The science behind the report:

A consistent Windows 10 Pro image deployment experience—regardless of processor

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 A consistent Windows 10 Pro image deployment experience— regardless of processor.

We concluded our hands-on testing on August 20, 2020. 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 August 13, 2020 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

Table 1: Results of our testing

	Lenovo® ThinkPad® T14 20UD with an AMD Ryzen™ 5 PRO 4650U processor	Lenovo ThinkPad T14 20S0 with an Intel® Core™ i5-10310U processor
Deploying one laptop using Configuration Manager		
Admin time (mm:ss)	1:47	1:49
System time (mm:ss)	14:54	15:35
Total time (mm:ss)	16:41	17:24
Total steps	6	6
Adding drivers to the boot image and driver package		
Time (mm:ss)	2:57	2:53
Total steps	11	11

System configuration information

Table 2: Detailed information on the laptops we tested.

Laptop configuration information	Lenovo ThinkPad T14 20UD with an AMD Ryzen 5 Pro 4650U processor	Lenovo ThinkPad T14 20S0 with an Intel Core i5-10310U processor
Processor		
Vendor	AMD	Intel
Model number	Ryzen 5 Pro 4650U	Intel Core i5-10310U
Core frequency (GHz)	2.10	1.70
Number of cores	6	4
Cache	8 MB	6 MB
Memory module(s)		
Amount (GB)	8 GB	8 GB
Type	DDR4	DDR4
Speed (MHz)	3,200	2,667
Integrated graphics		
Vendor	AMD	Intel
Model number	AMD Radeon™ Graphics	Intel UHD Graphics
Storage		
Amount (GB)	256	256
Type	PCIe® SSD (M2)	PCIe SSD (M2)
Connectivity/expansion		
Wired internet	1 Gbe Internet Realtek PCIe GbE Family Controller	1 Gbe Internet Realtek PCIe GbE Family Controller
Wireless internet	Intel Wi-Fi 6 AX200 802.11AX (2 x 2)	Intel Wi-Fi 6 AX200 802.11AX (2 x 2)
Bluetooth	Bluetooth® 5.1	Bluetooth® 5.1
USB	2x USB 3.2 Gen 1	2x USB 3.2 Gen 1
Thunderbolt	1x USB-C® Thunderbolt 1x USB-C (DisplayPort, Data Transfer, Power Delivery)	1x USB-C Thunderbolt 1x USB-C (DisplayPort, Data Transfer, Power Delivery)
Video	1x HDMI 1.4	1x HDMI 1.4
Battery		
Type	Lithium Ion	Lithium Ion
Size	3-cell	3-cell
Rated capacity (Wh)	50	50
Display		
Size (in.)	14.0	14.0
Type	LED IPS	LED TN

Laptop configuration information	Lenovo ThinkPad T14 20UD with an AMD Ryzen 5 Pro 4650U processor	Lenovo ThinkPad T14 20S0 with an Intel Core i5-10310U processor
Resolution	1,920 x 1,080p	1,366 x 768
Touchscreen	No	No
Operating system		
Vendor	Microsoft	Microsoft
Name	Windows 10 Pro	Windows 10 Pro
Build number or version	18362	18362
BIOS		
BIOS name and version	Lenovo 1.06	Lenovo 1.06
Dimensions		
Height (in.)	0.7	0.7
Width (in.)	12.9	12.9
Depth (in.)	8.9	8.9
Weight (lbs.)	3.3	3.3

How we tested

Our Configuration Manager (formerly known as SCCM) testing environment consisted of one server installed with VMware vSphere 6.7. We installed one Microsoft Windows Server 2019 Active Directory Server VM named "DC01" with Domain Name Services (DNS), and Dynamic Host Configuration Protocol (DHCP) roles installed on it. We also installed a management server (site server VM) named "Deployment" with Microsoft Endpoint Configuration Manager version 2002 released April 2020 and Microsoft SQL Server 2019 Enterprise Evaluation Edition.

