name**. From the drop down list select **Network name** as the resource type and click **Next**. Select available nodes and click **Next**. Add IP Address resource as a dependency and click **Next**. Enter the unique network name and uncheck the **DNS registration must succeed** checkbox then click **Finish**.

If the DTC disk drive has already been discovered by Cluster Administrator you may skip this paragraph. Otherwise, right click the group and select **New** > **Resource**. Give the resource a name **DTC Data** and from the drop down list select **Physical Disk** as the resource type, then click **Next**. Select available nodes and click **Next**. Click **Next** through the dependencies. From the drop down list on the parameters dialog select the disk drive to use (P:) then click **Finish**.

Lastly create the DTC resource by right clicking the group and selecting **New** > **Resource**. Give the resource a name **INST1DTC SVC** and select **Distributed Transaction Coordinator** from the **Resource Type** drop down list, then click **Next**. Select available nodes and click **Next**. At the dependency dialog select the resources for Network Name and Physical Disk only (These resources must be online for the service to start) then click **Finish**. Now right click the group and bring it online.

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SERVER INSTANCE.

After the server is created and configured you may then proceed to install the SQL Server instance. This is done as follows, at the splash screen select to install the SQL Server components;

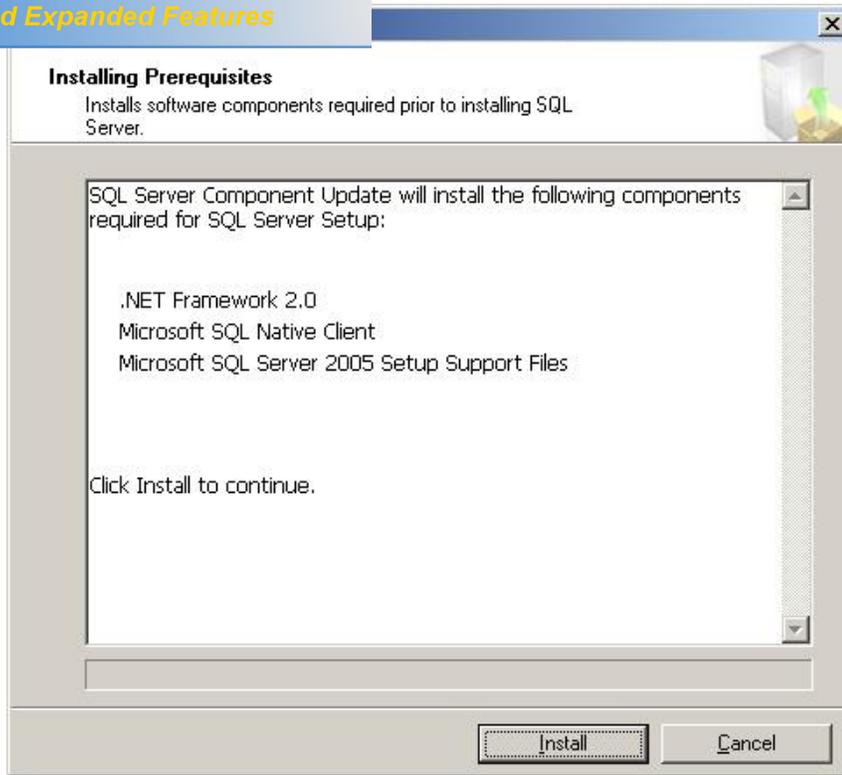


Accept the EULA and click **Next**;

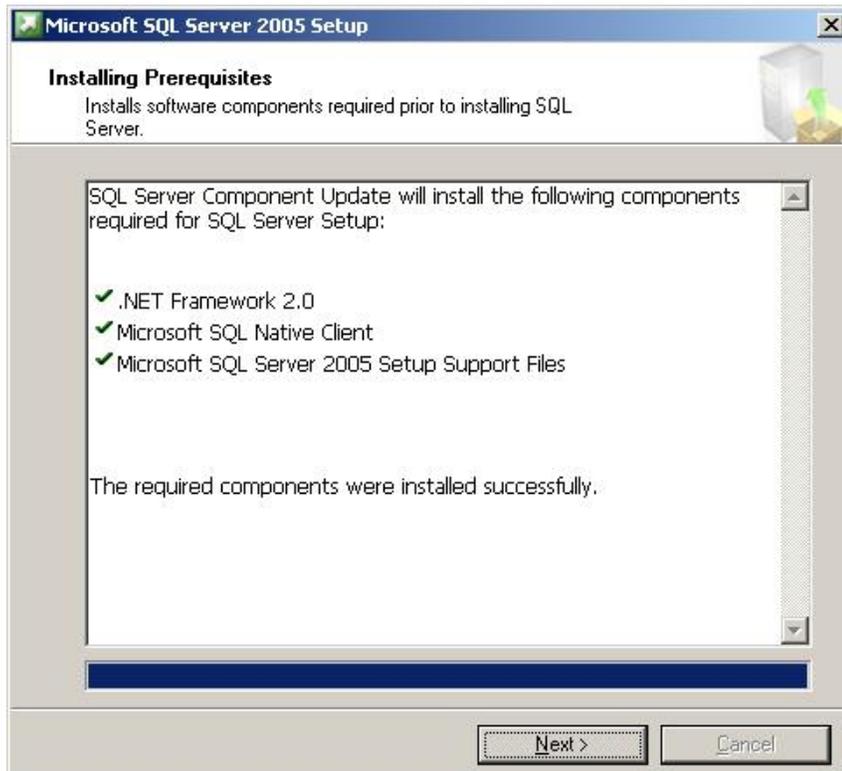


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server support files and .NET Framework



