EFFICIENT AND VERSATILE HARDWARE MANAGEMENT WITH DELL POWEREDGE VRTX

Simplicity. Efficiency. Versatility. Dell™ PowerEdge™ VRTX

Simplicity
Space savings through consolidation*

Efficiency
Multi-faceted management toolset

Versatility
Accelerate performance with PCIe SSDs*

Powered by Intel® Xeon® processor E5-2400 v2 product family

Businesses with remote offices or branch offices (ROBOs) can benefit from the automation and streamlining of management tasks with the products they integrate into their environment. With simplicity, efficiency, and versatility in mind, Dell designed the new PowerEdge VRTX, powered by the Intel Xeon processor E5-2400 v2 product family and running Microsoft® Windows® Server 2012 R2, so that administrators can maximize their ability to provide these automation and streamlining benefits to remote offices in a straightforward manner using established methods and toolsets.

In this report, we focus on the efficiency and versatility of the Dell PowerEdge VRTX by looking specifically at automation, deployment, monitoring, and management features. In the Principled Technologies labs, we found that the Dell PowerEdge VRTX offers IT administrators simplified cluster setup with the Dell OpenManage® Cluster Configurator, versatile hardware resource reassignment through shared PCIe slots, and efficient centralized management through Dell management tools. Additionally, we found that the Dell System Update Utility works seamlessly with Microsoft Cluster-Aware Updating to update your server nodes while keeping the failover cluster online and minimizing downtime.

*For performance and consolidation highlights, see the companion report, "Save space, increase efficiency, and boost performance in your remote office with Dell PowerEdge VRTX," at www.principledtechnologies.com/Dell/VRTX_performance_0314.pdf.

ENHANCED MANAGEMENT TOOLS WITH DELL POWEREDGE VRTX

When administrators must manually deploy a clustered solution to remote offices, and maintain that solution over time, the processes can become time-consuming, error-prone, and costly. The Dell PowerEdge VRTX addresses administrators' needs for efficiency by offering options that automate some of these management processes, and provides flexibility through its highly available infrastructure.

In the sections below, we show how the Dell PowerEdge VRTX offers automated approaches to complete the following management tasks:

- Deployment
    - Deploying and configuring a Microsoft Windows Server 2012 Failover Cluster using Dell OpenManage Cluster Configurator
- Maintenance
    - Performing activities typical of situations requiring replacement servers or server maintenance, which include the following:
        - Using the system board replacement feature
        - Reassigning high-performance PCIe SSDs between server nodes through a common PCIe bus
        - Migrating critical VMs across server nodes with no downtime through live migration and storage migration
        - Performing updates that are cluster-aware through the Dell Server Update Utility
        - Centralizing and automating management through Dell Chassis Management Controller (CMC) or scripting

As a part of the functional demonstration of the PCIe device reassignment, we ran a light to moderate database workload to exercise the solution during the management tasks, as this would be typical in an actual environment.

SIMPLIFIED DEPLOYMENT WITH DELL OPENMANAGE CLUSTER CONFIGURATOR

When configuring multiple servers manually, an IT administrator has to configure each server node with the same settings. This can be a repetitive, detail-oriented chore in which it is easy to overlook a setting. Failover clustering, which requires additional tuning and configuration so that all server nodes, networking components, and any shared storage is configured correctly and complies with the clustering requirement checks, further complicates this manual configuration process.

The Dell OpenManage Cluster Configurator is a tool that facilitates deploying a Microsoft Failover Cluster using the PowerEdge VRTX straight out of the box. The software comes pre-installed on each server node and is ready to implement into your

existing infrastructure once the system powers on. Rather than manually configuring each server node individually with the Windows Failover Cluster prerequisites, the OpenManage Cluster Configurator communicates with all four server nodes inside the Dell PowerEdge VRTX and lets you complete the work through a simple wizard, accessible through a single server node. You need only to enter the requested information one time; in a few steps, the Dell tool automates most of the Microsoft Windows Server Failover Cluster deployment process, including Hyper-V® and Cluster Shared Volumes (see Figure 1).
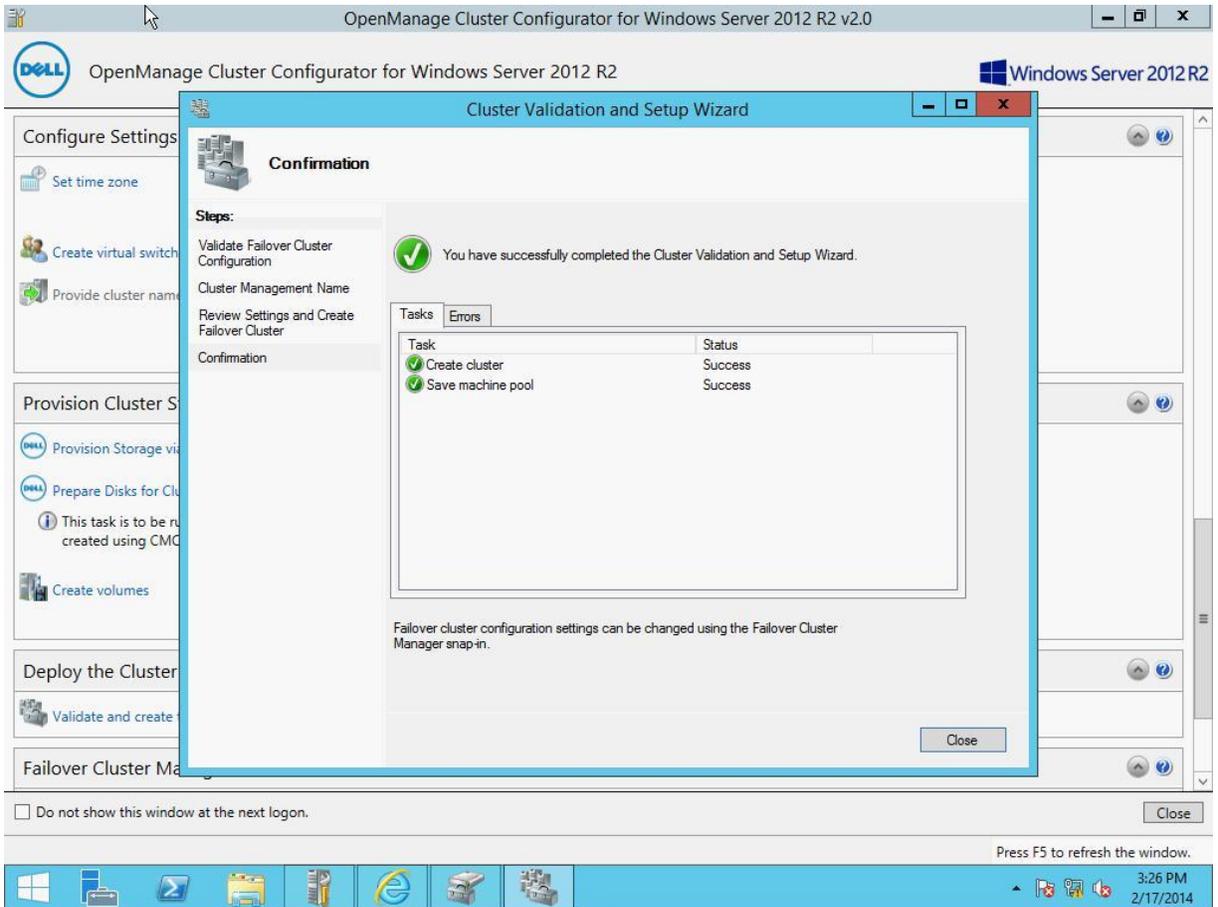
Figure 1: The Cluster Validation and Setup Wizard within OpenManage Cluster Configurator for Windows Server 2012 R2 v2.0.

