The science behind the report:

Send ready-to-work PCs to end users faster with Dell provisioning services for VMware Workspace ONE

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 Send ready-to-work PCs to end users faster with Dell provisioning services for VMware Workspace ONE.

We concluded our hands-on testing on April 8, 2022. 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 February 15, 2022 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.

Table 1: Results of our testing

Time to complete one-time configuration for Workspace ONE orders (hh:mm:ss)	
Completing first order with Factory Provisioning	2:50:42

Table 2: Results of our testing

Estimated time to complete additional orders with Workspace ONE Factory Provisioning Orders using previous configuration details (hh:mm:ss)	
Reusing configuration details for additional order with Factory Provisioning (estimated)	0:00:00

Table 3: Results of our testing

Estimated time to complete a new configuration for additional Workspace ONE Factory Provisioning orders (hh:mm:ss)	
Completing an additional order with a new configuration for Factory Provisioning (estimated)	2:20:42

Table 4: Results of our testing

On-site admin time required after initial configuration (hh:mm:ss)		
Number of systems	Admin time (traditional method)	Admin time (Factory Provisioning for Workspace ONE)
1	0:05:34	0:00:00
2	0:08:26	0:00:00
5	0:17:06	0:00:00
25	1:14:47	0:00:00
100	4:51:07	0:00:00
500	24:04:55	0:00:00
1,000	48:07:10	0:00:00

*We extrapolated values for configuring 25 or more systems. To calculate the extrapolated admin time for large deployments, we used the method of fewest squares to find the line of best fit for the data from our hands-on testing. For the traditional deployment, we determined the equation for the line of best fit was $y = 173.07x + 160.46$, where y was the amount of time required to deploy the system and x was the number of systems. The equation has a correlation coefficient of 0.99.

System configuration information

Table 5: Detailed information on the system we tested.

System configuration information	Dell Latitude 5420
Processor	
Vendor	Intel®
Name	Core® i5-1135G7
Core frequency (GHz)	2.40
Number of cores	4
Cache (MB)	8
Memory	
Amount (GB)	8
Type	DDR
Speed (MHz)	3,200
Graphics	
Vendor	Intel
Model number	Iris® Xe Graphics
Storage	
Vendor	Western Digital
Model Number	PC SN530
Amount (GB)	256
Type	M.2 NVMe SSD
Connectivity/expansion	
Wired internet	1 x 1 GbE Ethernet
Wireless internet	Intel Wi-Fi 6 AX201 2x2 160 MHz
Bluetooth	5.2
USB	1 x USB 3.2 Gen 1 port 1 x USB 3.2 Gen 1 port with PowerShare 2 x Thunderbolt 4 ports (powered)
Video	1 x HDMI 2.0 port
Battery	
Type	Lithium-Ion
Rated capacity (mAh)	3,150
Display	
Size (in)	14"
Type	FHD
Resolution	1,920 x 1,080
Touchscreen	No

System configuration information	Dell Latitude 5420
Operating system	
Vendor	Microsoft
Name	Windows 10
Build number or version	10.0.19043
BIOS	
BIOS name and version	Dell Inc 1.11.2
Dimensions	
Height (in)	.76
Width (in)	12.65
Depth (in)	8.35
Weight (lbs.)	3.03

How we tested

Report methodology overview

Our aim was to show two different methods of deployment: Factory Provisioning and a traditional process using Microsoft Endpoint Manager (formerly SCCM). To do this, we configured the basic tools for our local Configuration Manager Environment and our VMware Workspace ONE unified endpoint manager (UEM) environment. This included setting up the devices, adding applications, managing drivers and updates, and validating deployments. After completing all necessary configuration steps, we captured times for an IT administrator to fulfill an order using each provisioning type. The following sections detail our steps.

Factory Provisioning

Completing a configuration

For Factory Provisioning, we completed the configuration process once and used that configuration for multiple systems. Table 6 shows the tasks we completed to create a configuration and the times to complete each task.

Table 6: The Factory Provisioning tasks we completed to create a configuration and the time it took to complete each. Source: Principled Technologies.