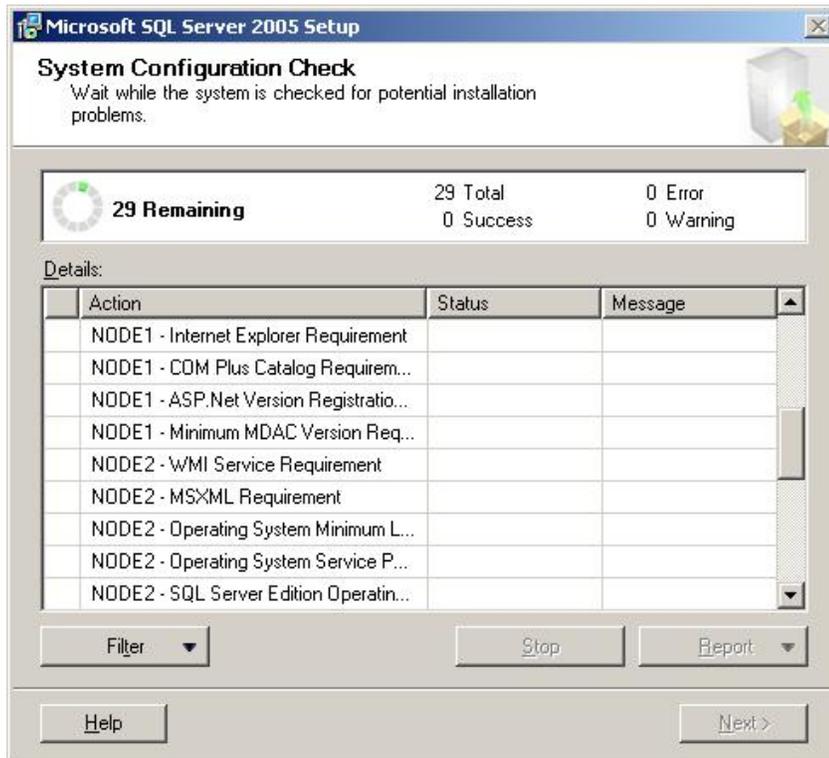
Click **Next >** to continue;



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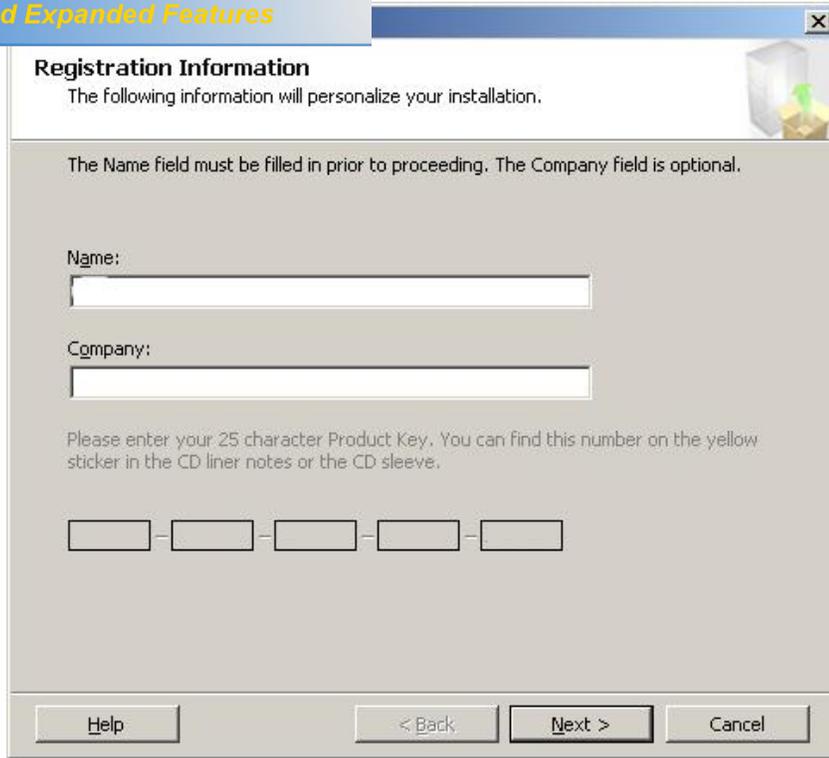


Click **Next >** to complete the System Configuration Check. Review any errors or warnings (IIS is only required for Reporting Services installations so ignore this)



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licence details (the product is pre-pidded)



Registration Information
The following information will personalize your installation.

The Name field must be filled in prior to proceeding. The Company field is optional.

