Create a 2 node virtual SQL Server 2005 Cluster Configuration

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UMENT

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

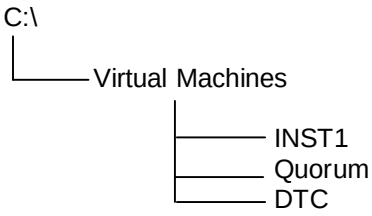
The document is intended for administrators wishing to simulate a SQL Server cluster environment for testing or as a tool when expressing a wish to learn more about Windows\SQL Server clustering. It is not expected that the reader is familiar with the Windows operating system and MSCS.

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.

WS CLUSTER

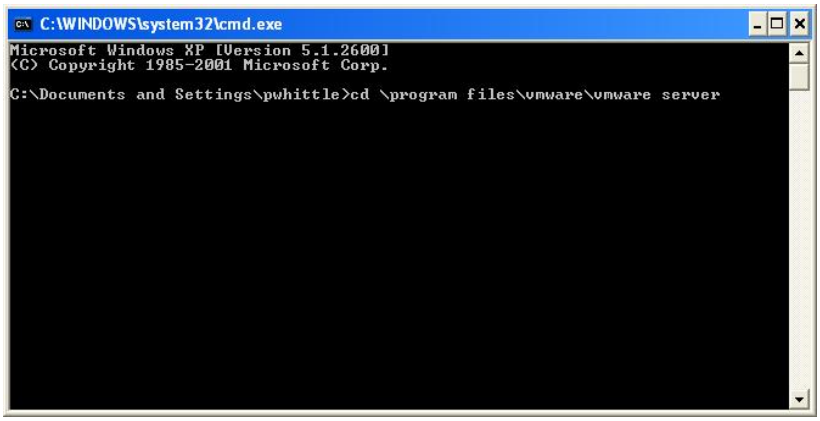
Install VMware Server 2.0.1 and then create the following folder structure locally



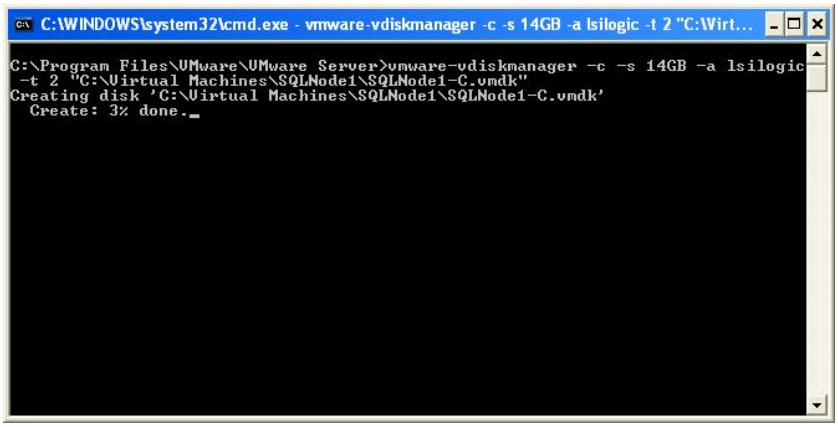
Use the commands listed below to create the virtual disks required. The **vmware-vdiskmanager.exe** resides in the following folder if a default installation of VMware Server was used;

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).



Create the drives as shown below



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"

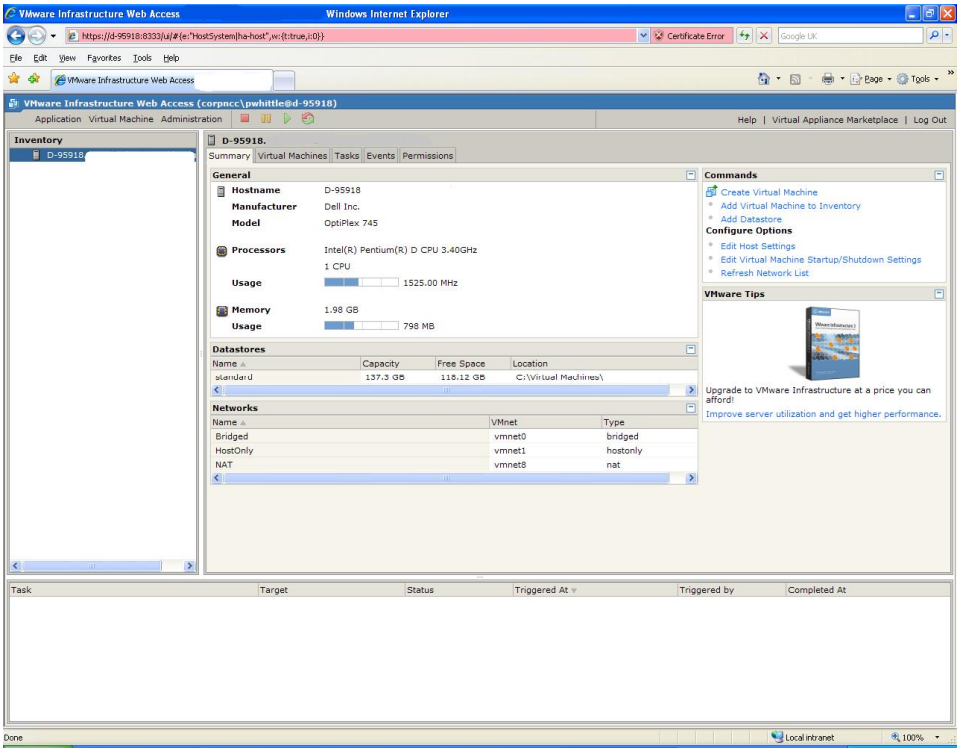
vmware-vdiskmanager -c -s 5GB -a lsilogic -t 2 "C:\Virtual Machines\INST1\INST1_Logs.vmdk"

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

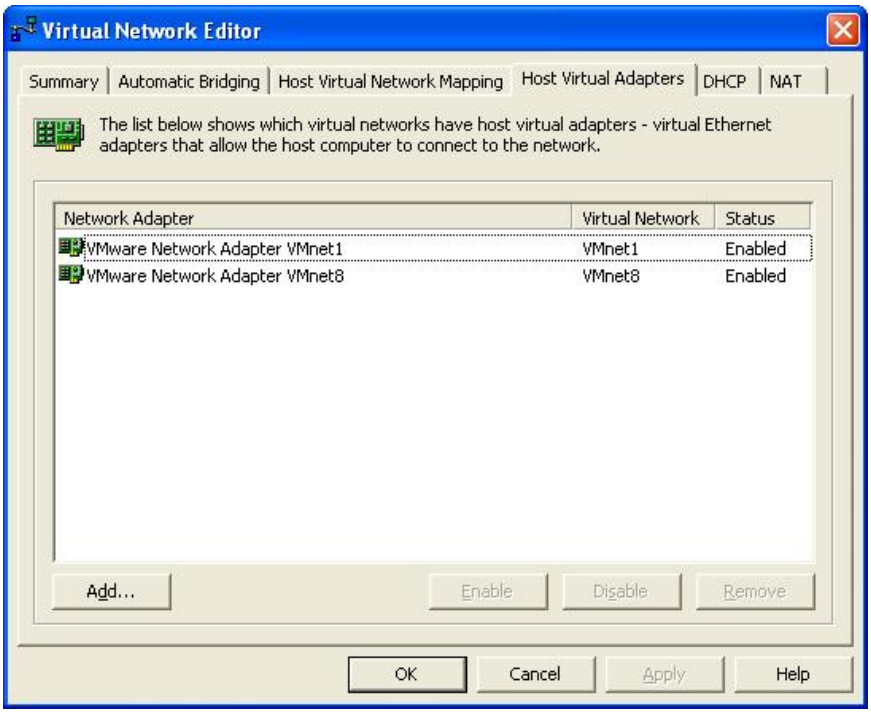
Ensure you add your Windows domain\local account to the following local group on your pc

__vmware__

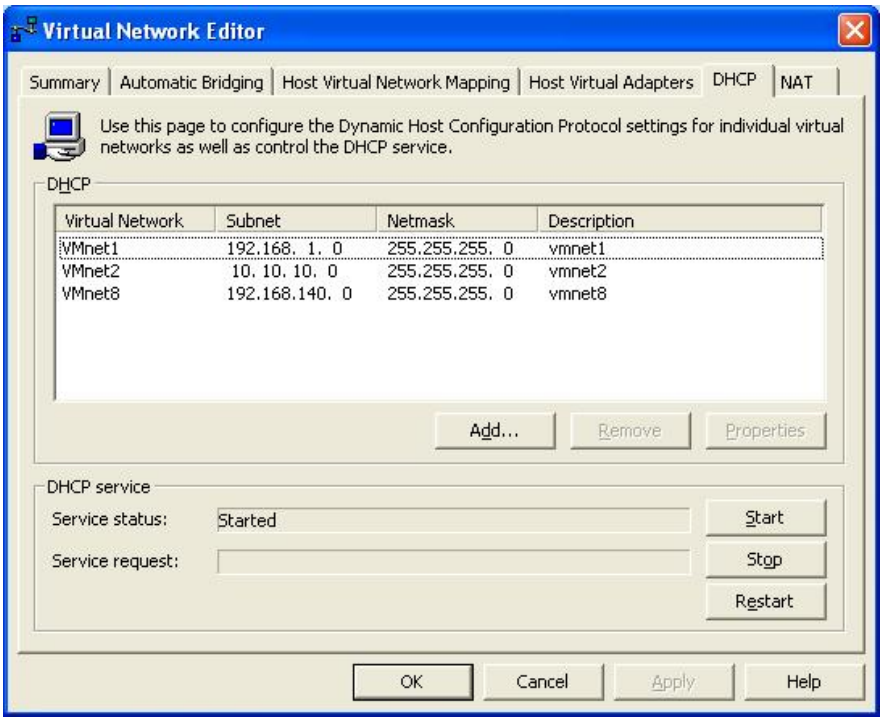
Log into the Vmware Server console supplying your Windows account and password and you will see the following;



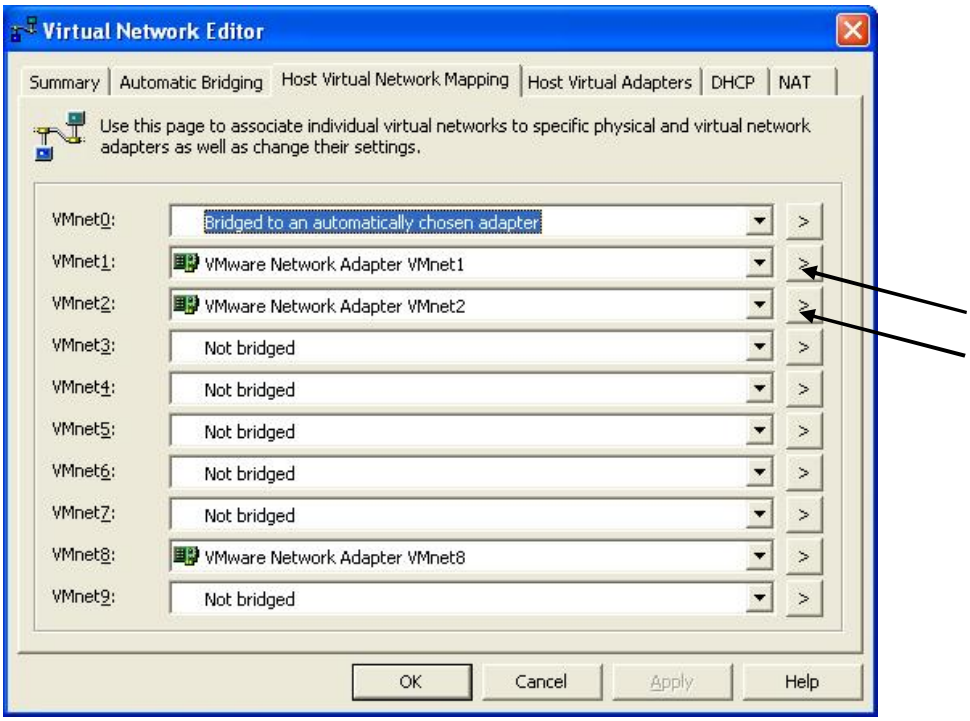
irtual networksòoption from the Start menu. Go straight
ab and add a new virtual adapter for VMnet2 and click



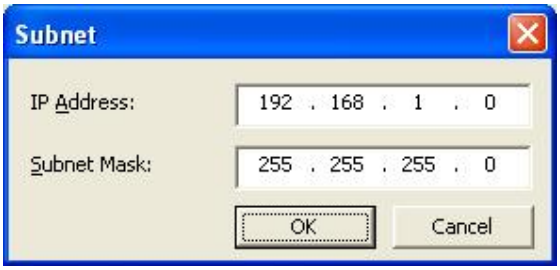
Now go to the DHCP tab and remove any DHCP assignments (click each item and remove) the click ñApplyò



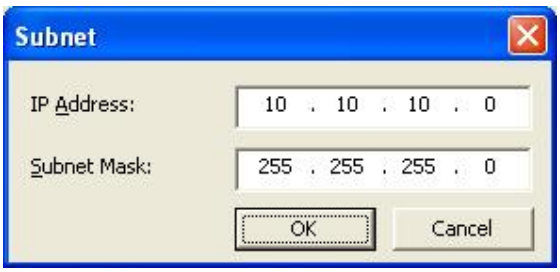
k mappingòoption and change the subnets to be used cking the arrow (indicated) and selecting ñSubnetòfrom



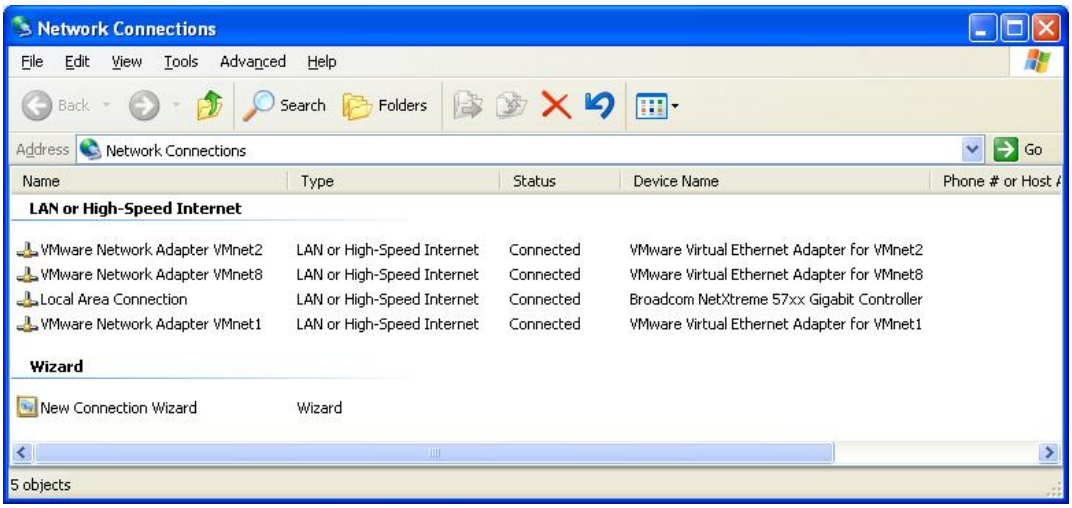
For VMnet1 set the IP address to 192.168.1.0



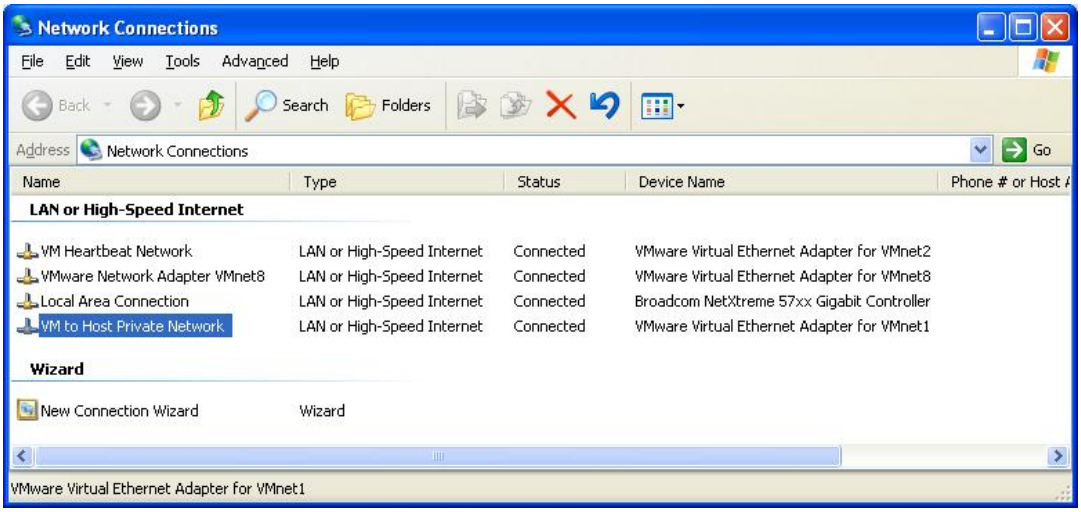
For VMnet2 set the IP address to 10.10.10.0



etwork editor. It is a good idea to open your host machine me the virtual LAN adapters to something a little more



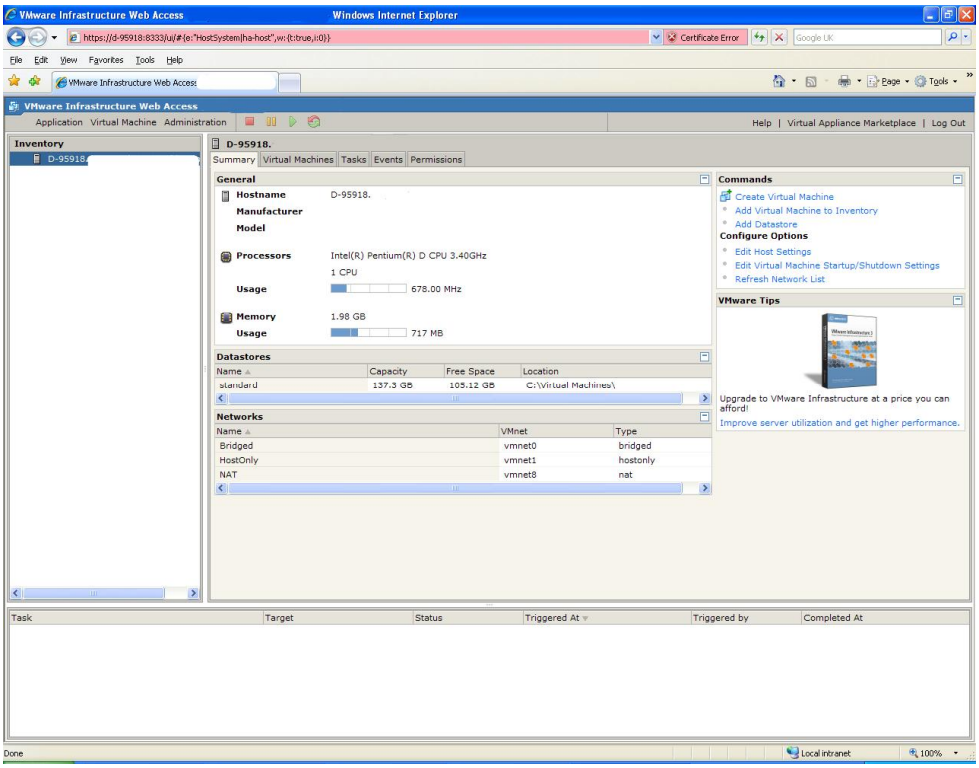
Renamed to



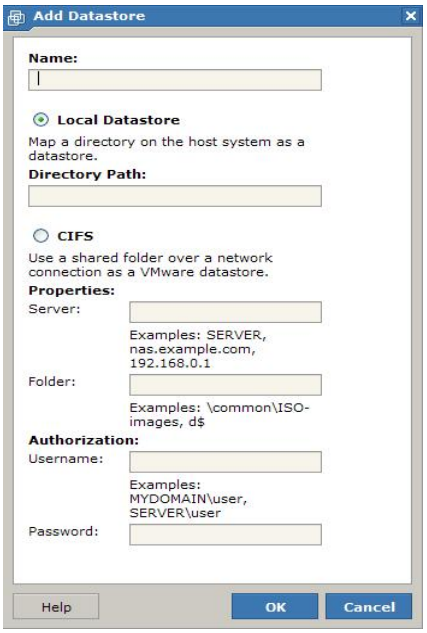
Click the ñrefresh networks list optionòwithin the VMWare Server console to refresh the virtual networks.