In our tests, we found the Dell OpenManage Cluster Configurator allowed us to set up our cluster out of the box easily. Once we turned on the nodes, we saw the Cluster Configurator screen and all four nodes were detected automatically. Going through the list of wizards, we configured prerequisites for the cluster, shared storage options, and Microsoft Hyper-V settings across all nodes, from just one screen.

BUILT-IN VERSATILITY AND EFFICIENT MANAGEMENT IN DELL POWEREDGE VRTX HARDWARE

When troubleshooting hardware, administrators must carefully weigh the options and, when limited by inflexible hardware environments, must plan for service outages to repair a malfunctioning server. In some cases, the server may go offline, causing unplanned outages until the administrator can travel to the site to perform the repair. The Dell PowerEdge VRTX is designed with flexibility and management efficiency in mind. Shared storage and a shared PCIe bus, along with Windows Server failover clustering, provide a highly flexible hardware infrastructure that allows administrators to migrate files and virtual disks, and transfer storage and PCIe-based resources when a server node needs to go offline for repairs. The Dell PowerEdge VRTX also provides an embedded alerting tool, allowing administrators to troubleshoot remotely.

In our tests, we simulated a server node issue where the first of four server nodes needed to be replaced. This server node was hosting a high-performance VM and had an allocated PCIe SSD where the VM data resided. In the sections below, we show how Dell features simplified the management process at each step of this scenario.

Monitor and receive alerts centrally through Dell OpenManage Essentials

Dell OpenManage Essentials (OME) is a tool to monitor the health of your cluster. This Dell-provided software works by communicating directly to your systems through iDRAC7 with Lifecycle Controller, monitoring everything from temperature to hardware faults. Dell OME allows for efficient management by enabling administrators to view on a single interface any issues across the entire datacenter that need attention rather than having to monitor server nodes individually.

In our test scenario, Dell iDRAC7 with Lifecycle Controller on the Dell PowerEdge VRTX sent an alert to a remote-monitoring OME server indicating that a server node in our failover cluster had a failing network card that needed to be replaced. The administrator was able to see the issue quickly through the OME console and could take steps to remotely mediate the issue and prevent downtime.

Reliable remote parts replacement with Dell iDRAC7 with Lifecycle Controller

If a server component should need replacing, Dell iDRAC7 with Lifecycle Controller makes this easy by providing a feature that will automatically update a new part to the firmware version or the configuration of the replaced part, or both. The update occurs automatically when you reboot your system after replacing the part. It is activated through a license, and can be disabled remotely using Lifecycle Controller-Remote Services, or through the Lifecycle Controller.

Dell iDRAC7 with Lifecycle Controller also provides a feature to save a server profile backup of all of a server's settings. An administrator only has to take this saved

profile and load it onto the server; it is then configured identically to the state at which the backup was taken. In case of a catastrophic failure, the backup can be used to easily roll back a server's hardware configurations to a previous state. All of this can be done remotely, saving valuable travel and labor time for servers located in remote offices.

In our testing, Dell OME alerted the administrator of an issue with a server node. Using Dell's built-in iDRAC7 with Lifecycle Controller, our administrator's first course of action was to save the settings of the failing server node remotely in case of a more serious failure (see Figure 2).
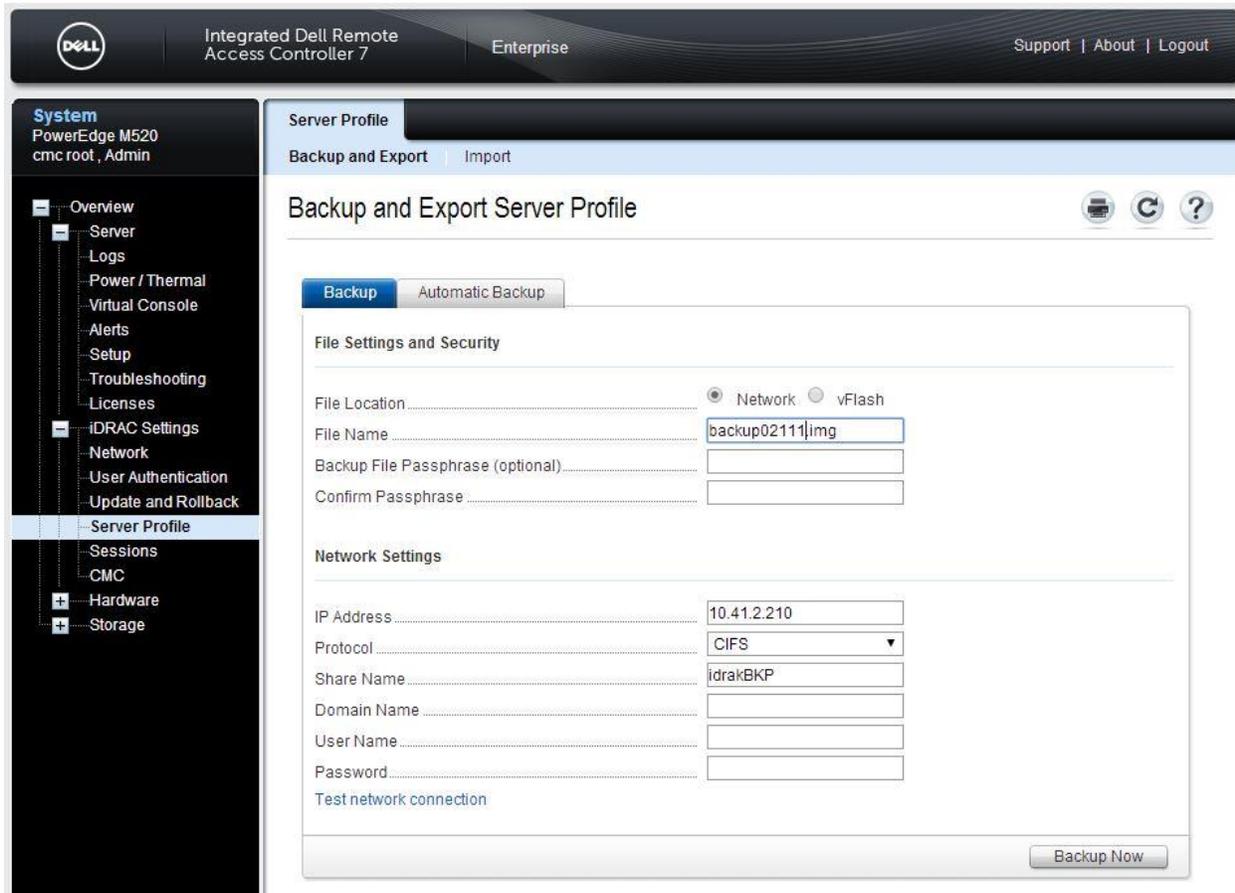
Figure 2: Backup and Export Server Profile screen in iDRAC7 with Lifecycle Controller.

Migrate highly available virtual machines with no downtime

Dell PowerEdge VRTX, when configured in a Windows Server failover cluster running Hyper-V, allows VMs to be migrated from one server node to another without any downtime through live migration. This means administrators can reduce the maintenance window when business applications may need to be offline.

In our test scenario with the server node in need of repair, using Hyper-V, we migrated a critical VM from the server node reporting issues to a secondary node. This

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allowed the VM to stay online while the administrator reallocated the high-performance hardware, in this case the PCIe SSD from the failing node, to a third node. With a PowerShell script, the migration was done quickly and without any downtime (see Migrate VM to Shared Storage on Node2 in Appendix D).

Reassign shared PCIe resources to restore high performance remotely

Using traditional hardware in a clustered environment, an administrator would need to physically move PCIe-based hardware components from one server to another. The Dell PowerEdge VRTX provides shared PCIe slots, allowing an administrator to remotely reassign PCIe devices from one server node to another via the VRTX Chassis Management Center Web interface, requiring only a power cycle of the nodes involved. This provides enhanced hardware versatility where a common failover cluster cannot, simplifying the movement of PCIe devices.