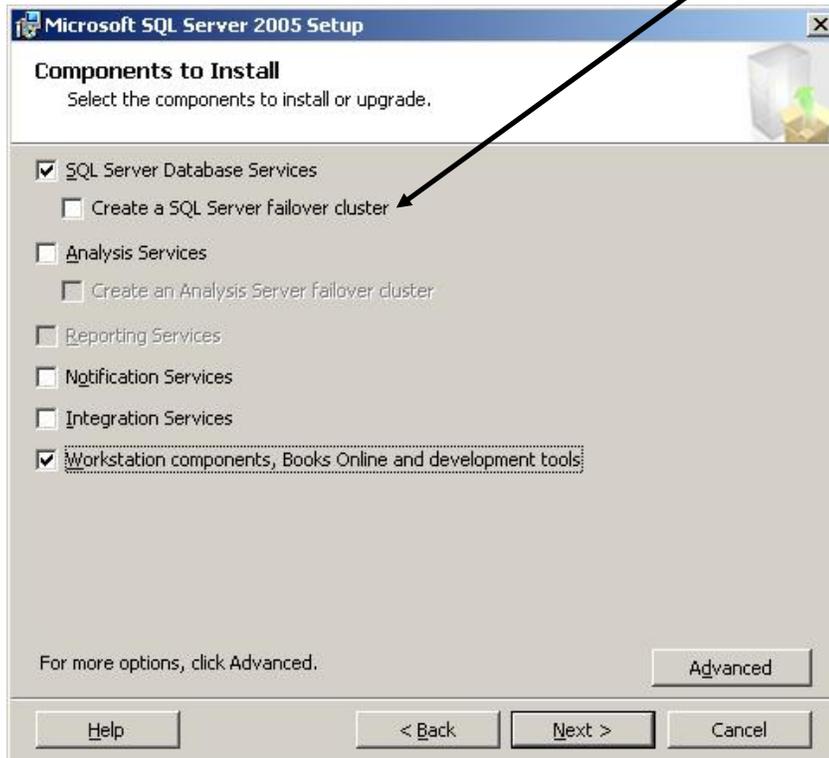
Name:

Company:

Please enter your 25 character Product Key. You can find this number on the yellow sticker in the CD liner notes or the CD sleeve.

- - - -

Select the options to install, note the option for a fail over cluster (select this now). Click **Next** to proceed



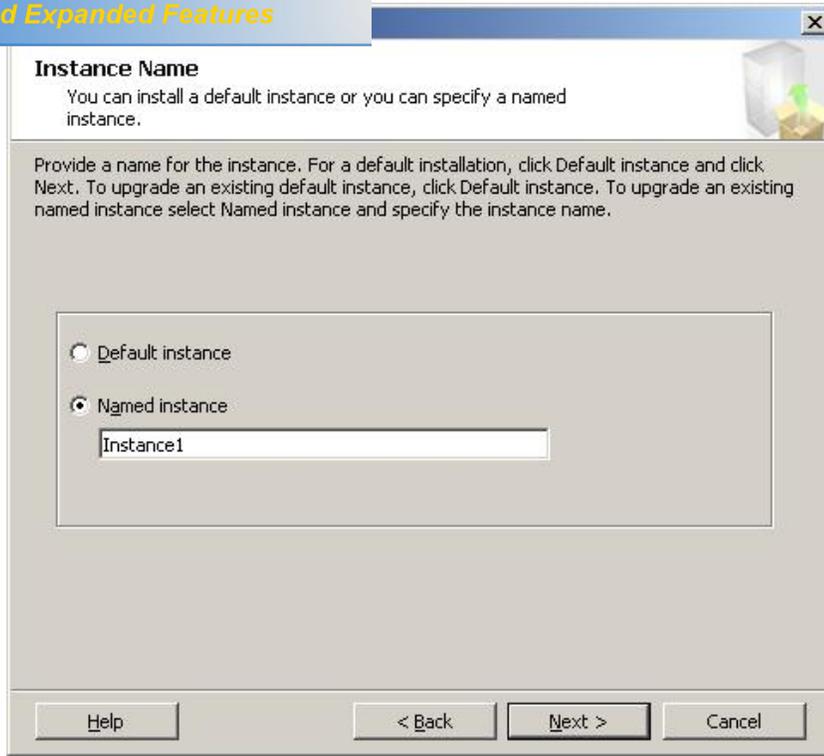
Microsoft SQL Server 2005 Setup
Components to Install
Select the components to install or upgrade.

- SQL Server Database Services
 - Create a SQL Server failover cluster
- Analysis Services
 - Create an Analysis Server failover cluster
- Reporting Services
- Notification Services
- Integration Services
- Workstation components, Books Online and development tools

For more options, click Advanced.

click %Next+

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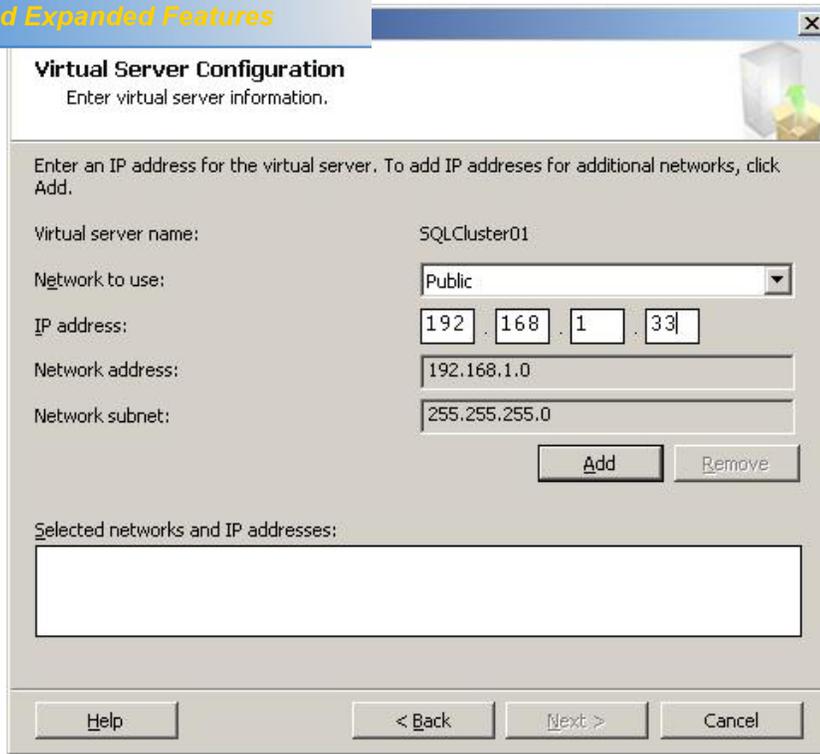


Supply a unique Virtual network name. For more info on network names and named instances see Appendix B.