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

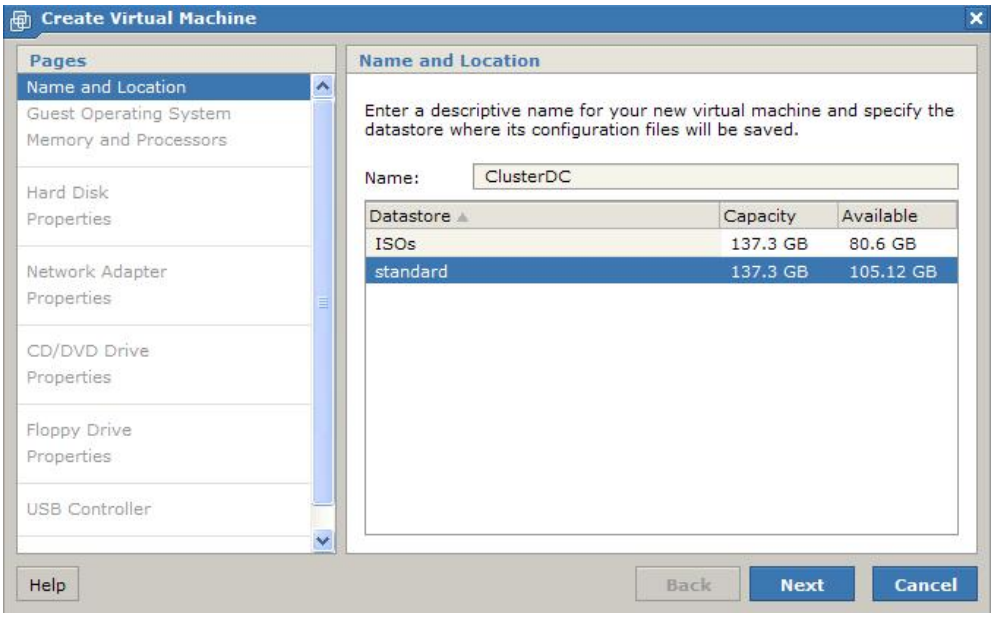
Select the host node in server console as shown below and under ñCommandsò click ñAdd datastoreò



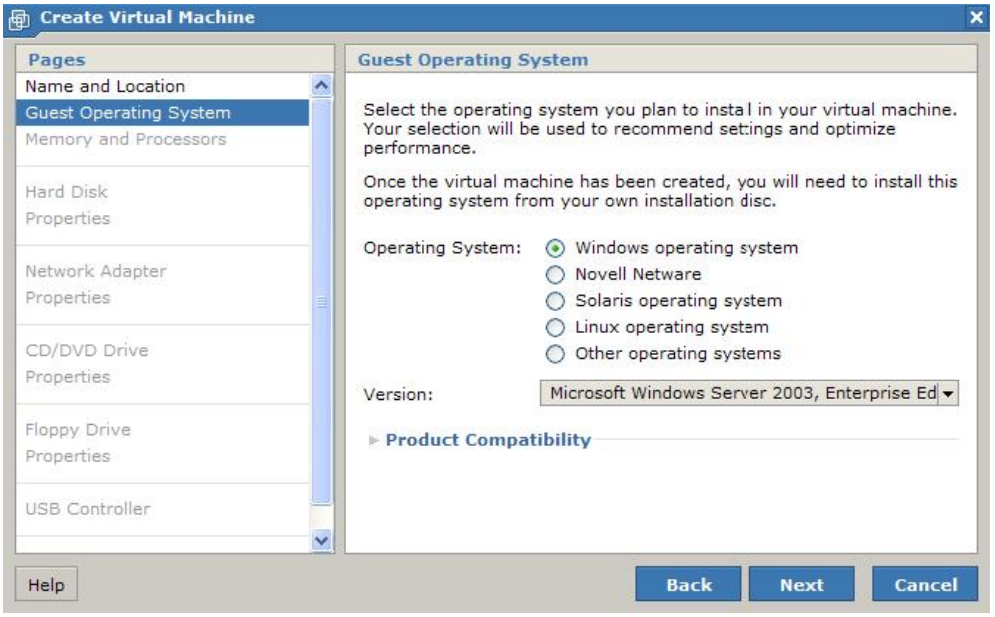
At the dialog supply a datastore name (ISOs) and a local path (C:\ISOs) then click ñOKò



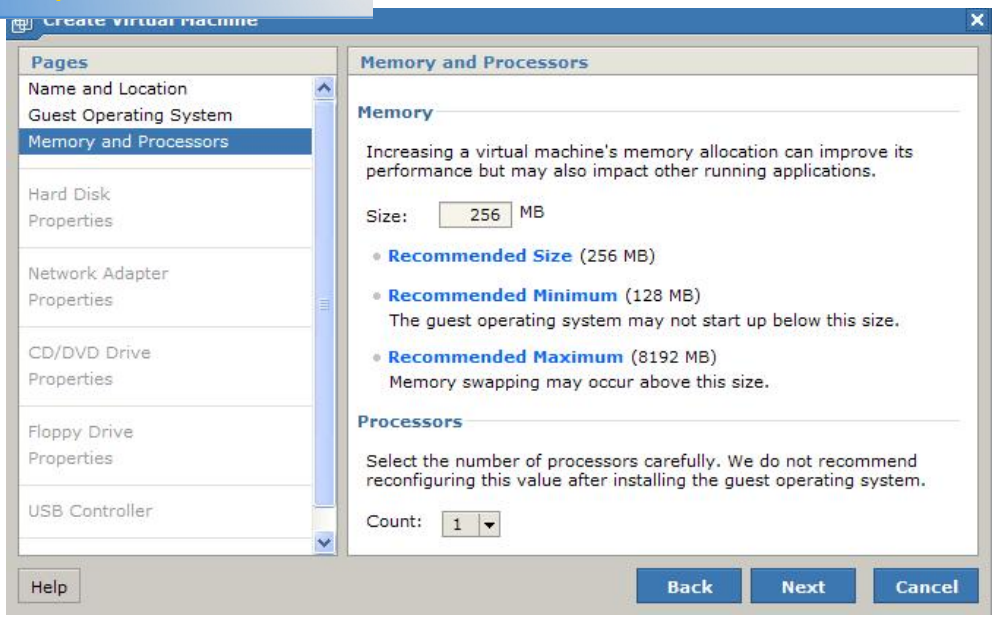
ating the VMôs. Under the ñCommandsò section, select
r a Virtual machine name and select a datastore (this
your local drive) then click ñNextò



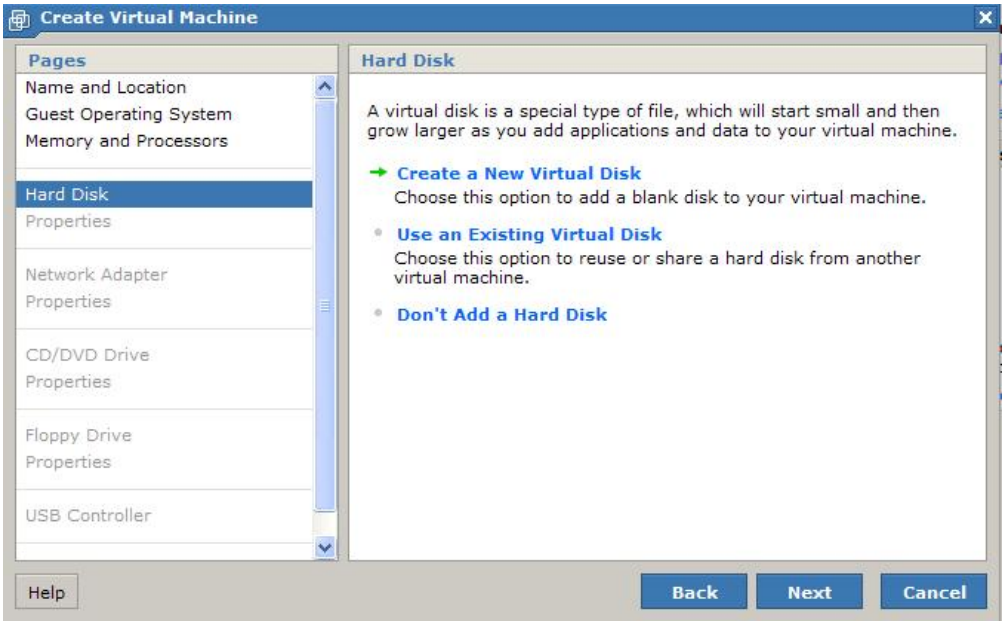
Select the Operating System type (Enterprise Edition for clustering. We will be using 32bit OS) and click ñNextò



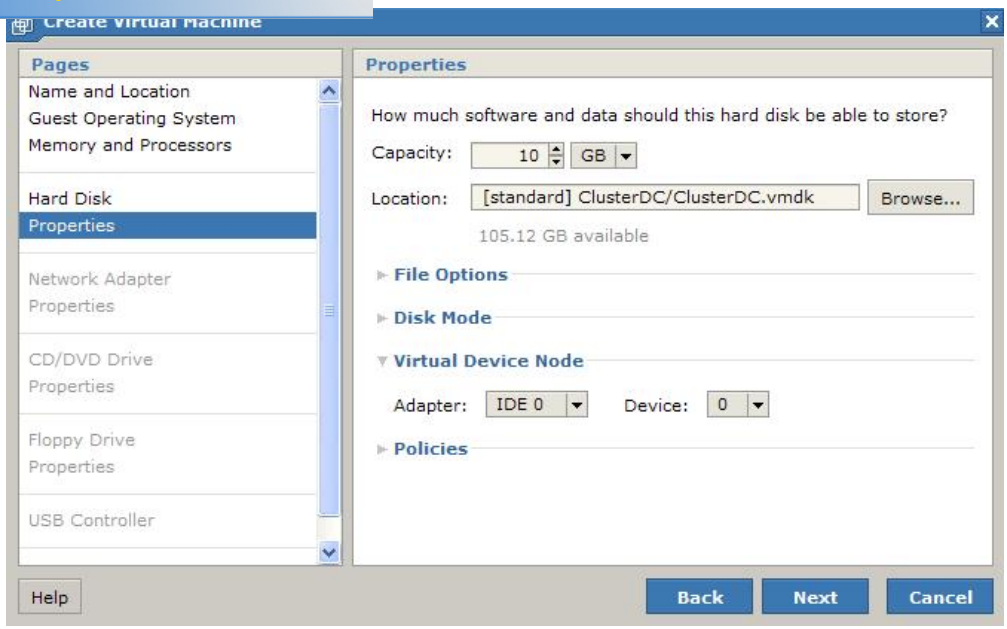
C and 400MB for each cluster node) and CPU (1 each)



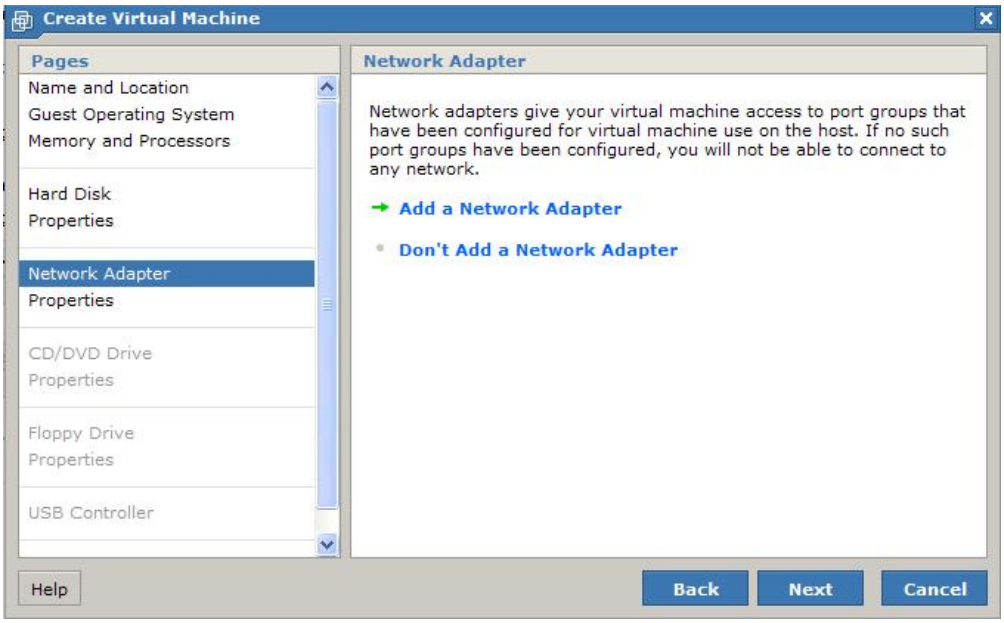
Select to create a new virtual disk;



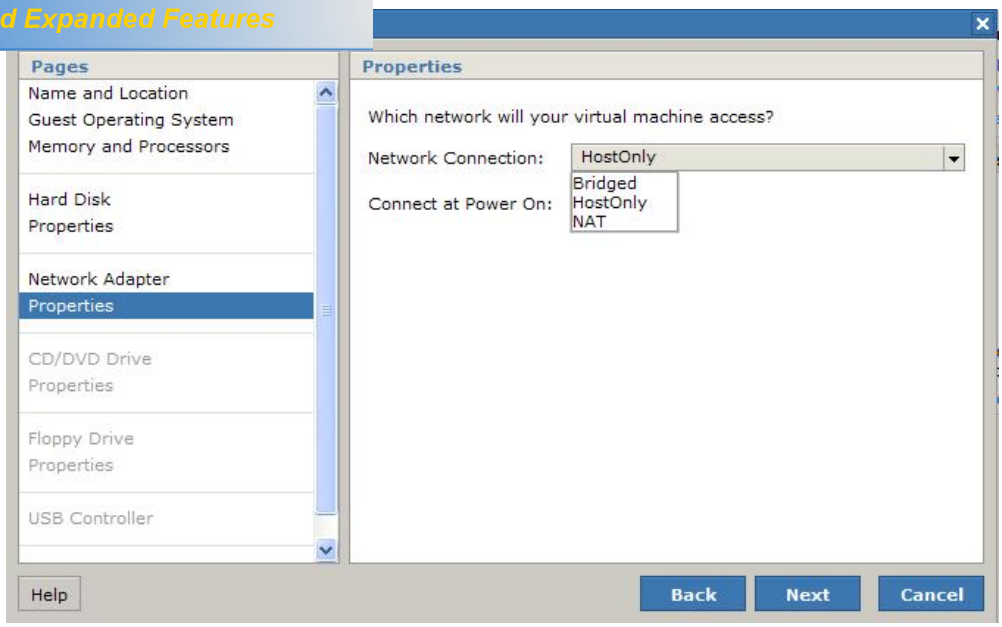
sk and select SCSI bus (SCSI ID 0 for the VM boot
Nextò



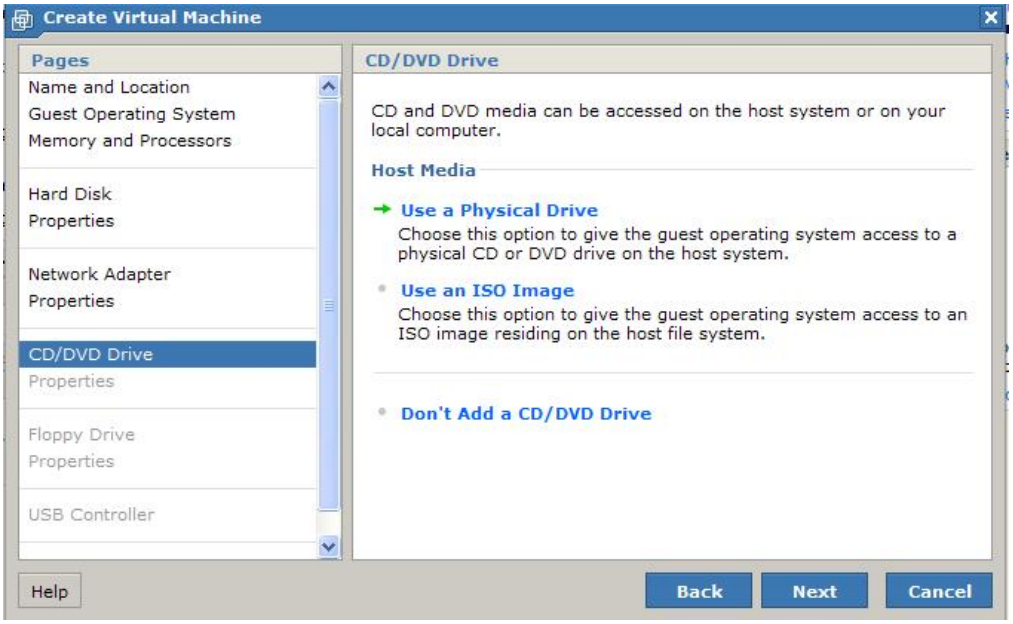
Select ñAdd a network adapteròand the network selection browse opens



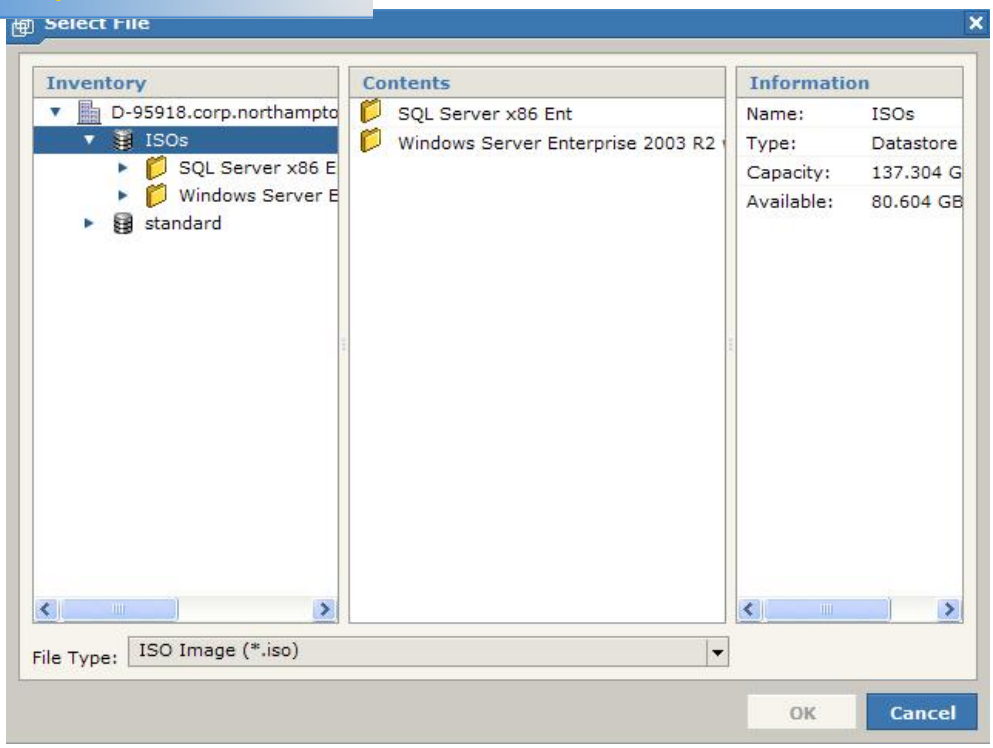
C and click ñNextò



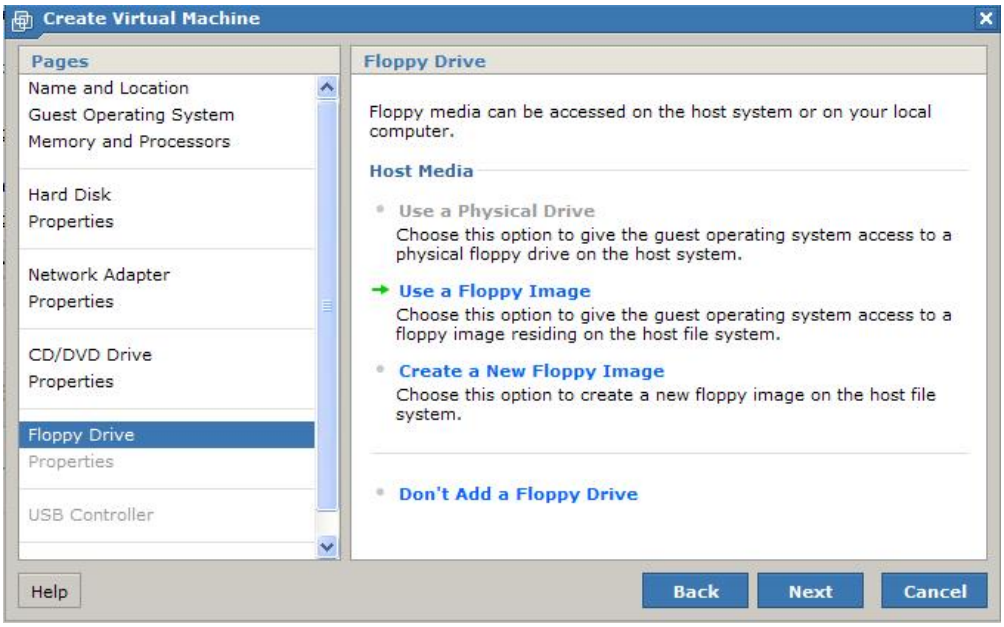
Select to use an ISO image for the vCD drive and click the browse button,