For our test scenario, the administrator migrated a high-performance VM and its virtual hard drives from the failing server node with two Micron® PCIe SSDs to a secondary node on the VRTX without PCIe SSDs to prevent application downtime. The administrator then used the shared PCIe bus feature to transfer the two PCIe SSDs from the failing node to a third server node on the Dell PowerEdge VRTX using a PowerShell script, with each node being offline only long enough to complete the transfer via CMC. To restore the high performance functionality of the Micron SSDs to the VM, the final step was to live migrate the VM from the secondary node to the third server node. The administrator completed all of these tasks remotely and, from an end-user perspective, the VM stayed online the entire time.

Replace the server node at your convenience

With the critical VM now running safely on another server node, the administrator can then plan for the repair of the failing server node. Dell maximizes efficiency of deploying replacement parts by allowing the administrator to use Dell iDRAC7 with Lifecycle Controller to automate most of the process.

In our test scenario, the administrator arranged for an on-site employee to replace the failed mezzanine card in our failing node, now safely offline, with a new one. Once the repaired server node was physically re-installed, Dell iDRAC7 with Lifecycle Controller automatically initialized the new part with the correct firmware versions to match the original mezzanine card. We then used iDRAC7 with Lifecycle Controller to deploy a Windows Server 2012 R2 image stored on a file share. With a Windows PowerShell script, we added the necessary roles and features, modified the operating system settings (See Initial VM Setup in Appendix D), and connected to the existing cluster (See Adding Replacement Node1 to Cluster in Appendix D). Other than the physical replacement of the server node's component, none of these steps required any

external media or manual intervention that would have forced the administrator to be physically present.

AUTOMATED CLUSTER-AWARE UPDATES

The Dell PowerEdge VRTX solution integrates with Microsoft Cluster-Aware Updating to simplify the update process in a Windows clustered environment. In an environment without this streamlined integration, an administrator must take additional precautions to keep critical business applications online and proper hardware resources available, which can be a hassle. Performing updates on clustered servers means moving these applications from node to node while individual nodes are updated and rebooted. Performing these maintenance tasks manually requires significant planning and accuracy to avoid accidental downtime.

With Microsoft Cluster-Aware Updating, an administrator can apply critical updates and the latest hotfixes from Windows Update to all of the compute nodes in the VRTX, rather than having to waste time performing manual repetitive update sequences on each server node individually. When used alongside Dell's Server Update Utility, the administrator can set driver and firmware updates to apply automatically as they are needed, a crucial timesaving feature for servers in remote offices.

During our testing, we set up Cluster-Aware Updating to update the firmware and drivers on all four nodes once the cluster was created using the latest Dell Server Update Utility. When our first node needed to be replaced, we were able to run Cluster-Aware Updating to update the replacement blade's drivers to the same versions as the other nodes (see Figure 3).
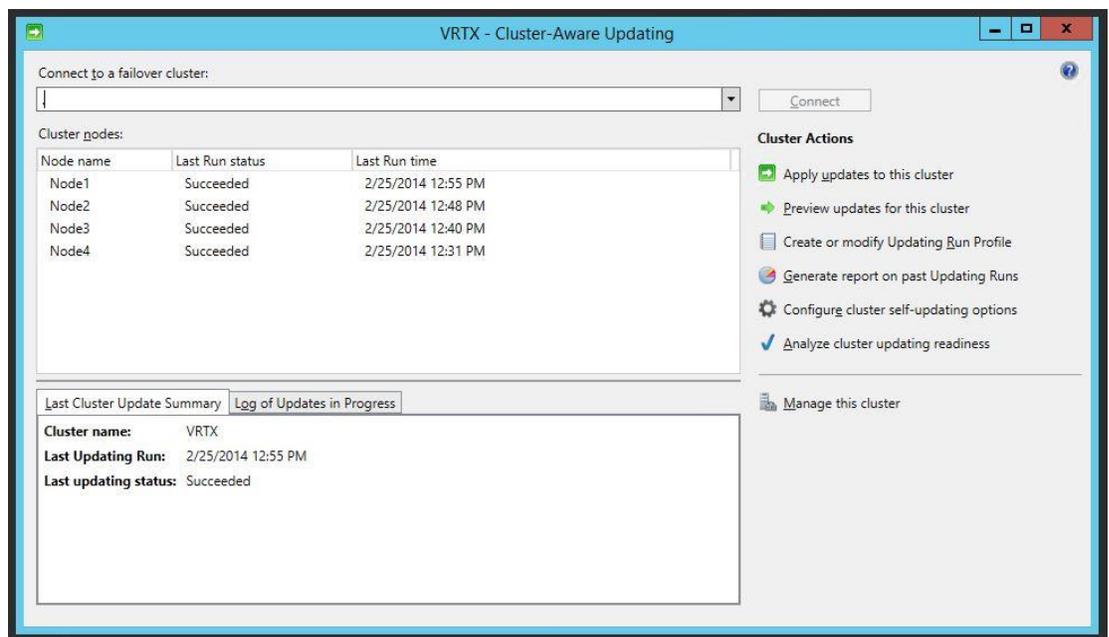
Figure 3: The Cluster-Aware Updating window.

ALL-IN-ONE SHARED INFRASTRUCTURE

The Dell PowerEdge VRTX solution with M-series compute nodes is an all-in-one solution designed to handle the performance needs of your small-to medium-business or remote office. Here, we provide information about each of the components we used as part of this solution.

About the Dell PowerEdge VRTX

The Dell PowerEdge VRTX is a compact, all-in-one solution in a 5U rack-able tower chassis. Designed to be quiet under normal operating conditions, the Dell PowerEdge VRTX can be stowed under a desk in a small office. Its four bays house M520 or M620 compute nodes, providing a space-saving alternative to four separate tower or rack servers. In addition to space savings, the Dell PowerEdge VRTX provides administrators with a unified interface, the Chassis Management Controller, for performing routine systems management tasks. The Dell PowerEdge VRTX chassis supports up to 48 TB of shared internal storage that is presentable as virtual drives to single or multiple compute nodes, and provides optional pass-through and eight PCIe slots for additional device connectivity. The chassis integrated storage can be configured with 25 bays for 2.5-inch drives or with 12 bays for 3.5-inch drives. The Dell PowerEdge VRTX integrated switch contains multiple external network ports for easy expansion or integration into any computing environment.

For more information about the Dell PowerEdge VRTX, visit www.Dell.com/PowerEdge/VRTX.

About the Dell PowerEdge M520 compute nodes

The Dell PowerEdge M520, a half-height compute node, has features optimized for performance, density, and energy efficiency.

- **Processors.** The Dell PowerEdge M520 is powered by two processors from the Intel Xeon processor E5-2400 v2 product family, which incorporate the latest in processor technology from Intel. The powerful processors provide the performance you need for your essential mainstream tasks. The Intel Xeon processor E5-2400 v2 product family gives you up to 10 cores per processor, or up to 20 cores per server.
- **Memory.** The Dell PowerEdge M520 holds up to 384GB DDR3 RAM (up to 1,600 MHz) across 12 DIMM slots per compute node.
- **Management.** The Dell PowerEdge M520, like all late-model Dell servers, includes the iDRAC7 with Lifecycle Controller Technology. This tool simplifies server management by providing a single interface for management functions and by storing critical system information in the system itself. There are no CDs or USB keys to keep track of for drivers or firmware.

About the Intel Xeon processor E5 family

The new Intel Xeon processor E5 family, which comes standard in new Dell PowerEdge servers, incorporates new technology and features to meet the computing demands of the present and future. The Intel Xeon processor E5 family delivers intelligent and adaptive performance using such features as Intel Turbo Boost Technology 2.0, Intel Advanced Vector Extension, Intel Integrated I/O, and Intel Data Direct I/O Technology. These new processors also feature Intel Trusted Execution Technology (Intel TXT) and utilize Intel Advance Encryption Standard New Instructions (Intel AES-NI) to help keep your data safe.