We used the following volumes on DC01:

- OS volume (40GB)
- General sharing for CIFS (40GB)

We used the following volumes on the VM named Deployment, which is our Configuration Manager server:

- OS and Configuration Manager installation - 300 GB thin-provisioned
- DB - 200 GBs thin-provisioned
- Logs - 40 GBs thin-provisioned
- Backup - 40 GBs thin-provisioned

After Configuration Manager was installed, we installed the following roles to the VM:

- Component server
- Distribution point
- Service Connection point
- Fallback status point
- Management point
- Site server
- Site database server (Database)
- Site database server (Transaction log)

For our testing we created a single task sequence and related media for deploying systems. The final sections of our methodology focus on adding the necessary drivers to enable deploying either model using the same task sequence. Once we created the deployment environment we could then install OS, applications and drivers to our endpoints.

Required installation media

- Microsoft Endpoint Configuration Manager 1902
- en_sql_server_2019_standard_x64_dvd_46f0ba38
- Windows 10 Enterprise x64

Preparing the Configuration Manager environment

Creating a Microsoft Windows 2019 VM template

1. From vCenter, boot the VM to the Windows Server 2019 installation media.
2. At the prompt to boot from the CD/DVD location, press any key.
3. Click Next.
4. Click Install now.
5. Click Windows Server 2019 Datacenter Edition (Desktop Experience), and click Next.
6. Click the checkbox beside I accept the license terms, and click Next.
7. Click the OS drive, and click Next.
8. After installation, enter a password for the Administrator, and click Finish.
9. Boot to Windows and log in.
10. Disable the firewall, IE enhanced security, and auto logoff with group policy objects.
11. Select Windows Update, patch the VM to June 2020, and disable Windows Update.
12. Close the server VM.
13. Clone and Create "DC01" and "Deployment" VMs.

Installing and configuring Active Directory and DNS on the DC01 VM

1. On the Active Directory VM, to install Windows remote tools, open a powershell windows and run the following command:

   ```
   Install-WindowsFeature RSAT-ADDS
   ```

2. When the installation is finished, close PowerShell.
3. Open Server Manager.
4. On the Welcome screen, click Add roles and features.
5. At the initial Before you begin screen, click Next three times.
6. At the Server Roles screen, select Active Directory Domain Services.
7. On the pop-up window, click Add features.
8. Click Next three times.
9. Verify the roles are correct, and click Install.
10. Once installation has finished, close the Add roles and features wizard.
11. In Server Manager, click the flag at the top, and select Promote this server to a domain controller.
12. Select Add a new forest, enter a root domain name of your domain, and click Next. We chose the name "test.local" for ours.
13. On the Domain controller options screen, enter a password, and click Next.
14. On the DNS Options screen, click Next.
15. On the Additional Options screen, click Next.
16. On the Paths screen, click Next.
17. On the Review Options screen, click Next.
18. On the Prerequisites screen, verify all prerequisites have passed, and click Install.
19. Once Active Directory Domain Services finishes installing, click Finish, and restart the system.
20. Open DNS by typing dnsmgmt.msc at a command prompt.
21. Traverse the DNS entries to reverse lookup, right-click, and select new zone.
22. Select primary zone, and click Next
23. Click To all DNS servers running on domain controllers in this forest, and click Next.
24. Click IPv4 Reverse lookup, and click Next.
25. Type in an appropriate IP address range. For example, 192.168.0.x
26. Select Allow only secure updates, click Next, and click Finish.

Installing DHCP on the DC01 VM

1. Open Server Manager.
2. On the Welcome screen, click Add roles and features.
3. At the initial Before you begin screen, click Next three times.
4. At the Server Roles screen, select DHCP Server.
5. On the pop-up window, click Add features.
6. Click Next three times.
7. Verify the desired role is being installed, and click Install.
8. Once installation has finished, close the Add roles and features wizard.
9. In Server Manager, at the top of the screen, click the flag, and select Complete DHCP configuration.
10. In the DHCP Post-Install configuration wizard window, click Next.
11. At the Authorization screen, click Commit.
12. At the Summary screen, click Close.

