DELL POWEREDGE M420: A MICROSOFT SQL SERVER 2012 ALWAYSON FAILOVER CLUSTER REFERENCE ARCHITECTURE



for Microsoft® SQL Server® 2012 AlwaysOn Failover Cluster Instances





A Principled Technologies Reference Architecture commissioned by Dell Inc.

WHAT YOU WILL LEARN

- The features and advantages of the Dell PowerEdge M420
- How to install and configure your Dell PowerEdge M420 hardware
- How to install Microsoft SQL Server 2012 on the Dell PowerEdge M420
- How to configure Microsoft SQL Server Failover Clustering

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EXECUTIVE SUMMARY

Data center space almost always comes at a premium. For that reason, it's important to consider not only performance and manageability, but also the amount of physical space your servers use when you are selecting a blade server to run your database applications. The ultra-dense, quarter-height Dell PowerEdge M420 blade server lets you fit twice as many servers in a single chassis than if you were using conventional half-height blades, without sacrificing performance or other features. Combined with high-performance storage and network options, such as the Dell EqualLogic PS6110XS storage array and Dell Force10MXL 10/40GbE switches, the M420 is able to provide excellent performance in a compact form-factor.

Dell designed the Dell PowerEdge M420 blade server specifically to meet the needs of organizations that want to maximize their data center space. In this reference architecture, we look at some of the many benefits that the Dell PowerEdge M420 server can bring to data centers in combination with the EqualLogic PS6110XS and Force10MXL switches, and describe in detail the setup of a common clustering configuration: Microsoft SQL Server 2012 AlwaysOn Failover Cluster Instances running on Microsoft Windows Server 2008 R2 on the Dell PowerEdge M420.

ABOUT THE TEST ENVIRONMENT

To create this guide, we set up and tested a SQL Server 2012 Failover Cluster with Dell PowerEdge M420 servers. Figure 1 presents a concise configuration summary for the solution we tested.

Solution	Dell PowerEdge M420 solution
Servers	2 x Dell PowerEdge M420
Operating system	Microsoft Windows Server 2008 R2 SP1
Database	Microsoft SQL Server 2012
Switches	2 x Dell Force10 MXL 10/40GbE
Storage	1 x Dell EqualLogic PS6110XS

Figure 1: General configuration summary for the solution we tested.

For more detail about the configuration of the servers we used, please see

Appendix A.

Features of the Dell PowerEdge M420 blade server

The new Intel[®] Xeon[®] processor E5-2470-powered Dell PowerEdge M420 blade server (see Figure 2) sets a new standard for computing density in a blade environment, all using your existing Dell PowerEdge M1000e blade enclosure. Features include:

- **Double the computing power per rack unit.** Quarter-height blades capable of handling Intel Xeon processor E5-2400-series parts in a two-socket configuration, with up to eight cores per processor allow you to use your rack space to its maximum potential.
- **Cost-efficient upgrade.** Utilizing the same M1000e chassis as previous Dell blades, deploy the PowerEdge M420 using the power, cooling, and network infrastructure already in your data center.
- Management. The Dell OpenManage[™] suite of tools, combined with the Integrated Dell Remote Access Controller (iDRAC7), give you maximum flexibility in administering your computing infrastructure.
- Connectivity. Snap-in FlexIO technology provides the backbone for a flexible, high-speed interconnect system. With options including 1 and 10 Gigabit Ethernet, Fibre Channel, InfiniBand[®], and the new Dell Force10 MXL 10/40GbE blade switches, the M420 is able to interface with your network at maximum speed.
- **Power efficiency.** Dell PowerEdge M420 servers implement leading industry power-efficiency standards, and are designed to optimize performance while maintaining low power consumption.
- Virtualization-ready. Supporting Hyper-V[™], Citrix[®] XenServer[™], and VMware[®] vSphere[®], the M420 contains two SD card slots for hypervisor, redundant hypervisor, and/or vFlash media support.

For details on the Dell PowerEdge M420 blade server configuration we used, see Appendix A.

Features of the Dell Force10 MXL 10/40GbE blade switch

The Dell Force10 MXL 10/40GbE blade switch brings new connectivity and performance options to blade computing environments with modular configuration options and standards-based 10/40GbE support. The Force10 MXL features:

 Performance. 10/40GbE connectivity minimizes latency and maximizes network throughput for data-intensive servers and applications, and Layer 3 routing guarantees fast traffic between isolated networks.



Figure 2: The Dell PowerEdge M420 blade server.

- Flexibility. Choose 1, 10, or 40GbE ports; FlexIO for plug-in QSFP+, SFP+; or 10GbE copper. Aggregate bandwidth on the FlexIO modules to support a maximum, bi-directional throughput of up to 160 Gigabits per second.
- Extend and simplify. The MXL is modular, and supports stacking for ease of management and higher performance. Support for converged switching allows iSCSI, NAS, Ethernet, and Fibre Channel traffic to all use the same physical hardware, potentially reducing additional management overhead and hardware costs.

Features of the Dell EqualLogic PS6110XS 10GbE iSCSI array

The Dell EqualLogic PS6110XS 10GbE iSCSI array combines the high-I/O strengths of solid-state storage and combines it with the raw capacity of traditional hard-disk drives in a single-chassis solution. Features include:

- Agility. Use storage that fits the demands of your server or application. Dell management software allows administrators to dynamically allocate storage on SSDs or HDDs, depending on the performance requirements for a specific situation.
- **Upgradable.** Start out using your existing 10GbE SFP+ modules, and build out to cost-effective 10GBASE-T as your budget allows. Move volumes between storage pools without downtime, and change hardware without disruption.
- **Robust.** Vertical port sharing keeps your bandwidth at full speed, even if a network port fails. Automatic load-balancing keeps data moving reliably to and from your physical or virtual server farm.
- **Management.** EqualLogic Host Software, Host Integration Tools, and EqualLogic SAN Headquarters (SANHQ) provide the tools administrators need to keep a high-level view of the storage system, while providing the flexibility to make granular changes as needed.

About Microsoft SQL Server 2012

According to the Microsoft Web site, SQL Server 2012 provides Mission Critical Confidence with greater uptime, blazing-fast performance and enhanced security features for mission critical workloads; Breakthrough Insight with managed self-service data exploration and stunning interactive data visualizations capabilities; Cloud On Your Own Terms by enabling the creation and extension of solutions across on-premises and public cloud. SQL Server 2012 is available in three main editions: Enterprise, Business Intelligence, and Standard. For this reference architecture, we use the available trial of Enterprise Edition.