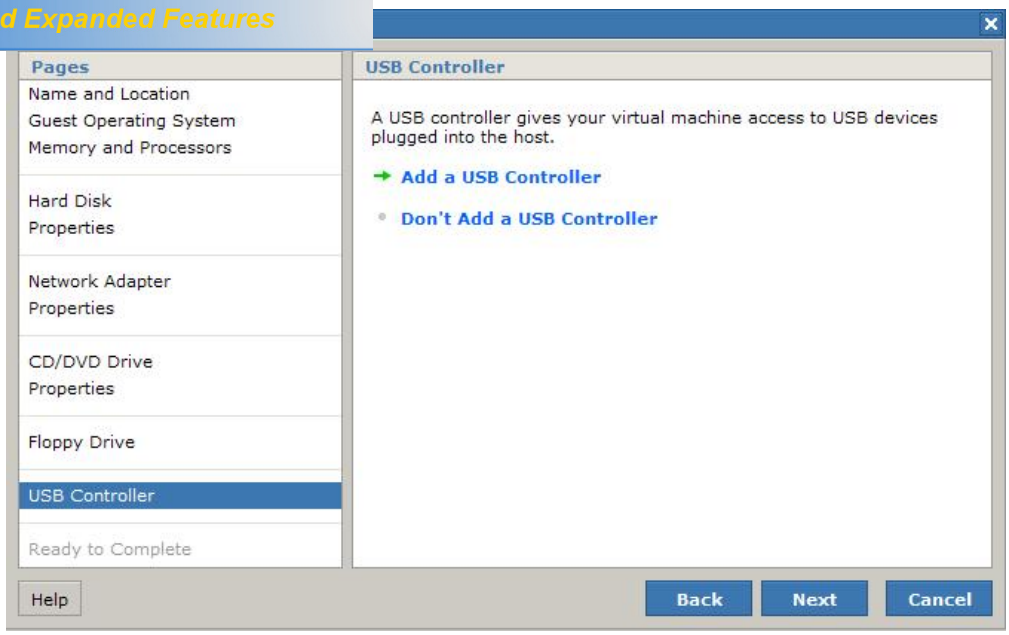
drill down and select the Windows 2003 R2 Enterprise
eate virtual machine windowòclick ñNextò



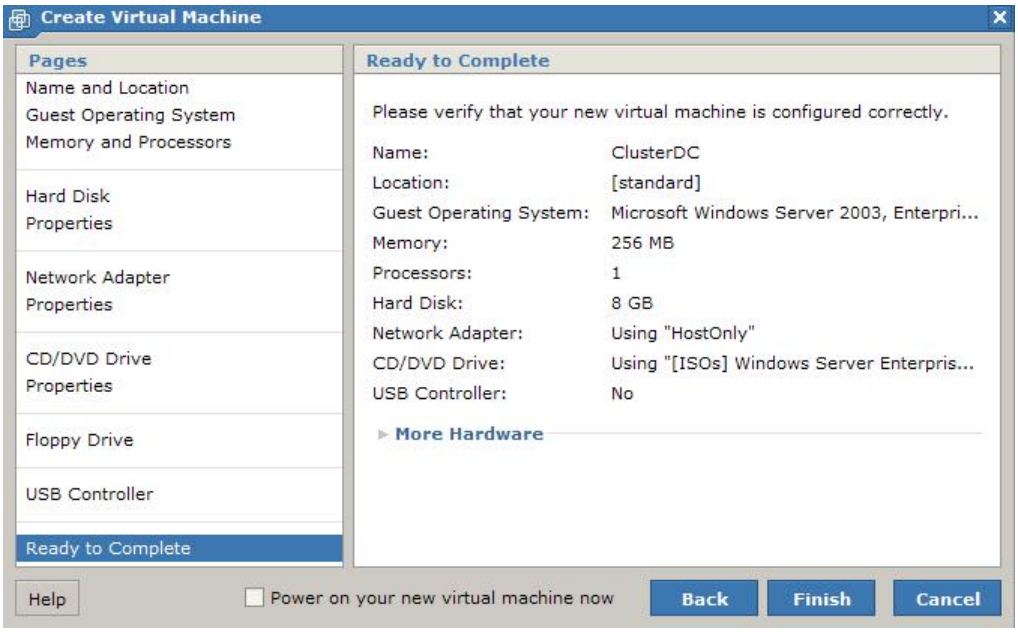
At the next screen do not add a floppy drive and click ñNextò



nd click ñNextò

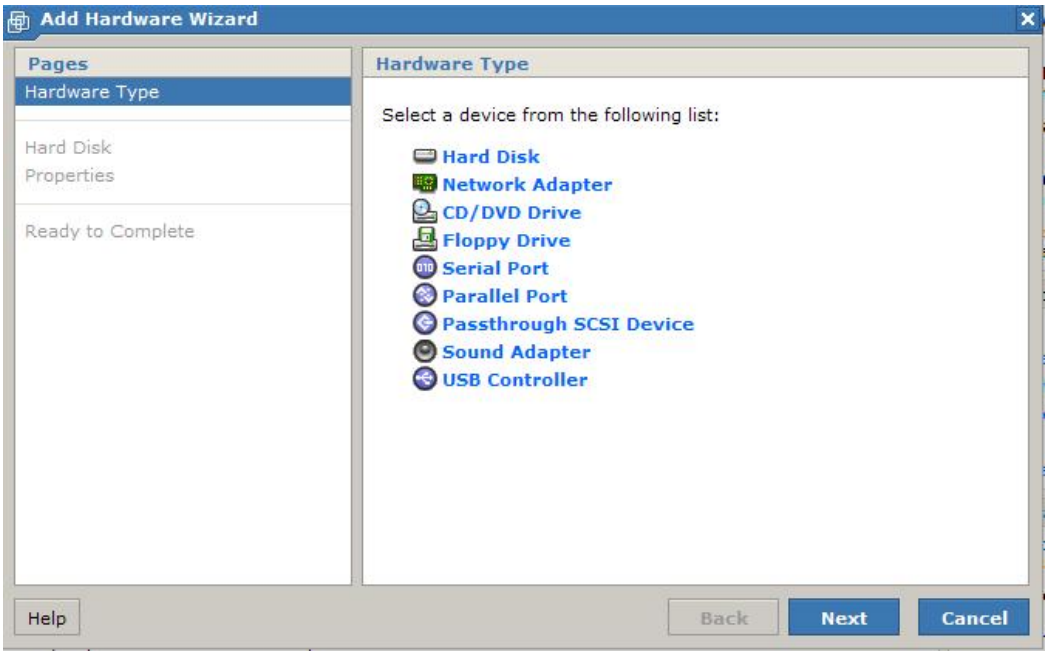


At the last screen click ñFinishòto complete the VM

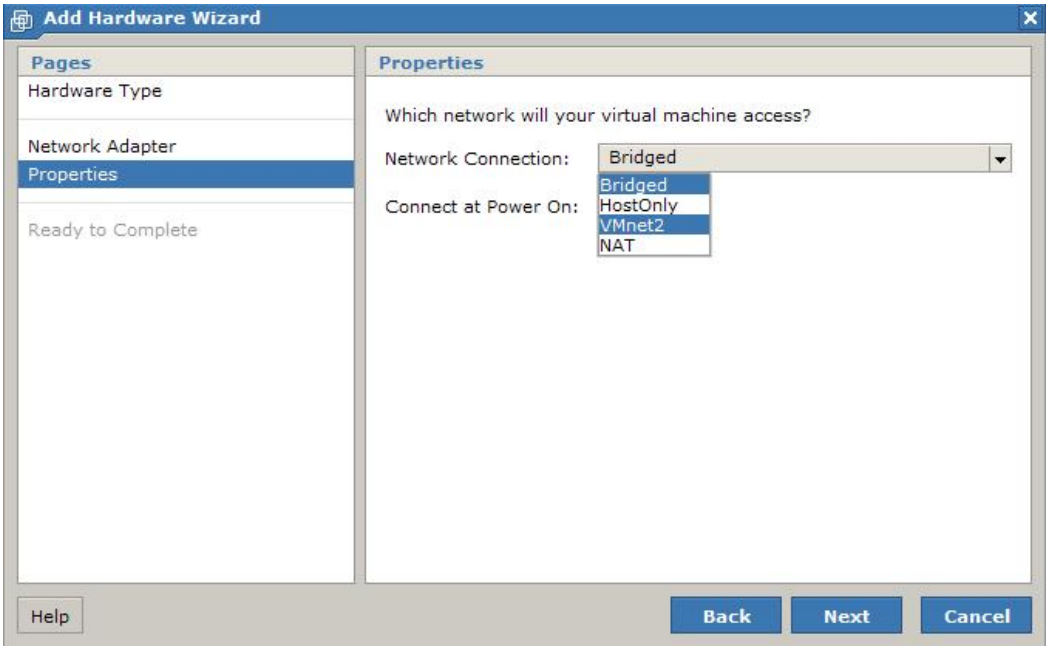


de 1 and node 2). For each of the cluster nodes add a for the Heartbeat network. This is done as follows;

Select the first node and under the ñCommandòsection click ñAdd hardwareò, the following screen appears. Click ñNetwork adapterò and the vNIC properties appear;

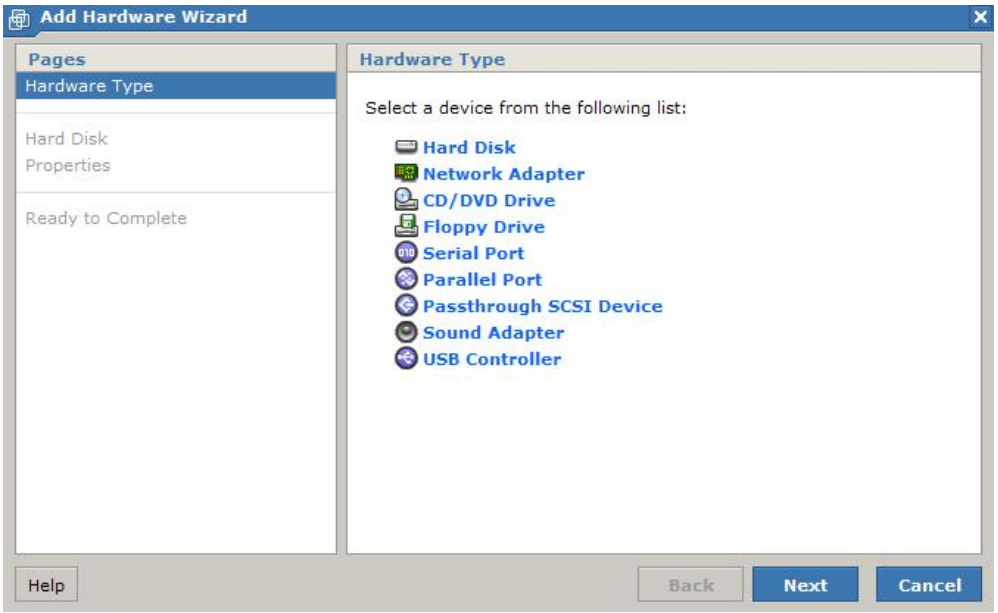


Select the ñVMnet2òoption from the drop down list and click ñNextò, then click ñFinishò to complete. Do this for the second cluster node too.

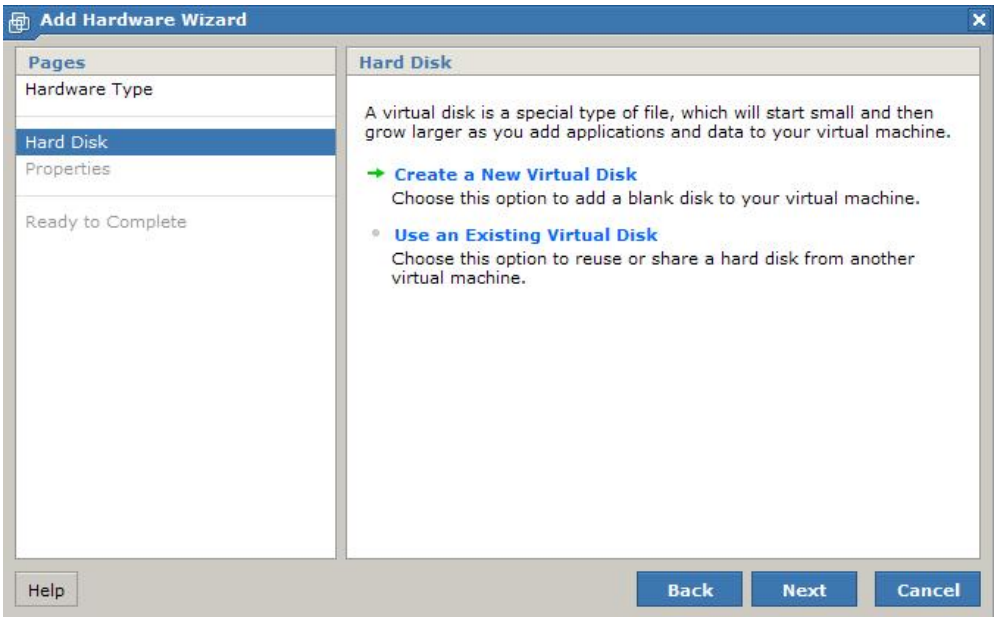


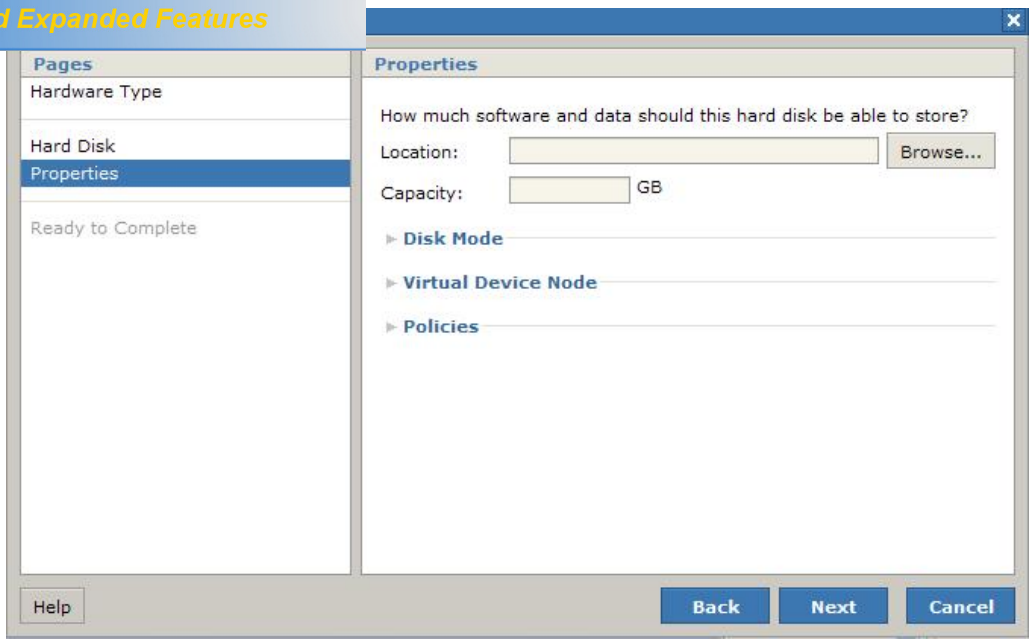
systems on each VM and create a domain controller
C. Configure networking (Public and Heartbeat)
e 2 nodes to the domain. Once this is done you may
proceed with the rest of the instructions in this document.

Once the cluster nodes have been created we need to shut the VMôs down and attach the pre created virtual disks to each cluster node this involves also manually editing the VM configuration file (*.vmx). With the VMôs powered off start as follows.
Select node 1 and click ñAdd hardwareò Click ñHard diskò

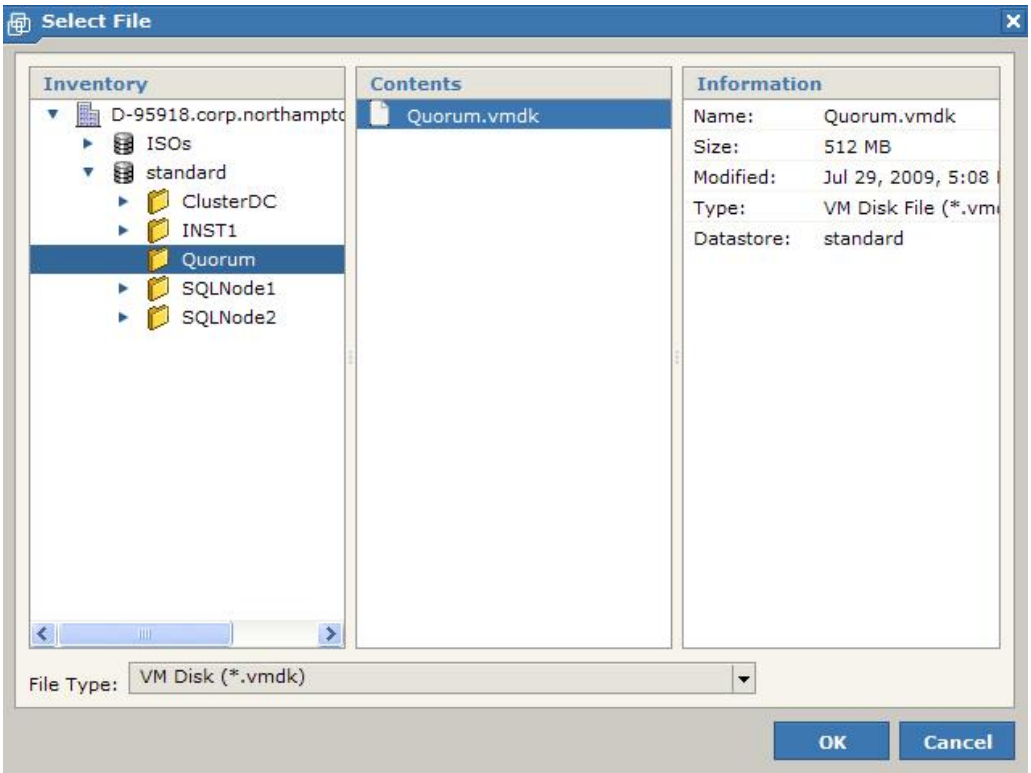


Use existing hard disk;

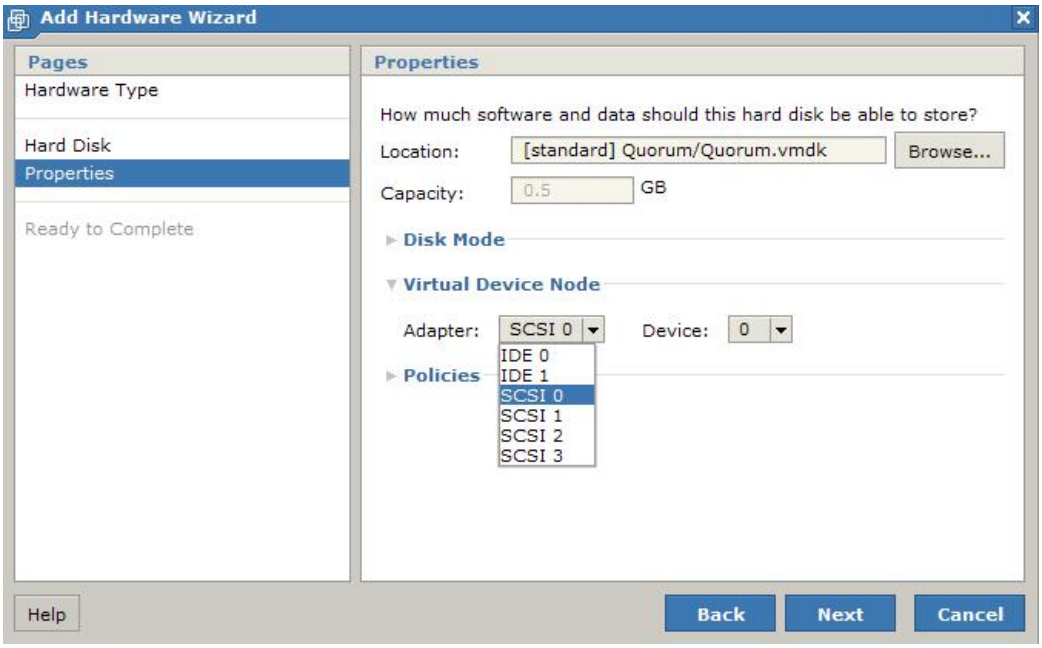




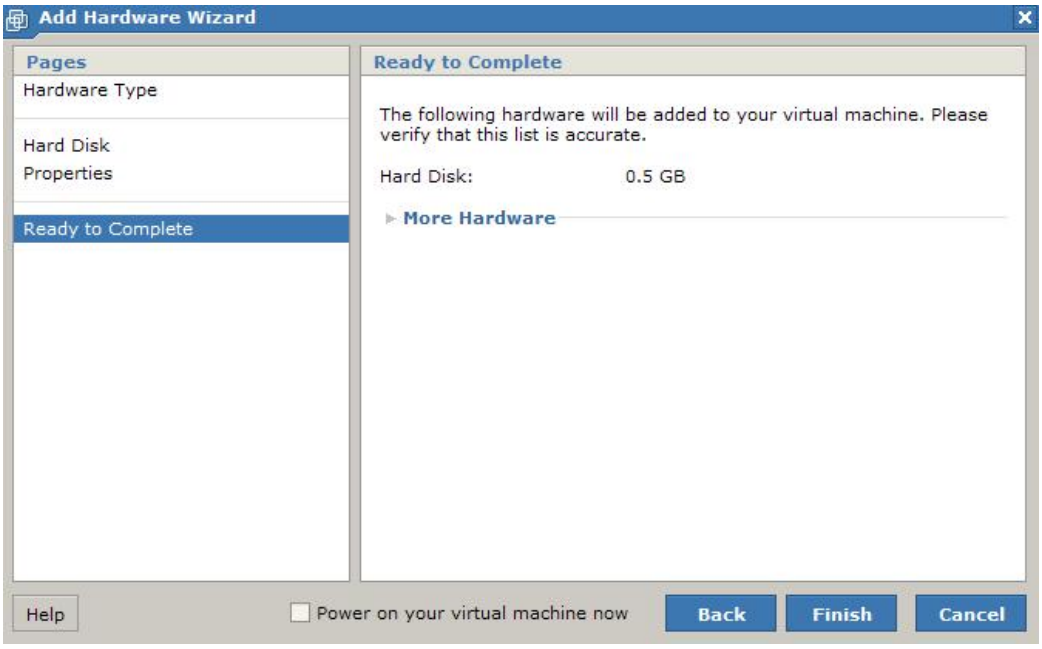
The datastore browser opens. Select the first disk ñQuorumòand click ñOKò