Factory Provisioning setup task	Time to complete task for a new order (hh:mm:ss)	Time to complete an additional order using an existing configuration (hh:mm:ss)	Time to complete an additional order using a new configuration (hh:mm:ss)
Attending an introductory meeting with the Dell team	0:30:00	0:00:00	0:00:00
Completing the Export Compliance Form	0:02:32	0:00:00	0:02:32
Preparing the provisioning package file (PPKG)	0:01:37	0:00:00	0:01:37
Downloading the PPKG	0:01:08	0:00:00	0:01:08
Copying the PPKG to the verification VM	0:09:34	0:00:00	0:09:34
Running the PPKG validation	0:10:08	0:00:00	0:10:08
Validating the PPKG installation (OOBE)	0:03:41	0:00:00	0:03:41
Installing the Dell File Transfer software	0:46:29	0:00:00	0:46:29
Starting the file transfer	0:00:54	0:00:00	0:00:54
Completing the file transfer	0:59:26	0:00:00	0:59:26
Approving the technical specifications document	0:05:13	0:00:00	0:05:13
Total IT admin time to complete order	2:50:42	0:00:00	2:20:42

Meeting durations can vary. Our Table 6 list of tasks does not include the time to configure and place the orders because these take the same amount of time for Factory Provisioning and our traditional method. Some tasks in Table 6 are not required for existing accounts or when using existing configurations.

Provisioning systems

We focused our report on provisioning times. For Factory Provisioning, Dell provisioned the systems with our configuration before shipping, and there were no additional provisioning steps to prepare the systems. The systems shipped straight to their destination.

Traditional process

Completing a configuration

For the traditional process, we ordered the systems and had them shipped to our offices for provisioning. There was no additional time to configure the order of laptops for the traditional process. We did not include the time to configure Endpoint Configuration Manager because organizations could have different processes for configuring additional distribution points, preparing task sequences, and creating update repositories.

Provisioning systems

Our administrator provisioned one, two, and five systems using our traditional process. We timed each of those deployment scenarios and provide data in Tables 7, 8, and 9, respectively. In the tables, we denote whether the administrator or the system completes the task. We had to complete all admin tasks for the initial and subsequent orders. We consider system tasks to be background tasks, which means administrators can provision systems as other systems finish provisioning and updating.

Table 7: The tasks we completed to provision one system using our traditional process and the time it took to complete each task. Source: Principled Technologies.

Deployment task for one device	Task type	Time (seconds)	Time (hh:mm:ss)
Unboxing and powering on the device	Admin	63	0:01:03
Starting the OS installation on the first device	Admin	42	0:00:42
Deploying Windows 10 and applications using task sequence	System	1,424	0:23:44
Initiating the first-time boot and applying updates	System	739	0:12:19
Repackaging the device	Admin	88	0:01:28
Weighing the device	Admin	21	0:00:21
Creating a shipping label	Admin	78	0:01:18
Printing and applying the shipping label	Admin	42	0:00:42
Total time	-	2,497	0:41:37
Admin time total (does not include deployment or initial boot)	-	334	0:05:34

Table 8: The tasks we completed to provision two systems using our traditional process and the time it took to complete each task. Source: Principled Technologies.

Deployment task for two devices	Task type	Time (seconds)	Time (hh:mm:ss)
Unboxing and powering on the devices	Admin	125	0:02:05
Starting the OS installation on the first device	Admin	41	0:00:41
Starting the OS installation on the second endpoint	Admin	41	0:00:41
Deploying Windows 10 and applications using task sequence	System	1,504	0:25:04
Initiating the first-time boot and applying updates	System	752	0:12:32
Repackaging the devices	Admin	145	0:02:25
Weighing the devices	Admin	21	0:00:21
Creating shipping labels	Admin	82	0:01:22
Printing and applying shipping labels	Admin	51	0:00:51
Total time	-	2,762	0:46:02
Admin time total (does not include deployment or first time boot)	-	506	0:08:26

Table 9: The tasks we completed to provision five systems using our traditional process and the time it took to complete each task. Source: Principled Technologies.

