



The science behind the report:

Reduce hands-on deployment times to near zero with iDRAC9 automation

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report [Reduce hands-on deployment times to near zero with iDRAC9 automation](#).

We concluded our hands-on testing on January 27, 2023. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on January 20, 2023 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

To learn more about how we have calculated the wins in this report, go to <http://facts.pt/calculating-and-highlighting-wins>. Unless we state otherwise, we have followed the rules and principles we outline in that document.

The table below presents our findings in detail. Please note that organizations can order new Dell EMC PowerEdge servers with Zero-Touch provisioning already enabled, which would eliminate all steps and time to complete these tasks.

Time to provision	One-time setup (mm:ss)	Single server (mm:ss)	10 servers (hh:mm:ss)	50 servers (hh:mm:ss)	100 servers (dd:hh:mm:ss)
Manual attended	N/A	27:07	4:31:10	22:35:50	1:21:11:40
Manual unattended	N/A	20:01	*	*	*
Manual total	N/A	47:08	*	*	*
Automated with iDRAC9 v6.10.05.00 attended	18:21	00:33	00:05:30	00:27:30	0:00:55:00
Automated with iDRAC9 v6.10.05.00 unattended	00:00	36:21	*	*	*
Automated with iDRAC9 v6.10.05.00 total	18:21	36:54	*	*	*

* We did not extrapolate the unattended times because they would not scale linearly as the attended times do. An admin would configure each system and allow the OS to install automatically, so many OS installations would happen in parallel.

Number of steps to provision	Single server	10 servers	50 servers	100 servers
Provision a server manually	39	390	1,950	39,000
One-time setup for automated provisioning	47	N/A	N/A	N/A
Automated provisioning with iDRAC9 v6.10.05.00	4	40	200	4,000

System configuration information

The table below presents detailed information on the systems we tested.

Server configuration information	Dell™ PowerEdge™ R760
BIOS name and version	Dell 1.0.1
Non-default BIOS settings	N/A
Operating system name and version/build number	Windows Server 2022 Datacenter, Build 20348
Date of last OS updates/patches applied	1/20/23
Power management policy	Performance
iDRAC version	6.10.05.00
Processor	
Number of processors	2
Vendor and model	Intel® Xeon® Platinum 8452Y
Core count (per processor)	36
Core frequency (GHz)	2.0
Stepping	6
Memory module(s)	
Total memory in system (GB)	1,024
Number of memory modules	16
Vendor and model	Hynix® Semiconductor HMCG94AEBRA109N
Size (MB)	65,536
Type	ECC DDR5
Speed (MHz)	4,800
Speed running in the server (MHz)	4,800
Storage controller A	
Vendor and model	Marvell BOSS-N1 Monolithic
Cache size (GB)	0
Firmware version	2.1.13.2004
UEFI Driver version	0.0.13.0011
Storage controller B (not utilized)	
Vendor and model	Dell PERC H965i Front
Cache size (MB)	8,361
Firmware version	8.0.0.0.18-74
UEFI Driver version	0.0.13.0011

Server configuration information	Dell™ PowerEdge™ R760
Local storage A	
Number of drives	2
Drive vendor and model	Dell EC NVMe ISE 7400 RI M.2 480GB
Drive size (GB)	447
Drive information (speed, interface, type)	8 GT/s, M.2, NVMe 1.4
Local storage B (not utilized)	
Number of drives	4
Drive vendor and model	WDC WUSTR6416BSS200
Drive size (GB)	1,489.88
Drive information (speed, interface, type)	12 Gbps, SAS, SSD
Local storage C (not utilized)	
Number of drives	8
Drive vendor and model	Dell Ent NVMe v2 AGN MU U.2 3.2TB
Drive size (GB)	2,980.82
Drive information (speed, interface, type)	16 GT/s, PCIe 4.0, NVMe
Network adapter	
Vendor and model	Broadcom® NetXtreme Gigabit Ethernet BCM5720
Number and type of ports	2, 1000 Base T
Firmware version	21.6.40.163
Cooling fans	
Vendor and model	Fan.Embedded
Number of cooling fans	6
Power supplies	
Vendor and model	Dell PWR SPLY,1400W,RDNT,DELTA
Number of power supplies	2
Wattage of each (W)	1,400