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virtual network name and click %Add+



Virtual Server Configuration
Enter virtual server information.

Enter an IP address for the virtual server. To add IP addresses for additional networks, click Add.

Virtual server name: SQLCluster01

Network to use: Public

IP address: 192 . 168 . 1 . 33

Network address: 192.168.1.0

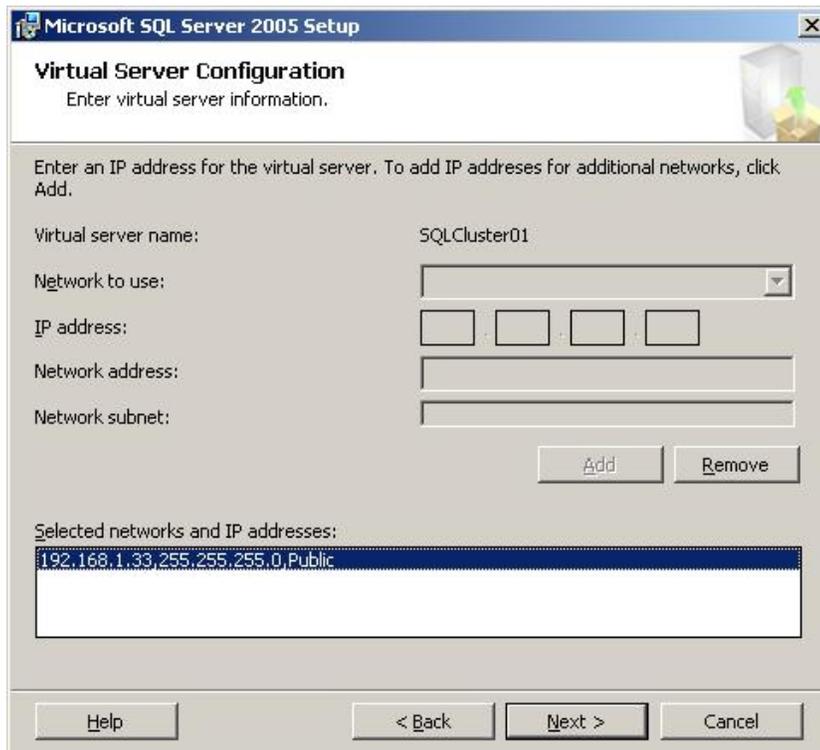
Network subnet: 255.255.255.0

Add Remove

Selected networks and IP addresses:

Help < Back Next > Cancel

Then click %Next+to proceed



Microsoft SQL Server 2005 Setup

Virtual Server Configuration
Enter virtual server information.

Enter an IP address for the virtual server. To add IP addresses for additional networks, click Add.

Virtual server name: SQLCluster01

Network to use:

IP address:

Network address:

Network subnet:

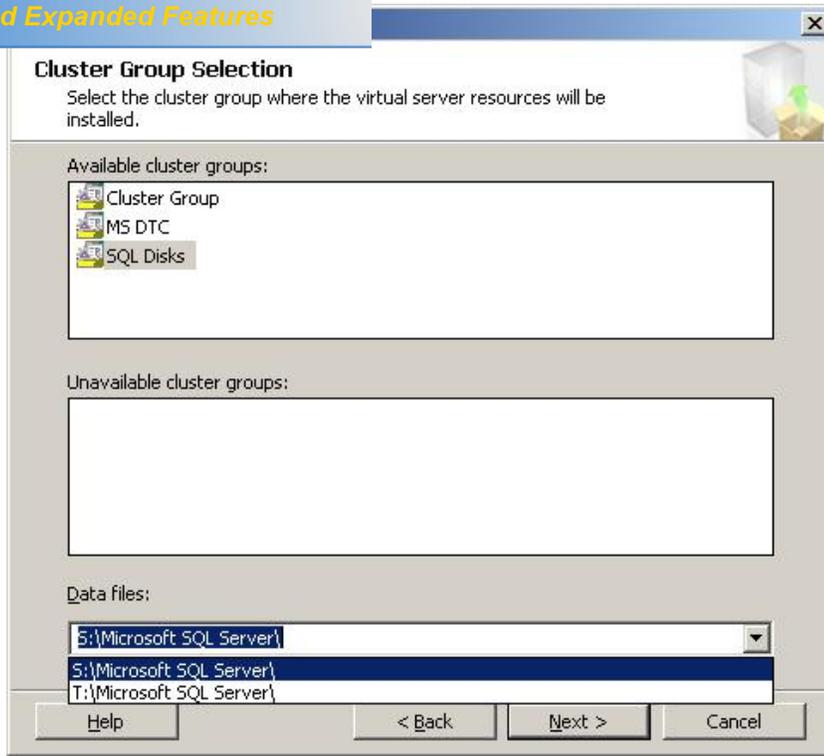
Add Remove

Selected networks and IP addresses:
192.168.1.33, 255.255.255.0, Public

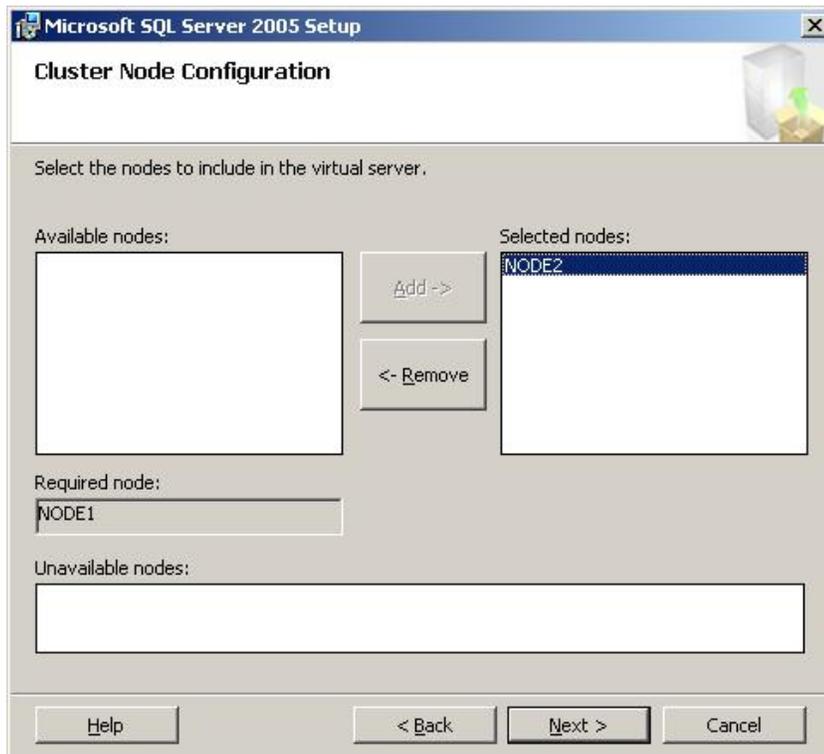
Help < Back Next > Cancel

contains the resources you wish to use;

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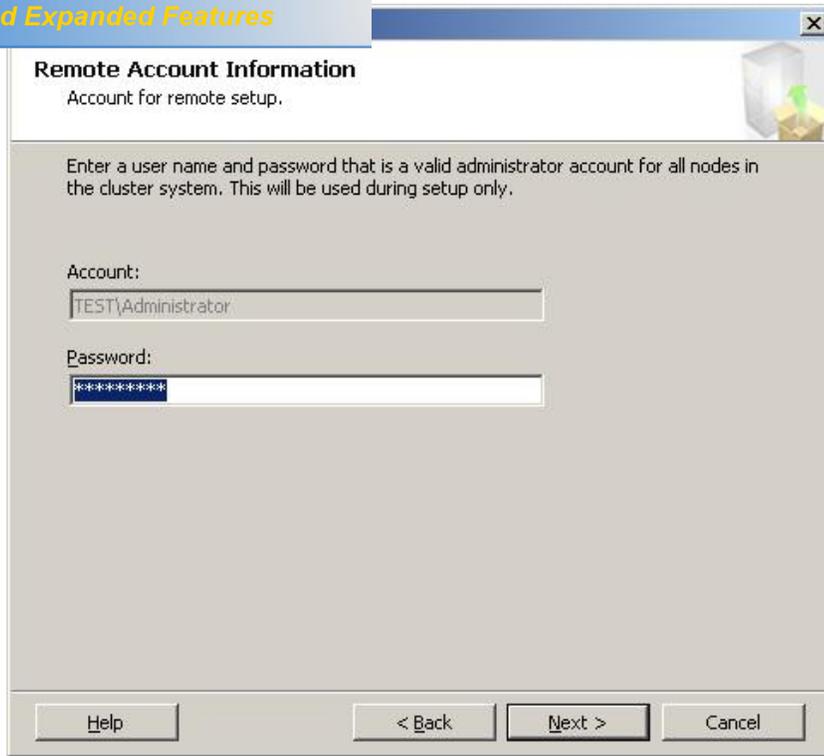


Select the required nodes to participate in the SQL Server cluster and click **Next+**



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Account for the remote setup;



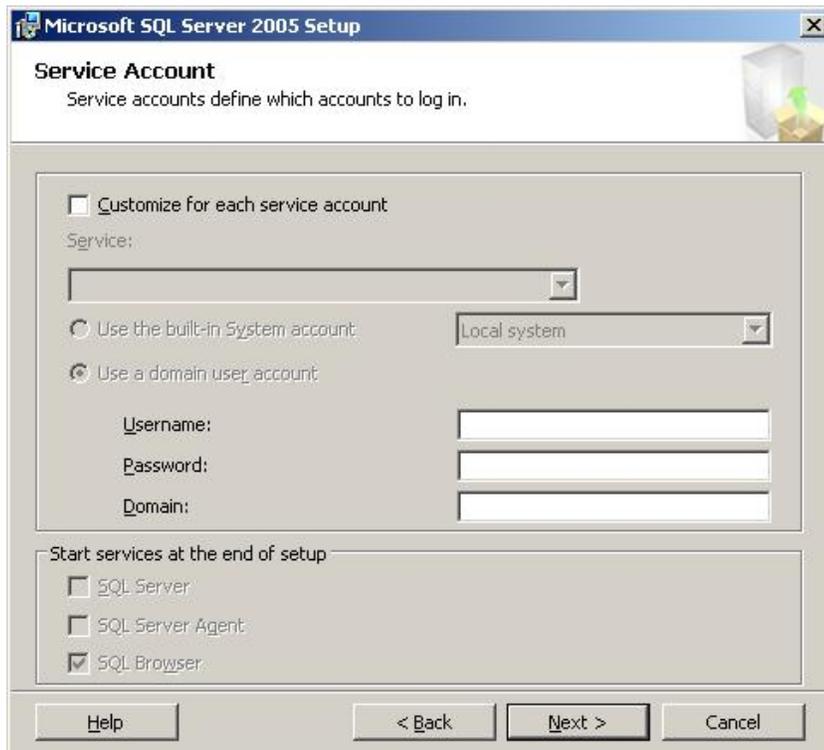
Remote Account Information
Account for remote setup.