Deployment task for five devices	Task type	Time (seconds)	Time (hh:mm:ss)
Unboxing and powering on the devices	Admin	301	0:05:01
Starting the OS installation on the first device	Admin	43	0:00:43
Starting the OS installation on the second endpoint	Admin	42	0:00:42
Starting the OS installation on the third endpoint	Admin	44	0:00:44
Starting the OS installation on the fourth endpoint	Admin	44	0:00:44
Starting the OS installation on the fifth endpoint	Admin	45	0:00:45
Deploying Windows 10 and applications using task sequence	System	1,435	0:23:55
Initiating the first-time boot and applying updates	System	716	0:11:56
Repackaging the devices	Admin	320	0:05:20
Weighing the devices	Admin	21	0:00:21
Creating shipping labels	Admin	85	0:01:25
Printing and applying shipping labels	Admin	81	0:01:21
Total time	-	3,177	0:52:57
Admin time total (does not include deployment or first time boot)	-	1,026	0:17:06

Infrastructure overview

For our testing, Factory Provisioning used a cloud -based Workspace ONE console, and Traditional Provisioining used a local Active Directory (AD) environment with a Microsoft Endpoint Manager Configuration Manager server.

For our Factory Provisioning environment, we configured our Workspace ONE UEM settings, installed the AirWatch Cloud Connector to connect our local AD server, and added applications and profiles for distribution to our provisioning devices. Then we added the necessary components to integrate our Workspace ONE environment with our local AD server.

Our local environment consisted of one server installed with VMware vSphere 7.0. We installed one Microsoft Windows Server 2022 AD server VM named "DC01" with Domain Name Service (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 2111 (formerly known as SCCM) and Microsoft SQL Server 2019 Enterprise Evaluation Edition.

We used the following volumes on the DC01 VM:

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

We used the following volumes on the Deployment VM, which was our Microsoft Endpoint manager:

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

After we installed Endpoint Manager, 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)

Required installation media

We acquired the relevant installation media and keys for the following items:

- Microsoft Endpoint Configuration Manager 2103 - mu_microsoft_endpoint_configuration_manager_current_branch_version_2103_x86_x64_dvd_77e1425b
- SQL Server 2019 Enterprise Core - en_sql_server_2019_enterprise_core_x64_dvd_5e1ecc6b
- Windows 10 Enterprise x64

Application details

We deployed applications using either Workspace ONE or Configuration Manager. Microsoft Office requires separate steps for both environments, so we've included those steps in our methodology that follows Table 10.

Table 10: Details for the applications we installed on the devices.

Product	Filename	Install command	Uninstall command	URL
Google Chrome	GoogleChromeStandalone Enterprise64.msi	msiexec /i "GoogleChromeStandaloneEnterprise64.msi" /qn	msiexec /x {27AE757E-4286-3D70-ACB1-4FEAC2F15FB9} /q	https://chromeenterprise.google/browser/download/#windows-tab
Notepad ++	Notepad++7_9_1.msi	msiexec /i "Notepad++7_9_1.msi" /q	msiexec /x {84AB9486-65EF-402E-B061-B128FBCEF91B} /q	https://sourceforge.net/projects/notepadmsi/
Slack	slack-standalone-4.23.0.0.msi	msiexec /i "C:\slack-standalone-4.23.0.0.msi" /qn	msiexec /x {9B7C2512-8A00-4207-8A9E-F837271B2524} /q	https://slack.com/help/articles/212475728-Deploy-Slack-via-Microsoft-Installer
VLC Media Player	vlc-3.0.16-win64.msi	msiexec /i "C:\vlc-3.0.16-win64.msi" /qn	msiexec /x {1BB20266-7C52-4909-B075-22156F75D22C} /qn	https://get.videolan.org/vlc/3.0.16/win64/vlc-3.0.16-win64.msi
Zoom	ZoomInstallerFull.msi	msiexec /i "C:\ZoomInstallerFull.msi" /qn	msiexec /x {1B8D4A17-201A-4113-A512-B7DEEF293AF1} /q	https://zoom.us/client/latest/ZoomInstallerFull.msi

Preparing the Configuration Manager environment

Creating a Microsoft Windows 2019 VM template

1. From VMware 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. Install VMware tools.
12. In your VM's hardware, ensure that you are using VMXNET3 for the Network Adapter and VMware Paravirtual for the SCSI controller.
13. Select Windows Update, patch to the latest updates, and disable Windows Update.
14. Sysprep the device using the following command.

- C:\Windows\System32\Sysprep.exe /generalize /oobe /shutdown /unattend

15. Close the server VM.
16. Clone and create "DC01" and "Deployment" VMs, and add necessary disk space as outlined in the Overview section.