How we tested

The following methodology provides the steps to enable and execute zero-touch provisioning of Dell servers with iDRAC 9 version 6.10. We compare the time it takes to change select BIOS settings, create a RAID, and deploy Windows manually vs. automatically via iDRAC. Zero-touch provisioning via Server Configuration Profile (SCP) requires an environment that includes a DHCP server, a network file share, and a Windows Server 2022 ISO with the \boot\bootfix.bin file removed to prevent the “press any key to boot” option. For the sake of this report and methodology, we are assuming that these already exist in a company’s IT infrastructure, so we do not include time and steps to create or obtain them. We do, however, include time and steps for any modifications to the DHCP and file share necessary for the automation task. For this methodology, we used NFS for our network file share. We outline the steps and time required to modify the DHCP, create the SCP, and run the automated install. These are one-time tasks that admins must perform to enable one-touch provisioning. Once these tasks are complete, admins can quickly and easily provision additional servers as needed. The automation process also requires an unattend.xml or answer file for the SCP to call to perform the OS deployment. Many companies already have this file, and there are multiple ways to create one. Because of this, we’ve included the steps we took to create the file for our testing for reference but do not include it in the total time and steps for the one-time tasks necessary for the iDRAC automation. We also record time and steps for performing the same tasks manually.



Manually configuring and deploying the OS

Configuring the manually installed server

We configured a Dell PowerEdge R760 with the following settings to build a manually installed server:

1. Log into the iDRAC console.
2. Open the Virtual Console.
3. Power on the server.
4. When the prompt appears, press F10 to enter the Lifecycle Controller.
5. In the Lifecycle Controller, select System Setup.
6. Navigate to Advanced Hardware Configuration → Device Settings → BOSS in SL 12: BOSS-N1 Boot Controller.
7. In the Configuration Utility, click Create RAID Configuration.
8. Select both NVMe drives, click Goto RAID Config, and make the following selections:
 - Select RAID Level: RAID1
 - Stripe Size: 128
 - Quick Initialization: Quick
 - Name: OS
9. To create the virtual disk, click the radio button beside Yes for the question Would you like to create this virtual disk?
10. At the Warning popup window, click OK, and click Accept.
11. Click OK, and click Back until you return to the RAID controller’s Main Menu.
12. Click Finish, click Yes to save the changes, and click OK.
13. Click Finish until you return to the LC main menu, and click Yes to reboot.
14. In the Lifecycle Controller menu, click System Setup → Advanced Hardware Configuration → System BIOS.
15. Change the following settings, clicking Apply after each change:
 - Memory Settings → Memory Operating Mode:
 - Change to Optimizer Mode.
 - Boot Settings → Hard-disk Drive Placeholder:
 - Change to Enabled.
 - Integrated Devices → iDRAC Direct USB Port:
 - Change to Off.
 - System Profile Settings → System Profile:
 - Change to Performance.

16. In Lifecycle Controller, click Back, click Finish twice, and click Yes to confirm you would like to exit and reboot.
17. The system reboots multiple times. View the progress by clicking Job Queue or by viewing the Virtual Console.
18. From the Virtual Console, click Virtual Media at the top of the window.
19. Under Map CD/DVD, click Choose File, browse to and select your ISO, click Open, click Map Device, and click Close.
20. When the prompt appears, press F10 to enter the Lifecycle Controller.
21. Click OS Deployment, and click Deploy OS.
22. Select Go Directly to OS Deployment, and click Next.
23. Select the following, and click Next:
 - Boot Mode: UEFI
 - Secure Boot: Disabled
 - Secure Boot Policy: Standard
 - Available Operating Systems: Microsoft Windows Server 2022
24. Check Manual Install, and click Next.
25. In the Select Media drop-down menu, select your ISO File, and click Next.
26. To reboot the system, click Finish.
27. To boot from CD/DVD, click any key.
28. In the Windows Setup window, select your Language, Time and Keyboard, and click Next.
29. Click Install Now.
30. Enter the license key, and click Next.
31. Select Windows Server 2022 Datacenter (Desktop Experience), and click Next.
32. Accept the license terms, and click Next.
33. Select Custom: Install Windows only (advanced).
34. Select the drive on which to install the OS, and click New.
35. Use the maximum size, and click Apply.
36. In the popup window, click OK.
37. To begin OS installation, click Next.
38. Allow OS to complete installation, and boot to the customization screen.
39. Enter and confirm a password for the Administrator account, and click Finish.