For more information about the Intel Xeon processor E5 family, visit www.intel.com/content/www/us/en/processors/xeon/xeon-processor-5000-sequence.html.

About Microsoft Windows Server 2012 R2

Windows Server 2012 R2, the latest release of this server OS from Microsoft, includes many new features and enhancements. According to Microsoft, Windows Server 2012 R2 focuses on four core areas:

- **Beyond virtualization.** Windows Server 2012 R2 provides a robust and dynamic virtualization platform through Hyper-V™, and includes new features that provide flexible options for delivering cloud services.
- **The power of many servers, the simplicity of one.** Windows Server 2012 R2 offers improvements in its features that allow for better-than-ever high availability and ease of management for multiple-server infrastructures.
- **Every app, any cloud.** Windows Server 2012 R2 delivers a scalable and flexible Web and application platform by providing a consistent and open set of tools and frameworks that apply to applications on-premises, in the cloud, or in a hybrid environment.
- **Modern work style, enabled.** Microsoft Windows Server 2012 R2 empowers users and IT staff with remote access to data, applications, and simpler management tools while strengthening security and compliance.

IN CONCLUSION

Administrators can spend a great deal of time deploying and managing computing resources, especially when dealing with ROBO environments. The Dell PowerEdge VRTX, powered by the Intel Xeon processor E5-2400 v2 product family and running Microsoft Windows Server 2012 R2, gives administrators centralized management tools to help them provide time saving benefits and integrated toolsets.

In our hands-on testing, we found that the Dell PowerEdge VRTX greatly simplified deployment through an easy, wizard-based setup of Microsoft Windows Server Failover Clusters across server nodes with the Dell OpenManage Cluster Configurator. It also provided versatile hardware resource reassignment through a shared PCIe bus and efficient centralized management through CMC and scripting. Finally, we found that the Dell System Update Utility worked seamlessly with Microsoft Cluster-Aware Updating to update server nodes while keeping the failover cluster online and minimizing downtime. These advantages make the Dell PowerEdge VRTX an attractive choice for those who seek to reduce the management overhead of their ROBO environments.

APPENDIX A – DETAILED CONFIGURATION INFORMATION

Figure 4 provides detailed configuration information about the Dell PowerEdge VRTX solution we set up.

System	Dell PowerEdge VRTX solution
Enclosure	
Compute node enclosure	Dell PowerEdge VRTX
General dimensions of compute node enclosure	
Height (inches)	8
Width (inches)	19
Depth (inches)	29.5
U size in server rack (U)	5
Power supplies	
Total number	4
Vendor and model number	Dell 80 Plus Platinum E1100E-S0 (P/N 0YT39Y)
Wattage of each (W)	1,100
Cooling fans	
Total number	6
Vendor and model number	Delta Electronics, Inc.
Dimensions (h × w) of each	60mm × 60mm
Volts	12
Chassis RAID controller	
Vendor and model number	Dell Shared PERC8
Firmware version	23.8.2-0005
Cache size (GB)	1
Chassis shared hard drives	
Vendor and model number	SEAGATE ST3000NM0023
Number of drives	5
Size (TB)	3
RPM	7.2K
Chassis USB ports	
Number	2
Type	2.0
Platform	
Vendor and model number	Dell PowerEdge M520
Motherboard model number	0NRG83X03
BIOS name and version	Dell BIOS 2.0.23
BIOS settings	Performance
General	
Number of processor packages	2
Number of cores per processor	10
Number of hardware threads per core	2
System power management policy	Performance

System	Dell PowerEdge VRTX solution
CPU	
Vendor	Intel
Name	Xeon E5-2430L
Stepping	C1
Socket type	Socket 1356 / LGA1356
Core frequency (GHz)	2.00
L1 cache	32 KB (per core)
L2 cache	256 KB (per core)
L3 cache	15 MB (shared)
Memory modules (per node)	
Total RAM in system (GB)	16
Vendor and model number	Samsung M393B5270DH0-YH9
Type	PC3-10600
Speed (MHz)	1,333
Speed in the system currently running @ (MHz)	1,333
Timing/latency (tCL-tRCD-iRP-tRASmin)	9-9-9-36
Size (GB)	4
Number of RAM modules	4
Chip organization	Double-sided
RAID controller	
Vendor and model number	Dell PERC H310 mini
Firmware version	20.12.0-0004
Cache size (GB)	0
Hard drive	
Vendor and model number	TOSHIBA AL13SEB300
Number of drives	2
Size (GB)	300
RPM	10K
Type	SAS
Network adapter	
Vendor and model number	Broadcom NetXtreme BCM5720 Gigabit Ethernet PCIe
Type	Embedded
Number of ports	2
USB ports (per node)	
Number	2 External, 1 Internal
Type	2.0

Figure 4: Detailed configuration information for the Dell PowerEdge VRTX solution.

APPENDIX B – SETUP METHODOLOGY

Setting up the infrastructure

We detail our Dell PowerEdge VRTX configuration steps below. Perform the following steps on each Dell PowerEdge server.

Setting up and configuring an Active Directory and OpenManage VM

We configured two virtual machines as an OpenManage server and an Active Directory server for authentication on a separate utility hypervisor.

Installing Windows Server 2012 R2 on the VMs

1. Create a VM on a separate hypervisor host; choose 4GB RAM and 30GB virtual disk size.
2. Install the operating system on the VM.
3. Copy the installation DVD image for Windows Server 2012 R2 into the local machine storage. Mount the DVD ISO to the guest VM.
4. Choose the language, time and currency, and keyboard input. Click Next.
5. Click Install Now.
6. Enter product key, and click Next.
7. Choose Windows Server 2012 R2 Datacenter (Server with a GUI), and click Next.
8. Accept the license terms, and click Next.
9. Click Custom, and select Install Windows Only.
10. Click the Disk, and click Drive options (advanced).
11. Click New→Apply→Format, and click Next.
12. After the installation completes, click OK to set the administrator password.
13. Enter the administrator password twice, and click OK.
14. Connect the machine to the Internet and install all available Windows updates. Restart as necessary.
15. Clone the VM to create an OpenManage VM.
16. Run the Initial AD Setup script located in Appendix D on the AD VM.
17. Run the Initial VM Setup script located in Appendix D on the OpenManage VM.
18. After the VMs restart, log into the domain using the administrator account.
19. Create Computer accounts for each server to be used in the domain in the Active Directory Manager on the AD VM.

Setting up OpenManage Essentials on the OpenManage VM

1. Run the setup file for OpenManage Essentials.
2. On the window that appears, click Extract.
3. Once the file is finished extracting, click OK.
4. In the Dell OpenManage Install window, select Dell OpenManage Essentials, and click Install.
5. On the Prerequisites scan page, click Install Essentials.
6. On the Welcome page, click Next.
7. Click Next, and then click Install.
8. When the installation is finished, click Finish.

Setting up the VRTX

Configuring the VRTX shared storage

1. Open a Web browser, and enter the address listed for the CMC IP on the front LCD panel.
2. Log in with the appropriate credentials.
3. Expand Storage**.**
4. Click Storage.
5. Click the Setup tab.
    a. Under Assignment Mode, select the radio button for Multiple Assignment, and click Apply.
    b. Click OK to confirm the message box indicating Operation Successful.

Configuring the virtual disks

1. Click Storage→Virtual Disks.
2. On the Virtual Disks tab, click Create.
    a. For Choose a virtual disk type, select RAID 10.
    b. Select the first four disks, and click Create Virtual Disk.
    c. Click OK to confirm the message box indicating Operation Successful.
3. On the Virtual Disks tab, click Manage.
    a. Select the Virtual Disks Action pull-down menu for Virtual Disk 0, and initialize the drives.
    b. Click Apply.
    c. Click OK to confirm the message box indicating Operation Successful once the initialization completes.
4. Configure the remaining physical disk as a global hot spare.
5. In this step, we will allow shared LUN access to all compute nodes. On the Virtual Disks tab, click Assign.
    a. Use the pull-down menu for all virtual disks and SLOT-01, and select Full Access.
    b. Use the pull-down menu for all virtual disks and SLOT-02, and select Full Access.
    c. Use the pull-down menu for all virtual disks and SLOT-03, and select Full Access.
    d. Use the pull-down menu for all virtual disks and SLOT-04, and select Full Access.
    e. Click Apply.
    f. Click OK to confirm the message box indicating that the operation was successful.