Installing and configuring AD and DNS on the DC01 VM

1. To install Windows remote tools on the AD VM, open a PowerShell window, and run the following command:

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

2. When the installation finishes, close PowerShell.
3. Open Server Manager.
4. On the Welcome screen, click Add roles and features.
5. At the Before you begin screen, click Next three times.
6. At the Server Roles screen, select Active Directory Domain Services.
7. In the pop-up window, click Add features.
8. Click Next three times.
9. Verify the roles are correct, and click Install.
10. Once installation finishes, close the Add roles and features wizard.
11. At the top of the screen in Server Manager, click the flag, and select Promote this server to a domain controller.
12. Select Add a new forest, enter a root domain name, and click Next. We chose the name `test.local`.
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 AD Domain Services finishes installing, click Finish, and restart the system.
20. Open DNS by typing `dnsmgmt.msc` in 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 select all DNS servers running on domain controllers in this forest, and click Next.
24. Click IPv4 Reverse lookup, and click Next.
25. Enter an appropriate IP address range. For example, `192.168.0.x`.
26. Select Allow only secure updates, click Next, and click Finish.

Customizing Active Directory

1. Configure Active Directory users and computers, and edit the Domain Administrator account to never expire.

Installing DHCP on the DC01 VM

1. Open Server Manager.
2. On the Welcome screen, click Add roles and features.
3. At the Before you begin screen, click Next three times.
4. At the Server Roles screen, select DHCP Server.
5. In the pop-up window, click Add features.
6. Click Next three times.
7. Verify the desired role will install, and click Install.
8. Once installation finishes, close the Add roles and features wizard.
9. At the top of the screen in Server Manager, 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 test.local, 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 administrator@test.local account added as an administrator, join the Configuration Manager and Deployment VM to the test.local domain.
11. Log into the target server using the administrator@test.local user.

Creating the system management container

1. On the AD VM, open a command window, and run the following:

```
ADSI edit
```

2. On the toolbar, click Action → Connect to….
3. To accept the defaults, click OK.
4. Under Default Naming Context → DC=test, DC=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.

Extending the AD schema on the DC01 VM

To publish key information in a secure location, we needed to extend the AD schema for Configuration Manager. The extended schema helps for process deploying as well as for setting up clients and additional services that the Configuration Manager site system roles provide.

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

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 System Management, 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, additionally add the domain administrator account 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.

Setting up the Configuration Manager server on the deployment VM

Installing required roles

1. Create a deployment share at the root of the installation drive with read and write permissions for everyone. We named our deployment share.
2. Verify that the share is accessible. Our share location was \\deployment.test.local\deploymentshare.