Configuring DCHP on the DC01 VM

1. In Administrative Tools, open the DHCP service.
2. Expand ad.domain, right-click IPv4, and select "New Scope"
3. In the New Scope Wizard window, click Next.
4. At the scope name screen, name the scope Laptops, and click Next.
5. In the IP Address Range, enter the desired scope settings for your network.
6. Click Next four times.
7. At the Router screen, enter the gateway address that the clients will use, and click Next.
8. Click Next three times.
9. At the Completing the New Scope Wizard screen, click Finish.
10. With the domain\administrator account added as an administrator, join the Configuration Manager server to the domain.
11. Log in to the target server using the domain\administrator user.

Creating the System Management container

1. On the Active Directory server, run ADSI edit.
2. On the toolbar, click Action→Connect to…
3. To accept the defaults, click OK.
4. Under Default Naming Context→DC=test àDC=local, right-click the System container, and click New→Object…
5. Select Container, and click Next.
6. Under Value, enter `System Management`, click Next, and click Finish.

Setting permissions for Configuration Manager on the DC01 VM

1. Open Active Directory Users and Computers.
2. On the toolbar, select View, and click Advanced features.
3. Under test.local→System, right-click Endpoint Configuration Manager, and click Delegate control.
4. Click Next.
5. Click Add.
6. Click Object types, click Computers, and click OK.
7. Enter the computer account for the Endpoint Configuration Manager server as an object name, and click OK.
8. Click Next.
9. Select Create a custom task to delegate, and click Next.
10. Choose This folder, existing objects…, and click Next.
11. Click Full Control, and click Next.
12. Click Finish.

Extending the AD Schema on the DC01 VM

1. Extract the contents of Configuration Manager installation media to the Active Directory virtual machine named "DC01".
2. From the installation media, navigate to \SMSSETUP\BIN\X64, right-click extadsch, and run as administrator.
3. Review extadsch.log at the root of the system drive to confirm the operation was successful. If successful, the log will include, "Successfully extended the Active Directory schema."

Setting up the Configuration Manager server on the deployment VM

Installing required roles

1. Log on to the Endpoint Configuration Manager server.
2. Run the following commands in an elevated Powershell terminal:

```
Import-module ServerManager
Add-WindowsFeature Web-Common-Http,Web-Static-Content,Web-Default-Doc,Web-Dir-Browsing,Web-Http-
Errors,Web-Http-Redirect,Web-Asp-Net,Web-Net-Ext,Web-ASP,Web-ISAPI-Ext,Web-ISAPI-Filter,Web-Http-
Logging,Web-Log-Libraries,Web-Request-Monitor,Web-Http-Tracing,Web-Basic-Auth,Web-Windows-Auth,Web-
Url-Auth,Web-Filtering,Web-IP-Security,Web-Stat-Compression,Web-Mgmt-Tools,Web-WMI,RDC,BITS -Restart
```

Installing the Windows 10 ADK on the deployment VM

1. Download the Windows Assessment and Deployment Kit for Windows 10 from the following website:
   https://go.microsoft.com/fwlink/?linkid=2086042
2. Click the executable named adksetup.exe.
3. Click Next twice.
4. Accept the licensing agreement.
5. On the Select the features you want to install screen, select these features, and click install:

   • Deployment Tools
   • Imaging and Configuration Designer (ICD)
   • Configuration Designer
   • User State Migration Toll (USMT)
6. Download the Windows PE add-on for the ADK.
7. Specify Location, and click Next.
8. Select these features to install:.

   • Deployment Tools
   • Imaging and Configuration Designer (ICD)
   • Configuration Designer
   • User State Migration Tool (USMT)
9. Click Next, and click Close.

Installing the Windows Assessment and Deployment Kit Windows Preinstall Environment Add-ons – Windows 10 on the deployment VM

1. Download the adkwinpesetup.exe. from https://docs.microsoft.com/en-us/windows-hardware/get-started/adk-install.
2. Click/run adkwinpesetup.exe.
3. Accept the default locations, and click Next.
4. Select the checkbox next to Windows Preinstallation Environment (PE), click Install, and click Close.