Setting up the Dell PowerEdge M520s

Perform the following steps on each Dell PowerEdge server.

Configuring boot properties

1. Open a Web browser, and enter the address listed for the CMC IP on the front LCD panel.
2. Log in with the appropriate credentials.
3. Expand Server Overview, and select a blade slot.
4. Click the Setup tab. Perform the following steps in the iDRAC settings:
    a. Check the box for Enable LAN.
    b. Check the box for Enable IPv4.
    c. Check the box for DHCP.
    d. Check the box for IPMI Over LAN.
    e. Click Apply iDRAC Network Settings.
    f. To confirm changes to the iDRAC network settings, click OK.

5. Power on the server.
    a. Click the Power tab.
    b. Select Power On Server.
    c. Click Apply.
    d. To confirm the server control action, click OK.
    e. To confirm that the operation was successful, click OK.
6. Click the Properties tab.
7. Click Launch Remote Console.
8. On new browser page, click Continue to website (not recommended) if prompted.
    a. If a message appears indicating a pop-up was blocked, select Always allow pop-ups from this site.
    b. Close the browser tab for the iDRAC.
    c. Click Launch Remote Console.
    d. If a message appears indicating the Web page wants to run an add-on called "Virtual Console from Dell Inc.," select Allow for all websites.
9. A new window appears showing the console for the server to configure. Select Power→Reset System.

Installing Windows Server 2012

We used a pre-installed image provided by Dell for all compute nodes in the Dell PowerEdge VRTX.

Deploying a cluster with Dell OpenManage Cluster Configurator v2

1. Power on all four Dell PowerEdge M520 blades.
2. Choose a language, and click Next.
3. Accept the license agreement, and click Next.
4. If the initial cluster search does not locate all the nodes, click Cancel, and click OK.
5. At the OpenManage Cluster Configurator for Windows Server 2012 R2 v2.0, click Connect to remote nodes.
6. Log in to the other three nodes, and write down their IP addresses.
7. Enter the IP addresses for the other three nodes into the box, and click OK.
8. Scroll to Configure Settings, and click Create virtual switches for Hyper-V.
9. Select Create Virtual Switches, and click Next.
10. Verify the nodes are correct, and click Create.
11. Click Provide cluster name and domain.
12. For the domain, type `test.local`. Enter the administrator account details, and click Next.
13. For the Cluster management name, type `VRTX1`, and click Next.
14. At the Add Accounts to the Local Admininstrators Group screen, click Next.
15. At the Change the Local Administrator Password screen, enter the new password twice, and click Next.
16. Verify the details are correct, and click Create.
17. Click OK to restart all nodes.
18. Log in to the first node using the domain administrator account.
19. Scroll to Provision Cluster Storage, and click Provision Storage via CMC.
20. Log in with the appropriate credentials.
21. Expand Storage**.**
22. Click Storage.
23. Click the Setup tab.

24. Under Assignment Mode, select Multiple Assignment, and click Apply.
25. To confirm that the operation was successful, click OK.
26. Click Storage→Virtual Disks.
27. On the Virtual Disks tab, click Create.
    a. For Choose a virtual disk type, select RAID 10.
    b. Select the first four disks, and click Create Virtual Disk.
    c. To confirm that the operation was successful, click OK.
28. On the Virtual Disks tab, click Manage.
    a. Select the Virtual Disks Action pull-down menu for Virtual Disk 0, and initialize the drives.
    b. Click Apply.
    c. To confirm that the operation was successful once the initialization completes, click OK.
29. Configure the remaining physical disk as a global hot spare.
30. In this step, we will allow shared LUN access to all compute nodes. On the Virtual Disks tab, click Assign.
    a. Use the pull-down menu for all virtual disks and SLOT-01, and select Full Access.
    b. Use the pull-down menu for all virtual disks and SLOT-02, and select Full Access.
    c. Use the pull-down menu for all virtual disks and SLOT-03, and select Full Access.
    d. Use the pull-down menu for all virtual disks and SLOT-04, and select Full Access.
    e. Click Apply.
    f. To confirm that the operation was successful, click OK.
31. Click Prepare Disks for Cluster, and when it is finished, click OK.
32. Click Create Volumes, and click Next.
33. Under Disk, select Disk 1, and click Next.
34. For the Volume size, type `1 GB`, and click Next.
35. With the drop-down list, assign the letter Q, and click Next.
36. Change the Volume label to Quorum, and click Next.
37. Verify the settings, and click Create.
38. When complete, click Close.
39. Click Create Volumes, and click Next.
40. Under Disk, select Disk 1, and click Next.
41. Leave the default Volume size, and click Next.
42. With the drop-down list, assign the letter D, and click Next.
43. Leave the default Volume label, and click Next.
44. Verify the settings, and click Create.
45. Scroll to Deploy the Cluster, and click Validate and create the cluster.
46. At the Validate Failover Cluster Configuration screen, click Validate.
47. When the validation completes, click Next.
48. For the Cluster management name, type `VRTX1`, and click Next.
49. Verify the settings, and click Create.
50. Once the cluster is created, click Close.

Cluster-Aware Updating

1. Create a shared folder that is accessible to all nodes in the cluster.
2. Copy the Dell SUU XML configuration file DELL_UPDATE_SUU.xml to the shared folder.
3. Rename the XML configuration file to `DefaultHotfixConfig.xml`.
4. In the shared folder, create a folder named `CAUHotFix_All`.
5. Extract all files from the Dell SUU DVD to the new folder.
6. Run both of the Update SMB settings scripts located in Appendix D.
7. Run the Set up Cluster-Aware Updating with Dell SUU script located in Appendix D.
8. Run the Run Cluster-Aware Updates script located in Appendix D.

Creating a VM

1. Log into Node 1.
2. Run the Create Clustered VM Role script located in Appendix D.

Installing the VM operating system on the VM

1. Connect to the ISO image of the installation DVD for Windows Server 2012 R2 from the VM console. If the ISO image is not stored on the host, start the VM first and then connect to the ISO image.
2. Start the VM.
3. At the Language Selection screen, click Next.
4. Click Install Now.
5. Select Windows Server 2012 R2 (Full Installation), and click Next.
6. Click the I accept the license terms check box, and click Next.
7. Click Custom.
8. Click Next.
9. At the User's password must be changed before logging on warning screen, click OK.
10. Enter the desired password for the administrator in both fields, and click the arrow to continue.
11. At the Your password has been changed screen, click OK.
12. Connect the machine to the Internet, and install all available Windows updates. Restart as necessary.
13. Run the Initial VM Setup script located in Appendix D.

Microsoft SQL Server installation and workload configuration

We installed Microsoft SQL Server 2012 R2 on the VM residing on the Dell PowerEdge M520s.

Configuring the SQL Server VM on the VMs

Modify the SQL VMs to contain the following settings:

- Memory: 12GB
- Virtual Processors: 12
- Additional virtual disks:
  - o 1 x 30GB virtual disk for SQL database data
- In the VM, configure the VM storage:
  - o Click the Server Manager icon in the taskbar.
  - o In the left pane, expand Storage, and click Disk Management.
  - o Right-click the uninitialized volume, and choose Initialize Disk.
  - o In the right pane, right-click the volume, and choose New Simple Volume…

- o At the welcome window, click Next.
- o At the Specify Volume Size window, leave the default selection, and click Next.
- o At the Assign Drive Letter or Path window, choose a drive letter, and click Next.
- o At the Format Partition window, choose NTFS, and click Next.
- o At the Completing the New Simple Volume Wizard window, click Finish.

