Dell EMC HCI Solutions for Microsoft Windows Server: Life Cycle Management Approach Comparison

Benefits of Automating the Windows Server HCI Hardware Update Process

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White Paper

Abstract

This white paper quantifies the time savings and reliability improvements gained by automating the hardware update process with Dell EMC OpenManage Integration with Microsoft Windows Admin Center.

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Executive summary

Overview

Life cycle management (LCM) is a priority for every IT operations team. It ensures that systems maintain a sound security posture, run at peak performance and availability, and benefit from newly released features and functionality. However, LCM is often neglected due to manual processes that are time consuming and prone to human error. Dell Technologies and Microsoft remove the stress associated with applying critical updates to HCI infrastructure by automating the process. Dell EMC OpenManage Integration with Microsoft Windows Admin Center makes the update process efficient, repeatable, and predicable.

This white paper quantifies the profound impact that this automation has on a Dell EMC HCI Solutions for Microsoft Windows Server environment. In the Dell Technologies labs, we used two different approaches to update component firmware and Windows Server 2019 operating system drivers (referred to as hardware updates). In the first test, we applied updates by using a fully automated, cluster-aware approach that was enabled by Dell EMC OpenManage Integration. In the second test, we performed updates by using a manual, node-based approach enabled by the Integrated Dell Remote Access Controller (iDRAC) on each AX node.

This paper details the testing methodology that we followed, including assumptions, procedural steps, task durations, and conclusions.

Automation benefits

Based directly on the testing of the four-node cluster in the lab, the automated approach:

- Required 82 percent fewer steps
- Required 90 percent less focused attention from an IT operator
- Reduced by 40 percent the total time required and resulting maintenance window
- Minimized risk caused by IT operator data entry mistakes or installation option guesswork

For larger implementations, we expect that the automated approach will:

- Require 95 percent fewer steps for the maximum cluster size of 16 nodes
- Require 97 less focused attention from an IT operator on maximum cluster sizes of 16 nodes
- Save enterprise customers one week of effort per year if they are running 20 discrete four-node clusters

Note: These projected outcomes are based on our analysis of the evidence that we collected in the lab testing. Results will vary.

We value your feedback

Dell Technologies and the authors of this document welcome your feedback on the solution and the solution documentation. Contact the Dell Technologies Solutions team by email or provide your comments by completing our documentation survey.

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Note: For links to additional documentation for this solution, see the Info Hub for Microsoft HCI Solutions from Dell Technologies.

Lab setup

We built a four-node Windows Server HCI cluster using AX-740xd nodes and following the procedures in the *Microsoft HCI Solutions from Dell Technologies Deployment Guide*. This deployment guide applies only to infrastructure that is built with validated and certified AX nodes from Dell Technologies that are running Microsoft Windows Server 2019 Datacenter. The AX nodes are designed for a hyperconverged infrastructure. The nodes are based on Dell EMC PowerEdge servers, but they are populated with engineered configurations—components, firmware, and drivers that are optimized for software-defined infrastructures.

In our lab setup, we configured a fully converged scalable network topology to run storage, management, and virtual machine (VM) traffic over the same network adapter interfaces. We provisioned five VMs on each node in the cluster so that live migration would be necessary when nodes were placed into maintenance mode. No applications or workloads were running within the VMs during the testing.

The following figure illustrates the lab environment. Ancillary services that are required for cluster operations, such as Active Directory, DNS, and file server witness, are not depicted.