Installing Web Server (IIS) prerequisites on the deployment VM

1. Launch Server Manager, click Manage→Add Roles and features→Select Web Server (IIS) server role, and click Next.
2. Enable/install the following features:

   • Net Framework 3.5 Features [Install all sub-features]
   • Net Framework 4.5 Features [Install all sub-features]
   • BITS
   • Remote Differential Compression

3. Enable/install the following Roles services:

   • Common HTTP Features – Default Document, Static Content
   • Application Development – .NET Extensibility 3.5 and 4.5. Select ASP.NET 3.5, ISAPI extensions, ASP.NET 4.5
   • Security – Windows Authentication
   • IIS 6 Management Compatibility – IIS Management Console, IIS 6 Metabase Compatibility, WMI Compatibility and IIS Management Scripts and Tools.

Installing SQL 2019 on the deployment VM

1. Log in to the Configuration Manager VM, named deployment, as domain\administrator.
2. Attach the installation media for SQL 2019 enterprise core, and run the setup.exe file.
3. In the SQL Server Installation Window, select Installation from the menu on the left, and select New SQL Server stand-alone installation or add features to an existing installation.
4. In the SQL Server 2019 Setup Window, select the evaluation edition.
5. On the License Terms page, accept the terms, and click Next.
6. On the Microsoft Update screen, check the box for Use Microsoft Update to check for updates, and click Next.
7. On the Feature Selection screen, under Instances Features, select Database Engine Services and Reporting Services – Native, and select locations for your instance root and Shared Features directory, and click Next. We used our second virtual volume.
8. On the Instance Configuration screen, select Default Instance, and leave the default Instance ID.
9. On the Server Configuration screen, set Startup Type to Automatic for all four services.
10. Select the Collation tab.
11. On the Collation tab, verify that the Database Engine is set to SQL_Latin1_General_CP1_CI_AS, and click Next.
12. On Database Engine Configuration screen, select mixed authentication mode.
13. Under Specify SQL Server administrators, click Add Current User, and click Add.
14. Add the Configuration Manager Admins group, and click OK.
15. On the Data Directories tab, use separate virtual drives for each directory.
16. On the TempDB tab, enter the following settings:

    - Number of files: 1
    - Initial size (MB): 1024
    - Autogrowth (MB): 512
    - Data directories: [use default]
    - Initial size of TempDB log file (MB): 1024
    - Autogrowth (MB): 512
    - Log directory: [use default]

17. Click Next.
18. On the Reporting Services Configuration screen, select Install and configure, and click Next.
19. On the Ready to Install screen, review your settings, and click Install.
20. Click Next.
21. At the Ready to Install, run the SP2CU6 SQL server update.
22. Run Windows updates.

Installing Report Viewer and the SQL Server Management Studio on the deployment VM

1. Download the Report Viewer from https://www.microsoft.com/en-US/download/confirmation.aspx?id=6442, and install using all defaults.
2. In the SQL Server Installation Center, select Install SQL Server Management Studio.
3. Click the link to Download SQL Server Management Studio (SSMS).
4. From your Downloads folder, run SSMS-Setup-ENU.exe.
5. In the Microsoft SQL Server Management Studio installation wizard, click Install.
6. After the installation is complete, click the Restart button to restart your server.

Configuring SQL Server settings on the deployment VM

We ensured our SQL server had a minimum and maximum bound for memory to ensure repeatability.

1. Open SSMS.
2. Sign into your SQL database.
3. Right-click your SQL host, and select Properties.
4. Select the memory page.
5. Change the minimum server memory to 8192.
6. Change maximum server memory to 16384, and click OK.
7. In the SQL Server Configuration Manager, click SQL Server Services in the tree.
8. Right click SQL Server [Instance Name].
9. On the Log On tab, change the Account Name to test\administrator.
10. In the popup that requests to restart the service, select Yes.

Installing WSUS role on the deployment VM

1. Open Server Manager.
2. Click Add Roles and Features.
3. Select Windows Server Update Services, and click Next.
4. Uncheck WID Connectivity, select SQL Server Connectivity, and click Next.
5. Select an appropriate directory for Windows updates.
6. On the database instance selection screen, enter the database server name, and click Check Connection. Ensure you see the Successfully connected to server message, and click Next
7. Click Install.
8. Click Close.