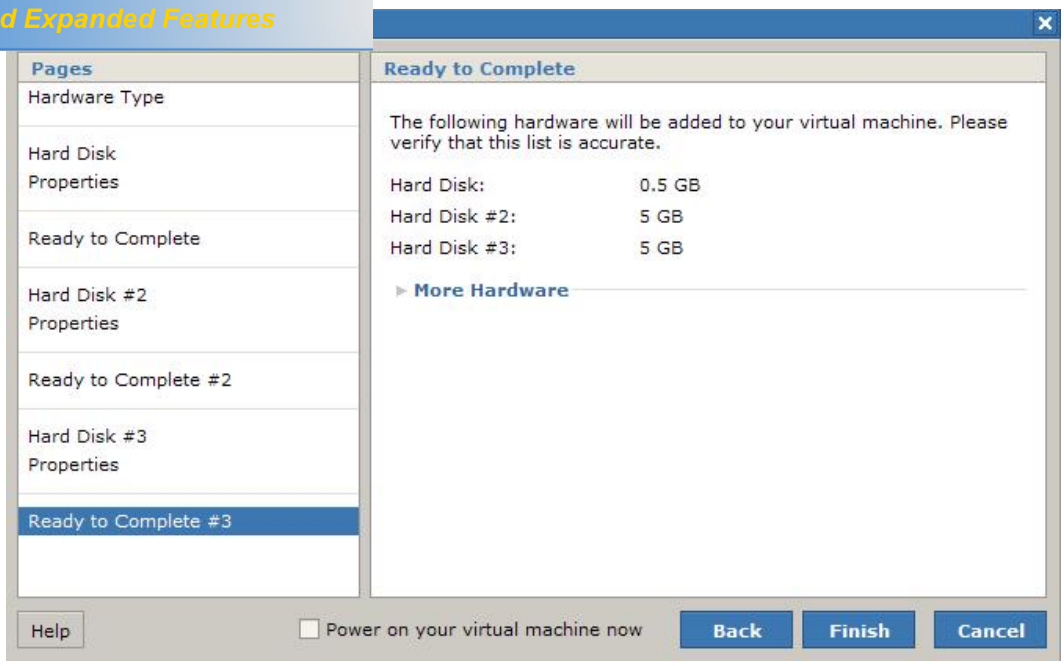
èosettings accept the default assignment for node1 if you chose a SCSI bus boor drive change the adapter extò



At the next screen select the ñMore hardwareòoption to add the 2 remaining SCSI disks.



Finishòto complete the configuration;



Now do the same for Node 2.

Once the disks have been added to both VMôs 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 ñApplyòand ñOKòto 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;

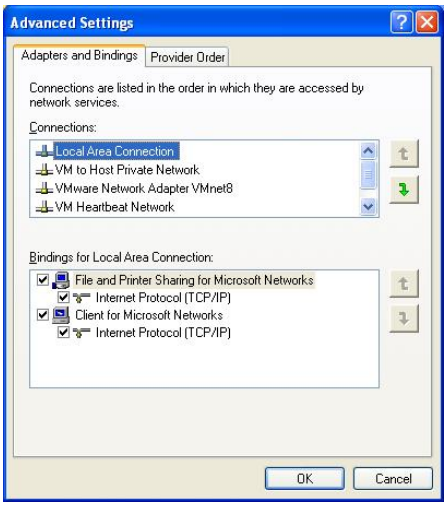
scsiX.sharedBus = "none" where X is the SCSI bus number the shared disks are attached too (1 in our case).

Change the text to;

scsiX.sharedBus = "virtual"

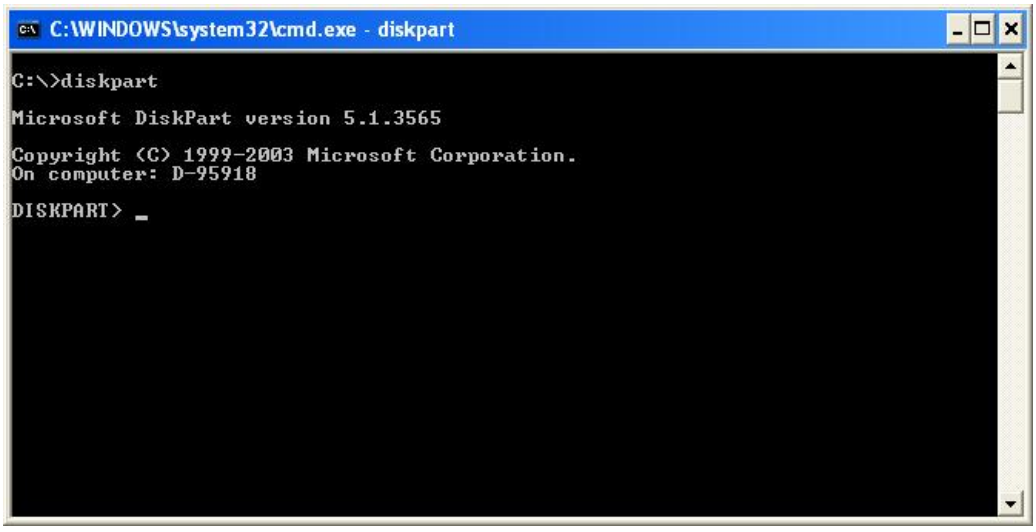
Close the file and save it.

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

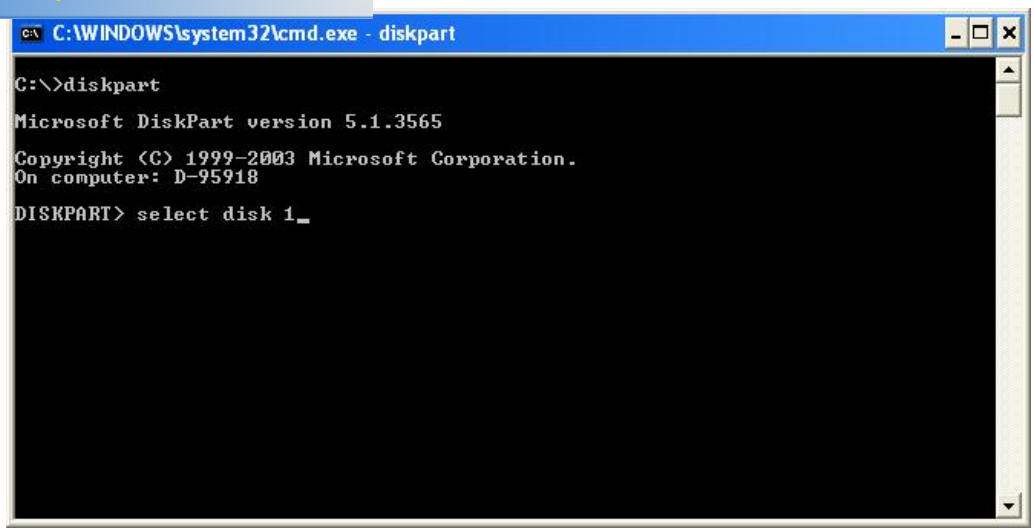


Highlight the connection and click the up or down arrow to move. Ensure the Public connection is topmost

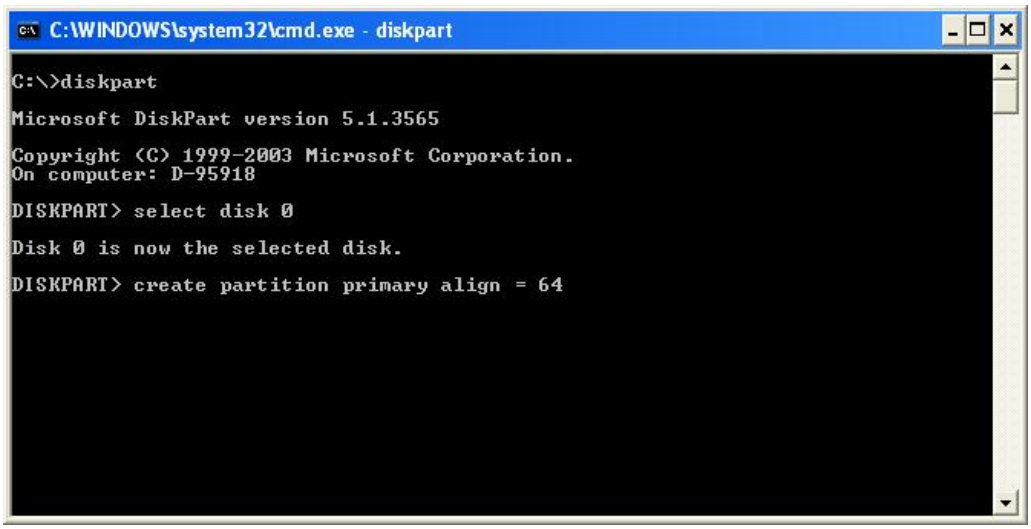
Boot the first node and create 3 NTFS partitions on the 3 new drives, use drive letters Q (Quorum), S (SQL Data) and T (SQL Logs). Although not necessary on your virtual machines the following instructions are used to create aligned partitions for use with SQL Server.
Open a command prompt and type diskpart followed by return as shown below



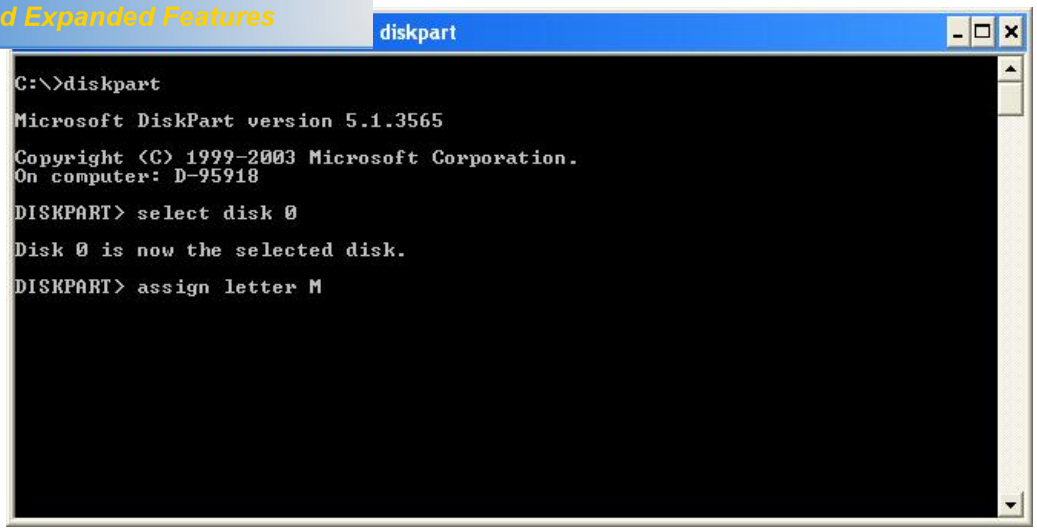
number (you may get these from disk management),



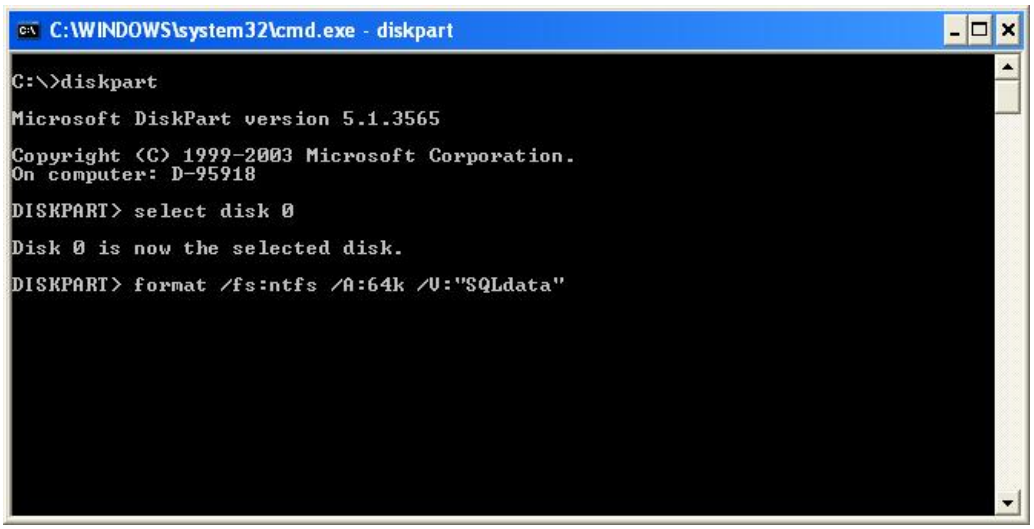
Now issue the command to create the partition shown below



reated assign a drive letter using the following



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



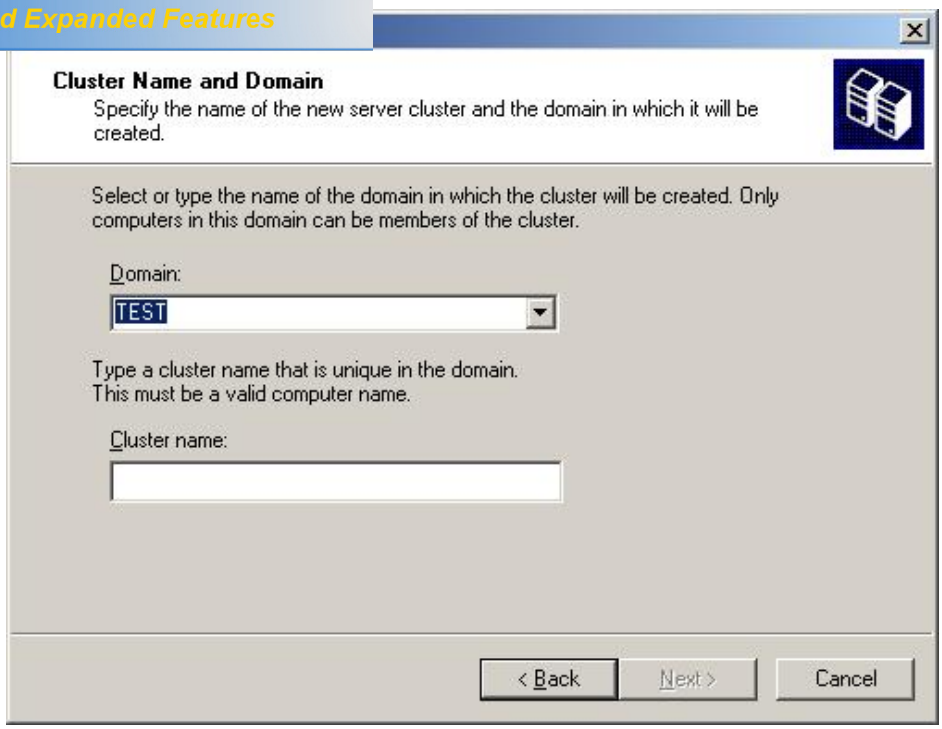
The partition will be created using the label SQLData and NTFS file system with a cluster size of 64kb. (Note that NTFS disk compression will be disabled on this partition).

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 VMôs first).

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

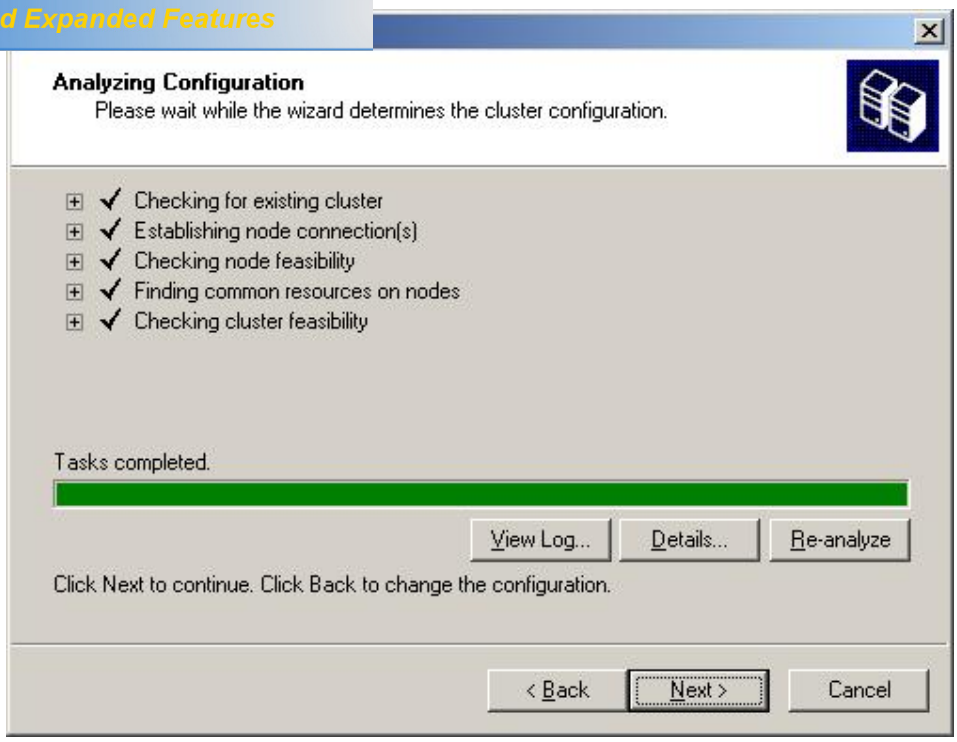
Click ñNextòat the welcome screen;

unique cluster name, then click ñNextò

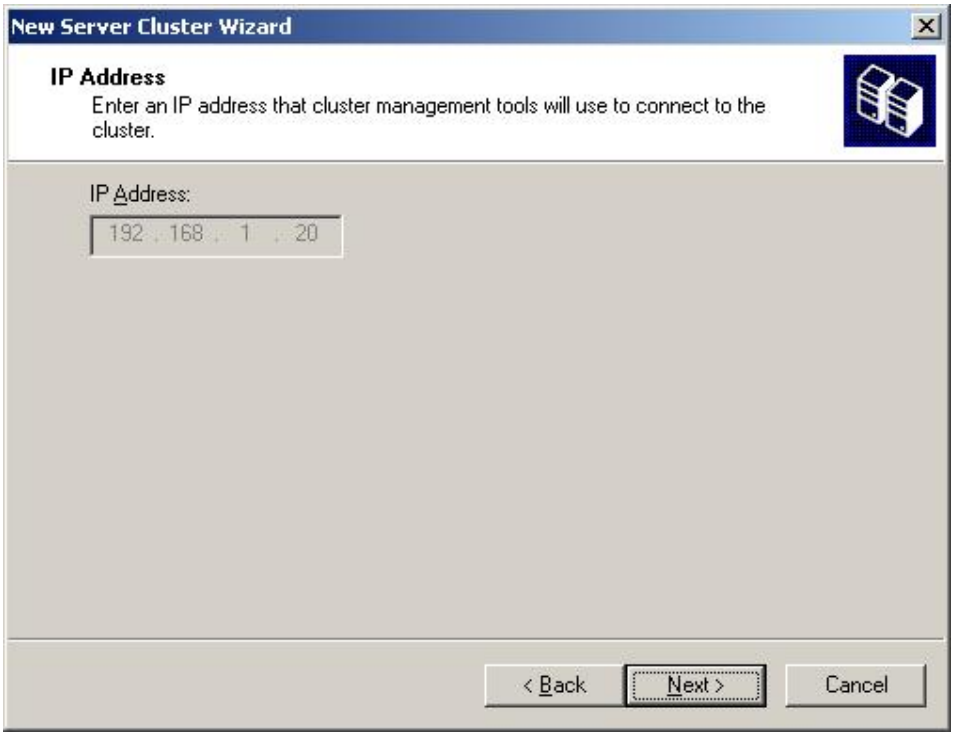


Confirm the node to add to the cluster and click ñNextò

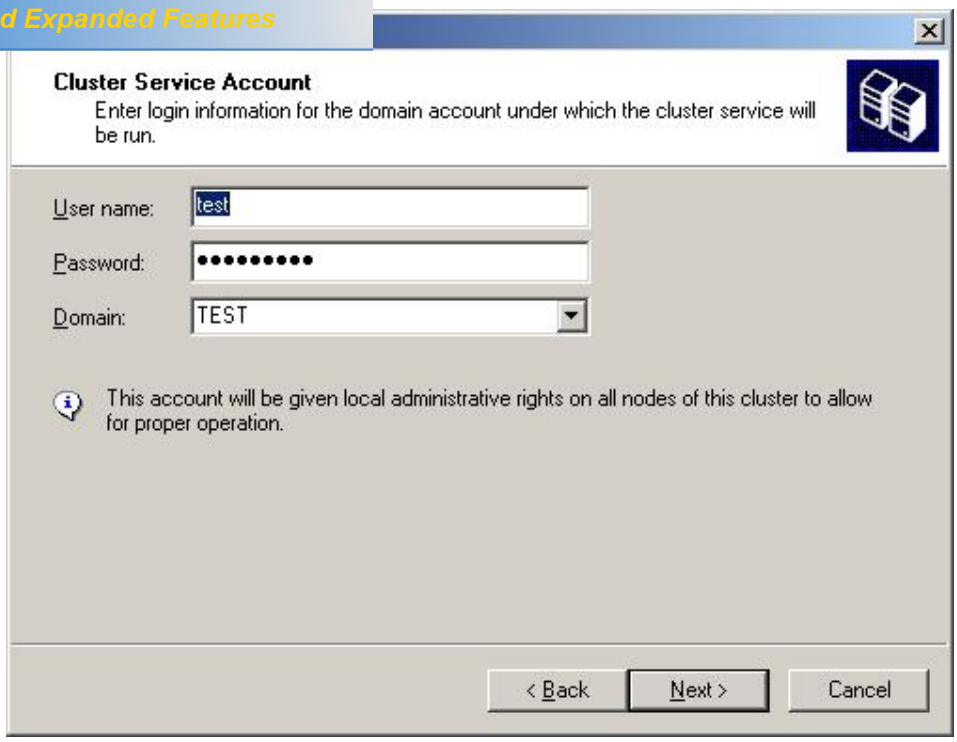
s from the analysis stage and click ñNextò to proceed;