Enter a user name and password that is a valid administrator account for all nodes in the cluster system. This will be used during setup only.

Account:

Password:

Switch to the domain controller and create a user account for the SQL Server service. Supply the service account information and click **Next**;



Microsoft SQL Server 2005 Setup

Service Account
Service accounts define which accounts to log in.

Customize for each service account

Service:

Use the built-in System account:

Use a domain user account:

Username:

Password:

Domain:

Start services at the end of setup

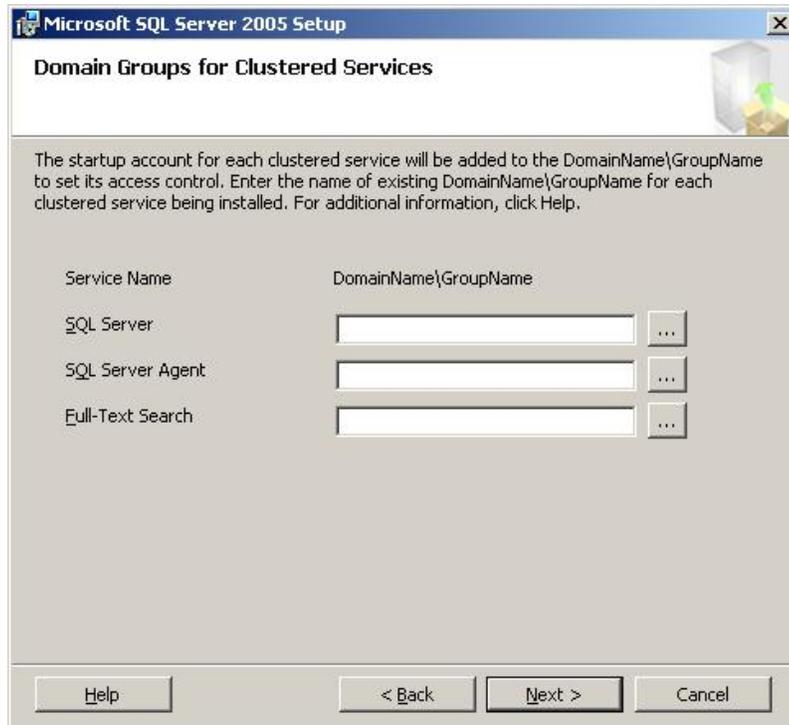
SQL Server

SQL Server Agent

SQL Browser

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and create a set of Global security groups for the SQL Server. Create a group for each resource indicated below, or create a single group if the server service domain user account must be a member of the group(s). Supply the group name(s) and click **Next**;

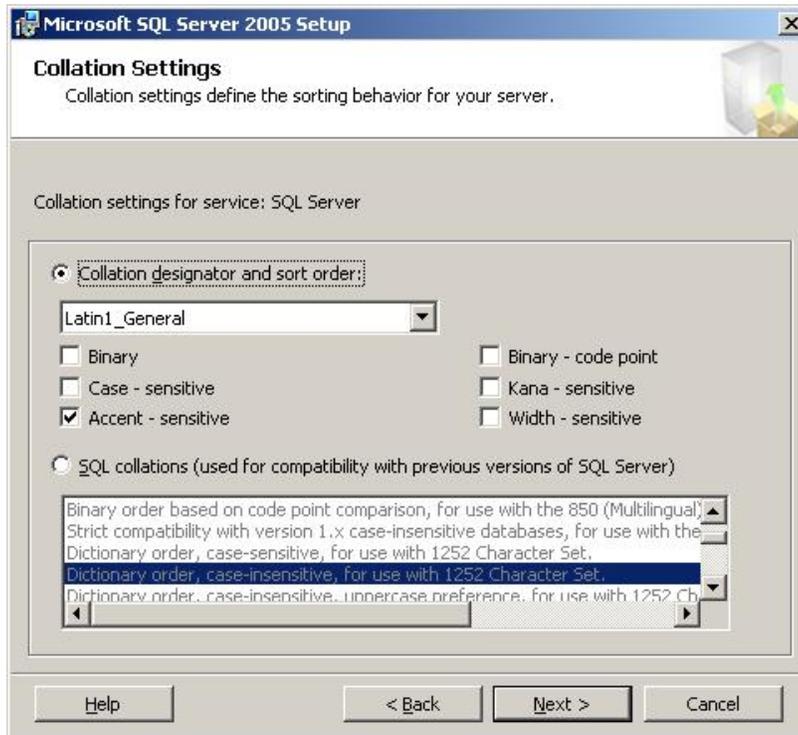


Select the SQL Server authentication method and click **Next**;