Installing SQL Server 2012 on the VM

1. Open the console for the VM or connect to the VM with RDP.
2. Mount the installation ISO to the VM.
3. Click Run SETUP.EXE. If Autoplay does not begin the installation, navigate to the SQL Server 2012 DVD, and double-click.
4. If the installer prompts you with a .NET installation prompt, click Yes to enable the .NET Framework Core role.
5. In the left pane, click Installation.
6. Click New SQL Server stand-alone installation or add features to an existing installation.
7. At the Setup Support Rules screen, wait for the rule check to complete. If there are no failures or relevant warnings, click OK.
8. Select the Specify a free edition and select Evaluation from the drop-down menu. Click Next.
9. Click the checkbox to accept the license terms, and click Next.
10. If no failures are displayed after the setup support files are installed, click Next.
11. At the Setup Role screen, choose SQL Server Feature Installation.
12. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Click Next.
13. At the Installation Rules screen, click Next after the check completes.
14. At the Instance configuration screen, leave the default selection of default instance, and click Next.
15. At the Disk Space Requirements screen, click Next.
16. At the Server Configuration screen, check that NT AUTHORITY\SYSTEM is selected for SQL Server Agent and SQL Server Database Engine. Click Next.
17. Assuming there are no failures, click Next.
18. At the Database Engine Configuration screen, select Mixed Mode.
19. Enter and confirm a password for the system administrator account.
20. Click Add Current user. This may take several seconds.
21. Click the Data Directories tab and enter the appropriate drive and folders for database and logs.
22. Click Next.
23. At the Error and usage reporting screen, click Next.
24. At the Installation Configuration Rules screen, check that there are no failures or relevant warnings, and click Next.
25. At the Ready to Install screen, click Install.
26. After the installation completes, click Close.
27. Create a SQL Server login for the ds2user (see the [Configuring the database (Data generation overview)](#) section for the specific script to use).
28. Copy the pre-created DVD Store backup to the specified backup volume.

29. Download and install any available updates for Microsoft SQL Server 2012.

Configuring the database workload client

For each test VM on the host machines there must be a corresponding client VM to generate the workload to stress the database under test. To do this, we configured a virtual machine with Windows Server 2008 R2 SP1 on a separate utility hypervisor. To create this client, we installed Windows Server 2008 R2 SP1, assigned a static IP address, and installed .NET 3.5.

Configuring the database

Data generation overview

We generated the data using the Install.pl script included with DVD Store version 2.1 (DS2), providing the parameters for our 10GB database size and the database platform on which we ran Microsoft SQL Server. We ran the Install.pl script on a utility system running Linux. The database schema was also generated by the Install.pl script.

After processing the data generation, we transferred the data files and schema creation files to a Windows-based system running SQL Server 2012. We built the 10GB database in SQL Server 2012 and then performed a full backup, storing the backup file on the C: drive for quick access. We used that backup file to restore the server between test runs.

The only modification we made to the schema creation scripts were the specified file sizes for our database. We explicitly set the file sizes higher than necessary to ensure that no file-growth activity would affect the outputs of the test. Besides this file size modification, the database schema was created and loaded according to the DVD Store documentation. Specifically, we followed the steps below:

1. We generated the data and created the database and file structure using database creation scripts in the DS2 download. We made size modifications specific to our 10GB database and the appropriate changes to drive letters.
2. We transferred the files from our Linux data generation system to a Windows system running SQL Server.
3. We created database tables, stored procedures, and objects using the provided DVD Store scripts.
4. We set the database recovery model to bulk-logged to prevent excess logging.
5. We loaded the data we generated into the database. For data loading, we used the import wizard in SQL Server Management Studio. Where necessary, we retained options from the original scripts, such as Enable Identity Insert.
6. We created indices, full-text catalogs, primary keys, and foreign keys using the database-creation scripts.
7. We updated statistics on each table according to database-creation scripts, which sampled 18 percent of the table data.
8. On the SQL Server instance, we created a ds2user SQL Server login using the following Transact SQL (TSQL) script:

```
USE [master]
GO
CREATE LOGIN [ds2user] WITH PASSWORD=N'',
            DEFAULT_DATABASE=[master],
            DEFAULT_LANGUAGE=[us_english],
            CHECK_EXPIRATION=OFF,
```

<div align="center">CHECK_POLICY=OFF</div>

GO

9. We set the database recovery model back to full.
10. We created the necessary full text index using SQL Server Management Studio.
11. We created a database user and mapped this user to the SQL Server login.
12. We then performed a full backup of the database. This backup allowed us to restore the databases to a pristine state relatively quickly between tests.

Figure 5 shows our initial file size modifications.

Logical name	Filegroup	Initial size (MB)
Database files		
primary	PRIMARY	3.25
cust1	DS_CUST_FG	5,767
cust2	DS_CUST_FG	5,767
ind1	DS_IND_FG	2,621
ind2	DS_IND_FG	2,621
ds_misc	DS_MISC_FG	2,621
orders1	DS_ORDERS	2,621
orders2	DS_ORDERS	2,621
Log files		
ds_log	Not Applicable	20,480

Figure 5: Our initial file size modifications.

Running the test

Test start and run times

We ran all workloads concurrently in order to start and record all performance counters for this report. The specific testing parameters we used are included in the setup section, and specifics for launching these tests are described below.

About running the DVD Store tests

We created a series of batch files, SQL scripts, and shell scripts to automate the complete test cycle. DVD Store outputs an orders-per-minute metric, which is a running average calculated through the test. In this report, we report the last OPM reported by each client/target pair.

Each complete test cycle consisted of the general steps listed below.

1. Clean up prior outputs from the target system and the client driver system.
2. Drop the database from the target.
3. Restore the database on the target.
4. Shut down the target.
5. Reboot the host and client system.
6. Wait for a ping response from the server under test (the hypervisor system), the client system, and the target.
7. Let the test server idle for 20 minutes.

8. Start the DVD Store driver on the client.

   We used the following DVD Store parameters for testing:

```
ds2sqlserverdriver.exe --target=<target_IP> --ramp_rate=10 --run_time=30 --
n_threads=12 --db_size=10GB --think_time=0.3 --detailed_view=Y --warmup_time=15
```

APPENDIX C – SCENARIO METHODOLOGY

Moving the VM and SSD storage to another node

1. Run the Migrate VM to Shared Storage on Node2 script in Appendix D.
2. Run the Shutdown Nodes 1 & 3 and Remove Node1 from Cluster script in Appendix D.
3. Run the Reassign PCIe Cards to Node3 script in Appendix D.
4. Log in to Node3 using the domain administrator account.
5. On the server, click the Tools → Computer Management option in the Server Manager.
6. In the left pane, expand Storage, and click Disk Management.
7. Right-click one of the newly added SSD volumes, and choose Import Foreign Disks.
8. Select the set of two drives listed and click OK.
9. Run the Migrate VM to PCIe SSD Storage on Node3 script in Appendix D.

Backing up and exporting the Server Profile of the old blade

1. Log into iDRAC.
2. Click iDRAC Settings → Server Profile.
3. Enter a filename for the backup profile image.
4. Enter the IP address of the remote fileshare.
5. Enter the share name.
6. Enter the domain name of the file server. Leave this blank if you are using a fileshare without a domain.
7. Enter a username and password with permission to access the fileshare.
8. Click Test network connection to validate connection.
9. Click OK.
10. Click Backup Now.
11. Click OK. The status of the job can be viewed by clicking Overview→Server→Job Queue.
12. Wait for the Backup and Export job to complete, then remove the old blade and replace it with a new blade.