For more information about Microsoft SQL Server 2012, visit <u>http://www.microsoft.com/sqlserver/en/us/editions.aspx</u>.

SUPPORTING HARDWARE – POWEREDGE M1000E AND FABRIC

The Dell PowerEdge M1000e blade chassis and its supported fabric interconnects are designed for dense computing situations. Features of the PowerEdge M1000e include:

- Management. Reduces administrative demand by providing a secure centralized management interface for the chassis and blades within, using proven Web (SSL-encrypted) and CLI (SSH/Telnet) technologies.
- Simplified configuration. The Chassis Management Controller allows administrators to control up to nine enclosures and 144 server blades, including BIOS/firmware change management and updates, thermal monitoring, and power threshold configuration.
- Flexible I/O. Six interconnect sockets with the capability to support three fully-redundant fabrics, a passive midplane with more than 8Tbps in I/O bandwidth capacity, and FlexIO support provide a number of connectivity options for your servers.
- Reliability and efficiency. Six power supplies and nine fans, all hotswappable, allowing for no-downtime maintenance of key chassis components. All components are tuned for maximum power efficiency to reduce data center power consumption.

All situations vary and you should consider your specific scenario when designing your topology. In our case, we used two Force10 MXL 10/40GbE switches along with four Dell PowerConnect[™] M8024-K switches for fabrics A, B, and C in our PowerEdge M1000e chassis.

For redundancy, we combined the Force10 MXL switches in a single stack to support our iSCSI traffic, and also, we teamed the NICs on Fabric A in each of our two PowerEdge M420 nodes. For Fabrics B and C, we stacked the PowerConnect M8024-K switches and teamed the third and fourth NICs in each node for our client application and cluster heartbeat traffic. This configuration allowed for full redundancy and the highest level of throughput. Each networking situation will vary, so consult your network administrator and the network hardware manuals for best practices on balancing performance and redundancy. See Appendix B for specific details on Broadcom NIC teaming on the PowerEdge M420 using Microsoft Windows. Figure 3 shows our setup for this reference architecture.



Figure 3: The topology we used for this reference architecture.

Storage configuration

Storage considerations and best practices

The storage subsystem plays a vital role in any database system design. In our test environment, we used a Dell EqualLogic PS6110XS as the main storage hardware for our SQL Server clustered instances. You should consider the following points when designing your storage for your SQL Server database environment:

- Always ensure that you have applied the latest firmware and updates to your storage subsystem and storage network hardware.
- If using iSCSI, consult the manufacturer's best practices for switch configuration, such as settings related to Jumbo Frames, Flow Control, Spanning tree, and so on.
- If using iSCSI, use VLANs to separate storage traffic when physically separate networks are unavailable.
- Redundancy is critical always plan for and provide multiple paths for your hosts to communicate with your storage. Use multipath drivers from the storage hardware vendor to ensure optimal performance.
- Use some type of tiering if possible if your environment does not contain an EqualLogic PS6110XS or other storage with auto-tiering functionality, consider tiering your data manually, placing critical and volatile database files on faster storage, and placing data accessed less frequently on slower storage.
- Consider the workload application workloads can vary greatly in data access patterns, and can therefore affect your system's performance. OLTP workloads and SQL Server tempdb system databases should generally be placed on RAID 10 volumes, while read-intensive OLAP workloads can be placed on RAID 5 volumes.
- SQL Server transaction logs should go on RAID 10 volumes for fastest write completion. When possible, SQL Server transaction log files should reside on separate physical media.
- Create separate volumes for SQL Server database data files, database log files, and tempdb files. This allows for flexibility in file placement on the underlying storage.

Each situation and application design is different. Consider all layers of your hardware and software stack and their interoperability prior to establishing a storage design.

Configuring the Dell EqualLogic PS6110XS

Thanks to the unified management interface of Dell EqualLogic storage (see Figure 4), configuring the Dell EqualLogic PS6110XS is like configuring any other Dell EqualLogic array. To configure your storage, you should:

- Configure your group, if not already configured. You can perform this action via a serial connection to the first member array, using the setup command.
- Configure RAID levels on your arrays. In the Web interface, right-click the member, and choose Modify Raid Configuration.
- Create the volumes and configure authentication to those volumes. In the Web interface, click Volumes, and select Create volume. You can configure volume access from the Access tab.
- After configuration, use SAN HeadQuarters (SANHQ) to monitor your SAN for any issues.
- Monitor the Dell EqualLogic support site for any firmware or Host Integration ToolKit upgrades.

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Figure 4: The Dell EqualLogic management Web interface.

Server configuration

Dell PowerEdge M420 considerations and best practices

The Dell PowerEdge M420 blade server ships with the Intel Xeon processor E5-2400-series in a two-socket configuration and with up to 192GB RAM. When configuring your PowerEdge M420 hardware, consider the following:

- Most database workloads are RAM intensive. Configure your server with enough RAM to handle your database workloads.
- Core count options for the PowerEdge M420 are 4, 6, and 8. Processor cache options range from 10MB to 20MB cache. We recommended buying the processors with as many cores and as much cache as your budget allows for maximum performance. This is especially true for CPU-intensive database application workloads that may thrive with many cores, faster frequencies, or more CPU cache.
- Ensure your PowerEdge M420 BIOS and firmware are at the latest levels released by Dell.
- Test your workload patterns and performance profiles using the Dellsupplied BIOS power options to be as power-efficient as possible.

INSTALLING AND CONFIGURING THE OPERATING SYSTEM

Installing Microsoft Windows 2008 R2 and clustering prerequisites OS installation

To begin building your SQL Server 2012 Failover Cluster, start by installing Microsoft Windows Server 2008 R2 SP1 and all current Microsoft updates. The installation can be performed manually via physical media, using the iDRAC management functionality, or by mass deployment methods, such as those provided by Microsoft System Center Configuration Manager (SCCM) with the Dell Server Deployment Plugin. Basic OS installation is outside the scope of this paper.

After installing the operating system and updates, the next preparation steps are simple:

- Assign a static IP address to the servers that will be members of the SQL Server cluster.
- Join each server node to the Active Directory[®] domain, which SQL Server AlwaysOn Failover Cluster Instances require.

SQL Server Failover Clustering prerequisites and considerations

Though Microsoft has streamlined the cluster installation process greatly in SQL Server 2012, there are various prerequisites and points to consider prior to beginning your cluster installation and configuration. We list several of those considerations below.