One-time configuration for automated process

Configuring the initial server

We configured a Dell PowerEdge R760 with the following settings to use as the template for the SCP XML file that iDRAC will use to automate the server provisioning process:

1. Log into the iDRAC console.
2. Open the Virtual Console.
3. Power on the server.
4. When the prompt appears, press F10 to enter the Lifecycle Controller.
5. In the Lifecycle Controller, select System Setup.
6. Navigate to Advanced Hardware Configuration → Device Settings → BOSS in SL 12: BOSS-N1 Boot Controller.
7. In the Configuration Utility, click Create RAID Configuration.
8. Select both NVMe drives, click Goto RAID Config, and make the following selections:
 - Select RAID Level: RAID1
 - Stripe Size: 128
 - Quick Initialization: Quick
 - Name: OS
9. To create the virtual disk, click the radio button beside Yes for the question Would you like to create this virtual disk?
10. At the Warning popup window, click OK, and click Accept.
11. Click OK, and click Back until you return to the RAID controller's Main Menu.
12. Click Finish, click Yes to save the changes, and click OK.

13. Click Finish until you return to the LC main menu, and click Yes to reboot.
14. When the prompt appears, press F10 to enter the Lifecycle Controller.
15. In the LC menu, click System → Advanced Hardware Configuration → System BIOS.
16. Change the following settings, clicking Apply after each change:
 - Memory Settings → Memory Operating Mode:
 - Change to Optimizer Mode.
 - Boot Settings → Hard-disk Drive Placeholder:
 - Change to Enabled.
 - Integrated Devices → iDRAC Direct USB Port:
 - Change to Off.
 - System Profile Setting → System Profile:
 - Change to Performance.
17. From the Virtual Console, power off the system.
18. In the LC menu, at the bottom of the BIOS Setup page, click Apply and Reboot.
19. The system reboots multiple times. View the progress by clicking Job Queue or by viewing the Virtual Console.

Creating the SCP Config File

We performed the following steps on a Dell PowerEdge R760 to create the SCP config file in XML format:

1. Log into the iDRAC console.
2. Click Configuration.
3. Click Server Configuration Profile.
4. Expand Export.
5. Select the following:
 - Location Type: Network Share
 - IP Address: 192.168.1.1
 - Export Type: Clone
 - File Name: system_config.xml
 - Share Name: NFS_Share
 - Export File Format: XML
 - Protocol: NFS
 - Export Components: All
6. Click Export. An Information window pops up showing that the job has started.
7. Click Job Queue to monitor until it's completed.
8. Log into the file server and edit the system_config.xml file with the following changes and additions:

- Change the following under the Component FQDD="BOSS.SL.12-1" section:

```
<Attribute Name="Size">0</Attribute>
```

- Change/Verify the following under the "Component FQDD="BIOS.Setup.1-1"" section:

```
<Attribute Name="HddPlaceholder">Enabled</Attribute>
```

- Add the following to the system_config.xml file to set up the OS installation information:

```
<Component FQDD="LifecycleController.Embedded.1">
<!-- <Attribute Name="OSD.1#SupportedOSList">Microsoft Windows Server 2016, Microsoft Windows Server
2012 R2, Microsoft Windows Server 2019, Microsoft Windows Server 2022, Red Hat Enterprise Linux 8.0
x64, Red Hat Enterprise Linux 7.6 x64, SuSE Enterprise Linux 15 x64</Attribute> -->
<Attribute Name="OSD.1#OSName">Microsoft Windows Server 2022</Attribute>
<Attribute Name="OSD.1#OSMediaShareIP">192.168.1.1</Attribute>
<Attribute Name="OSD.1#OSMediaShareName">NFS_Share</Attribute>
<Attribute Name="OSD.1#OSMediaShareType">NFS</Attribute>
<Attribute Name="OSD.1#OSMediaName">WindowsServer2022.iso</Attribute>
<Attribute Name="OSD.1#AnswerFileName">autounattend.xml</Attribute>
<Attribute Name="OSD.1#ExposeDuration">3600</Attribute>
</Component>
```

- Change/Verify the following under the Component FQDD="iDRAC.Embedded.1" section:

```
<Attribute Name="Users.2#UserName">root</Attribute>
<Attribute Name="IPv4.1#DHCPEnable">Enabled</Attribute>
<Attribute Name="Users.2#Password">Calvin#SCP#CloneReplace1</Attribute>
<Attribute Name="NICStatic.1#DNSDomainFromDHCP">Enabled</Attribute>
<Attribute Name="IPv4Static.1#DNSFromDHCP">Disabled</Attribute>
<Attribute Name="IPv6Static.1#PrefixLength">64</Attribute>
<Attribute Name="IPv6Static.1#DNSFromDHCP6">Disabled</Attribute>
```