Importing the Server Profile of the blade

1. After the blade is re-installed, log into iDRAC.
2. Click iDRAC Settings → Server Profile.
3. Enter the filename of the backup profile image that was created earlier.
4. Enter the IP address of the remote fileshare.
5. Enter the share name.
6. Enter the domain name of the file server. Leave this blank if you are using a fileshare without a domain.
7. Enter a username and password with permission to access the fileshare.
8. Click Test network connection to validate connection.
9. Click OK.
10. Select whether you want to keep the existing virtual disk configuration (Preserve) or to replace with the settings in the backup file (Delete and Replace).
11. Click Import.
12. Click OK. The status of the job can be viewed by clicking Overview → Server → Job Queue.
13. Wait for the import job to complete, power on the blade, and continue to deploying the operating system.

Re-deploying the operating system to the blade

1. Select Server →Attached Media.
2. In the section for Remote File Share, enter the path to your OS image.
3. Enter the username and password for a user with access to the share.
4. Click Connect.
5. Click Overview.
6. Click Launch on the Virtual Console Preview panel.
7. Reboot the server.
8. Press F10 to enter Lifecycle Controller.
9. Select OS Deployment.
10. Click Deploy OS.
11. Select Configure RAID First. Click Next.
12. Select the RAID controller, and click Next.
13. Select the RAID level for the virtual disk (RAID 1), and click Next.
14. Click the box for Select All, and click Next.
15. Enter a Virtual Disk Name (default), and click Next.
16. Click Finish.
17. Click Yes to confirm changes to the disk array.
18. Click OK to confirm the RAID operation.
19. Select the operating system to deploy (Microsoft Windows Server 2012 R2), and click Next.
20. Select Unattended Install, and click next.
21. Select Network Share.
22. Change the type to NFS.
23. Enter the share name where the answer file is hosted.
24. Enter the full name of the answer file (.xml) in the File Path.
25. Click Test Network Connection.
26. Click OK.
27. Click Next.
28. Click OK to confirm answer file verification is complete.
29. Accept BIOS as the boot mode and click Next.
30. At the Insert OS Media screen, click Next.
31. Click Finish.
32. Once the installation is complete, log in to Windows.
33. Connect to the Internet, and install all available Windows updates. Restart as necessary.
34. Run the Initial System Setup script located in Appendix D.
    a. Use Node1 as the Node name in the script.
35. Run the Adding Replacement Node1 to Cluster script located in Appendix D.

APPENDIX D – POWERSHELL SCRIPTS USED

The following Powershell scripts denote where they need to be edited with specific information with `<angled brackets>`. An accent (`` ` ``) character indicates that the code continues to the next line; this will be automatically parsed by Powershell if the code is copied as written and run from a script file.

Initial AD Setup (run locally on VM)

```
Rename-Computer Test_AD -Force;
Enable-PSRemoting –force;
Set-ExecutionPolicy RemoteSigned –force;
Set-Item wsman:localhost\client\trustedhosts *.test.local –force;
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server'`
 -name "fDenyTSConnections" -Value 0;
Enable-NetFirewallRule -DisplayGroup "Remote Desktop";
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server\WinStations\RDP-Tcp'`
 -name "UserAuthentication" -Value 1;
New-NetIPAddress –InterfaceIndex 14 -IPAddress 192.168.200.110 -Prefixlength 24`
 -defaultgateway 192.168.200.110;
Install-ADDSForest -DomainName test.local –CreateDnsDelegation –InstallDns`
 –NoDnsOnNetwork;
Restart-Computer –force;
```

Initial System Setup (run locally on each node)

```
Add-Computer -DomainName test.local -NewName <Node1, Node2, Node3, or Node4> -Force;
Enable-PSRemoting –force;
Set-ExecutionPolicy RemoteSigned –force;
Set-Item wsman:localhost\client\trustedhosts *.test.local –force;
Install-WindowsFeature Failover-Clustering -IncludeManagementTools –Confirm;
Install-WindowsFeature Hyper-V -IncludeManagementTools –Confirm;
$TestSwitchNIC = Get-NetAdapter NIC1_Private;
$HVSwitch = New-VMSwitch -Name TEST -NetAdapterName $TestSwitchNIC`
 -AllowManagementOS True -ErrorAction SilentlyContinue;
New-ItemProperty -Path HKLM:\SYSTEM\CurrentControlSet\Services\ClusDisk\Parameters`
 -Name 'AllowBusTypeRAID' -Value 1 -PropertyType 'DWord' -Force;
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server'`
 -name "fDenyTSConnections" -Value 0;
Enable-NetFirewallRule -DisplayGroup "Remote Desktop";
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server\WinStations\RDP-Tcp'`
 -name "UserAuthentication" -Value 1;
New-NetIPAddress –InterfaceIndex 14 -IPAddress 192.168.200.`
 <Node=21, Node2=22, Node3=23, or Node4=24> -Prefixlength 24`
 -defaultgateway 192.168.200.110;
$NodeName = "<Node1, Node2, Node3, or Node4>";
$admin = [adsi]("WinNT://" + $strComputer + "/administrator, user");
```

```
$admin.psbase.invoke("SetPassword", "<New Administrator Password>");
Restart-Computer –force;
```

Initial VM Setup (run locally on VM)

```
Rename-Computer Test_VM -Force;
Enable-PSRemoting –force;
Set-ExecutionPolicy RemoteSigned –force;
Set-Item wsman:localhost\client\trustedhosts *.test.local –force;
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server'`
 -name "fDenyTSConnections" -Value 0;
Enable-NetFirewallRule -DisplayGroup "Remote Desktop";
Set-ItemProperty`
 -Path 'HKLM:\System\CurrentControlSet\Control\Terminal Server\WinStations\RDP-Tcp'`
 -name "UserAuthentication" -Value 1;
New-NetIPAddress –InterfaceIndex 14 -IPAddress 192.168.200.51 -Prefixlength 24`
 -defaultgateway 192.168.200.110;
Restart-Computer –force;
```

Set up Cluster (run from any node)

```
Mkdir C:\ClustersReports;
Test-Cluster –Node Node1.test.local,Node2.test.local,Node3.test.local,Node4.test.local`
 -ReportName C:\ClustersReports\Creation_Report;
Invoke-Item \\192.168.200.21\C$\ClustersReports\Creation_Report.mht;
New-Cluster -Name "CN=VRTX,OU=Cluster,DC=test,DC=local"`
 –Node Node1.test.local,Node2.test.local,Node3.test.local,Node4.test.local`
 -StaticAddress <Desired Cluster Management IP>;
$Cluster = Get-Cluster;
$Cluster.EnableSharedVolumes = 'Enable/NoticeRead';
$disk = Get-Disk | Where FriendlyName -Like "Dell Shared PERC8*";
Set-Disk -InputObject $disk -IsOffline $False;
Set-Disk -InputObject $disk -IsReadonly $False;
Initialize-Disk -InputObject $disk -PartitionStyle MBR -PassThru;
New-Partition -InputObject $disk -UseMaximumSize |`
 Format-Volume -FileSystem NTFS -Confirm:$false;
Add-ClusterDisk -InputObject $disk;
Get-ClusterResource *disk* | Add-ClusterSharedVolume;
```

Create Clustered VM Role (run from Node 1)

```
New-VM -Name Test_VM -Path "D:\Test_VM" -MemoryStartupBytes 12GB`
 -NewVHDPath "D:\Test_VM\OS.vhdx" -NewVHDSizeBytes 60GB -SwitchName TEST;
Set-VMProcessor -VMname Test_VM -count 8;
New-VHD -Path "D:\Test_VM\DATA.vhdx" -SizeBytes 30GB –Fixed;
Add-VMHardDiskDrive -VMName Test_VM -Path "D:\Test_VM\DATA.vhdx";
Add-ClusterVirtualMachineRole -VirtualMachine Test_VM;
```

Migrate VM to Shared Storage on Node2 (run from Node 1)

```
Move-VMStorage -VMName BASE –DestinationStoragePath`
 "C:\ClusterStorage\Volume1\<Target VM Path>" –AllowUnverifiedPaths;
Move-ClusterVirtualMachineRole -Name <VM Name> -Node NODE2;
```