- Join the Active Directory domain prior to beginning setup. Do not install SQL Server on a domain controller.
- Verify your hardware with Microsoft's recommendations. For full details on Microsoft recommendations, see: <u>http://msdn.microsoft.com/en-us/library/ms189910#Hardware</u>.
- The installation process requires the .NET4 framework and will install it if necessary. To save cluster installation time, you may consider installing .NET4 prior to beginning the cluster installation.
- Configure the Windows Server Failover Cluster feature in Server Manager, and create a cluster at the operating system level. For details, see Appendix C.
- Create the shared disk resources on your SAN prior to beginning installation, and add those disks in Windows Server Failover Cluster Manager.

Before installing your SQL Server AlwaysOn Failover Cluster, there are many considerations. For full details on all prerequisites and considerations, see the Microsoft Web site at: <u>http://msdn.microsoft.com/en-us/library/ms189910</u>.

SQL SERVER FAILOVER CLUSTER INSTALLATION AND CONFIGURATION Installing SQL Server 2012

In this section, we review the process of installing a SQL Server AlwaysOn Failover Cluster Instance on the PowerEdge M420 platform – first on one node, then on subsequent nodes. For more details on installing SQL Server 2012, consult the full Microsoft Books Online documentation at <u>http://msdn.microsoft.com/en-</u> <u>us/library/bb500469</u>.

Installing SQL Server 2012 on the first cluster node

In SQL Server 2012, Microsoft provides a cluster-specific installation option, streamlining the process for systems and database administrators. Whereas in past versions, systems and database administrators had a long list of manual prerequisites, in SQL Server 2012, the installer completes much of the work. The cluster installation option includes a prerequisite checker and other features that automate aspects of cluster configuration. The full installation may take 30 to 60 minutes depending on the specific services and security your database environment needs.

To begin the installation, attach the SQL Server 2012 installation media to the server, either via virtual media or physical media, and begin setup. The first screen that appears is the SQL Server Installation Center on the Planning page. To view all installation options and begin the setup of SQL Server 2012, click Installation. Below, we walk you through the specific steps for installing the first node of the SQL Server failover cluster instance.

- Sta Server Installation Ce New SQL Server stand-alone installation or addifeatures to an misting installation Flanning Loundh a wibard to install SQL Server 2012 in a non-clustered environment or to add features to an existing SQL Server 2012 instance. Installation Maintenance Tools New SQL Server fallower cluster installation Resources Launch a waard to install a single-node 50%. Server 2012 fallover cluster. Advanced Add node to a SQL Server Fallover cluster Add holds to a big, between rational following SQL Server 2012 Failower cluster. Upgrade from SQL Server 2005, SQL Server 2008 or SQL Server 2008 R2 Launch a woard to upgrade 503. Server 2005, 501. Server 2008 or 501. Server 2008 R2 to 501. Server 2012. SOL Server 2012
- 1. On the SQL Server 2012 installation page, click New SQL Server failover cluster installation.

 Prior to any user interaction, the SQL Server 2012 installer performs a quick system check to ensure that the server is prepared for the installation. If any warnings or alerts occur, verify that your server meets all requirements and best practices found at <u>http://msdn.microsoft.com/en-</u> <u>us/library/ms189910</u>. After any warnings or failures are resolved, click Rerun. After all checks are passed, click OK to continue the installation.



3. On the next page, enter your specific product key for SQL Server 2012 or select the free evaluation edition. Click Next to continue the installation.

SQL Server 2012 Setup		
Product Key		
Specify the edition of 9QL 5	erver 2012 to install	
Product Key Licenie Terms Product Lubates Instal Solup Files	Valdes this instance of 503. Server 2002 by entering the 25-character key from the Pionosit certificate of subtenticity or product polyaging. You can also specify a free etition of 503. Server, such as brakater on Express. Scheduten has the largest set of 503. Server features, as documented in 503. Server Boots Online, and a activated with a 180-dev expiration. To upgrade from one edition to another, run the Edition Lipp ade Woord "Specify a free editors"	•
		-
	< Bed: Next > Cano	+

4. Review the Microsoft License Terms carefully, select I accept the license terms, and click Next.



5. During this step, the SQL Server 2012 installer checks for updates and installs the necessary files to begin the installation setup process. Click Install to continue to the next section of the installation.

\$QL Server 2012 Setup		- 19
Install Setup Files		
SQL Server Setup vill now be installed.	be installed. If an update for SQL Server Setup is fo	und and specified to be included, the update vell also
Product Key License Terms	SOL Server Setup files are being installed or	itte sisten.
Product Updates	Tank	Sala
Install Setup Files	Scen for product updates	Completed
	Download Setup files	Skipped
	Extract Setup files	Skipped
	Instal Setup files	In Progress
		< Back Install Cancel

6. Before continuing with the SQL Server 2012 configuration steps, the installer performs another system check to ensure that all prerequisites are met. This is the main prerequisite check in the installation process. Due to

NIC teaming and VLANs that we set up with our network configuration, the Microsoft Cluster Service verification presented a warning stating that two of the network adapters have the same MAC address. This warning is expected and will not affect the functionality of SQL Server failover instances. Again, if any errors are reported, resolve them following Microsoft best practices and prerequisites, re-run the system check, and click Next to continue.

Setup Support Rule	5	
Setup Support Rules identify before Setup can continue.	problems that might occur when you install SQL Server Setup support files. Fo	alures must be corrected
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TODUCT KEY		
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Nisk Space Requirements	Rule	Status
irror Reporting	Pusion Active Template Library (ATL)	Passed
Juster Installation Rules	Cluster Node	Passed
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nstallation Progress	Cluster Remote Access (SQLNODE1)	Passed
Complete	Ouster service verification	Possed
	Distributed Transaction Coordinator (MSDTC) installed (SQUNODE1)	Passed
	Distributed Transaction Coordinator (MSDTC) service	Passed
	Distributed Transaction Coordinator (MSDTC) clustered	Passed
	Microsoft Cluster Service (MSCS) duster verification errors	Passed
	A Microsoft Cluster Service (MSCS) duster verification warnings	Warning
	Remote registry service (SQLNODE1)	Passed
	Ø Domain controller	Passed
	Memorit MET Application Security	Passed

- 7. The next page again asks for the product key. Select the desired option, and click Next.
- 8. The installer once again presents the Microsoft Software License Terms. To continue, select I accept license terms, and click Next.
- On the next screen, select the desired setup role. Select the SQL Server Feature Installation. SQL Server PowerPivot for SharePoint is beyond the scope of this paper. Click Next to continue the installation.