Enter a unique IP Address for the cluster and click ñNextò

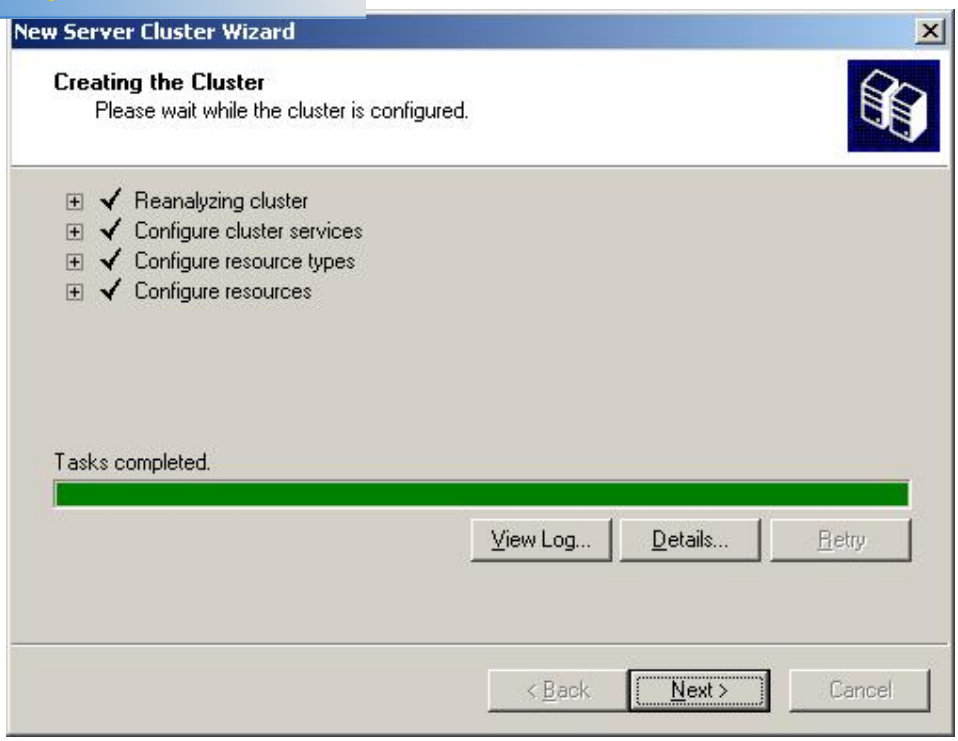


unt credentials and click ñNextò



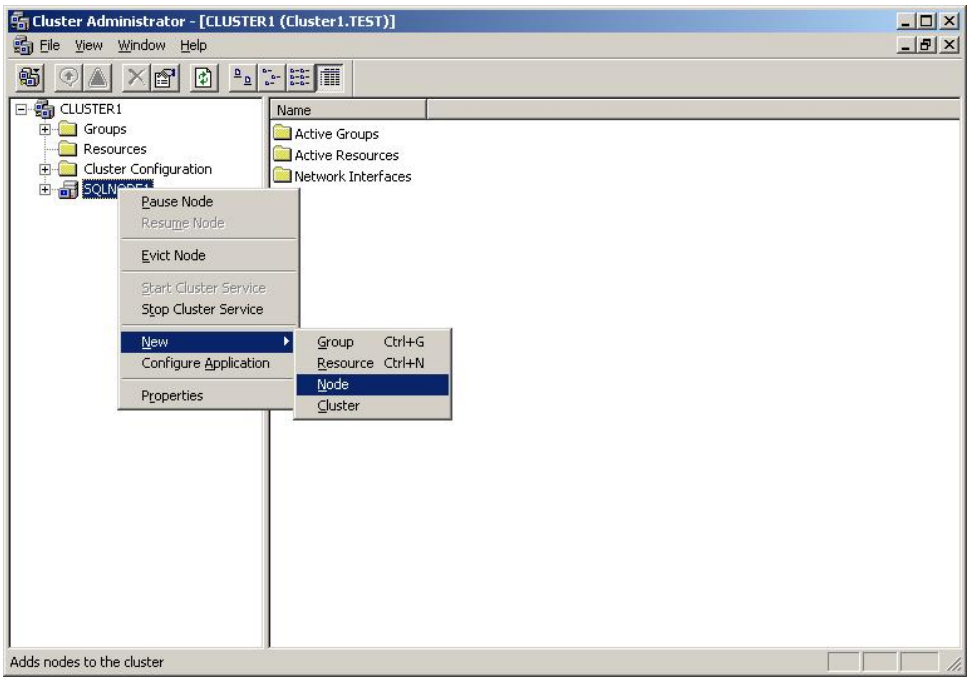
Review the proposed configuration and click ñNextò

nfigured review any errors or warnings and click ñNextò

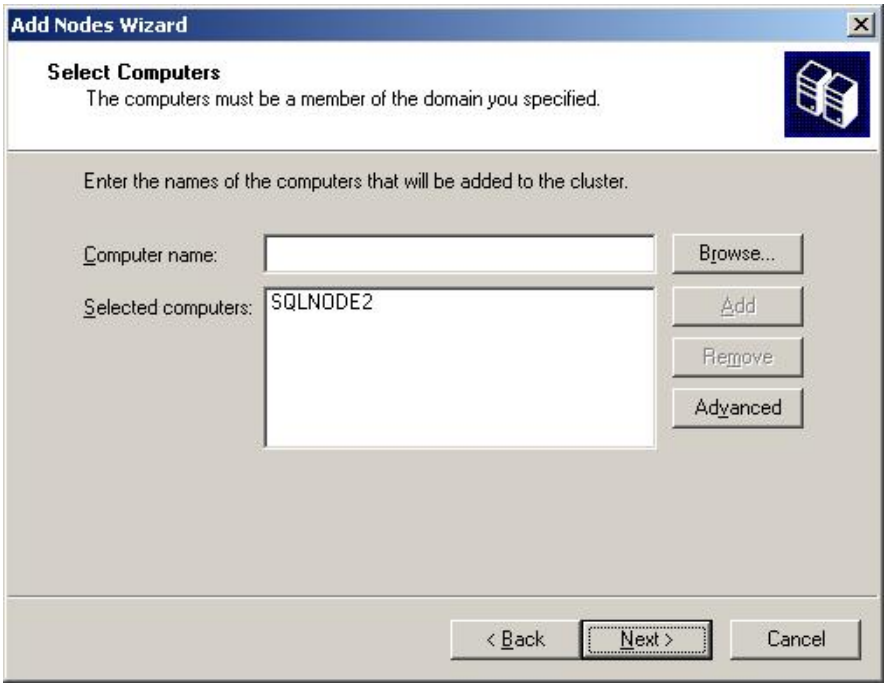


Finally click ñFinishòto exit;

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

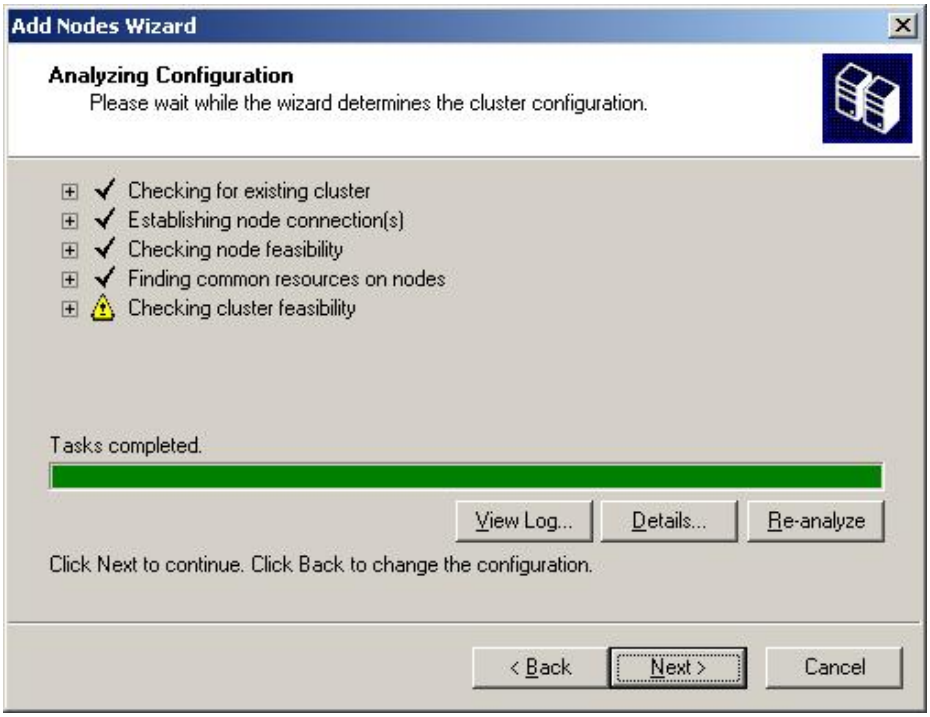


Click ñNextòthrough the welcome screen and you will be asked to provide the computer name of the node you wish to add. Browse for the computer name and select from the list returned. Click the ñAddòbutton to confirm the node;

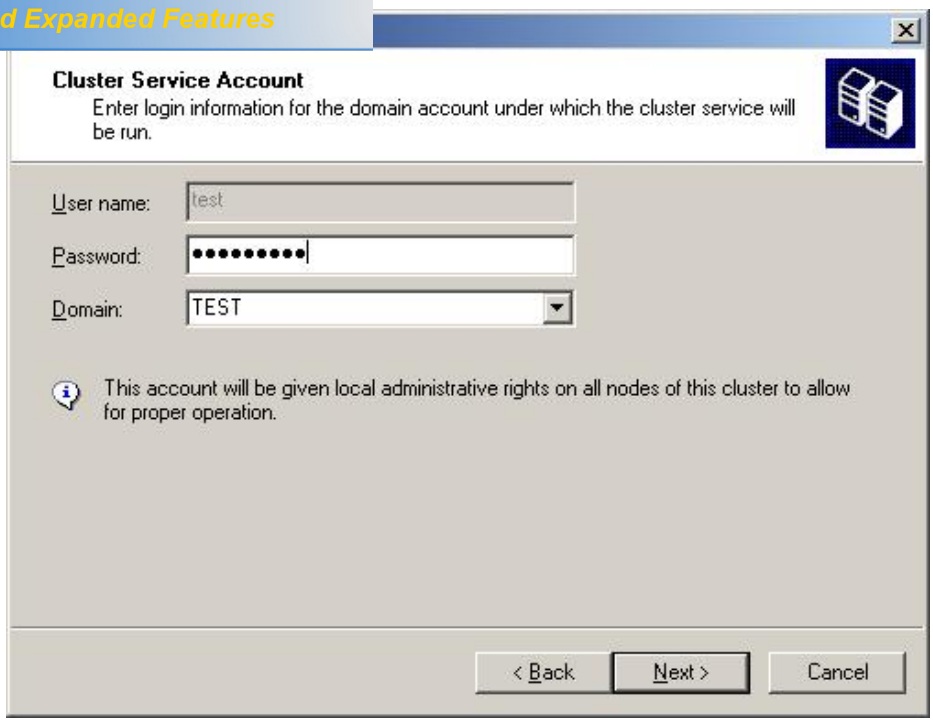


minimal configuration by clicking the advanced button.

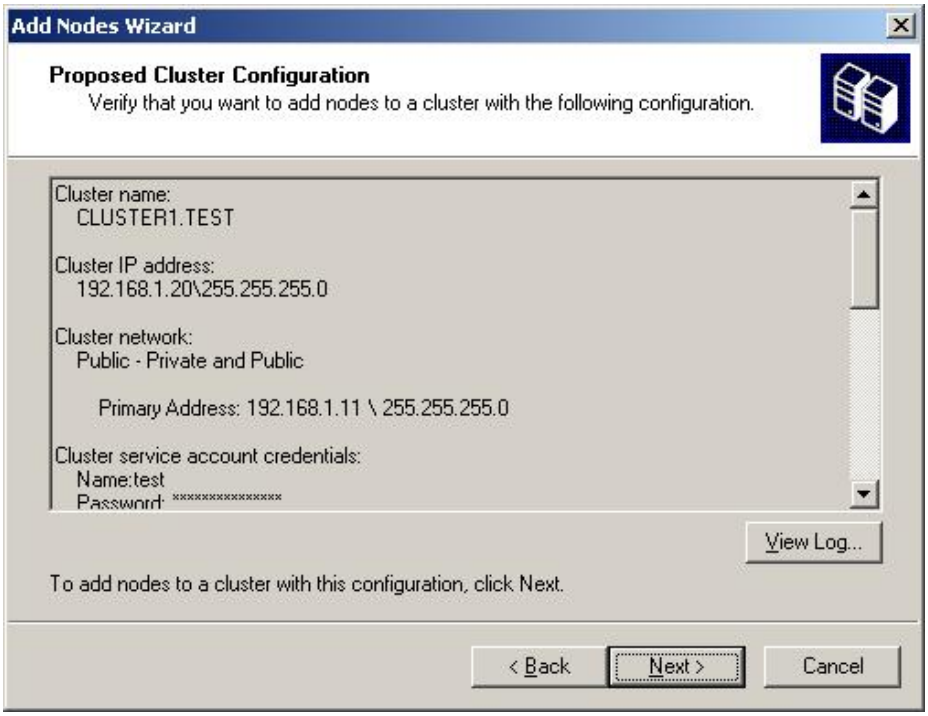
Cluster administrator analyses the configuration, review any errors or warnings.



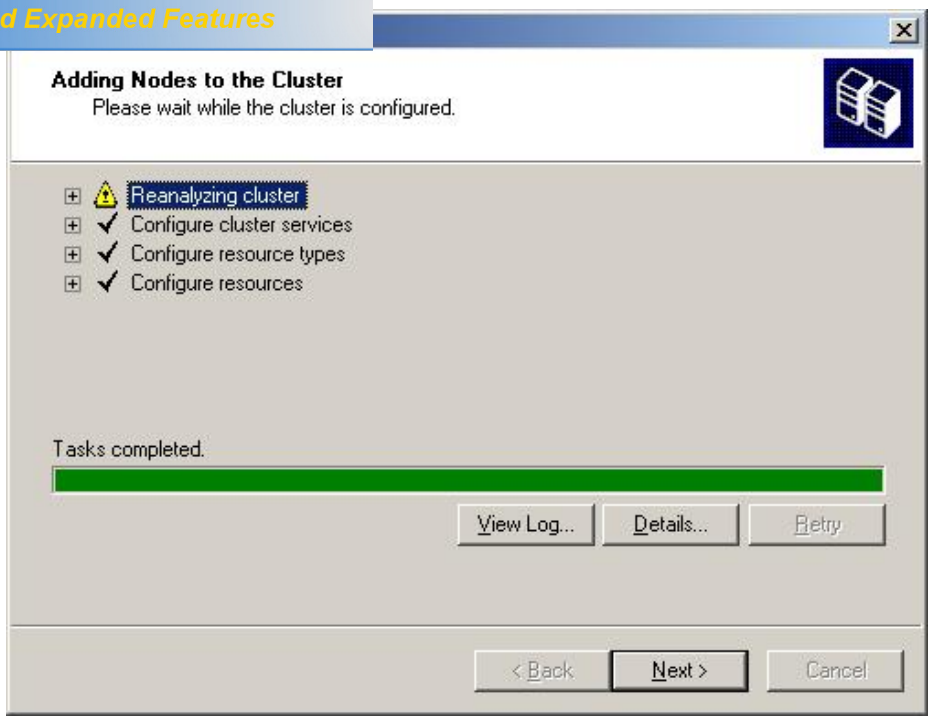
ount credentials



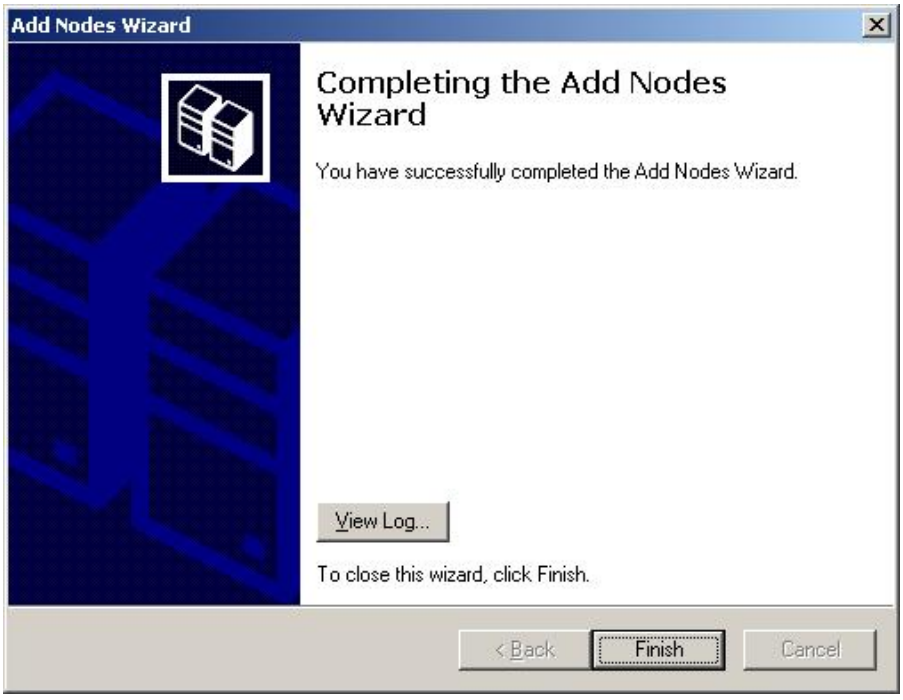
Review the proposed configuration and click ñNextò