Installing Endpoint Configuration Manager update 2002 on the deployment VM

1. Sign into the Endpoint Configuration Manager VM using the domain\administrator account.
2. Attach the Configuration Manager 2002 Installation media to the management server.
3. Open splash.hta.
4. Click Install.
5. Read the Before You Begin section, and click Next.
6. Choose Install a primary site.
7. Choose Use typical options.
8. Enter the product key, and click Next
9. Check the boxes to accept the License Terms, and click Next.
10. Enter a path for the prerequisite file downloads, and click Next. We used User\Downloads\ConfigMgr.
11. Select a language, and click Next for both server and client.
12. On the Site and Installation Settings screen, enter a site code for the primary site and site name, and click Next. We used PTL and PTlabs, respectively.
13. On the Primary Site Installation screen, select Install the primary site as a stand-alone site, and click Next.
14. On the Database Information screen, leave the defaults, and click Next.
15. On the Database Information screen, click Next.
16. On the SMS Provider Settings screen, click Next.
17. On the Client Computer Communications Settings screen, select Configure the communication method on each site system role, check the box for Clients will use HTTPs when they have a valid PKI certificate…, and click Next.
18. On the Site System Roles screen, select HTTP for client connections for both the management and distribution points, and click Next.
19. On the Diagnostic and Usage Data screen, click Next.
20. On the Service Connection Point Setup screen, click Next.
21. On the Settings Summary screen, click Next.
22. Click Install.

Enabling PXE service on the distribution point on the deployment VM

1. Open Configuration Manager→Administration→Distribution points, and right-click Properties.
2. Navigate to the PXE tab, and select:

    • Enable PXE support for clients
    • Allow distribution point to respond to incoming PXE requests
    • Enable unknown computer support
    • Enable a PXE responder without Windows Deployment services.

Importing Windows 10 software for .wim creation on the deployment VM

1. On the Endpoint Configuration Manager VM, launch the Configuration Manager console.
2. Navigate to Software Library→Overview→Operating Systems.
3. Right-click Operating systems images, and click Add Operating System Image.
4. On the Data Source page, specify the path to Windows 10 2004 install.wim file. Note: This must be a UNC path to a file share. We used DC01.
5. Select 3- Windows enterprise and x64, and Click Next.
6. Type in the image details for reference.
7. Click Next twice.
8. Close Add Operating System Wizard.

Creating an Office 365 application package on the deployment VM

1. Click Software Library→Office 365 Client Management→Office 365 installer.
2. Name the package, select a location, and click Next.
3. Select the following and click Next.

   - x64
   - Office 365
   - Office plus
   - Semiannual update
   - Newest version available
   - English

4. Accept the EULA.
5. Do not include Access, OneDrive, Skype for business (Groove) and publisher.
6. Click Finish and Submit.

Creating an application package for Slack on the deployment VM

1. Download the Slack MSI installer file to the DC01 CIFS share.
2. In Configuration Manager, navigate to Open software library→Overview→Application Manager→Applications→Create new application.
3. Point the installer to the slack.msi file on the CIFS share, and click Next.
4. On Information about the application, click Next.
5. On summary, click Next.
6. Click Close.

Distributing applications on the deployment VM

1. Open Software Library→Overview→Application Management→Application.
2. Select Slack, and click Properties
3. Select the Distribution settings tab, and ensure Automatically download content when packages are assigned to distribution points is selected, and click OK.
4. Repeat steps 2 and 3 for Office 365 ProPlus.
5. Right-click Slack, and click Distribute content.
6. Repeat step 5 for Office 365 ProPlus.

Creating a Configuration Manager task sequence to deploy Windows 10 on the deployment VM

1. Launch the Configuration Manager console.
2. Navigate to Software Library→Overview→Operating Systems→Task Sequences.
3. Right-click Task Sequences, and click Create Task Sequence.
4. Select Install an existing image package, and click Next
5. Specify a task sequence name as windows 10 x64, check the box next to Run as high performance power plan, and click Next.
6. Select the image.
7. Select Partition and format the target computer before installing the operating system. Deselect Configure task sequence for use with Bitlocker. Enable the administrator account and enter an administrator password, and click Next.
8. Specify the domain and OU, and administrator account and click Next.
9. Select the Configuration Manager client you want, and click Next.
10. On the State Migration screen, deselect all configuration state migration boxes, and click Next.
11. Do not include any software updates, and click Next.
12. On the Install Application screen, click the Add button.
13. Add the Slack and click OK. Then click Next. Note that Office will automatically be included.
14. Confirm the settings, and click Next.
15. Click Close.