9. Save the file and power off the server.

Configuring options 43 and 60 on the DHCP server

1. Log into the DHCP Server.
2. Click Start → Administrative Tools → DHCP.
3. Navigate to <server> > IPv4 > Scope <ip> > Scope Options.
4. Right-click Scope Options, and select Configure Options to open the popup window.
5. In the popup window, check the box for 043 Vendor Specific Info.
6. Inside the Data Entry location, enter the IP address of your DHCP server in the ASCII column, and click OK.
7. Navigate to <server> > IPv4.
8. Right-click IPv4, and select Define Vendor Classes.
9. In the popup window, click Add and edit the following information:
 - Display name: iDRAC
 - Description: Vendor Class
 - ASCII: iDRAC
10. Click OK, and click Close.
11. Right-click IPv4, and select Set Predefined Options.
12. In the popup window, use the Option Class drop-down menu to select iDRAC, and click Add.
13. In the Option Type popup window, enter the following, and click OK:
 - Name: iDRAC
 - Data Type: String
 - Code: 60
14. Navigate to <server> > IPv4 > Scope <ip> > Scope Options.
15. Right-click Scope Options, and select Configure Options to open the popup window.
16. Click the Advanced Tab, and select iDRAC from the Vendor Class drop-down menu.
17. Under the Available Options column, select the 060 iDRAC box.
18. Under the Data Entry section, enter the appropriate String Value. This must include the Answer file name, file server IP, and share name. Click Apply, and click OK. We used the following:

```
-f system_config.xml -i 192.168.1.1 -n /nfs_share -s 0 -d 1
```

19. Click OK, exit DHCP, and log out of the DHCP server.

Installing the Configuration and OS via Auto Config with DHCP Provisioning

We performed the following on a Dell PowerEdge R760 server to automatically provision the BIOS and RAID settings and deploy the OS via iDRAC:

1. Log into the system's iDRAC.
2. Click iDRAC Settings.
3. Click Connectivity.
4. Expand Network → Auto Config, select Enable Once in the DHCP Provisioning drop down menu, and click Apply.

To monitor the job's progress, click Maintenance, and click Job Queue. You can also watch progress via the Virtual Console. The system boots into the Lifecycle Controller and reboots several times while running tasks from the Automated Task Application screen.

Non-timed steps

Creating the Windows autounattend.xml file

As we stated previously, we did not include this segment in our time and steps to create the environment for the automated provisioning. We provide these steps for reference only.

1. Log into Windows Server 2022 (Infrastructure server).
2. Download the Windows ADK for Windows Server 2022 at the following location: <https://go.microsoft.com/fwlink/?linkid=2162950>.
3. Right-click the download → Mount to make the .iso available for use.
4. Double-click adksetup.exe, and click Run.
5. Select Install the Windows Assessment and Development Kit - Windows 10 to this computer, use the default path C:\Program Files (x86)\Windows Kits\10\ , and click Next.
6. On the Windows Kits Privacy screen, select No, and click Next.
7. Accept the License Agreement.
8. On the Select the features you want to install, keep the default selections, click Install, and click Close.
9. Download the Windows PE add-on for the ADK at the following location: <https://go.microsoft.com/fwlink/?linkid=2163233>.
10. Double-click the .iso for the Windows PE add-on for the ADK for Windows Server 2022.
11. Double-click adkwinpesetup.exe.
12. Select Install the Windows Assessment and Development Kit Preinstallation Environment Add-ons - Windows 10 to this computer, use the default path C:\Program Files (x86)\Windows Kits\10\ , and click Next.
13. On the Windows Kits Privacy screen, select No, and click Next.
14. Accept the License Agreement, and click Next.
15. On the Select the features you want to install, keep the default selections, and click Install.
16. Reboot the server.
17. Create the folder C:\ISO_Build\ISO_Extracted.
18. Mount and extract Windows Server installation ISO, and copy contents to C:\ISO_Build\ISO_Extracted.
19. From the Start Menu, Launch Windows System Image Manager.
20. Click File, and click Select Windows Image.
21. Browse to C:\ISO_Build\ISO_Extracted\sources, select install.wim, and click Open.
22. Select Windows Server 2022 SERVERDATACENTER, and click OK.
23. Click Yes to create a catalog file. This takes several minutes.
24. Click File, and click New Answer File.
25. In the Windows Image section, perform the following:
 - Right-click amd64_Microsoft-Windows-International-Core-WinPE__neutral, and select Add Setting to Pass 1 windowsPE.
 - Right-click amd64_Microsoft-Windows-Setup__neutral ,and select Add Setting to Pass 1 windowsPE.
 - Right-click amd64_Microsoft-Windows-International-Core__neutral, and select Add Setting to Pass 7 oobeSystem.
 - Right-click amd64_Microsoft-Windows-Shell-Setup__neutral, and select Add Setting to Pass 7 oobeSystem.
26. In the Answer File section, modify the following:
 - amd64_Microsoft-Windows-International-Core-WinPE__neutral:
 - Change InputLocale, SystemLocale, UILanguage, and UserLocale to en-US.
 - amd64_Microsoft-Windows-International-Core-WinPE__neutral > SetupUILanguage:
 - Change WillShowUI to Never.
 - Change UILanguage to en-US.
 - amd64_Microsoft-Windows-Setup__neutral > DiskConfiguration:
 - Right-click DiskConfiguration, and click Insert New Disk.
 - Click DiskConfiguration, and change WillShowUI to Never.
 - Expand amd64_Microsoft-Windows-Setup__neutral → DiskConfiguration.
 - Click the new disk.
 - In the Disk Properties section, modify the Disk ID to 0 and WillWipeDisk to true.
 - Expand Disk, right-click CreatePartitions, and click Insert new CreatePartition.
 - Repeat three more times for a total of four CreatePartition entries.
 - For the four new CreatePartition entries, modify them as follows:
 - Order = 1, Size = 500, Type = Primary, Extend = false.
 - Order = 2, Size = 100, Type = EFI, Extend = false.