 On the Feature Selection page, select the SQL Server features required for your database environment. This page includes brief descriptions of each feature as well as required prerequisites for each feature selected. Click Next.



11. After selecting the desired features, the SQL Server installer runs a system check to ensure that the prerequisites for the selected features are present on the server.

🚼 Install a SQL Server Failover ()	uster	
Feature Rules Feature rules identify problems	that night block this setup operation based on the features selected.	
Setup Support Rules Product Key License Tenns Setup Role Feature Selection Feature Balac	Operation completed. Passed: 3. Failed D. Warning D. Skipped D. Hde details << <u>View detailed report</u>	Revun
Instance Configuration Dek Space Requirements Ouster Dek Selection Ouster Dek Selection Ouster Dek Selection Ouster Network Configuration Environ Reporting Ouster Distallation Rules Ready to Distall Installation Progress Complete	Date Claster supported for editors Image: Claster supported for editors Prior Visual Studio 2010 Instances requiring update. Prior Visual Studio 2010 Instances requiring update. Prior Visual Studio 2010 Instances requiring update. Prior Visual Studio 2010 Instances requiring update. Prior Visual Studio 2010 Instances requiring update.	Status Executed Executed Executed Executed
	<back.< td=""><td>Next > Cancel Help</td></back.<>	Next > Cancel Help

12. Generally speaking, when installing failover cluster instances, you should choose to install a named instance. Enter a name for your SQL Server cluster network and failover instance. Click Next.

Install a SQL Server Failover Cl	luster					
Instance Configuration	DIN 3D for the instance of SQL Serve	r. Instance ID becom	es part of the inst	allation path.		
Setup Support Rules Product Key License Tems Setup Role Festure Selection Festure Selection Testance Configuration Disk Space Requirements Cluster Resource Group Cluster Resource Group Cluster Resource Group Cluster Releview. Configuration Server Configuration Database Engine Configuration	schy the name and instance ID for the instance of SQL Server. Instance ID becomes part of the installation path. support Rules Specify a network name for the new SQL Server falover cluster. This will be the name used to duster on the network. Server SQL Server Network Name: Industrial Instance Selection C Default Instance Falses P Named Instance Selection Instance Rol Selected SQL Server directory: C/Program Flest/Microsoft SQL Server() Selected SQL Server directory: C/Program Flest/Microsoft SQL Server() Selected SQL Server instances and features on this computeri Instance Instance Cluster Network Nerver Peatures Selected SQL Server instances and Features in this computeri Instance Cluster Network Nerver Peatures	used to identify you	r failover			
Chater Installation Rules Ready to Install Installation Progress Complete	Intarce Club	er Nåetsvork Narse	Features	Edition	Version	Drata P
			< Back	Next >	Cancel	Help

13. Select a name for the cluster resource group. The cluster resource group is a logical container in Window Failover Cluster manager that pairs the SQL Server Failover Cluster Instance with its shared resources and dependencies. Using the cluster resource group, you can easily move failover instances from one server to another valid cluster node in your Windows Failover Cluster. A red square beside an existing resource group means it is in use by other services and applications and therefore unavailable. Click Next.

Create a new duster resource gro	up for your 50	3. Server fækrver skaster.	
Setup Support Rules Product Key License Terms Setup Role Peature Selection	Specify an duster resi duster resi SQL Ser	ane for the SQL Server cluster o ources will be placed. You can ch nurce group name to be created. wer cluster resource group name:	essures group. The duster resource group is where 500. Server failower cose to use an existing duster resource group name or enter a new 500. Server (INSTANCE001)
resture finales instance Configuration isis Space Requirements Duster Resource Group Duster Deli Selection Duster Idenority Duster Deli Selection Duster Idenority Duster Installation Rules leady to Install Dustel Install Dustel Install Dustel Install Dustel Install	Qualified (B) (B) (B) (C) (C) (C) (C) (C) (C) (C) (C	Noné Available Storage Cluster Group agiclusterOtz	Hessage The duater group 'Available Storage' is reserved by 'Windows Pallover Cl The duater group 'Eduater Group' is reserved by Windows Pallover Clast. The duater group 'indoluterDic' contains resource 'indoluterDic' of type
	1		Refred

14. Ensure that you have available cluster disks in the Windows Failover Cluster before proceeding. In our setup, we allotted three disks specifically for use by SQL Server: database, log, and the tempdb database. These shared disks allow for the instance to failover to another host. Click Next.

🍿 Install a SQL Server Failover Clu	der 🛛		
Cluster Disk Selection Select shared duster disk resource	e for your %). Server fallover	ckatur.
Setup Support Rules Product Key License Tenns Setup Role Feature Selection Feature Rules Instance Configuration Disk Space Requirements Ouster Resource Group	Specify the default de pages.	e shared disks to ive for all databas 56 shared disks i	be included in the SQL Server resource duater group. The first drive will be used as the es, but this can be changed on the Database Engine or Analysis Services configuration
Duster Network Selection Ouster Network Configuration Server Configuration Database Engine Configuration Error Reporting Ouster Installation Rules Heady to Install Installation Progress Complete	a AQL Server Falever Elaster ther Disk Selection at shared duster dak resources for your 5Q. Server falover clater. poort Rules (b) poort Rules (c) poor	Versage The disk resource 'DTC' is already in use by resource 'MSDTC-sightisterDtc'. To use The disk resource 'Quorum' cannot be used because it is a cluster quorum drive. Bafreah	
			< Bod: Bext > Cancel Help

15. Select the appropriate cluster network, and enter the desired IP address for the new SQL Server failover instance. Click Next.