Shutdown Nodes 1 & 3 and Remove Node1 from Cluster (run from Node 2 or 4)

```
$Username = "<Admin Account Name>"
$Password = "<Admin Password>" | ConvertTo-SecureString -AsPlainText -Force
$Credentials = new-object -typename System.Management.Automation.PSCredential`
 -argumentlist $Username, $Password
Stop-Computer -ComputerName Node1 -Credential $Credentials
Stop-Computer -ComputerName Node3 -Credential $Credentials
Remove-ClusterNode -Name Node1.test.local -Force
```

Reassign PCIe Cards to Node3 (run from Node 2 or 4)

```
$CMCIPAddress="<CMC Management IP>"
$Node3iDRACIP="<Node 3 iDRAC Management IP>"
$BadBladeSlotNumber="<Slot # of blade being replaced>"
$ReplacementBladeSlotNumber="<Slot # to assign PCIe cards>"
$username = "<CMC/iDRAC Username>"
$readpassword = "<CMC/iDRAC Password>"

$password = $readpassword | ConvertTo-SecureString -AsPlainText –Force;
$credentials = new-object -typename System.Management.Automation.PSCredential`
 -argumentlist $username,$password;

$cimop = New-CimSessionOption -SkipCACheck -SkipCNCheck -Encoding Utf8 -UseSsl
$session = New-CimSession -Authentication Basic -Credential $credentials`
 -ComputerName $CMCIPAddress -Port 443 -SessionOption $cimop -OperationTimeoutSec
10000000;

$PCIServiceobj=Get-CimInstance -CimSession $session`
 -ResourceUri "http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ChassisPCIService"`
 -Namespace root/dell/cmc -Filter 'CreationClassName="DCIM_ChassisPCIService"`
 SystemCreationClassName="Dell_ChassisMgr"; SystemName="srv:system"`
 Name="DCIM:ChassisPCIService"';

$slotfqdd = Get-CimInstance -CimSession $session`
 -ResourceUri "http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ChassisPCISlot"`
 -Namespace root/dell/cmc -QueryDialect "http://schemas.microsoft.com/wbem/wsman/1/WQL"`
 -Query "select * from DCIM_ChassisPCISlot WHERE`
 AssignedBladeFQDD='System.Modular.0$BadBladeSlotNumber'"`
 | select Tag | ft -HideTableHeaders | Out-String;

$SringToSplit1 = $slotfqdd.replace(" ","").replace("`n","").replace("`"","")`
 .replace("PCIE.ChassisSlot",";PCIE.ChassisSlot").Substring(2).TrimEnd().TrimEnd();
$SlotSplit = $SringToSplit1.split(";");
$SlotFQDDs = @($SlotSplit);
```

```
$bladeslotfqdd = Get-CimInstance -CimSession $session`
 -ResourceUri "http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ChassisPCISlot"`
 -Namespace root/dell/cmc -QueryDialect "http://schemas.microsoft.com/wbem/wsman/1/WQL"`
 -Query "select * from DCIM_ChassisPCISlot`
 WHERE AssignedBladeFQDD='System.Modular.0$BadBladeSlotNumber'"`
 | select AssignedBladeFQDD | ft -HideTableHeaders | Out-String;
$SringToSplit2 = $bladeslotfqdd.replace(" ","").replace("`n","").replace("`"","")`
 .replace("System.Modular",";System.Modular").Substring(2).TrimEnd();
$SlotSplit = $SringToSplit2.split(";");
$BladeSlotFQDDs = @($SlotSplit);

$unassignmethodobj = Invoke-CimMethod`
 -ResourceUri "http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ChassisPCIService"`
 -InputObject $PCIServiceobj -CimSession $session -MethodName UnassignPCISlotsfromBlades`
 -Arguments @{SlotFQDDs=$SlotFQDDs[0].TrimEnd(),$SlotFQDDs[1].TrimEnd()`
 ;BladeSlotFQDDs=$BladeSlotFQDDs[0].TrimEnd(),$BladeSlotFQDDs[1].TrimEnd()};
$unassignmethodobj;

$bladeslotfqdd=@("System.Modular.0$ReplacementBladeSlotNumber"`
 ;"System.Modular.0$ReplacementBladeSlotNumber");
$SringToSplit2 = $bladeslotfqdd.replace(" ","").replace("`n","").replace("`"","")`
 .replace("System.Modular",";System.Modular").Substring(1).TrimEnd();
$SlotSplit = $SringToSplit2.split(";");
$BladeSlotFQDDs = @($SlotSplit);

$assignmethodobj = Invoke-CimMethod`
 -ResourceUri "http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ChassisPCIService"`
 -InputObject $PCIServiceobj -CimSession $session -MethodName AssignPCISlotstoBlades`
 -Arguments @{SlotFQDDs=$SlotFQDDs[0].TrimEnd(),$SlotFQDDs[1].TrimEnd()`
 ;BladeSlotFQDDs=$BladeSlotFQDDs[0].TrimEnd(),$BladeSlotFQDDs[1].TrimEnd()};
$assignmethodobj;

$cimop=New-CimSessionOption -SkipCACheck -SkipCNCheck -SkipRevocationCheck -Encoding Utf8
-UseSsl
$session=New-CimSession -Authentication Basic -Credential $credentials -ComputerName
$Node3iDRACIP -Port 443 -SessionOption $cimop -OperationTimeoutSec 10000000
$inst=Get-CimInstance -CimSession $session  -Namespace root/dcim -ResourceUri
"http://schemas.dell.com/wbem/wscim/1/cim-schema/2/DCIM_ComputerSystem" -Filter
'CreationClassName="DCIM_ComputerSystem"'
Invoke-CimMethod -InputObject $inst -MethodName RequestStateChange -CimSession $session -
Arguments @{RequestedState="2"}
```

Migrate VM to PCIe SSD Storage on Node3 (run from Node 3)

```
Move-ClusterVirtualMachineRole -Name BASE -Node NODE3
Move-VMStorage -VMName BASE -DestinationStoragePath "D:\VM_BASE\BASE"`
 -AllowUnverifiedPaths
```

Adding Replacement Node1 to Cluster (run from new Node 1)

```
Add-ClusterNode -Name Node1.test.local -Cluster VRTX
```

Update SMB settings (run from File Server)

```
Add-WindowsFeature RSAT-AD-PowerShell;
Set-SmbServerConfiguration -EncryptData $True -RejectUnencryptedAccess $False`
 -EnableSecuritySignature $True -RequireSecuritySignature $True –Force;
Enable-SmbDelegation –SmbServer <File Server> -SmbClient <CAU Created Account>;
```

Update SMB settings (run from all nodes)

```
Set-SmbClientConfiguration -EnableSecuritySignature $True`
 -RequireSecuritySignature $True –Force;
```

Set up Cluster-Aware Updating with Dell SUU (run from any node)

```
Add-CauClusterRole -ClusterName VRTX1 -Force -CauPluginName Microsoft.HotfixPlugin`
 -CauPluginArguments @{ 'HotfixRootFolderPath' = '<CAU share:\\server\CAUshare\>';`
 'DisableAclChecks' = 'True'; 'HotfixConfigFileName' = 'DefaultHotfixConfig.xml';`
 'RequireSmbEncryption' = 'False' } -MaxRetriesPerNode 3`
 -StartDate "1/1/2099 12:00:00 AM" -DaysOfWeek 32 -WeeksOfMonth @(5)`
 -EnableFirewallRules;
Enable-CauClusterRole -ClusterName VRTX1 -Force;
```

Run Cluster-Aware Updates (run from any node)

```
Set-CauClusterRole -ClusterName VRTX1 -UpdateNow –Force;
```

Script references

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   technet.microsoft.com/library/dn249523.aspx

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