- Order = 3, Size = 16, Type = MSR, Extend = false.
- Order = 4, Type = Primary, Extend = true.
- Right-click ModifyPartitions, and click Insert new ModifyPartition.
- Repeat three more times for a total of four ModifyPartition entries.
- For the four new ModifyPartition entries, modify them as follows:
 - Order = 1, PartitionID = 1, Format = NTFS, Label = WinRE, TypeID = DE94BBA4-06D1-4D40-A16A-BFD50179D6AC.
 - Order = 2, PartitionID = 2, Format = FAT32, Label = System.
 - Order = 3, PartitionID = 3.
 - Order = 4, PartitionID = 4, Format = NTFS, Label = OS, Letter = C.
- amd64_Microsoft-Windows-Setup__neutral > ImageInstall:
- Navigate to OSImage → InstallFrom.
- Right-click InstallFrom, and select Insert NewMetadata.
- Click MetaData.
- In the MetaData Properties section, modify the following:
 - Key = /IMAGE/NAME , Value = Windows Server 2022 SERVERDATACENTER
- Navigate to InstallTo, and change the following in the InstallTo Properties section:
 - Disk ID = 0 , PartitionID = 4
- amd64_Microsoft-Windows-Setup__neutral > UserData:
- Change AcceptEULA to true.
- Change Organization to your organization name.
- Select ProductKey and add your key (with dashes), and change WillShowUI to Never.
- amd64_Microsoft-Windows-International-Core__neutral:
- Change InputLocale, SystemLocale, UILanguage, and UserLocale to en-US.
- amd64_Microsoft-Windows-Shell-Setup__neutral > OOBE:
- Change HideEULAPage to true.
- Change HideOEMRegistrationScreen to true.
- amd64_Microsoft-Windows-Shell-Setup__neutral > UserAccounts > LocalAccounts:
- Right-click LocalAccounts, and select Insert New LocalAccount.
- Select LocalAccount, and change Description to Local Administrator.
- Change DisplayName to Administrator.
- Change Group to Administrators.
- Change Name to Administrator.
- Select Password, and change value to your specified password.

27. Remove residual stale entries in the Answer File.
28. Click Tools → Validate Answer File to make sure there are no errors.
29. Save Answer file as autounattend.xml.
30. Copy autounattend.xml to your NFS Share.

Creating the custom Windows Server ISO

1. Navigate to C:\ISO_Build\ISO_Extracted\boot, and delete bootfix.bin.
2. Copy autounattend.xml to C:\ISO_Build\ISO_Extracted.
3. Open a command prompt as Administrator.
4. Navigate to C:\Program Files (x86)\Windows Kits\10\Assessment and Deployment Kit\Deployment Tools\amd64\Oscdimg.
5. Use the following command to create your custom ISO:

```
OSCDIMG -lWinServer2022 -m -u2 -bc:\ISO_Build\ISO_Extracted\boot\etfsboot.com C:\ISO_Build\ISO_Extracted C:\Shares\NFS_Share\WindowsServer2022.iso
```

Read the report at <https://facts.pt/COiK7Jf> ►

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