🚼 Install a SQL Server Failover Clus	ter						
Cluster Network Config	ura	tion					
Select network resources for your :	sqt se	rver fallove	H CIUSON				
Setup Support Rules	Spec	ify the neb	work gett	ings for this failower	cluster:		
Product Key	ন	IP Type	DHCP	Address	Subnet Mask	Subnet(s)	Network.
License Terris	R	JPv4	Г	10.152.55.71	295.295.295.0	10.152.55.0/24	Ouster Network 2
Setup Mole		-					
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Instance Configuration							
Did: Space Requirements							
Cluster Resource Group							
Cluster Dick Selection							
Cluster Network Configuration							
Server Configuration							
Detabase Engine Configuration							
Error Reporting							
Cluster Installation Rules							
Ready to Install							
Installation Progress							
Complete							
							Befresh
					< 8	sok Next >	Cancel Help

16. SQL Server requires security user accounts for different services. For added security, Microsoft recommends that you assign individual low-permission Active Directory user accounts to each service and do not use administrator accounts. The default collation settings are typically sufficient, but you can find additional settings on the Collation tab. For more information regarding collation, see http://technet.microsoft.com/en-us/library/cc281995. Once all credentials are configured, click Next.

server contiguration							
Specify the service accounts and collation configuration.							
etup Support Rules vodust Key	Service Accounts Collation						
icense Terms	Microsoft recommends that you use a si	eparate account for each SQL Se	ever service.				
etup Role	Service	Account Name	Password	Shartup Type			
sature Selection	SQL Server Agent			Manual	-		
toture Rules	SQL Server Database Engine			Manual	-		
stance Configuration	SQL Full-text Filter Daemon Launcher	NT Service//HSSQLFDLaun		Manual			
isk. Space Requirements	SQL Server Browser	NT AUTHORITY/LOCAL SE		Automatic			
erver Configuration stabase Engine Configuration wor Reporting Juster Installation Rules ready to Install notallation Progress iomplete							

17. At the Database Engine Configuration screen, select the desired authentication mode. By selecting Mixed Mode, authentication to SQL Server can use both Windows logins and built-in SQL Server security. If you choose to enable Mixed Mode, enter a strong password for the SQL Server administrator account (sa). Next, add all Domain or Local Windows accounts that you wish to be included as a SQL Server administrator. To add the user that you are currently using to log into Windows, click the Add Current User button. Continue by clicking the Data Directories tab.

Specify Database Engine authent	inistrators and data directories.
Setup Support Rules Voduct Key Jiomse Terms Setup Role Seture Rules Instance Configuration Nak Space Requirements Duster Resource Group Duster Net Setection Duster Network Configuration Server Configuration Database Engine Configuration Server Configuration Database Engine Configuration Dister Installion Rules Leady to Install Installation Progress Complete	Data Devotories PILESTREAM kotion mode

18. This screen lists the various data and log directories used by the instance database engine. Default locations are presented first, but the locations can be adjusted based on your desired setup. For our setup, we had a separate cluster disk for each basic directory listed: data, log, and tempdb database.

😚 Install a SQL Server Failover Clus	ter .						
Database Engine Configuration Specify Database Engine authentication security mode, administrators and data directories.							
Setup Support Rules Product Key License Terns Setup Rule Pesture Stlection Pesture Stlection Disk Space Requirements Cluster Recourse Group Cluster Recourse Group Cluster Recourse Group Cluster Recourse Group Cluster Install Server Configuration Detabase Engine Configuration Error Reporting Cluster Installation Rules Ready to Install Installation Progress Complete	Server Configuration Data De Data De Qata nost directory: Syntam database directory: User database log directory: Temp DB directory: Backup directory: Backup directory:	ectories PELESTREAM	10 10 10 10 10				
		< Back Next > Cancel	нер				

19. Choose your Error Reporting feature preference, and click Next.

20. Before continuing to the install page, the SQL Server 2012 installer runs a quick system check for clustering rules. Resolve any warnings and failures before continuing with the installation.

🐩 Install a SQL Server Failover C	uster	_ 0 ×
Cluster Installation R	ules	
Setup is running rules to deterr	ine if the failover duster installation operation vell be blocked. For more information, click Help.	
Setup Support Rules Product Key License Terms Setup Role Feature Video Feature Rules Instance Configuration Disk Space Requirements Ouster Net Section Ouster Disk Section Ouster Disk Section Ouster Configuration Server Configuration Server Configuration Diskbase Engine Configuration Error Reporting Cluster Installation Rules Ready to Install Installation Progress Complete	Operation completed. Passed 2. Paled D. Warring D. Slipped D. Store details >> Yree detailed report	Brun
	< gadk Mont > Cancel	Help

21. On the Ready to Install page, review the installation summary, and ensure that all settings are configured appropriately. If there are any items that need to be changed, click Back until you are on the correct setup page. To begin the installation of the single-node SQL Server 2012 failover cluster instance, click Install.



22. The installer then begins to install and configure the new instance. This process will take 20 minutes or more to complete depending on the SQL Server features selected.

🚼 Install a SQL Server Failover (luster	
Installation Progress		
Setup Support Rules Product Key		
Setup Rule Feature Selection Feature Rules Indrance Configuration Disk Space Requirements Ouster Resource Group Ouster Rule Selection Ouster Rule Selection Ouster Rule Selection Ouster Rule Schliguration Error Reporting Clauter Installation Rules Ready to Install Installation Progress Complete		
		Next > Cancel Halp

23. After the installation completes, check the Complete window and make sure that all items have successfully installed. If any errors occur, review the test environment and prerequisites for any issues you may have overlooked. For

unresolved errors, refer to the SQL Server troubleshooting and support page at http://msdn.microsoft.com/en-us/sqlserver/bb895923.aspx.

💱 Install a SQL Server Palover Clu	ater	
Complete Your SQL Server 2012 Fallover do	unter installation is complete with product updates.	
Setup Support Rules Setup Rule Feature Selection Feature Rules Instance Configuration Disk Space Requirements Outer Resource Group Cuter Resource Group Cuter Network Configuration Server Configuration Server Configuration Error Reporting Outer Installation Rules Ready to Installation Rules Ready to Installation Rules Complete	Information about the Setup operation or possible next Febture Client Tools Connectivity Client Tools Connectivity Client Tools Biolowards Compatibility Management Tools - Baic Debalase Engine Services Pull-Foot and Senartic Extractions for Search SQL Server Replication SQL Browser Details: Merida Bry default, the Heip Viewer co Server, you can use the Help Ubrary Management Ioral components that you use to view and been installed. By default, the Heip Viewer co Server, you can use the Help Ubrary Management Ioral computer. For more information, see Up Schift Way microsoft com/Weinb/7LinkID=2248 702699	
	Summary log file has been saved to the following local CLProgram File/Microsoft 502, Server1105/Setup Soc (Summary SOLHOOEL 2012/0714 204722.bd)	en: bitraci/Acci20120714_204722
		Close Help

With the installation complete, the new SQL Server 2012 Failover Cluster Instance appears in the Windows Failover Cluster Manager under Services and applications.