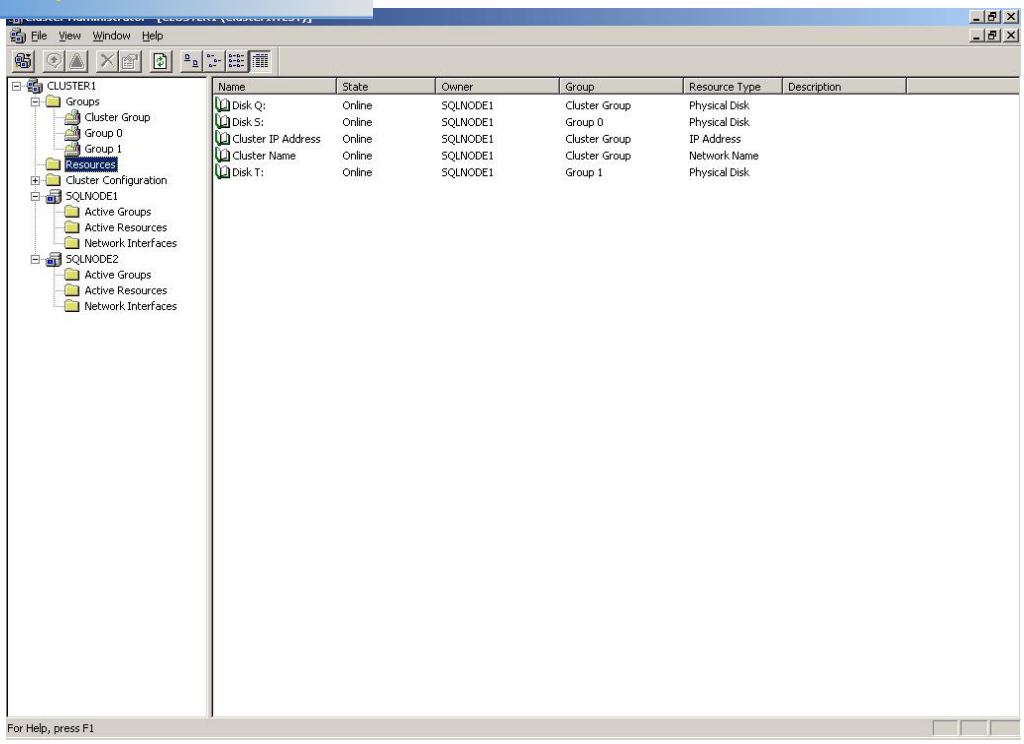
e cluster, again review any errors or warnings



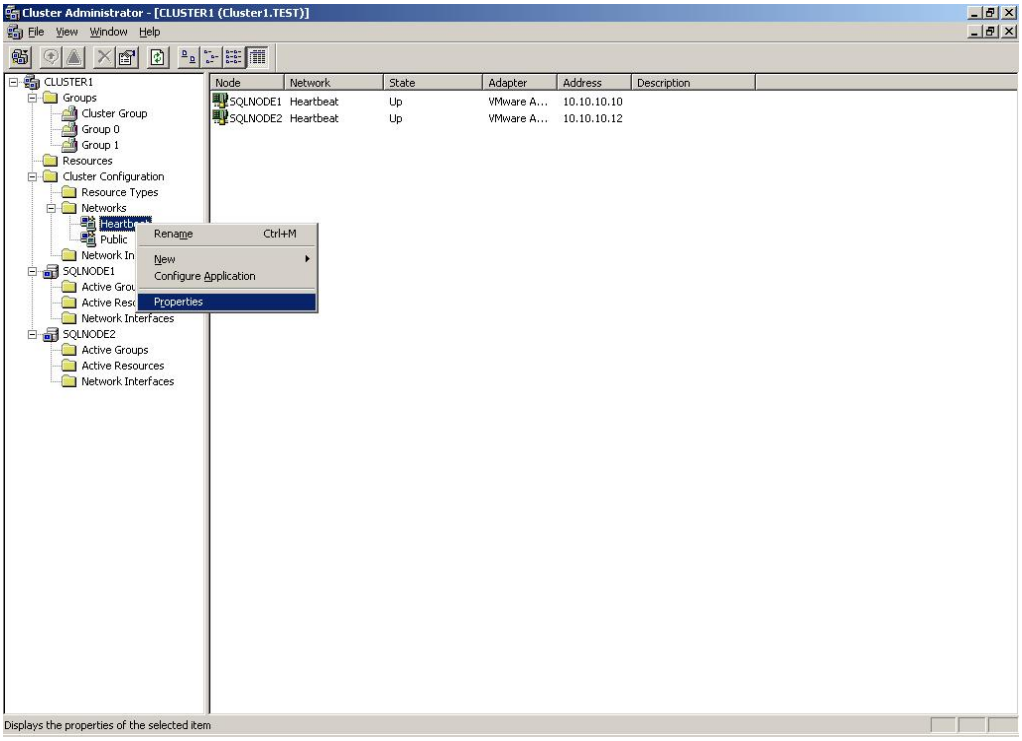
Finally click ñFinishòwhen the wizard has completed;



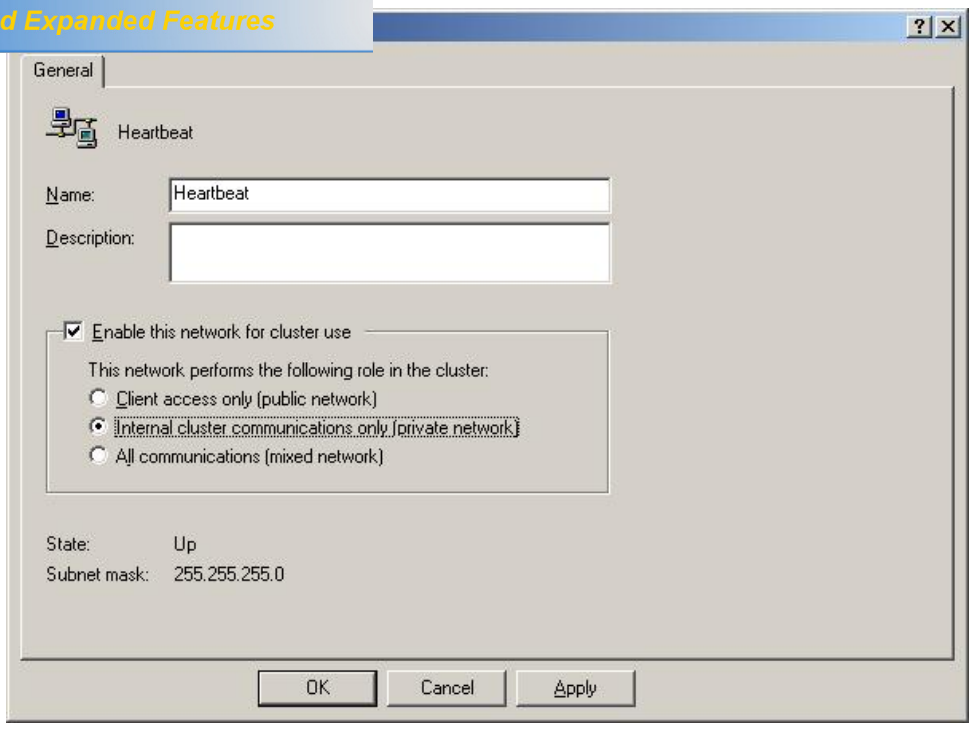
es configured you should see the following in cluster
rces owned by SQLNode1



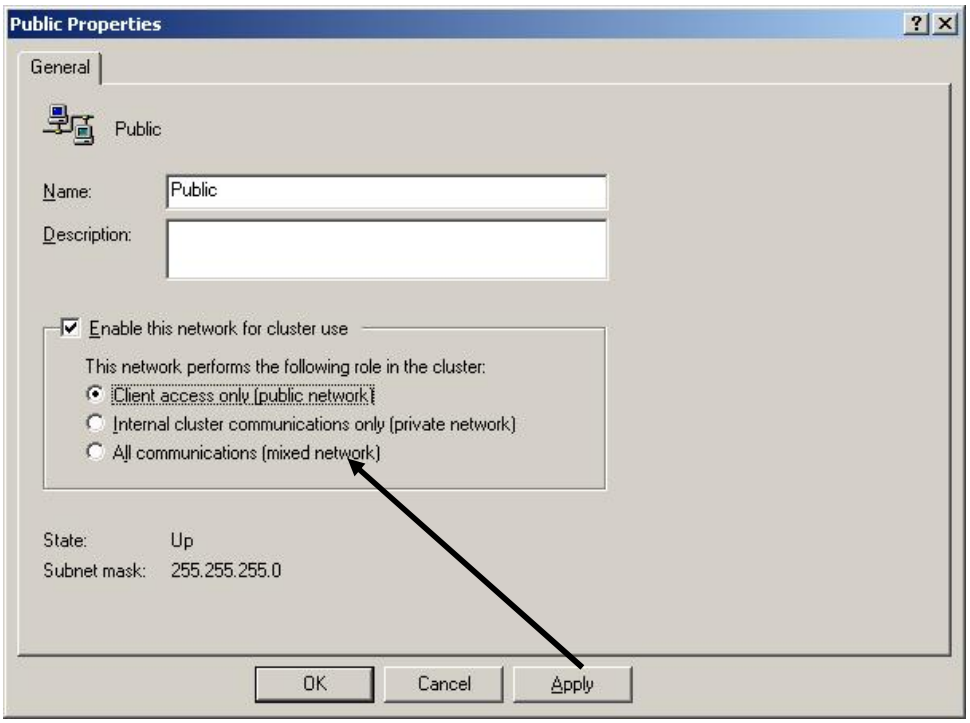
Open the networks information and set the properties for each item;



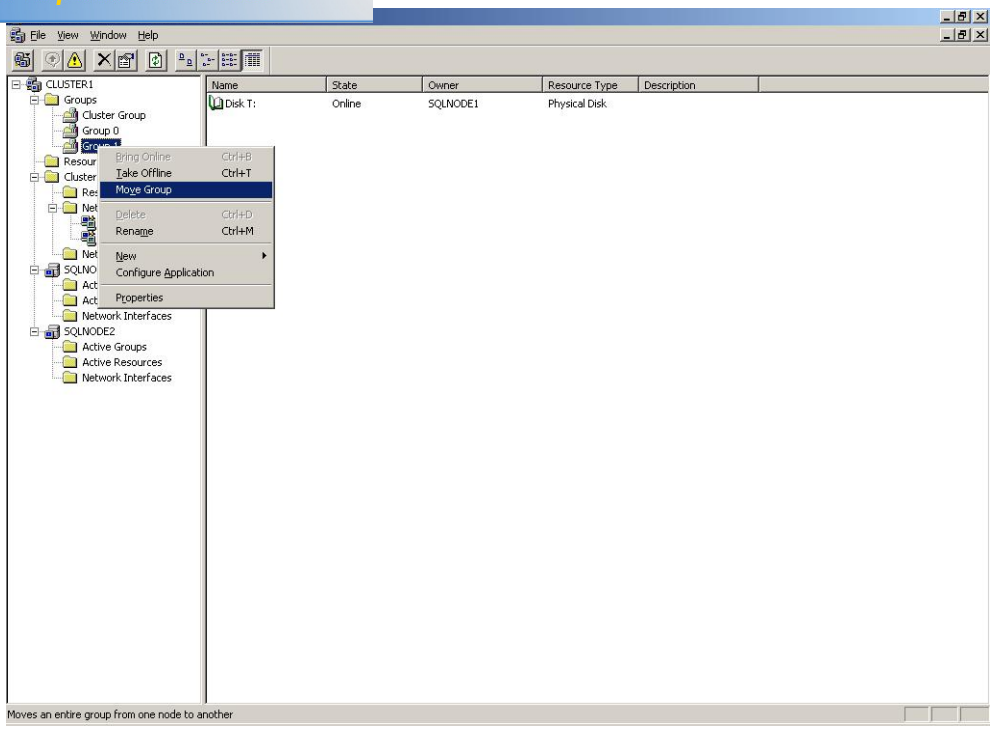
nal access;



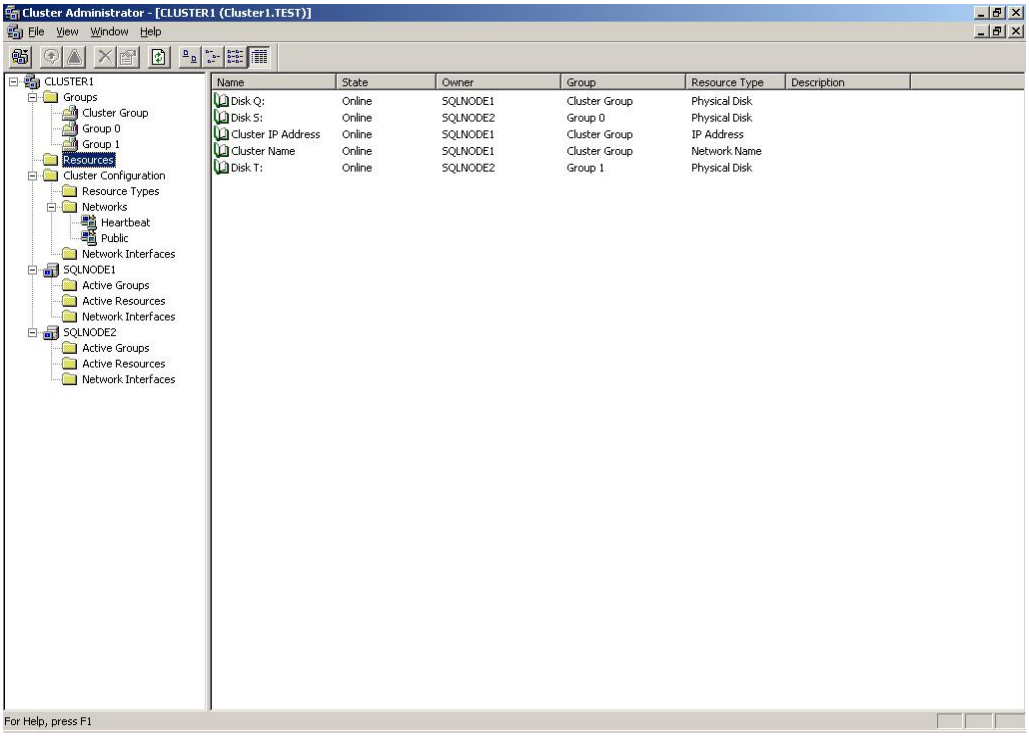
The Public should be set to Mixed Communication access;



by moving a cluster group from one node to another. Right groupà 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 óGroupsôand select ónewô> óGroupô Give the group a name and click ónextôthen add available nodes and click óFinishô
Right click the newly created group and select ónewô> óResourceô Give the resource a name óNST1DTC IPô from óResource Typeôdrop down list select óIP Addressôand click ónextô Select available nodes and click ónextô Click ónextôthrough dependencies, enter an IP Address and mask for the public network (192.168.0.30 and 255.255.255.0) and click óFinishô

Right click the group and select ónewô> óResourceô Give the resource a name óNST1DTC Nameô From the drop down list select óNetwork nameôas the resource type and click ónextô Select available nodes and click ónextô Add IP Address resource as a dependency and click ónextô Enter the unique network name and uncheck the óDNS registration must succeedôcheckbox then click óFinishô

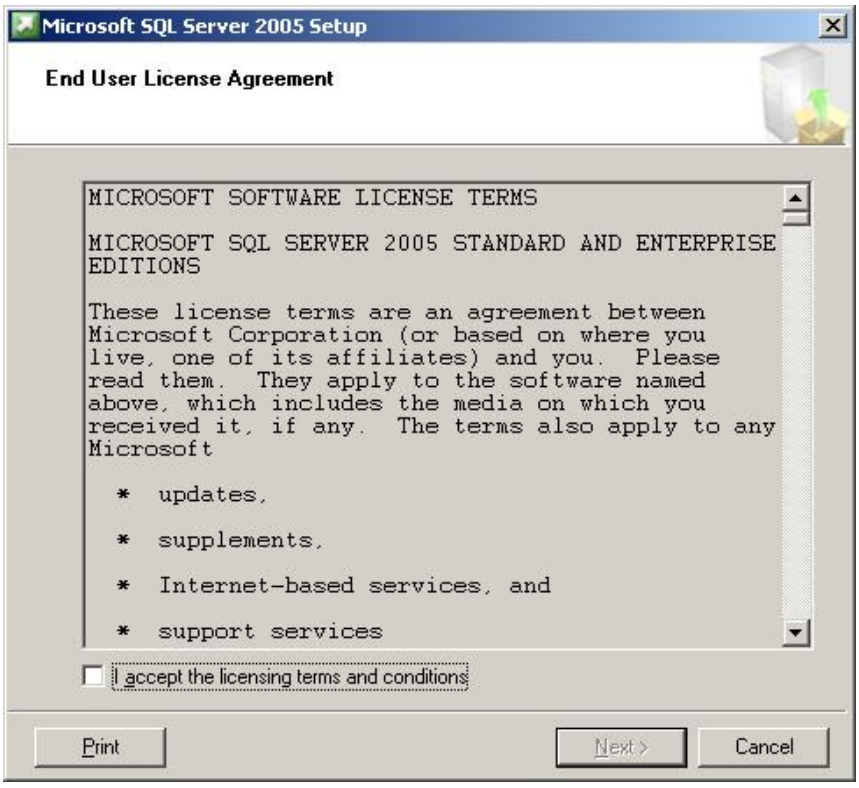
If the DTC disk drive has already been discovered by Cluster Administrator you may skip this paragraph. Otherwise, right click the group and select ónewô> óResourceô Give the resource a name óDTC Dataôand from the drop down list select óPhysical Diskôas the resource type, then click ónextô Select available nodes and click ónextô Click ónextô through the dependencies. From the drop down list on the parameters dialog select the disk drive to use (P:) then click óFinishô

Lastly create the DTC resource by right clicking the group and selecting ónewô> óesourceô Give the resource a name óNST1DTC SVCôand select óDistributed Transaction Coordinatorôfrom the óResource Typeôdrop down list, then click ónextô Select available nodes and click ónextô 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 óFinishô Now right click the group and bring it online.

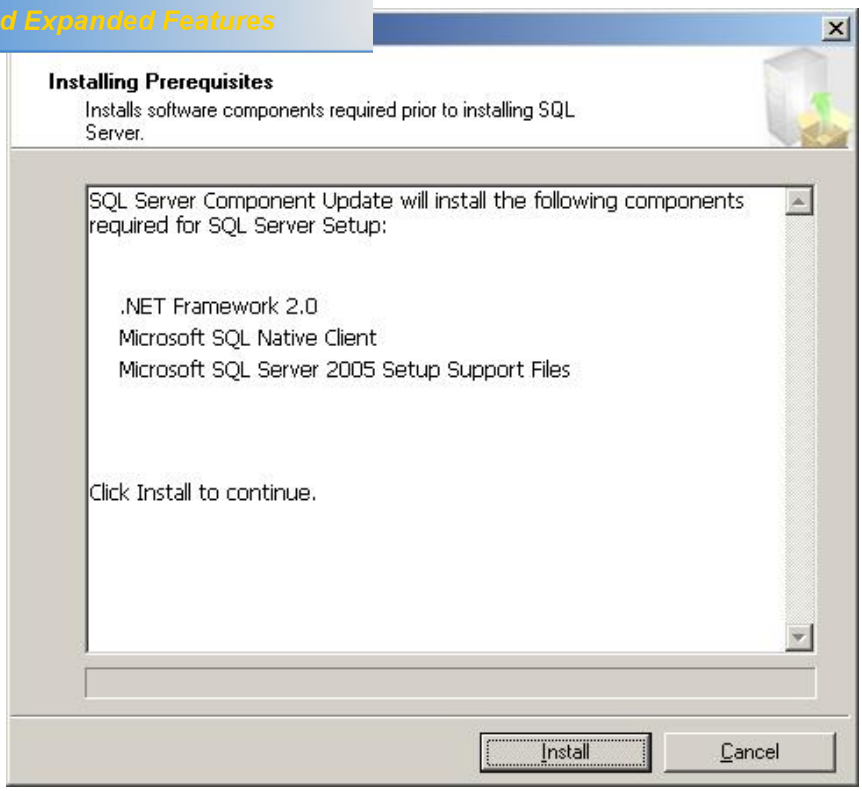
SERVER INSTANCE.

ated 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;