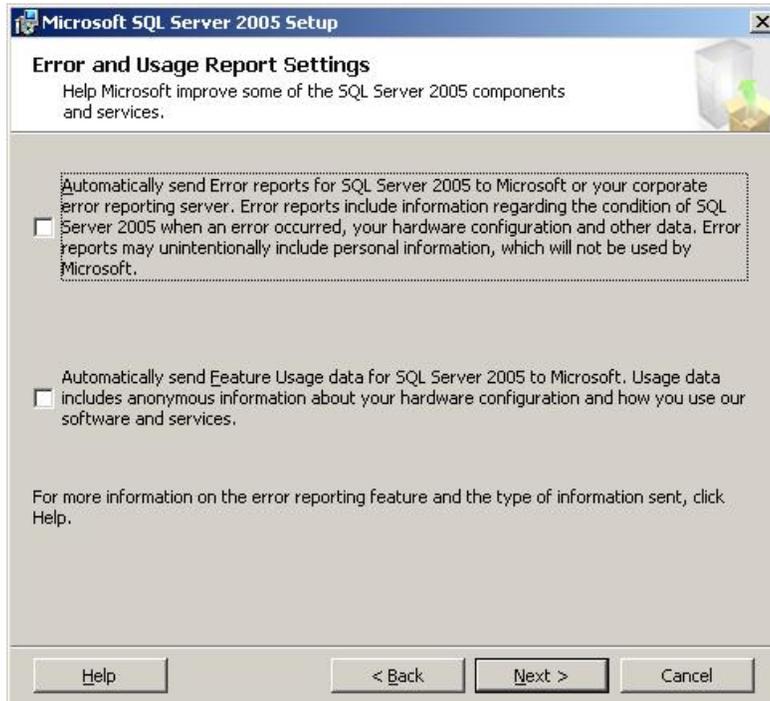


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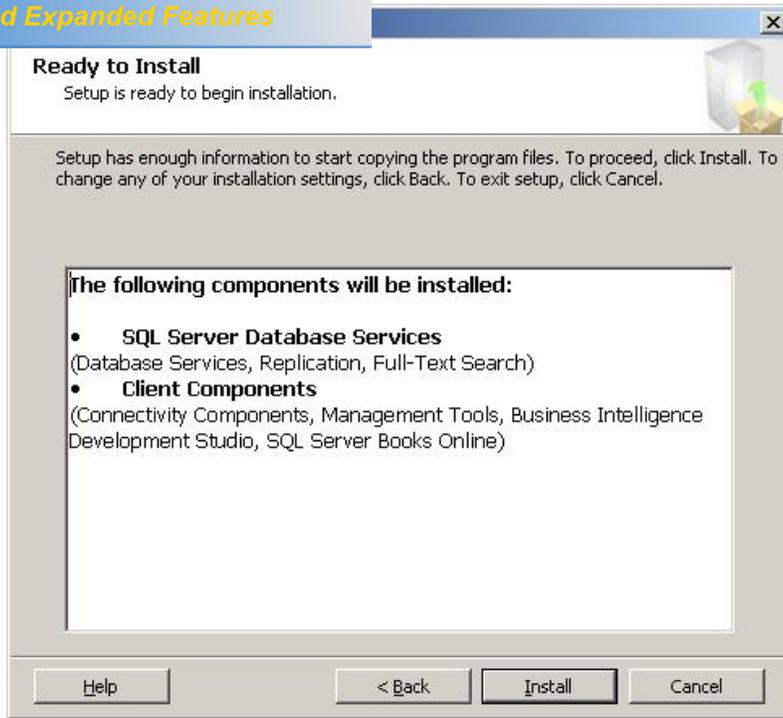
...n (if you set your Windows regional settings correctly
Click **N**ext;
...ed, the Regional Settings on the server are incorrect, stop the
installation and check and correct the regional settings.



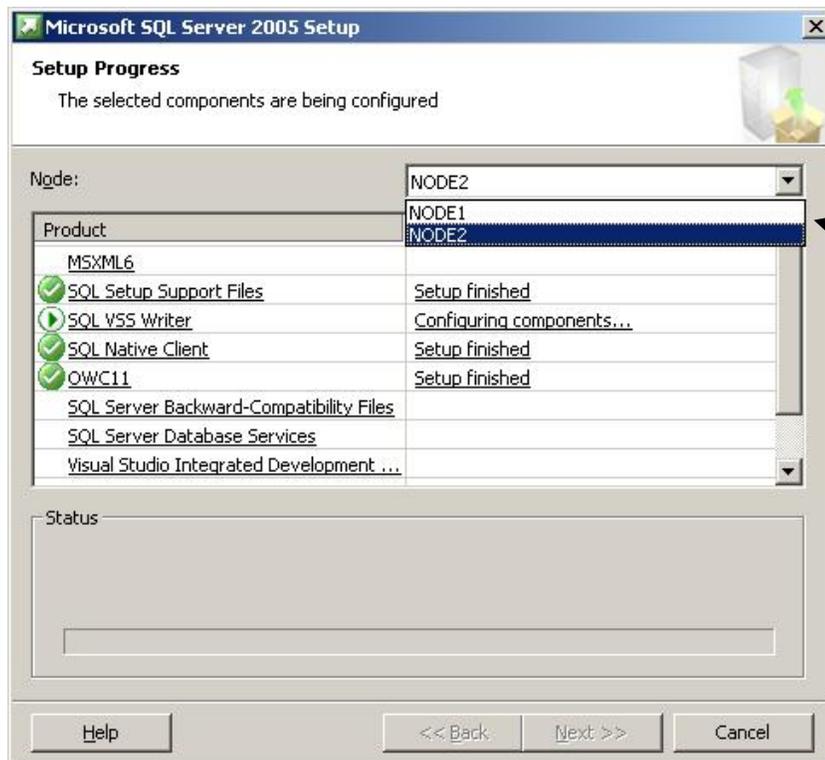
Click **N**ext;