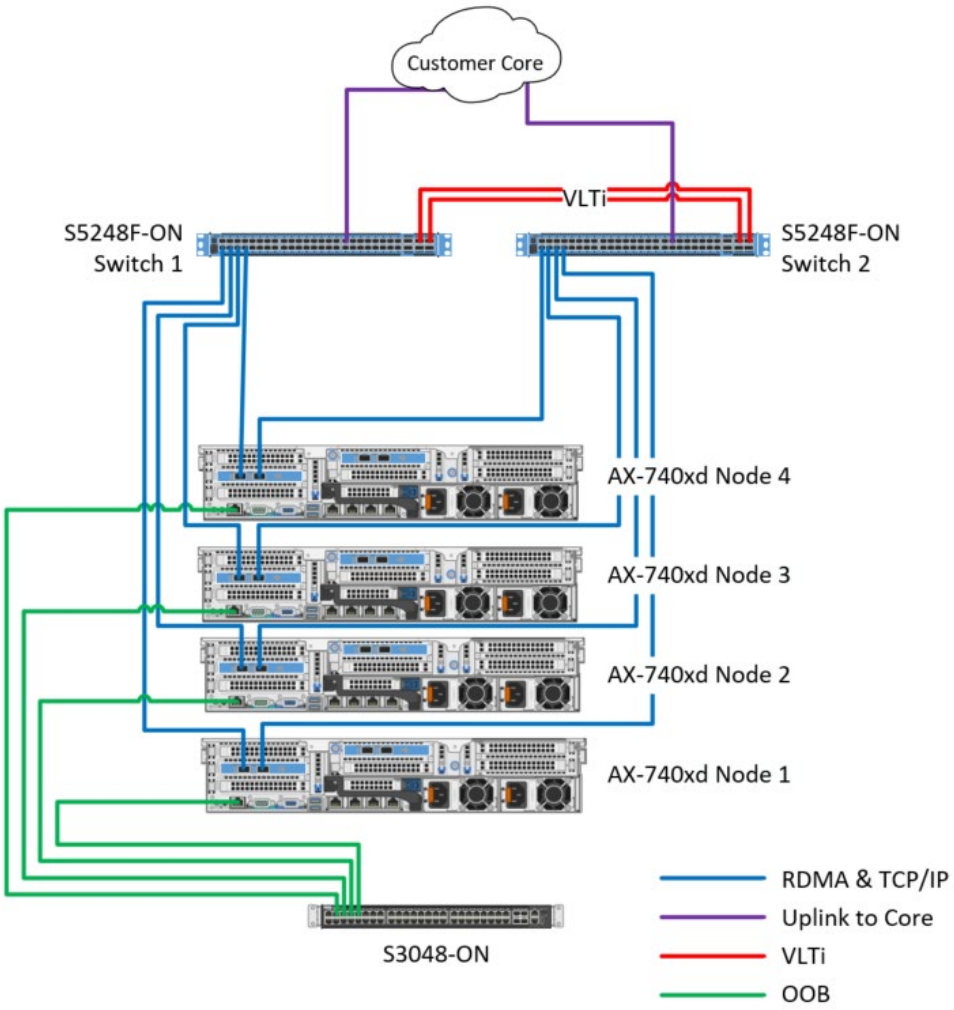

Figure 1. Windows Server HCI cluster configuration

The following tables describe the cluster configuration and node resources. The cluster included a hybrid storage subsystem with SSDs at the caching tier and spinning hard drives at the capacity tier.

Note: Other configurations might affect update performance.

Table 1. Cluster configuration

Cluster design element	Description
Number of cluster nodes	4
Cluster node model	AX-740xd
Number of network switches for RDMA and TCP/IP traffic	2
Network switch model	Dell EMC PowerSwitch S5248F-ON
Network topology	Fully converged network configuration; RDMA and TCP/IP traffic traversing 2 x 25 GbE network connections from each host
Network switch for OOB management	Dell EMC PowerSwitch S3048-ON
Resiliency option	Three-way mirror
Raw storage capacity	64 TB

Table 2. Node resources

Resource (per cluster node)	Description
CPU	Dual Intel Xeon Gold 6230 CPU @ 2.10 GHz
Memory	384 GB DDR4 RAM
Storage controller for operating system	BOSS-S1 adapter card
Physical drives for operating system	2 x Intel 480 GB M.2 SATA drives configured as RAID 1
Storage controller for Microsoft Storage Spaces Direct (S2D)	HBA330 Mini
Physical drives	• Cache Tier—6 x Samsung 960 GB MU SATA SSDs • Capacity Tier—12 x KIOXIA 3.5 in., 4 TB SATA hard drives
Network adapter	Mellanox ConnectX-4 LX dual-port 25 GbE SFP28
Operating system	Windows Server 2019 Datacenter

Testing procedure

Testing overview

To ensure an accurate comparison of the update approaches, we were rigidly systematic during our testing. In scope for the tests were hardware updates only, not updates to host and VM operating systems or applications. We applied component firmware and operating system drivers from the January 2020 release of the *Support Matrix for Microsoft HCI Solutions from Dell Technologies* to the newly deployed cluster. We then followed the procedures in the *Microsoft HCI Solutions from Dell Technologies: Operations Guide for Managing and Monitoring the Solution Infrastructure Life Cycle* to bring the cluster into compliance with the July 2020 release of the support matrix. We used the following test scenarios for comparison:

- Applied hardware updates following a fully automated, cluster-aware updating approach enabled by the Dell EMC OpenManage Integration
- Applied hardware updates following a manual, node-based approach enabled by the integrated Dell Remote Access Controller (iDRAC) on each AX node

The following table lists the components that required an update, the type of update, and the starting and ending release versions. Creating a 6-month gap between the release versions offered a realistic scenario, considering the complexity and time commitment that is typically required to update the hardware of most traditional virtualization environments. This gap also ensured that multiple firmware and driver packages would require updates to bring the cluster into compliance.

Table 3. Updates required during testing

Update	Type	January 2020 release version	July 2020 release version
BIOS	BIOS	2.4.8	2.6.4
BOSS	Firmware	2.5.13.3022	2.5.13.3024
Broadcom Adv. Dual 10 GbE	Firmware	21.40.25.31	21.60.22.11
Broadcom NetXtreme Driver Family	Driver	—	21.60.1
Broadcom NetXtreme-E Driver Family	Driver	—	21.60.22.11
Chipset INF	Driver	10.1.17861.8101	10.1.18243.8188
Dell HBA330 Mini Controller 0 Firmware	Firmware	16.17.00.05	16.17.01.00
Driver for Marvell Unify Configuration	Driver	1.2.0.1048	1.2.0.1051
iDRAC	Firmware	4.00.00.00	4.20.20.20
Mellanox ConnectX-4 LX Dual Port 25 GbE SFP28	Firmware	14.24.80.00	14.26.60.00

Note: The Broadcom NetXtreme Driver Family drivers were not installed during initial deployment of the cluster. The Broadcom adapters were not in use with the fully converged network configuration.