Editing the task sequence on the deployment VM

1. Open software library→Overview→Operating System→Task sequence.
2. Right-click the new sequence, and rename it `Windows x64 Lenovo`
3. Right-click the new sequence and select Edit.
4. Add task sequence items and reorder the tasks so that it matches our Task Sequence shown below. Then click OK.

Deployment task sequence

- Restart in Windows PE
- Partition Disk 0 – BIOS
- Partition Disk 0 – UEFI
- Apply operating system
- Apply Windows settings
- Apply Device Drivers
    - For this item, select the task and check the box for "Do unattended installation of unsigned drivers on versions of Windows where this is allowed."
- Apply Network Setting
- Setup Windows and Configuration Manager
- Restart Computer
- Install Software Updates
    - This step will need to be added by pressing the Add button and navigating to Install Software Updates under Software.
    - Select Install Software Updates and for type of software update deployment select Available. Deselect the check box for Evaluate software updates from cached scan results.
- Install Applications
- Restart Computer
    - This step will need to be added by pressing the Add button and navigating to Restart Computer under General.
    - Select Restart computer and deselect Notify the user before restarting.

Creating a Driver share on the deployment VM

1. On the Configuration Manager server, open File Explorer.
2. At the root of C:\ create a folder called Drivers.
3. Right click the newly created folder and select Give access to, then select Specific People.
4. In the Network Access window, type everyone, and click Add.
5. Select Everyone and change Permissions Level to Read/Write, then click Share.
6. In the Configuration Manager Console, on the Software Library panel, Under Operating Systems, select Driver Packages.
7. In the toolbar, click Create Driver Package.
8. In the Create Driver Package window, enter name enter DriverPackage01. Then click Browse.
9. Browse to the Deployment server, and select the shared Drivers folder.
10. Create a new folder called DriverPackages. Select the DriverPackages folder and click OK.
11. Click OK again.
12. Right click the new Driver package and select Distribute Content. Complete the prompts to distribute to the Deployment nodes. Wait till the package shows as distributed before continuing.

Timed steps

Adding drivers to the boot image and driver package

For the AMD testing, we downloaded the Configuration Manager (formerly SCCM) driver packs from https://support.lenovo.com/us/en/downloads/ds506553/.

For the Intel testing, we downloaded the Intel PRO/1000 LAN Adapter Software (Gigabit Ethernet Driver) from https://download.lenovo.com/pccbbs/mobiles/n2yrw04w.exe.

We completed and timed the steps below for both the AMD and Intel scenarios. In both cases, we downloaded the required drivers, run the Setup programs, and extract the drivers to the shared Driver folder. We then captured the time to add the drivers to the prepared task sequence.

1. Simultaneously open the Configuration Manager Console and start the timer.
2. Under Operating System on the software library panel, click Drivers.
3. In the home tab tool bar, click Import Driver.
4. Navigate to the Driver Share, and select the folder containing the drivers.
5. Click Next.
6. Once the system finishes validating the driver information, verify that the correct drivers are there, and click Next.
7. Select the Driver Package added earlier. and click Next.
8. When asked to update the distribution points, click Yes.
9. Select the Boot image (x64) and click Yes.
10. When asked to update the distribution points, click Yes twice.
11. On the Summary screen, click Next.
    - Once the process is done, simultaneously click Finish and stop the timer.

Deploying one laptop using Configuration Manager

Before starting the timer, plug the target system into the deployment network and power adapter. Start the timer for administrative deployment time.

1. Press the power button on the target device.
2. Press F12 during boot to bring up the boot menu.
3. Select PXE BOOT from the boot menu and press Enter.
4. Press Enter when prompted to boot.
5. Wait for the device to boot into the boot.iso. When the Task Sequence Wizard appears, click Next.
6. Select the Deployed Task Sequence and click Next.
    - Stop the timer and simultaneously start a different timer to capture the deployment system time.

Read the report at http://facts.pt/3jUVED0 ▶

This project was commissioned by AMD.