Configuring multiple nodes

For the new failover instance to be highly available, you must add a node to your SQL Server 2012 clustered instance. In the installer, Microsoft includes an additional installation option: Add node to a SQL Server Failover cluster. This option starts an install wizard that walks the user through a typical SQL Server installation with a few added options. You must add the new node to the Windows Failover Cluster prior to beginning the SQL Server 2012 Add Node installation. To begin the installation of a new SQL Server Failover cluster node, insert the installation media into the second Windows failover cluster server node. When the SQL Server Installation Center window appears, select Installation, and click the Add node option.

 As in the initial setup of the first node, setup runs a quick system check to catch any problems that could interfere with the installation of the SQL Server failover cluster node. Once all errors are resolved, click OK to continue the installation.



2. A product key or use of the evaluation edition is required to continue through the installation. Select the desired option, and click Next to continue.

Specify the edition of 5QL Server 2012 to Install. Preduct Key License Terms Product Updates Install Sebup Files Validate this instance of 5QL Server 2012 by entering the 25-character law from the Noncoort certificate of authentity or product packaging. You can also specify a free edition 05QL Server (South Section 5QL Server), such as busication and product Updates Install Sebup Files • Specify a free edition: Install Sebup Files Install Sebup Files 	SQL Server 2012 Setup Product Key	
Product Key Validate this instance of SQL Server 2012 by whenhing the 25-character law from the Monoofh certificate of authentiaty or product packaging. You can also specify a free edition (\$20, Server, such as SQL Server (SQL Server, Such as SQL Server, Such as SQL Server (SQL Server, Such as SQL S	Specify the edition of SQL S	arvar 2012 to install.
	vadact Key konse Tenns voduct Updates nstall Setup Files	Validate this instance of 50% Server 2012 by inhering the 25-character key from the Morosoft certificate of achievable packaging. You can also speedly a free rollion of 50% Server, such as Evaluation or Express, Evaluation has the largest set of 50% Server features, as documented in 50%. Server Books Online, and is school with a 100-by separation. To upgrade from one watch to another, non-the Edition Upgrade Weard.

3. Carefully read through the Microsoft Software License Terms, and click Next to continue.



4. Click Install to continue. The installation wizard will begin a quick check for updates and install the necessary setup files to continue with the Add node operation.

🍀 SQL Server 2012 Setup			_ 🗆 🗙
Install Setup Files			
SQL Server Setup will now be ins be installed.	talled. If an update for SQL Server Setup is f	ound and specified to be included, the update will also	
Product Key License Terms	SQL Server Setup files are being installed o	in the system.	
Product Updates	Task	Status	
Install Secup Tiles	Scan for product updates	Completed	
	Download Setup files	Skipped	
	Extract Setup files	Skipped	
	Install Setup files	In Progress	
	1		
		< Back Install	Cancel
			/

 After the setup files have been installed, the wizard runs a system check to ensure that the server meets all prerequisites for adding it to an existing SQL Server Failover cluster. Resolve any errors and review any warnings, and click Next.

🛠 Add a Failover Cluster Node Setup Support Rule	s	- - -
Setup Support Rules identify before Setup can continue.	problems that might occur when you install SQL Server Setup support files	s. Failures must be corrected
Setup Support Rules Cluster Node Configuration Error Reporting Add Node Rules Ready to Add Node	Operation completed. Passed: 21. Failed 0. Warning 1. Skipped Hide details_<< <u>View detailed report</u>	0. <u>Re</u> -run
Complete	Rule	Status
	Remote registry service (SQLNODE2)	Passed
	Oomain controller	Passed
	Microsoft .NET Application Security	Passed
	Network binding order	Passed
	Windows Firewall	Passed
	DNS settings (SQLNODE2)	Passed
	WOW64 setup	Passed
	Windows Management Instrumentation (WMI) service (SQLNOD	DE1) Passed
	Cluster Remote Access (SQLNODE1)	Passed
	Distributed Transaction Coordinator (MSDTC) installed (SQLNOD	DE1) Passed
	Remote registry service (SQLNODE1)	Passed
	DNS settings (SQLNODE1)	Passed
	< <u>B</u> ack	Next > Cancel Help

6. Select the desired SQL Server Failover cluster for the new node. Click Next to continue.

🚼 Add a Failover Cluster Node								_ 🗆 ×
Cluster Node Configura Add a node to an existing SQL Ser	ation ver failover cluster.							
Setup Support Rules Cluster Node Configuration Cluster Network Configuration Service Accounts Error Reporting	SQL Server insta Name of this noo	nce name: le:	INSTAN SQLNOD	CE001				•
Add Node Rules Ready to Add Node	Instance Name INSTANCE001	Network Name CLUSTER0	D1-SOL	Features	Nodes SOLNODE1			
Complete								
					< <u>B</u> ack	<u>N</u> ext >	Cancel	Help

7. Ensure that the proper cluster network is selected. Because the node has already been added to the Windows Failover Cluster, the correct cluster network already exists and is selected. Click Next to continue.

Add a Failover Cluster Node						
Cluster Network Config	guration					
The current node that is being ad-	- led does not rea	ire anv	additional or new IP	addresses The ID	addraccae and subnate sho	un are
the previously configured settings	for the SQL Serv	er cluster	r, and cannot be m	odified. Review and c	lick Next to continue.	and a set
etun Sunnort Rules						
uster Node Configuration	Speciry the net	WORK Set	tings for this fallove	r cluster:		
uster Network Configuration	✓ IP Type	DHCP	Address	Subnet Mask	Subnet(s)	Network
rvice Accounts	IPv4		10.152.55.71	255.255.255.0	10.152.55.0/24	Cluster Network
or Reporting						
ld Node Rules						
ady to Add Node						
d Node Progress						
omplete						
	1					
						Refres
						I
				< <u>B</u> a	ack <u>iv</u> ext >	Cancer Help

8. Enter the passwords for each Active Directory user account assigned to the existing SQL services in the SQL Server failover cluster. Click Next.

Add a Failover Cluster Node					
Service Accounts					
Specify the service accounts an	d collation configuration.				
Setup Support Rules	Microsoft recommends that you use a set	parate account for each SQL Server	service.		
Cluster Node Configuration	Service	Account Name	Password	Startup Type	
Cluster Network Configuration	SQL Full-text Filter Daenion Launcher	NT Service/MSSQLFDLaunch		Manual	
Service Accounts	SQL Server Database Engine	sqlservice		Manual	
Croor Reporting	SQL Server Browser	NT AUTHORETVILIOCAL SERV		Automatic	×
kaa waan kunnii	SQL Server Agent	salagent	*******	Manual	
				,	

9. The installer gives you the option to enable Error Reporting. If you wish to continue without enabling Error Reporting, click Next.