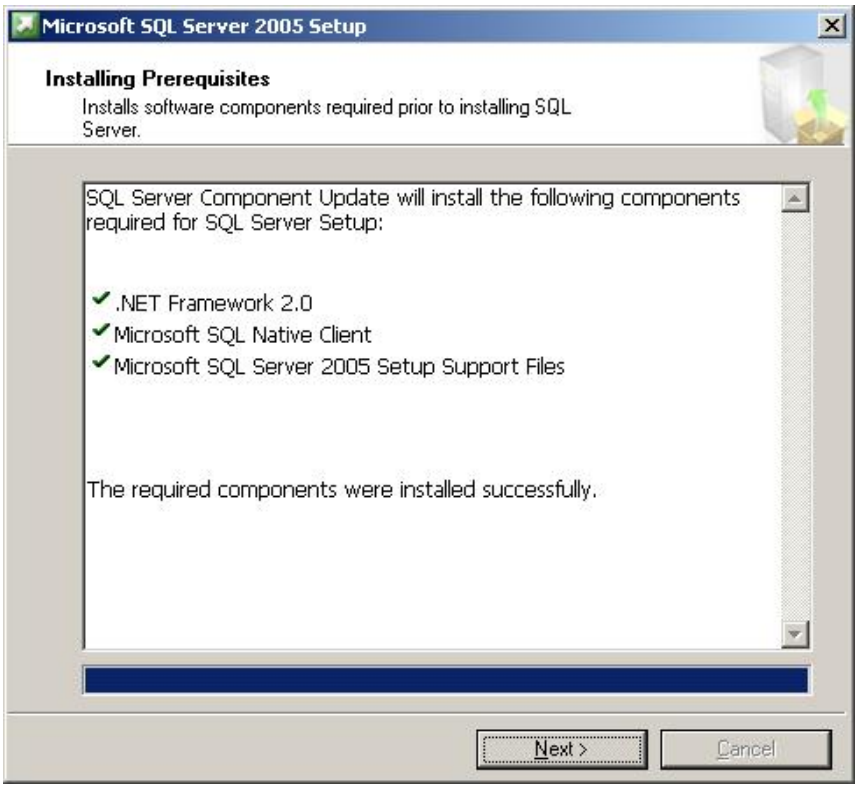
Accept the EULA and click ñNextò



erver support files and .NET Framework

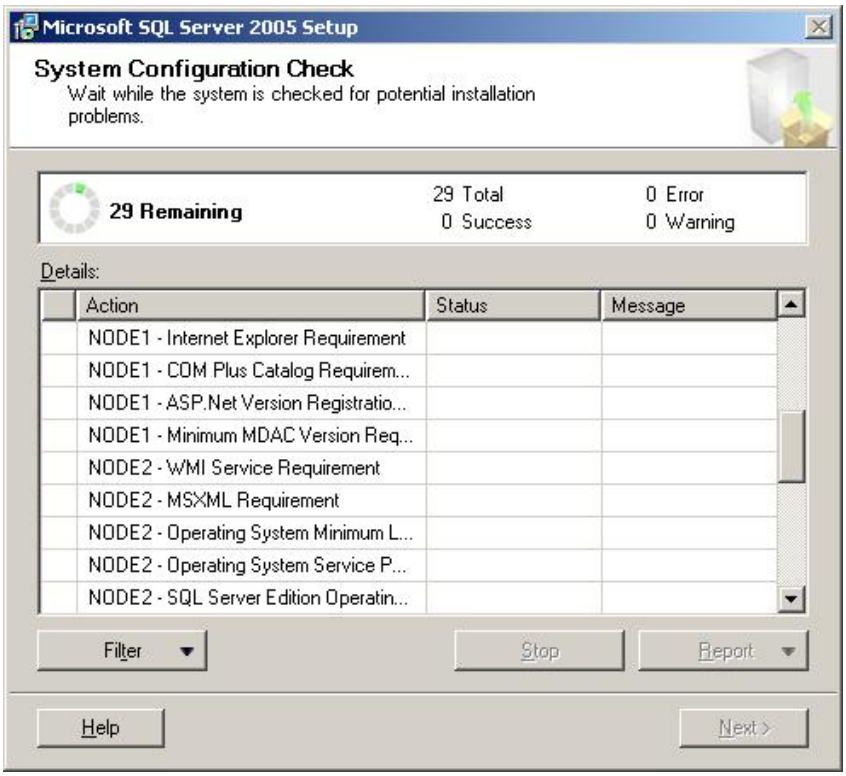


Click ñNextòto continue;

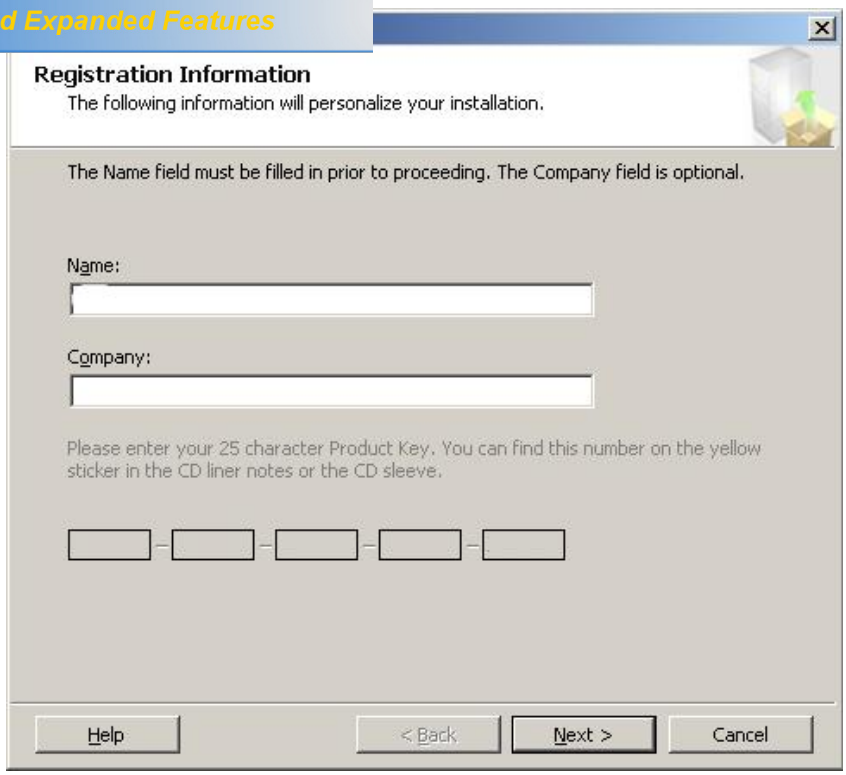


ialog

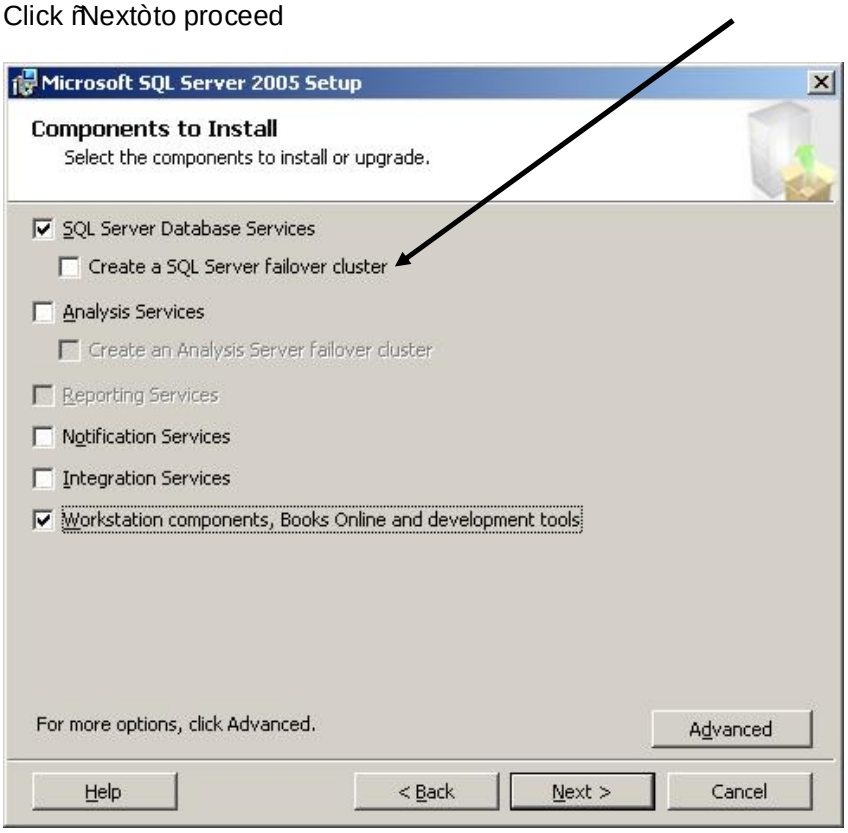
Click ñNextòto the complete the System Configuration Check. Review any errors or warnings (IIS is only required for Reporting Services installations so ignore this)



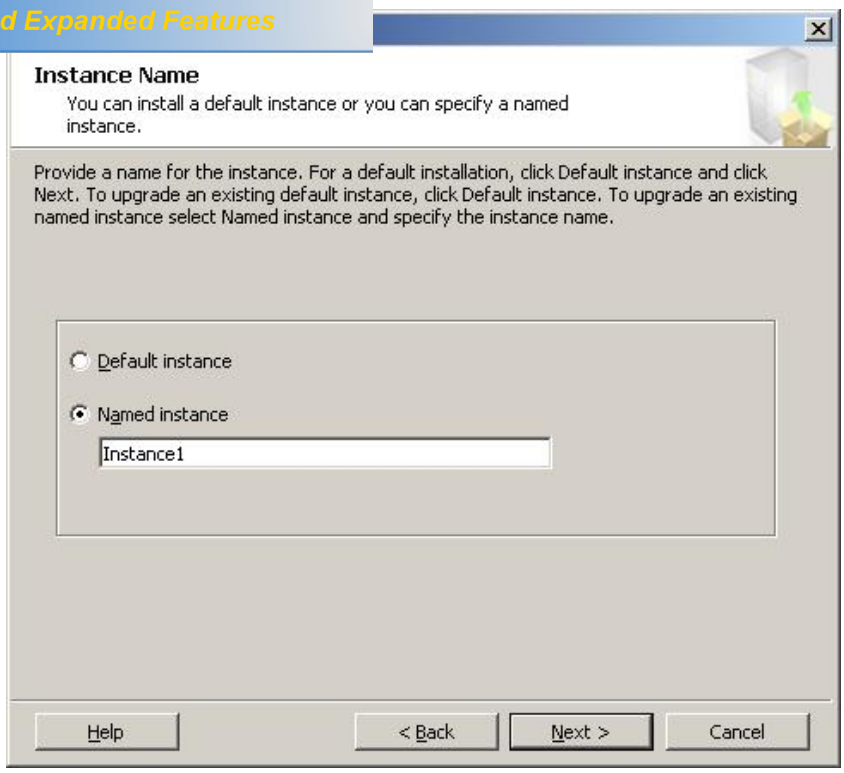
licence details (the product is pre-pidded)



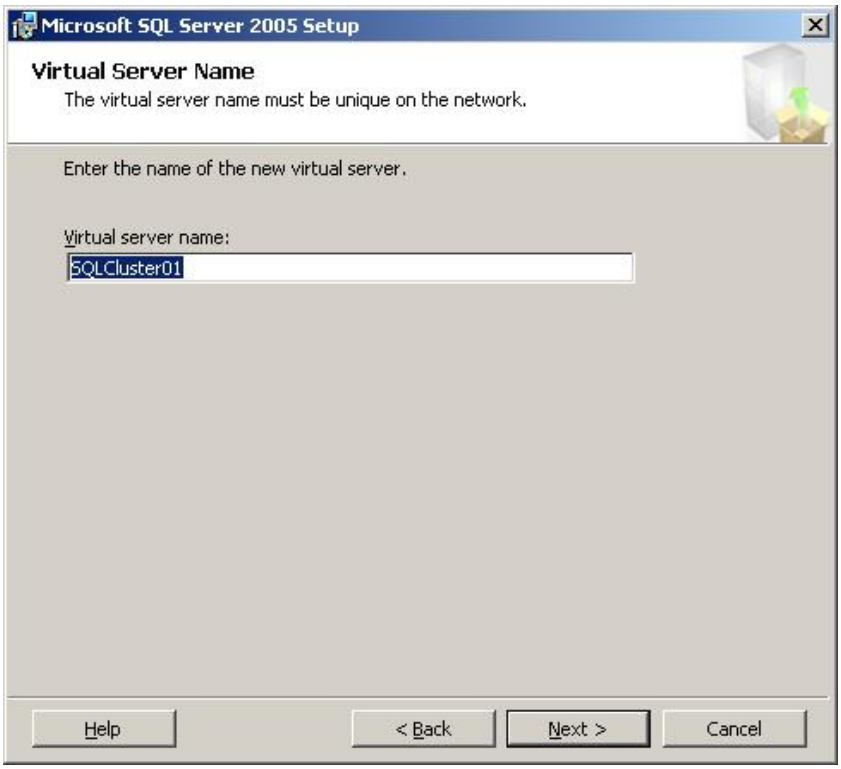
Select the options to install, note the option for a fail over cluster (select this now). Click ñNextòto proceed



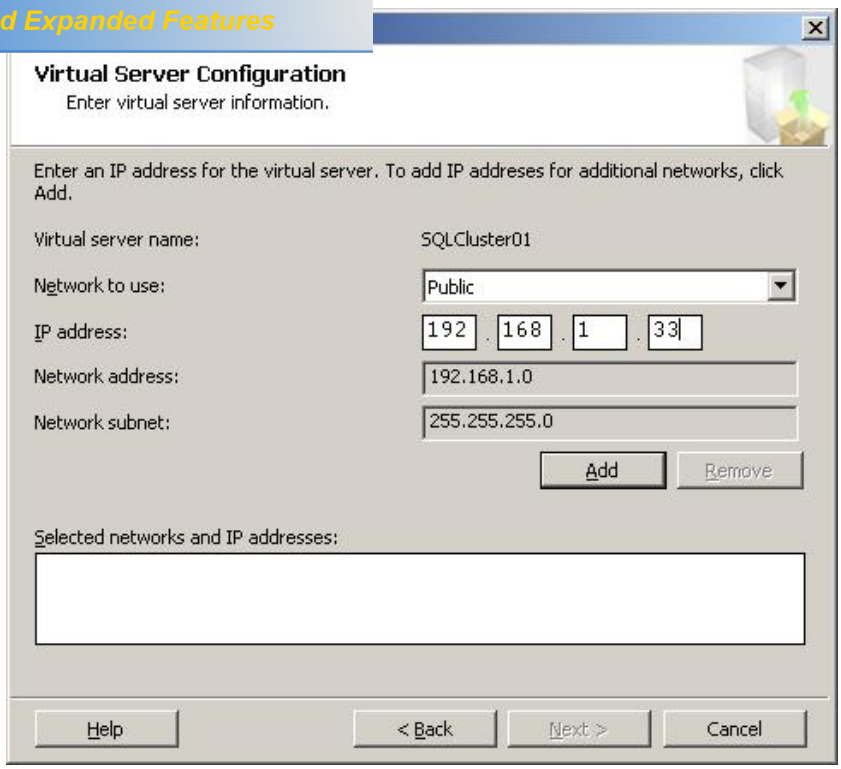
click ñNextò



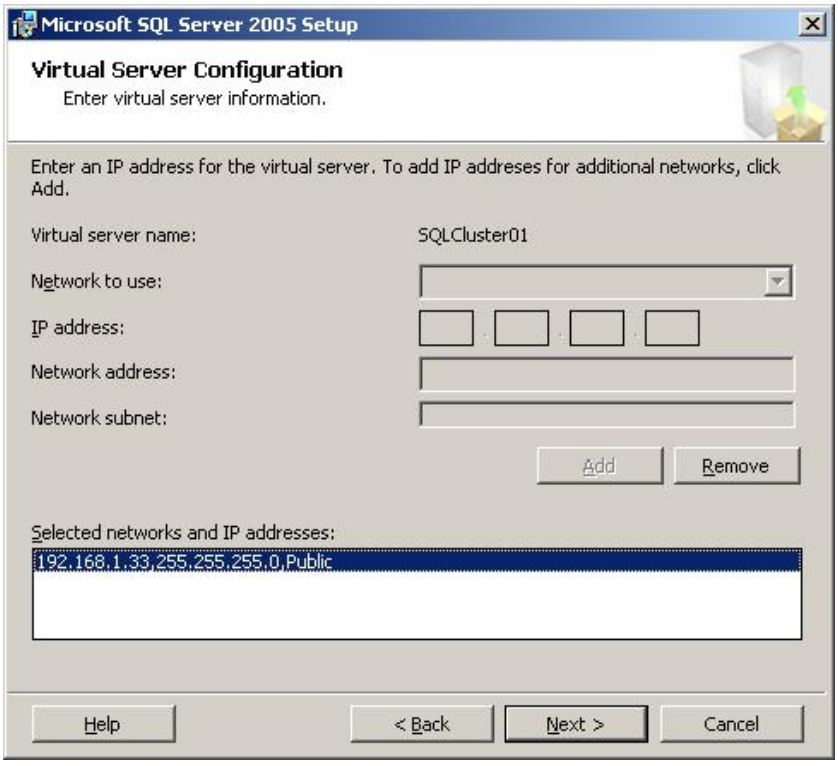
Supply a unique Virtual network name. For more info on network names and named instances see Appendix B.



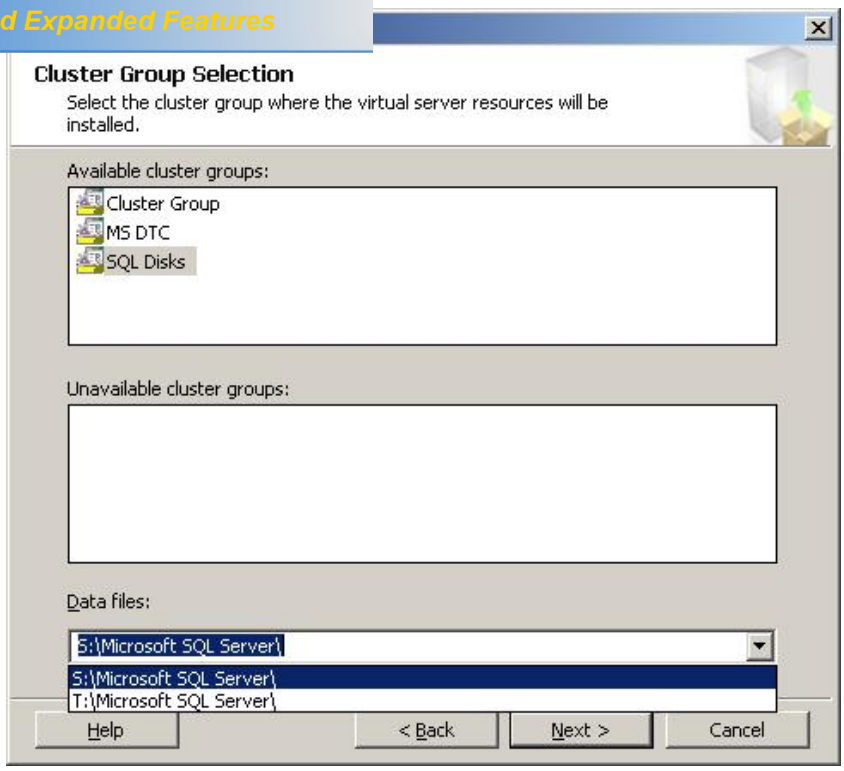
tual network name and click ñAddò



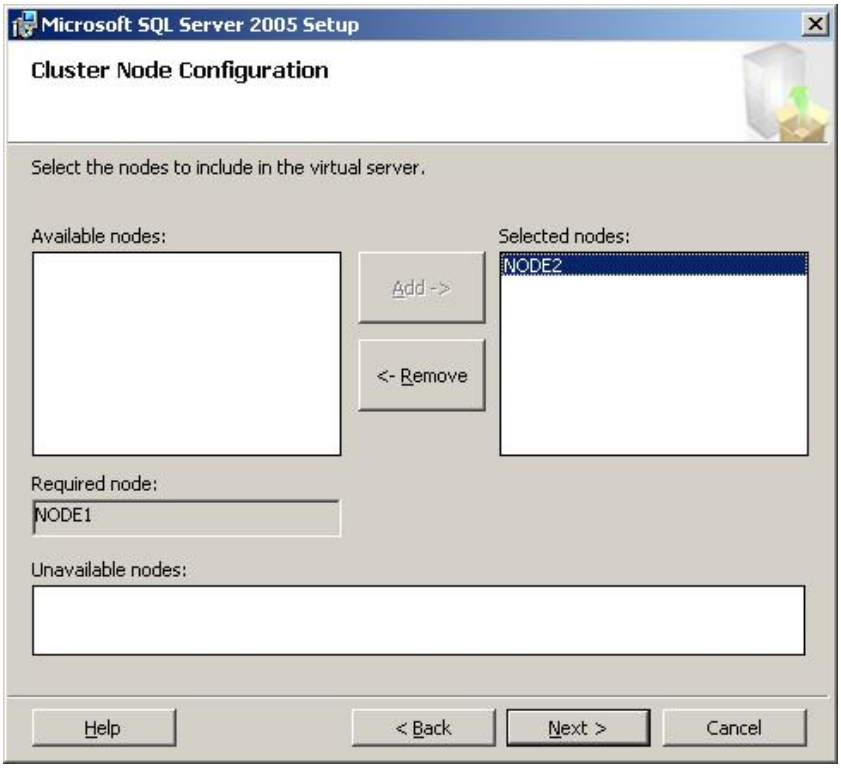
Then click ñNextòto proceed



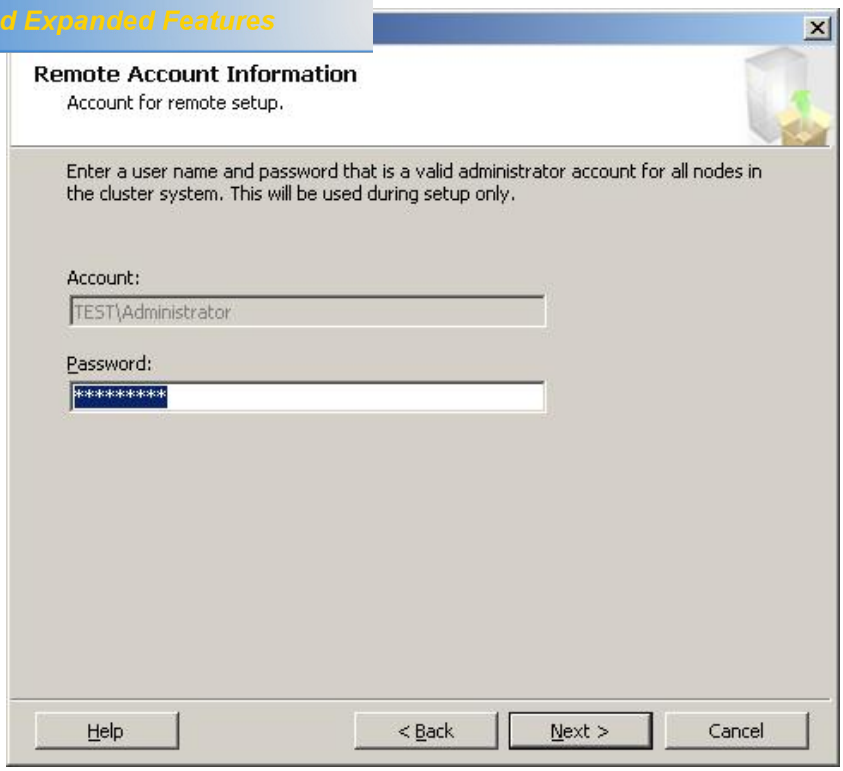
contains the resources you wish to use;