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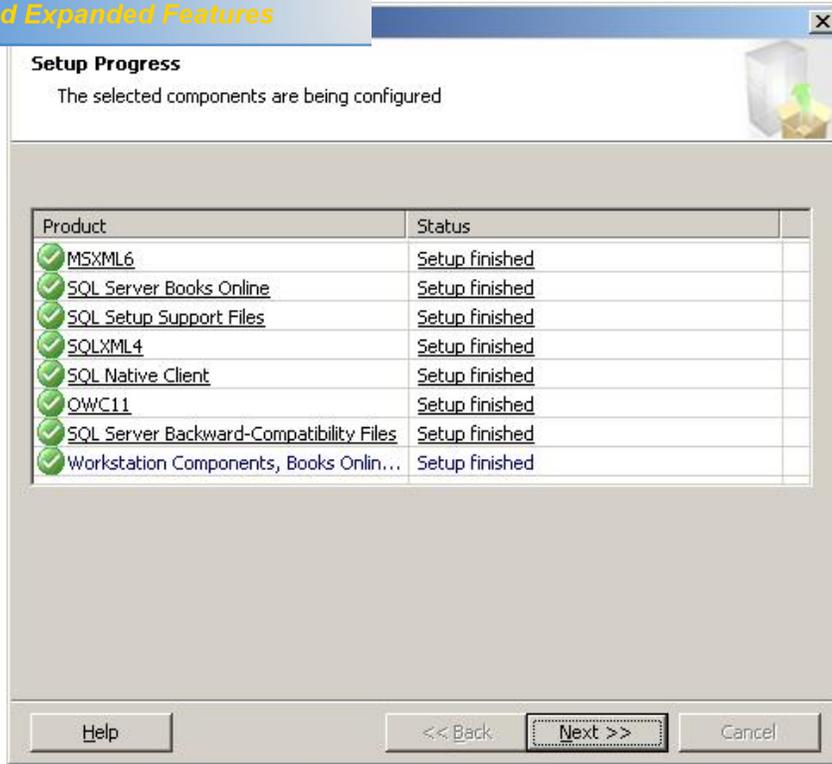


Setup displays the progress on each node via the drop down list indicated;

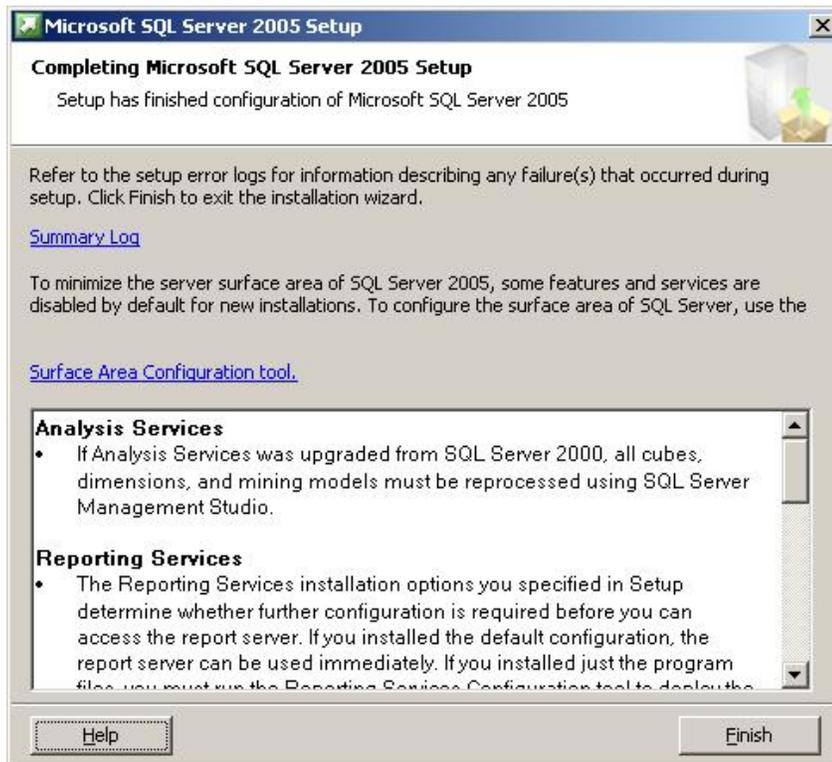


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Completed click %Next+;



Click %Finish+;



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INSTANCES & NETWORK NAMES

SQL Server setup requires you to supply an instance name for the SQL Server instance you are installing. On a non clustered system, the machine name is the instance name prefix. A virtual network name is essentially the same as a machine name in that it must be unique on the network.

Installations of SQL Server allow only one default instance, after that the rest must be named.

Take the following scenarios

5.1 NON CLUSTERED

A non clustered server named \\MYSERVER has 2 SQL Server instances installed to it. When the administrator installed SQL server they created a named instance using the name %Instance1+and a default instance.

To log on to each instance you would use,

Default

MYSERVER

Named

MYSERVER\Instance1

5.2 CLUSTERED

A 2 node clustered system exists using the following details,

Node1

Node 2

Name = SQLCLNODE01
IP = 10.10.10.17

Name = SQLCLNODE02
IP = 10.10.10.18

Windows Cluster

Name = WINCL01
IP = 10.10.10.12

Default SQL Instance

Named SQL Instance

Network Name = SQLCL01
Instance Name =

Network Name = SQLCL02
Instance Name = INST01

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added to the system as there are now more names and
the computers. In the clustered environment it is
regard the node names and IP addresses when
connecting to SQL Server. Everything is referenced by the Network name. In the
clustered environment the Network Name and not the machine name forms the
instances prefix.

To logon to the default instance you use

SQLCL01

To logon to the named instance you use

SQLCL01\INST01

Practice these by using names of your own to substitute the items above and ensure
you understand default and named instances in both clustered and non clustered
environments.