10. Before the node is added to the SQL Server failover cluster, the installer runs a system check to verify that the system meets the requirements to begin the installation. Resolve any errors, and click Next.



 Review the Add node summary, and ensure that the proper SQL Server failover cluster has been selected for the new node. Click Install to begin the Add node installation. This process takes 10 minutes or more.



12. After the installation completes, verify that all features have successfully installed. If there are any errors, refer to the last step of the *Installing SQL Server 2012 on the first cluster node* section in this document.



SUMMING IT ALL UP

By utilizing the Dell PowerEdge M420 blade server with SQL Server 2012 AlwaysOn Failover Cluster Instances, you can create a self-contained, highly available database solution while using minimal rack space. The ability to cluster SQL Server instances for high availability and redundancy in such a small and dense form factor with the Dell PowerEdge M420 is a powerful combination for your enterprise database needs.

APPENDIX A – DELL POWEREDGE M420 SYSTEM DETAILS

Figure 5 presents the server configuration we used for this guide.

System	Dell PowerEdge M420 Blade Server
Power supplies	Dell PowerEdge M1000e Blade Enclosure
Total number	6
Vendor and model number	Dell A236P-00
Wattage of each (W)	2,360
Cooling fans	Dell PowerEdge M1000e Blade Enclosure
Total number	9
Vendor and model number	Dell YK776 Rev. X50
Dimensions (h x w) of each	3.1" x 3.5"
Volts	12
Amps	7
General	
Number of processor packages	2
Number of cores per processor	8
Number of hardware threads per core	2
System power management policy	Balanced
СРИ	
Vendor	Intel
Name	Xeon
Model number	E5-2470
Stepping	C2
Socket type	FCLGA1356
Core frequency (GHz)	2.3
Bus frequency	8.0 GT/s
L1 cache	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)
L3 cache	20 MB
Platform	
Vendor and model number	Dell PowerEdge M420
Motherboard model number	0MN3VC
BIOS name and version	Phoenix 1.2.4
BIOS settings	Default
Memory module(s)	
Total RAM in system (GB)	96
Vendor and model number	Samsung M393B2G70BH0-YH9
Туре	PC3L-10600R
Speed (MHz)	1,333
Speed running in the system (MHz)	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-36

System	Dell PowerEdge M420 Blade Server
Size (GB)	16
Number of RAM module(s)	6
Chip organization	Double-sided
Rank	Dual
Operating system	
Name	Windows Server 2008 R2 SP1
Build number	7601
File system	NTFS
Kernel	APCI x64-based PC
Language	English
Graphics	
Vendor and model number	Matrox [®] G200eR
Graphics memory (MB)	16
Driver	2.4.1.0 9/8/2011
RAID controller	
Vendor and model number	Dell PERC H310 Embedded
Firmware version	20.10.1-0084
Driver version	5.1.112.64 6/12/2011
Cache size (MB)	0 MB
Hard drive	
Vendor and model number	Dell M16CSD1-50UCV-D
Number of disks in system	2
Size (GB)	50
Туре	SSD
Ethernet adapters	
Vendor and model number	4x Broadcom [®] BCM57810 NetXtreme [®] II 10 GigE
Туре	Mezzanine
Driver	7.2.8.0 3/13/2012
USB ports	
Number	2 external
Туре	2.0

Figure 5: The server configuration we used for this reference architecture.

APPENDIX B – BROADCOM NETWORK SETUP

Below we outline the steps we used within Windows to create the necessary NIC teams we used in our SQL Server 2012 Failover Cluster environment using the Dell PowerEdge M420 Broadcom NICs with the Dell Force10 MXL and PowerConnect M8024-K 10Gb switches. To complete these steps, you must have the latest Broadcom Advanced Control Suite (BACS) installed on each server. The BACS provides more advanced networking tools, allowing for a more user-friendly interface for configuring NIC teams, hardware iSCSI, and various other networking operations. Also, make sure that the blade has connectivity to the iSCSI, domain, and cluster heartbeat networks. Your specific situation may vary based on specific mezzanine cards chosen in your PowerEdge M420 and your specific switches.

For detailed information on configuring NIC teaming with the BACS, see Dell documentation at

http://support.dell.com/support/edocs/network/BroadCom/71921/NetXtremeII/en/bac s.htm.

- 1. Set up advanced networking (iSCSI offload):
 - a. Open the Broadcom Advanced Control Suite 4 application.
 - b. Select the Broadcom 10Gb NIC port 1 from the list.
 - c. In the Configuration tab, enable iSCSI Offload Engine from the Resource Reservation sub-section.
 - d. Select the newly created VBD interface under the same port name.
 - e. In the Configuration tab, set the MTU size to 9000, assign a static IP address, and click Apply.
 - f. Repeat steps b-e for Broadcom 10Gb NIC port 2 and apply the appropriate IP address.
 - g. Repeat for the remaining server nodes.
- 2. We teamed two NICs for iSCSI and cluster heartbeat traffic, and two NICs for SQL Server application traffic. Set up advanced networking (NIC Teaming):
 - a. Open the Broadcom Advanced Control Suite 4 application.
 - b. From the Team Menu, select Create a Team.
 - c. At the Broadcom Teaming Wizard welcome screen, click Next.
 - d. Enter a name for the team (e.g., Team 1), and click Next.
 - e. Select Smart Load Balacing(TM) and Failover (SLB) for the Team Type, and click Next.

- f. Select both Broadcom 10Gb adapters from the list, click Add, and click Next.
- g. Select Do not configure a standby member, and click Next.
- h. From the Configure LiveLink list, select No, and click Next.
- i. Select Skip Manage VLAN, and click Next.
- j. Select Commit changes to system and Exit the wizard, and click Finish.
- k. Repeat for the second NIC team.
- I. Repeat for the remaining server nodes.

APPENDIX C – WINDOWS FAILOVER CLUSTER SETUP

Prior to the installation of a SQL Server 2012 Failover Cluster, a Windows Failover Cluster must be configured on the servers where the SQL Server Failover Cluster instances will run. Below are the specific steps we took to configure a basic Windows Failover Cluster with two nodes. Before this configuration, both servers must have network connectivity to all three networks (iSCSI, domain, and cluster heartbeat), have the Failover Clustering feature installed, and all cluster disk formatted and attached to each server. The servers must be joined to the domain.