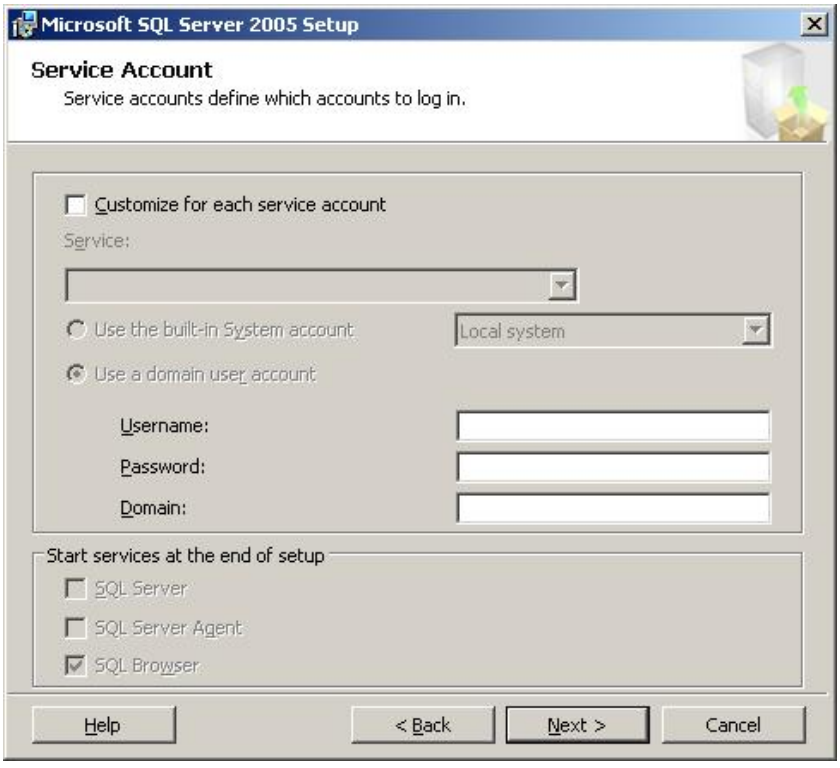
Select the required nodes to participate in the SQL Server cluster and click ñNextò



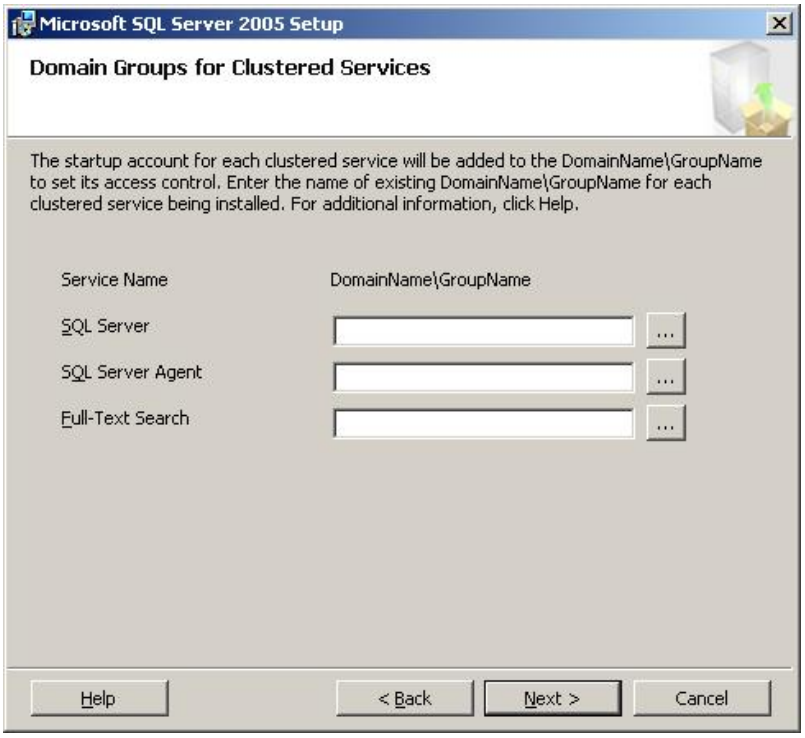
unt for the remote setup;



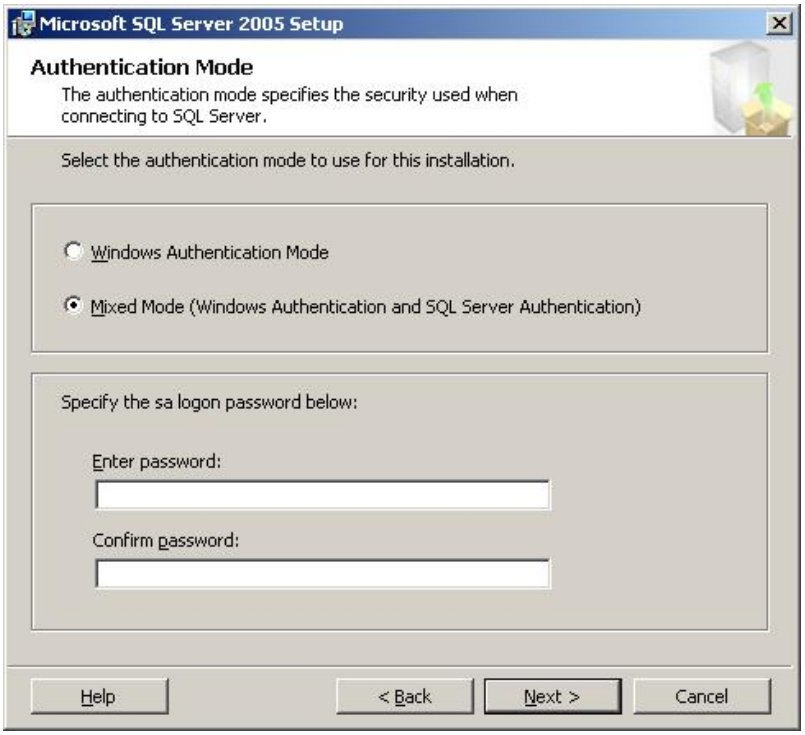
Switch to the domain controller and create a user account for the SQL Server service. Supply the service account information and click ñNextò



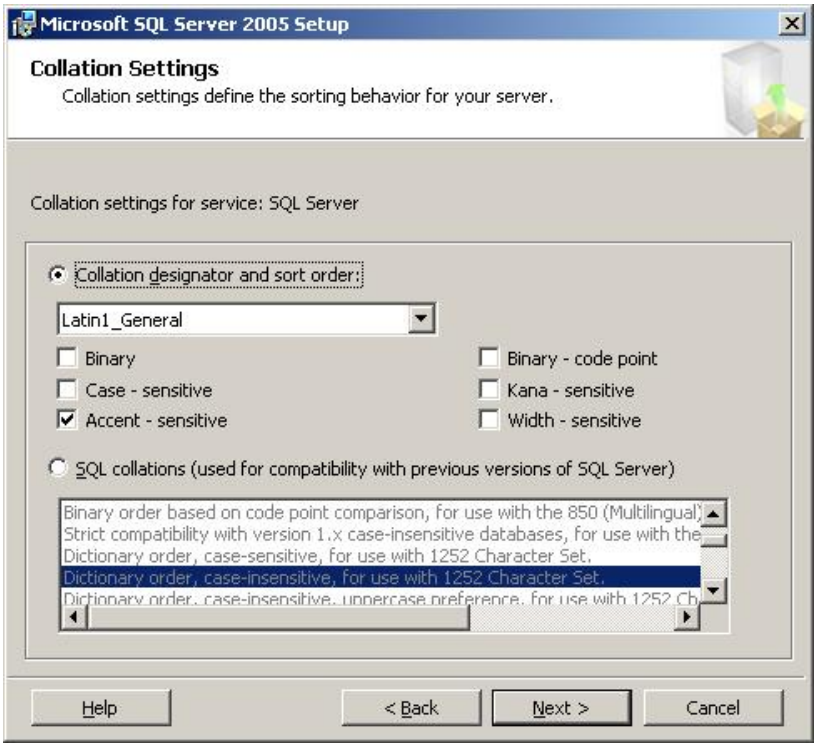
r and create a set of Global security groups for the SQL
ate a group for each resource indicated below, or create
rver service domain user account must be a member of
the group(s). Supply the group name(s) and click ñNextò



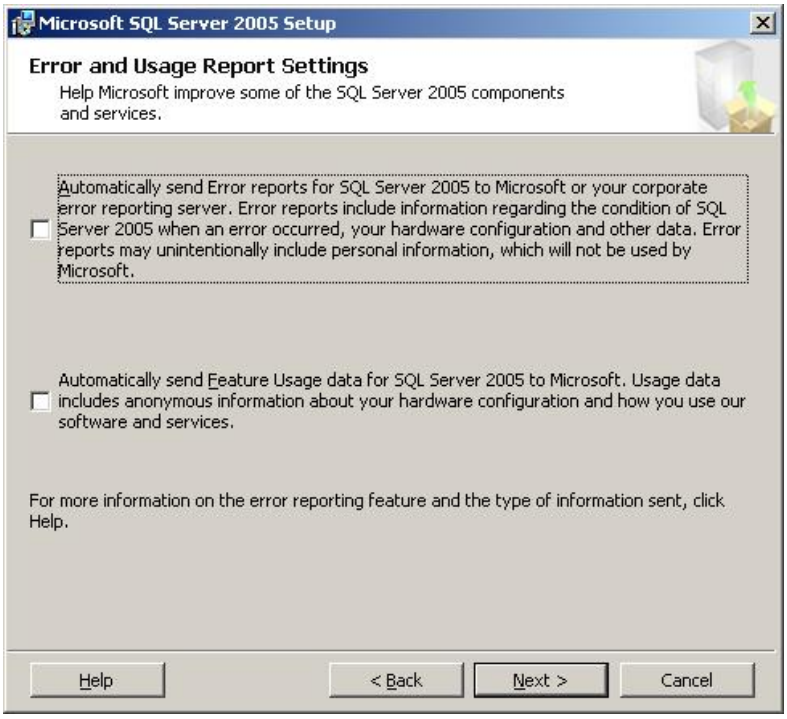
Select the SQL Server authentication method and click ñNextò

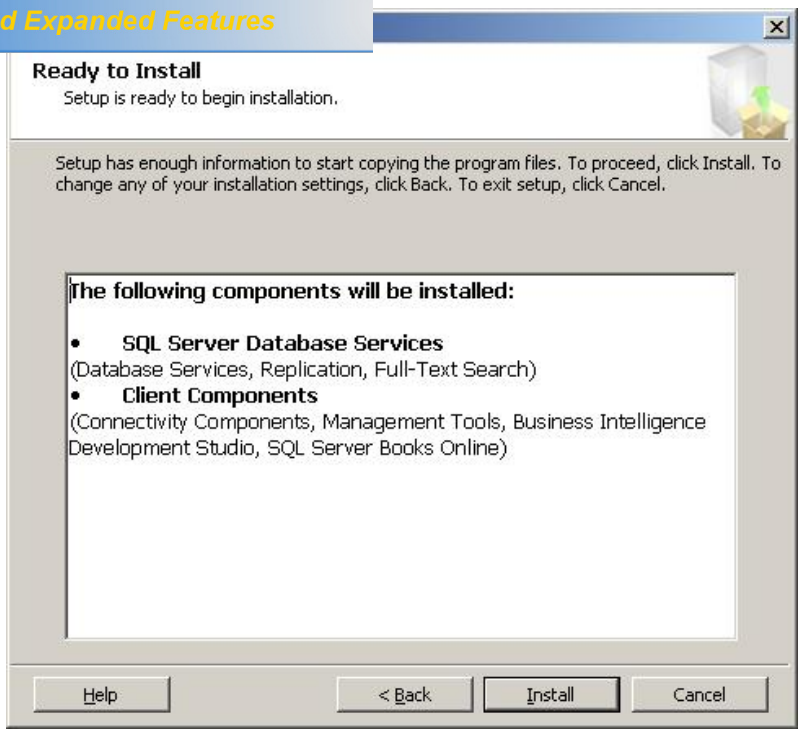


n (if you set your Windows regional settings correctly
Click ñNextò
ed, the Regional Settings on the server are incorrect, stop the installation and check and correct the regional settings.

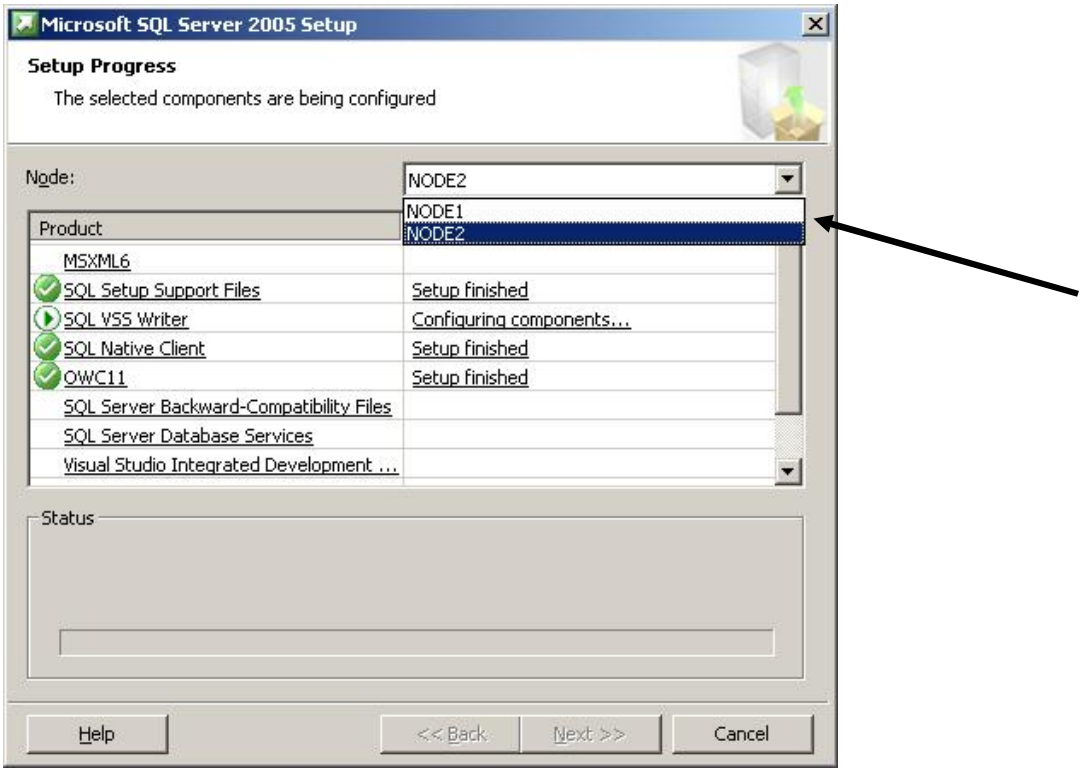


Click ñNextò

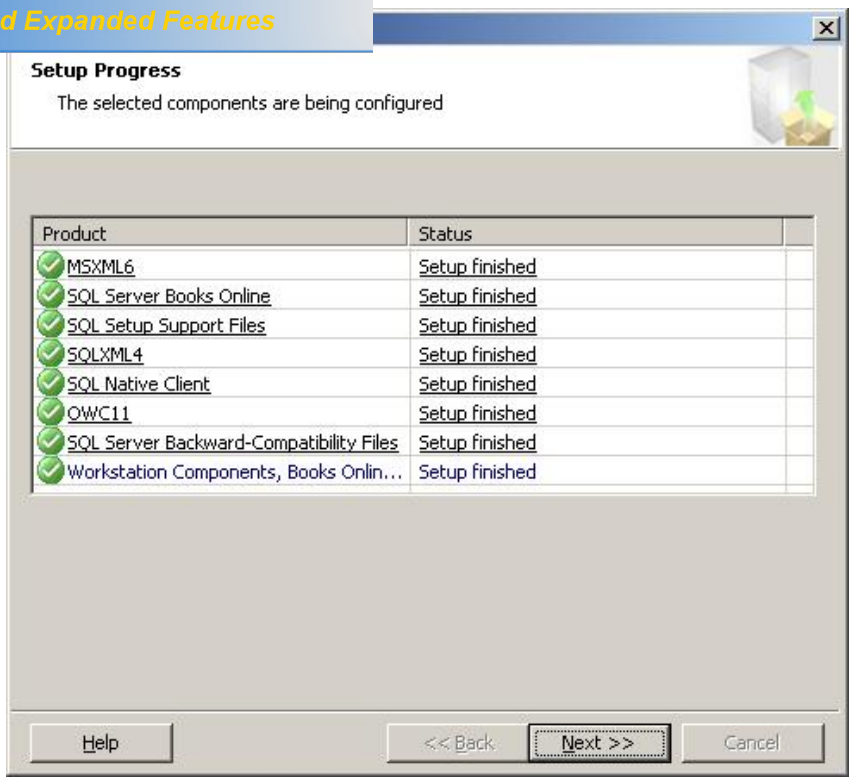




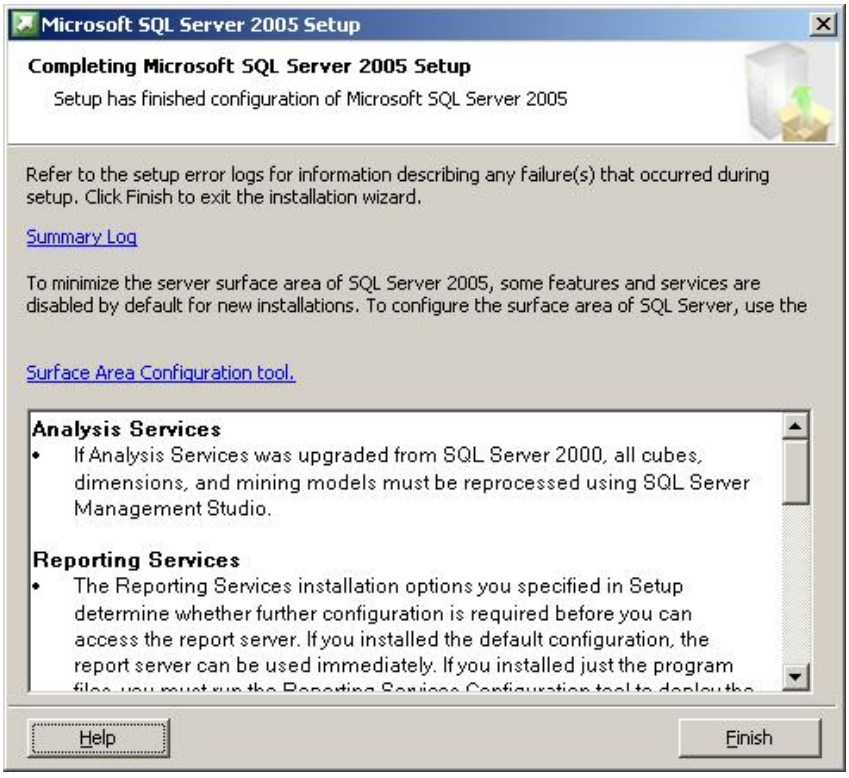
Setup displays the progress on each node via the drop down list indicated;



pleted click ñNextò



Click ñFinishò



NSTANCES & NETWORK NAMES

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 ñInstance1òand 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

dded to the system as there are now more names and
ne computers. In the clustered environment it is
egard 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.