We performed the update process first by following the automated approach. Then, the firmware and drivers were reverted to the January 2020 release level before we used the manual update approach. No errors or failures requiring investigation or remediation occurred in either the automated or the manual scenario.

The following criteria were common to both testing approaches:

- The July 2020 release of the Support Matrix contains the Dell Update Packages (DUPs) from the Dell EMC June 2020 block of updates.
- Although five VMs were provisioned to each cluster node using VMFleet, no load was generated using VMFleet during the update process. The goal was to have VMs running on each node, which would require a live migration when the host was placed into maintenance mode.

The following information applies to the test procedures and results discussion in the remainder of this paper:

- Firmware and driver installation packages are referred to as Dell Update Packages, or DUPs, throughout the update process steps.
- For task durations, we distinguish between attended and unattended administrative time as follows:
  - **Attended**—Requires IT operators' focused attention to complete.
  - **Unattended**—Requires only periodic progress monitoring by IT operators. Operators could potentially do other work during this time.
- Mistakes that occur during the operation of an HCI cluster could have catastrophic consequences to the business. In the following sections, the update process tables—Table 4 and Table 5—include a "Human error quotient" that identifies potential impact based on a relative scale of None, Low, or High. The subsequent discussion in Human error quotient provides additional information.

Many variables can affect update performance and duration. This paper includes specific cluster configuration and update process details to ensure an accurate comparison. Other variables that could affect the update performance are:

- Number of VMs running on the cluster
- Types of workloads running in the VMs
- Number, type, and version of the updates to be applied
- Hardware configuration of the nodes
- Network configuration
- Available Internet bandwidth for downloading all applicable component DUPs

Steps for an automated, cluster-aware approach

Microsoft Windows Admin Center (WAC), which includes a familiar user interface, is browser-based and agent-free. It communicates with managed devices using Windows Management Instrumentation (WMI) over Windows Remote Management (WinRM) and remote PowerShell. To monitor and manage the hardware, Dell EMC OpenManage Integration obtains information from managed servers' iDRACs using an OS to iDRAC Pass-through feature and Redfish technology. Thus, communications can occur in-band and remain agent-free with no other dependencies. Both WAC and Dell EMC OpenManage Integration use the Cluster-Aware Updating feature of Windows Server 2019 to ensure that operating system and hardware updates do not result in downtime to services.

The following figure shows an update compliance report in Dell EMC OpenManage Integration:

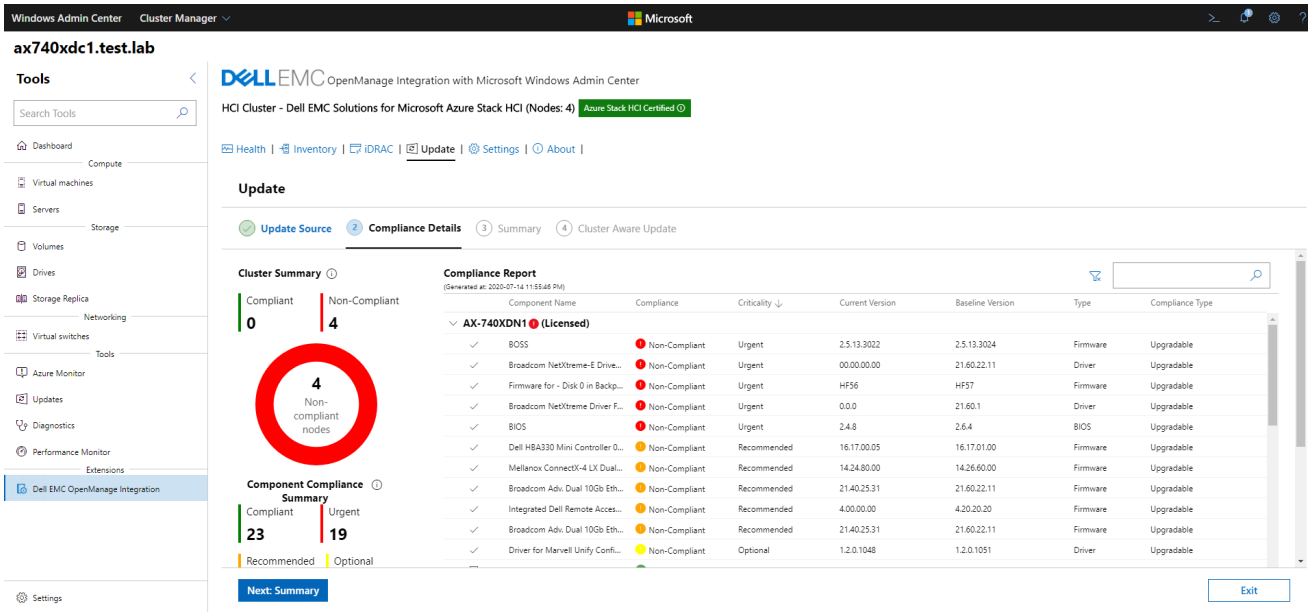

Figure 2. Compliance report depicting updates in Dell EMC OpenManage Integration

The following configuration information is specific to this automated update approach:

- The process steps do not include installation of WAC and Dell EMC OpenManage Integration. We assume that WAC version 1910.2 and Dell EMC OpenManage Integration version 1.1 are already installed and the cluster connection has been established.
- The WAC gateway host is connected to the Internet, so the online catalog could be used as the update source in Dell EMC OpenManage Integration. Choosing the online catalog automatically downloads the required software—Dell System Update (DSU) and Inventory Collector (IC) utilities, and all the DUPs applicable for the latest release of the Windows Server HCI support matrix with the Windows Server HCI Solutions catalog. Dell EMC OpenManage Integration can update AX nodes using an offline catalog and the Dell EMC Repository Manager if the WAC gateway host is not connected to the Internet; however, this scenario was not in scope for this testing.

The following table lists the process steps for the automated approach and the durations that we observed on the cluster in the lab. These steps are also described in the operations guide.

Table 4. Process steps for automated approach

Step		Duration	Details	Human error quotient
1	Review hardware Health tab.	1 min. **Attended**	Verify that all hardware components are healthy. Dell EMC OpenManage Integration automates the health checks for software-defined elements of the cluster.	None
2	Browse to Update tab.	10 sec. **Attended**	Select the online catalog because the WAC gateway host is connected to the Internet. All required utilities and DUPs are automatically downloaded and staged.	None
3	Generate Compliance Report and review updates.	4 min. **Attended**	This compliance report shows both firmware and drivers.	None
4	Initiate and monitor Cluster Aware Update and verify success.	3 hrs. **Unattended**	Cluster Aware Update places each node into maintenance mode for no interruption to VM services. Each node reboots only once because reboots between DUP installations are suppressed. The final compliance report is automatically generated to verify that all updates were successful.	None
Total number of steps = 4 **Total attended time = 5 minutes** **Total unattended time = 3 hours**				

Note: Task durations and total times have been rounded to the nearest minute or hour, wherever possible, for simplicity.

Steps for a manual, node-based approach

In the manual, node-based update scenario, we used corresponding iDRACs to apply the firmware DUPs to each AX node. We used RDP and remote PowerShell to connect to Windows Server 2019 on each AX node to copy driver DUPs, perform health checks, and install the DUPs. This process is in stark contrast to using Dell EMC OpenManage Integration, which addresses BIOS, firmware, drivers, and optional systems management application installations altogether using the same procedure and requires only a single reboot.

The following figure shows the manual update status in iDRAC:

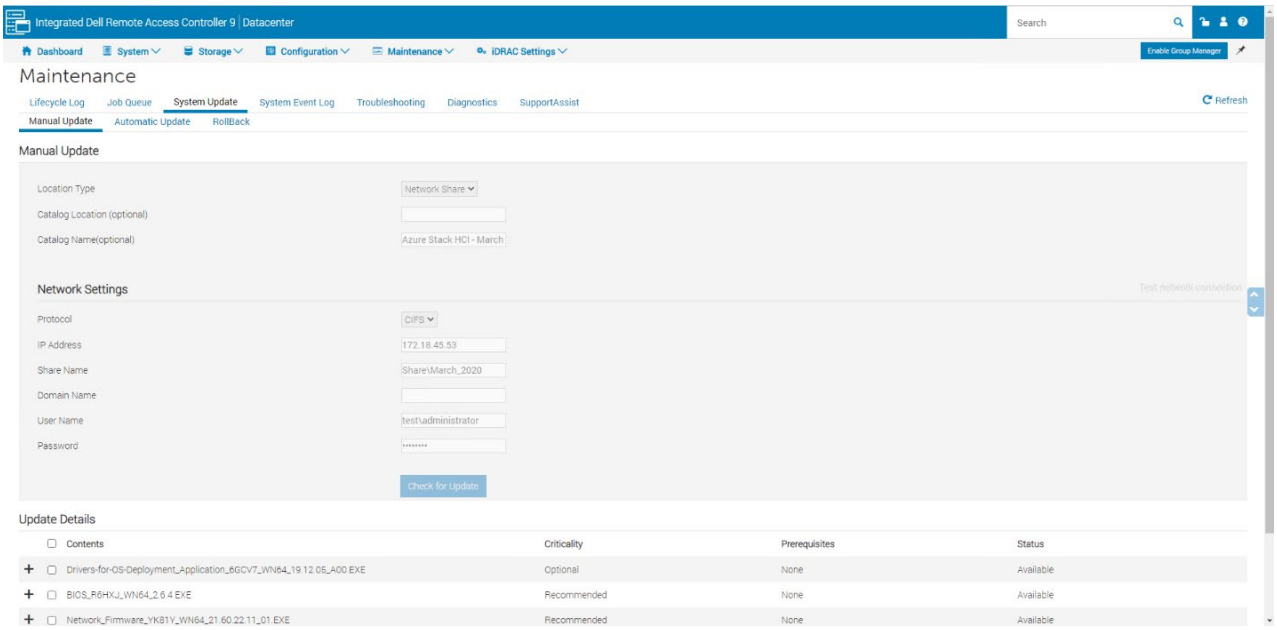

Figure 3. Manual update status shown in iDRAC

The following configuration information is specific to this manual update approach:

- Dell EMC Repository Manager (DRM) provides a simple way to download the correct DUPs when you are following the manual, node-based process. The process steps do not include installation of DRM.
- The process steps do not include creation of a Windows Server share for the DRM export. We assume that a Windows share already exists.
- We assume the existence of a certain level of PowerShell proficiency. To lessen some of the manual effort, you could write simple scripts (not included in the operations guide.

The following table lists the process steps for the manual approach and the durations that we observed on the cluster in the lab. These steps are further described in the operations guide.

Table 5. Process steps for manual approach

Step		Duration	Details	Human error quotient
1	Perform a cluster health check.	1 min. **Attended**	Run PowerShell commands as described in the following section of the operations guide: Preparing for maintenance operations.	High
2	Place AX node #1 into maintenance mode.	1 min. **Attended**	Run PowerShell commands as described in the following section of the operations guide: Placing an AX node in maintenance mode.	Low
3	Obtain the update catalog from DRM.	3 min. **Attended**	Add a repository in DRM and export it to Windows share. For details, see the following section of the operations guide: Obtaining the firmware catalog for AX nodes or Ready Nodes using Dell EMC Repository Manager.	High

Step		Duration	Details	Human error quotient
4	Update the AX node #1 firmware through iDRAC.	3 min. **Attended** 50 min. **Unattended**	a. Update the firmware through iDRAC. For details, see the following section of the operations guide: Updating the AX node by using iDRAC out of band. b. Check the iDRAC Job Queue to ensure that the firmware update was successful.	None
5	Retrieve a list of driver versions installed on AX nodes.	4 min. **Attended** 6 min. **Unattended (command execution)**	a. Run a PowerShell command as described in the following section of the operations guide: Updating the out-of-box drivers. b. Manually compare the list of drivers with the drivers in the July 2020 release of the support matrix. Select the correct drivers and copy them to AX nodes.	High
6	Install driver DUPs on AX node #1.	5 min. **Attended** 10 min. **Unattended (server reboot and command execution)**	a. Install the driver DUPs on AX node #1. b. Verify that the drivers were successfully installed by rerunning the command in the preceding step.	None
7	Exit AX node #1 from maintenance mode.	1 min. **Attended**	For details, see the following section in the operations guide: Exiting the AX node from maintenance mode.	Low
8	Perform a cluster health check.	1 min. **Attended**	For details, see step 1.	High
9	Place AX node #2 into maintenance mode.	1 min. **Attended**	For details, see step 2.	Low
10	Update the AX node #2 firmware through iDRAC.	3 min. **Attended** 50 min. **Unattended**	For details, see step 4.	None
11	Install driver DUPs on AX node #2.	5 min. **Attended** 10 min. **Unattended (server reboot and command execution)**	For details, see step 6.	None
12	Exit AX node #2 from maintenance mode.	1 min. **Attended**	For details, see step 7.	Low
For AX nodes 3 and 4, perform steps 8–12 on each server. **Total number of steps = 22** **Total attended time = 51 minutes** **Total unattended time = 4 hours**				

Note: Task durations and total times have been rounded to the nearest minute or hour, wherever possible, for simplicity.

Results and conclusions

Procedural steps

On the four-node cluster based on AX-740xd nodes from Dell Technologies, the automated approach required 82 percent fewer steps to fully update the hardware as compared with the manual approach. Based on an extrapolation of this figure to the maximum 16 nodes in a cluster, hardware updates using the automated approach would require 95 percent fewer steps. The following figure provides a visual comparison of the number of steps in the processes:

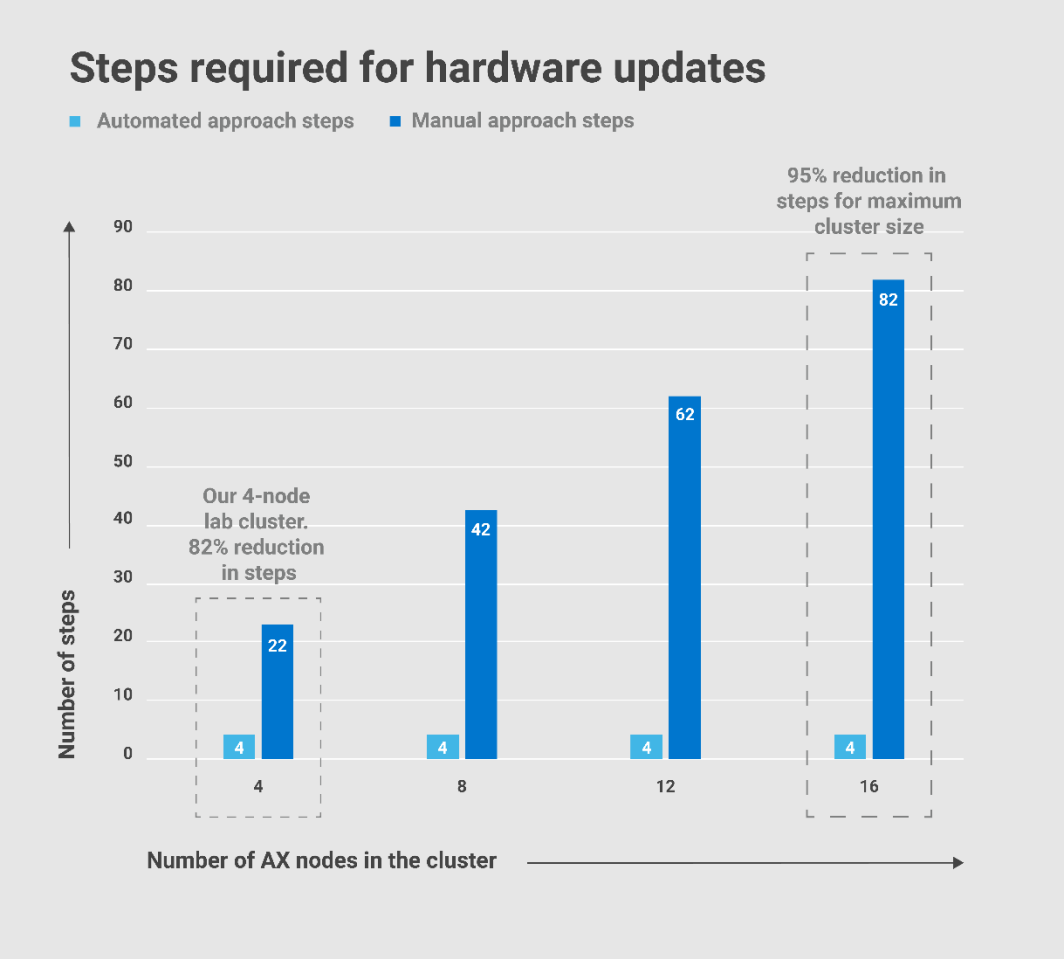

Figure 4. Required steps: Automated and manual approach comparison

With the automated approach, the number of steps always remains consistent as more nodes are added to a cluster. With the manual approach, the number of steps would increase linearly as the number of nodes in the cluster increases. The manual update process includes two steps that must only be completed once per cluster (that is, steps 3 and 5 in Table 4) and five steps that must only be completed once per node (steps 8 through 12 in Table 4).

Attended time

On the four-node cluster, the automated approach required 90 percent less focused, concentrated effort compared with the manual approach, as shown in the following figure. As previously noted, periodic progress monitoring is part of unattended time; thus, it is not addressed in the figure.