 To begin the process of setting up the cluster with the first node, open the Failover Cluster Manager located in Administrator Tools. Use the validation wizard to check the setup prerequisites needed to create a functional cluster. To do this, click Validate a Configuration.

2. The wizard begins with an overview screen, and offers links to more information if needed. Click Next.

3. Enter the fully qualified domain name of the server nodes for the new cluster. The validation wizard checks the readiness of all servers added to this list. Click Next.

👹 Validate a Configu	uration Wizard		×
Select S	ervers or a Cluster		
Before You Begin Select Servers or a Cluster	To validate a set of serve To test an existing cluster	rs, add the names of all the servers. , add the name of the cluster or one of its nodes.	
Testing Options Confirmation Validating Summary	Enter name: Selected servers:	<u> </u>	Browse Add Remove
		< Previous Next >	Cancel

4. On the Testing Options screen, if this is the first time running a validation with the selected configuration, it is best to select Run all tests. If you are troubleshooting errors, the second option gives you the flexibility to quickly determine whether an error is fixed. Select the desired option, and click Next.



🖏 Validate a Configu	ration Wizard		×
Confirmat	lion		
Before You Begin Select Servers or a Cluster	You are ready to start validation. Please confirm that the following settings are correct: 		
Testing Options	Servers to Test		-
Confirmation Validating	sqlnode1		
Summary	Tests Selected by the User	Category	
	List BIOS Information	Inventory	
	List Environment Variables	Inventory	
	List Fibre Channel Host Bus Adapters	Inventory	
	List iSCSI Host Bus Adapters	Inventory	-
	To continue, click Next. More about cluster validation tests		
		< Previous Next > Ca	ncel

- 5. Click Next to begin the cluster validation. When the cluster validation is complete, review any issues, resolve them and run the validation wizard again. If you have no issues, move on the in process.
- 6. From the Failover Cluster Manager window, click Create a cluster...



Create Cluster Wi	zard ervers	X
Before You Begin Select Servers Access Point for Administering the Duster	Add the names of all the Enter server name:	e servers that you want to have in the cluster. You must add at least one server.
Confirmation Creating New Cluster Summary	Selected servers:	Add Remove
		< Previous Next > Cancel

7. Add the applicable servers FQDNs in the Select Servers screen.

Freate Cluster Wi	zard X
Before You Begin Select Servers Access Point for Administering the Cluster	Type the name you want to use when administering the cluster. Cluster Name: sqlcluster One or more IPv4 addresses could not be configured automatically. For each network to be used, make sure the network is selected, and then type an address.
Conrimation Creating New Cluster Summary	Networks Address Image: The symptotic state is a cluster state in the administrative Access Point for a cluster.
	< Previous Next > Cancel

8. Assign the cluster name, choose the network, and set the static cluster IP address.

9. Click Next to confirm and let the Create Cluster Wizard complete the cluster creation.

Safadover Charter Manager					
Pile Adam Ven Help					
🗢 🔶 🙇 🖬 📓 🖬					
Reference Custer Manager	Storage			Actions	
R R spices and applications	- Cummun of Plane			Sarage	
E 🖗 Notes	aumory or stores	per -		🚅 Add a dsk.	
SQLNODE1	- P			Ven	•
E Tehvoris	Stanoge: No.doka	Total Capacity: Total Difutes	Available Capacity: Total Distan	G Retrieb	
Cluster Network 1	No doko available	Free Space: 0 Bytes	Free Space: 0 Bytes	Map Help	
Quiter Events	No-doka in use	Pescerx Free IDS	Percent Free D1:	-	
	1		1		
	Des	2M.E	Current Diviner	-	
		No starage exists in this cluste	ι.		

- 10. Next, add the shared storage disks to your cluster. This includes a small volume for MS DTC usage, and any or all database shared storage you wish to be available for later use by the SQL Server cluster installation process.
- 11. Click Storage in the left pane, and click Add a disk in the right pane. Select your applicable cluster volumes and add the volumes to the cluster.

🧱 High Availability W	Vizard	×
to Select Se	ervice or Application	
Before You Begin Select Service or Application Client Access Point Select Storage Confirmation Configure High Availability Summary	Select the service or application that you want to configure for high availability: Image: DFS Namespace Server Image: DFS Namespace Server Image: DFS Namespace Server Image: Distributed Transaction Coordinator (DTC) Image: File Server Image: Generic Application Image: Generic Service Image: Generic Service Image: Message Queuing Image: Other Service Image: Other Service <th></th>	

 In the Failover Cluster Manager application, install Microsoft Distributed Transaction Coordinator (DTC). To do this, right-click Services and Applications and choose Configure a Service or Application.

🧱 High Availability W	'izard							×
Client Acc	cess Poir	nt						
Before You Begin	Type the	name	that clients will use when acc	essing this ser	vice or app	olication:		
Select Service or Application	Name:		sqlclusterDtc					
Client Access Point	One or mo the netwo	ne IPv rk. is. se	4 addresses could not be con elected, and then type an add	figured autom ress.	atically. Fo	or each ne	twork to be	e used, make sure
Select Storage			,					
Confirmation								
Configure High			Networks	Address				
Summaru		◄	10.152.55.0/24	10 .	152 .	55	. 70	
Summary								
		_						
	More abo	uthou	u cliente accesso a clustered s	oruioo or anni	liention			
	More about now clients access a clustered service or application							
					< <u>P</u> revio	us	<u>N</u> ext >	Cancel

13. Name the DTC service and provide a static IP address. Click Next.

🧱 High Availability V	Yizard			×
to Select St	orage			
Before You Begin Select Service or Application	Select the storage volume tha You can assign additional stor	t you want to assign to this serv age to this service or application	rice or application. n after you complete this wizard.	
Client Access Point	Name	Status		
Select Storage	Cluster Disk 1	Online File Sustem: NTES	500.01 GB (100.0% free)	
Confirmation	volume. (r)	The System. NTT 5	300.01 db (100.0% liee)	•
Configure High Availability				
Summary				
			< Previous Next > Cance	3

- 14. Select the cluster disk you wish to associate with the DTC service. To finish the DTC installation, click Next, and click Finish.
- 15. Finally, run the Add Node wizard from the Failover cluster Manager application. Right-click Nodes, and choose Add Node. Follow the prompts and enter the server name and applicable information to add other nodes to this Windows Failover Cluster.

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