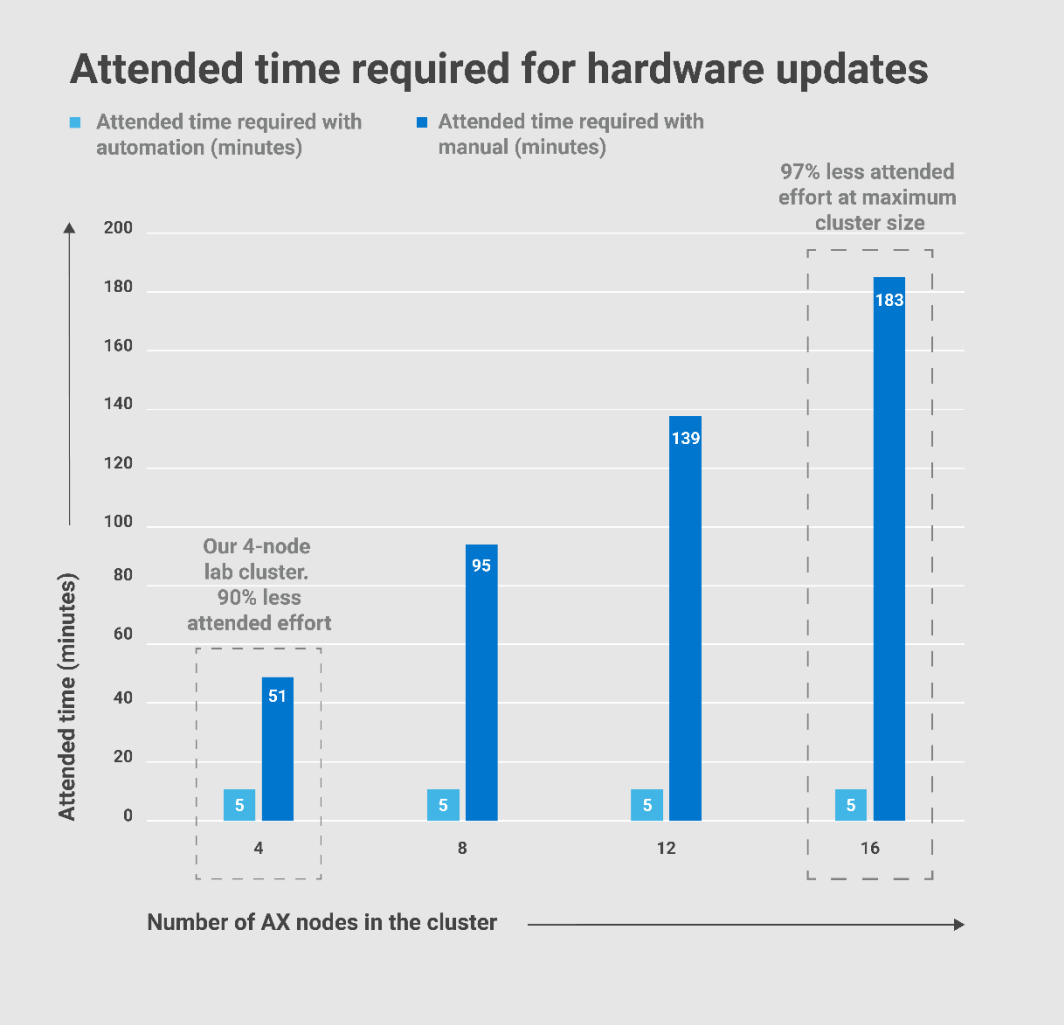

Figure 5. Attended time: Automated and manual approach comparison

Table 4 shows that the automated approach on the four-node cluster in the lab required only 5 minutes of attended time and does not change as the cluster is expanded. Table 5 shows that the manual approach on the four-node cluster in the lab required 51 minutes and increases incrementally as more nodes are added to the cluster. Thus, predictions for a 16-node cluster indicate that IT operators could save almost 3 hours of attended time by using the automated approach—a 97 percent reduction compared with the manual approach.

Total time for maintenance window

Maintenance windows that require change control board approval for Windows Server HCI updates must consider the total attended and unattended time. Typically, organizations require maintenance windows during LCM operations because update failures have the potential to affect the normal response times that end users experience. On the four-node cluster in the lab, the benefit of the automated approach meant a 40 percent shorter maintenance window as compared with the manual approach.

Note: Maintenance windows are not the same as scheduling downtime. Dell EMC OpenManage Integration places target nodes into maintenance mode, which migrates running VMs to other online hosts. This process ensures that there is no application downtime. However, most organizations still prefer to schedule maintenance windows when production systems are being updated.

In our lab testing of the automated process, each node beyond the first node took 45 minutes in total—including both unattended and attended time—to complete the update. (The first node took a little longer due to preparation tasks.) Using the manual process, each node beyond the first node took about 71 minutes total time to complete.

The following figure compares the total maintenance windows for automated and manual updates:

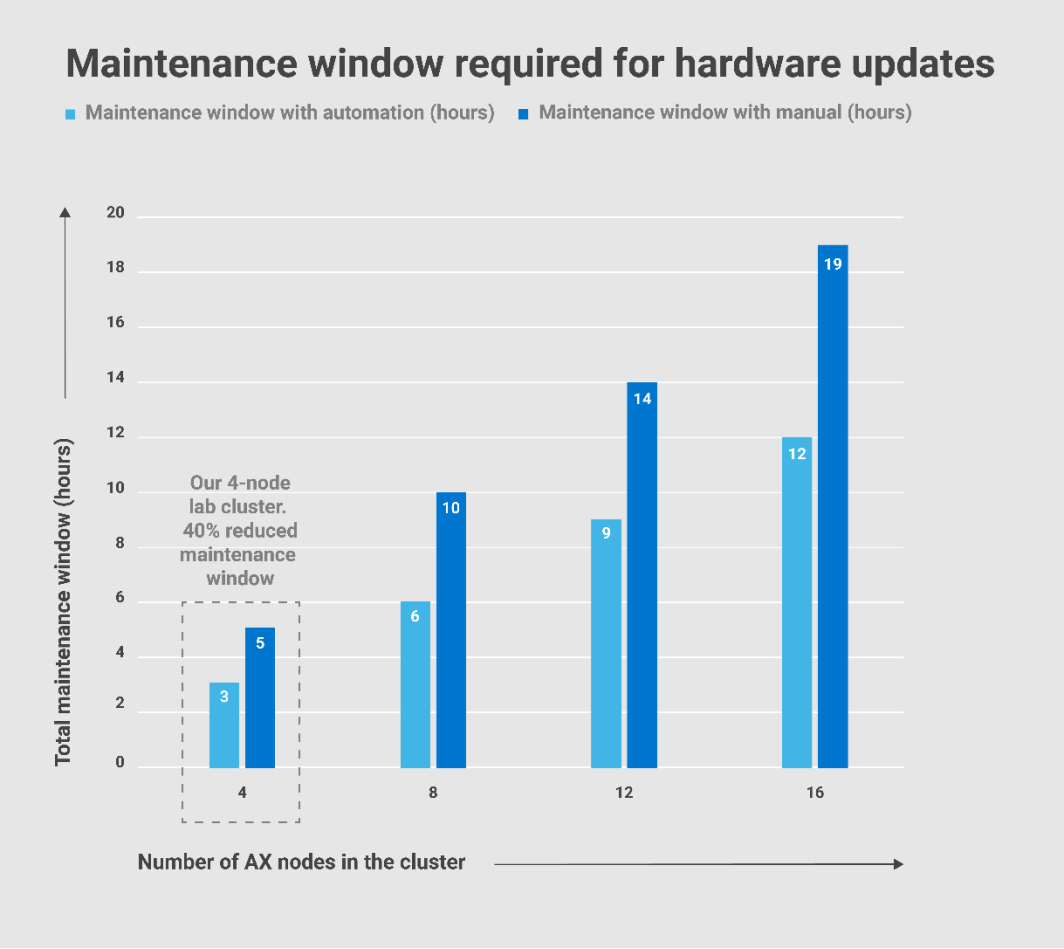

Figure 6. Maintenance window: Automated and manual approach comparison

To put this time savings into perspective, consider the time consumed by LCM tasks within large enterprise IT organizations. Some enterprises use Windows Server HCI to solve their business challenges in globally distributed remote branch offices and regional data centers. The challenges presented by LCM activities increase exponentially with multiple clusters. Dell Technologies releases quarterly updates for Dell EMC HCI Solutions for Microsoft Windows Server and recommends applying the updates as soon as possible. Based on the lab testing, an IT organization that must update 20 four-node clusters each quarter could expect to save almost an entire week of time per year by following the automated approach instead of the manual approach.

Human error quotient

Using the Dell EMC OpenManage Integration online catalog as the update source significantly minimizes risk related to performing the update process. It eliminates the need for installation decisions and manual data entry by an IT administrator. When you use the online catalog as the update source, you eliminate even the potential to inadvertently click the wrong button or proceed down the wrong path in an installation wizard. In addition, Dell EMC OpenManage Integration includes scripts that perform cluster health checks throughout the process that stop the update procedure if any errors are discovered.

Note: The online catalog method is only available if the Windows Admin Center gateway host is directly connected to the Internet.

The manual update method leaves far more potential for human error throughout the process that can result in workload interruption. The following table provides more details about this potential by explaining some of the riskiest steps:

Table 6. Manual steps with potential for human error

Manual step	Potential risk for human error
Perform cluster health check.	This step can be considered high risk because the PowerShell-based health check results can be misinterpreted. An IT operator can then unwittingly apply the updates to a cluster in a degraded state.
Place AX node #1 into maintenance mode.	This step is lower risk. However, IT operators must pay close attention and verify that the specific node has successfully entered maintenance mode before continuing.
Obtain update catalog from DRM.	This step is high risk because IT operators must select and export the catalog that is validated and certified for AX nodes. If they mistakenly select the catalog for another platform, the cluster will no longer be compliant with the support matrix, which can have severe consequences on performance and availability.
Retrieve the list of driver versions installed on AX nodes.	This step can be considered high risk because IT operators must analyze the list of drivers installed in the operating system and manually compare them with the drivers in the support matrix. Installing incorrect or noncertified operating system drivers places the nodes out of compliance with the support matrix, which could affect performance and availability.
Take AX node #1 out of maintenance mode.	This step is lower risk. However, after taking a node out of maintenance mode, IT operators must ensure that the cluster has properly rebalanced and that there are no storage jobs still in progress. If they are not paying close attention, the operators could move forward with placing the next node into maintenance mode before the cluster is healthy.

Summary

Our testing showed that using Dell EMC OpenManage Integration to automatically update hardware in the Windows Server HCI cluster brought tremendous benefits in time efficiency, repeatability, predictability, peace of mind, and solutions assurance. Further, it dramatically reduced the risk of human error. The benefits increased as we extrapolated the testing data to the maximum cluster size of 16 nodes and to multiple clusters.

References

The following web pages and documentation provide additional information. Access to this content depends on your login credentials. If you cannot access the content, contact your Dell Technologies representative.

- Info Hub—Microsoft HCI Solutions from Dell Technologies
- Product Page—Dell EMC HCI Solutions for Microsoft Windows Server
- Operations Guide—Microsoft HCI Solutions from Dell Technologies: Managing and Monitoring the Solution Infrastructure Life Cycle