Installing required roles

1. Log onto the Endpoint Configuration Manager server.
2. In an elevated PowerShell terminal, run the following commands:

```
Set-ExecutionPolicy Unrestricted
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 Assessment and Deployment Kit (ADK) on the deployment VM

For additional information around the Windows ADK, review the documentation at https://docs.microsoft.com/en-us/windows-hardware/get-started/adk-install. The site contains the latest versions for both installations.

1. Download the Windows Assessment and Deployment Kit for Windows 10 from https://go.microsoft.com/fwlink/?linkid=2165884.
2. Click the executable adksetup.exe.
3. Click Next twice.
4. Accept the licensing agreement.
5. On the Select the features you want to install screen, select the following features, and click Install:

   • Deployment Tools
   • Imaging and Configuration Designer (ICD)
   • Configuration Designer
   • User State Migration Toll (USMT)

6. Using the link above, download the Windows PE add-on for the ADK.
7. Specify location, and click Next.
8. Select the following 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 ADK Windows Preinstall Environment add-ons – Windows 10 on the deployment VM

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

Installing Microsoft SQL Server 2019 on the deployment VM

1. Log into the deployment Configuration Manager VM as `administrator@test.local`.
2. Attach the installation media for SQL 2019 enterprise core, and run the setup.exe file.
3. In the SQL Server Installation Window, from the left menu, select Installation, and select New SQL Server stand-alone installation or add features to an existing installation.
4. In the SQL Server 2016 Setup Window, select product key.
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 locations for your instance root and Shared Features directory, and click Next. We used our data 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. Select Grant Perform Volume Maintenance Task privilege to SQL Server Database Engine Service.

10. Select Collation.
11. In Collation, verify that the Database Engine is set to SQL_Latin1_General_CP1_CI_AS, and click Next.
12. In Database Engine Configuration, 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. In Data Directories, verify that the additional data drive is listed as the Data root directory.
16. In TempDB, enter the following settings:

- Number of files: `1`
- Initial size (MB): `1,024`
- Autogrowth (MB): `512`
- Data directories: [use default]
- Initial size of TempDB log file (MB): `1,024`
- Autogrowth (MB): `512`
- Log directory: [use default]

17. In Memory, select Recommended. For Min Server Memory (MB), type `8,192`, and for Max Server Memory (MB), type `16,384`.
18. Click Next.
19. In Ready to Install, review your settings, and click Install.
20. Click Next.
21. At 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. To restart your server after the installation completes, click Restart.

Changing SQL service to start as local system

1. Open SQL Server Configuration Manager.
2. Under SQL Service Services, right-click the SQL Server instance, and click Properties.
3. For Log on as, select Built-in account, and Local System. Click OK, and click Restart.

Installing Windows Server Update Services 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. We used \\deploy\deploymentshare\.
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 administrator@test.local account.
2. Attach the Configuration Manager update 2002 Installation media to the management server.
3. Open splash.hta.
4. Click Install.
5. Read Before You Begin, and click Next.
6. Choose Install a primary site.
7. Choose Use typical options.
8. Enter the product key, enter a Software Assurance Date, 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. Select Clients will use HTTPs when they have a valid PKI certificate…, and click Next.
18. On the Site System Roles screen, for client connections for both the management and distribution points, select HTTP. 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 the PXE service on the distribution point on the deployment VM

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

- 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

Adding a network access account

1.   In the Configuration Manager console, navigate to Administration → Site Configuration → Sites.
2.   Right-click the target site, and under Configure Site Components, select Software Distribution.
3.   To add a new user, select New account in Network access account, and click the star.
4.   Enter the domain administrator account, and click OK twice.

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 Images.
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.   Check Extract a specific image index from the specified WIM file.
6.   Select 3 - Windows enterprise and x64, and Click Next.
7.   Enter the image details for reference.
8.   Click Next twice.
9.   Close Add Operating System Wizard.

Creating a Windows 10 .wim file

1.   Extract the Windows 10 installation ISO.
2.   Find the index number of your image:

```
dism /Get-ImageInfo /ImageFile:[extracted win10 image root]\sources\install.wim"
```

3.   Mount the package:

```
dism /mount-wim /wimfile:" [extracted win10 image root]\\sources\install.wim" /index:3 /
mountdir:"C:\Mount"
```

4. Add the update packages:

```
dism /Add-Package /Image:"C:\Mount" /PackagePath="C:\UpdateTools\UpdatePackages" /LogPath="C:\
UpdateTools\update.log"
```

5. Commit changes to the image:

```
dism /Unmount-wim /mountdir:"C:\Mount" /commit
```

6. Add computer account to Full Control of System Management Container.
7. Add computer account to the local administrator group for the site server.
8. Create a boundary and boundary group.

Importing application files to Configuration Manager

1. Download the application installer file, and copy it to the DC01 network share. For URLs, see Table 10.
2. In Configuration Manager, navigate to Open software library → Overview → Application Manager → Applications → Create new application.
3. In the Create Application Wizard, select Automatically detect information about this application from installation files, and click Browse for location.
4. Navigate to the share location, and select the relevant .msi file for the target application, and click Open. For example, we used \\[deployment server]]\deployment \applications\Chrome\GoogleChromeEnterpriseBundle64\Installers\ GoogleChromeStandaloneEnterprise64.msi for the Chrome installation.
5. Click Next.
6. In View imported information, click Summary.
7. In Summary, click Next.
8. Click Close.
9. Right-click the application, and select Distribute Content.
10. On the Distribute Content Wizard, click Next.
11. On the Content screen, click Next.
12. On the Content Destination screen, select Add, and select the target distribution point. Click Okay, and click Next.
13. On the Summary Screen, click OK.
14. Right-click the target application, and click Properties.
15. Select Allow this application to be installed from the Install Application task sequence action without being deployed.
16. For each of the following applications, complete steps 1 through 15:

   • Chrome
   • Notepad++
   • Slack
   • VLC media player 3.0.16 (64-bit)
   • Zoom

Note: We later refer to steps 9 through 15 as the Application Distribution steps.

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.
7. To distribute the Office 365 content, complete the Application Distribution steps.

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, select Give access to, and select Specific People.
4. In the Network Access window, type `everyone`, and click Add.
5. Select Everyone, change Permissions Level to Read/Write, and 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, type `DriverPackage01`. 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.
12. Right-click the new Driver package, and select Distribute Content. To distribute to the Deployment nodes, complete the prompts. Before continuing, wait until the package shows as distributed.

Adding drivers to the prepared task sequence for a new system

We downloaded the drivers for our testing from https://www.dell.com/support/kbdoc/en-us/000181846/latitude-5420-windows-10-driver-pack and added the drivers to our deployment share.

1. In Software Library, in Configuration Manager, under Operating Systems, select Drivers.
2. In Home, in the toolbar, click Import Driver.
3. Click Browse, and navigate to the Driver Share. Select the folder containing the drivers, and click OK.
4. Click Next.
5. Once the system finishes validating the driver information, verify that you've included the correct drivers, and click Next.
6. Select the Driver Package added earlier, and click Next. When asked to update the distribution points, click Yes.
7. Select the Boot image (x64), select to include only updates to the Boot Image, and click Yes. When asked to update the distribution points, click Yes twice.
8. In Summary, click Next.
9. Once complete, click Finish.

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 as `windows 10 x64`, select Run as high performance power plan, and click Next.
6. Select the image.
7. Select Partition, and before installing the operating system, format the target computer. Deselect Configure task sequence for use with Bitlocker. Enable the administrator account, enter an administrator password, and click Next.
8. Specify the domain, OU, and administrator account, and click Next.
9. Select the Configuration Manager client you want, and click Next.
10. In State Migration, 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, click OK, and click Next.
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 Traditional Deployment`.
3. Right-click the new sequence, and select Edit.
4. Add task sequence items, and reorder the tasks so that the sequence matches our Task Sequence below. Click OK.

Deployment task sequence

- Restart in Windows PE.
- Partition Disk 0 – BIOS.
- Partition Disk 0 – UEFI.
- Apply operating system.
- Apply Windows settings.
- Apply network setting.
- Apply device drivers.
- Setup Windows and Configuration Manager.
- Install Software Updates (to add this step, click Add. Under Software, navigate to Install Software Updates.).
- Select Install Software Updates, and for type of software update deployment, select Available. From cached scan results, deselect Evaluate software updates.
- Install applications.
- Restart computer (To add this step, click Add. Under General, navigate to Restart Computer.).
- For Specify what to run after restart - select the currently installed default operating system.
- Select Restart computer, and deselect Notify the user before restarting.

Deploy the task sequence to unknown systems

1. Right-click the deployment task sequence, and select Deploy.
2. In the Deploy Software Wizard, for Collection, click Browse.
3. Select All Unknown Computers, and click OK.
4. Click Next.
5. For Purpose in Deployment Settings, select Required, and for make available to the following, select Only media and PXE.
6. In Scheduling, enable Schedule when this deployment will become available, and create a new assignment for Assign immediately after this event and As soon as possible. Click Summary.
7. Click Next and Close.

Note that we completed steps 1 through 7 between each new system deployment.

Configuring the Workspace ONE UEM Console

Configuring our Workspace ONE Account

To configure our Workspace ONE account, we purchased a domain and connected it to an email service. We validated the email in Workspace ONE and completed the following tasks:

- Connect to Workspace ONE Access
- Auto-discovery
- Mobile single sign-on

Changing settings for the Workspace ONE account

1. From the Workspace ONE UEM console, navigate to Groups and Settings → Devices & Users → Windows → Windows Desktop → Staging & Provisioning.
2. For Workspace ONE Drop Ship Provisioning under the Workspace ONE Drop Ship Provisioning section, select Enable.

Adding Applications in Workspace ONE

Repeat the following steps for each application.

1. From the Workspace ONE UEM console, navigate to Apps and Books → Applications → Native.
2. Click Add → Application File.
3. Click Upload.
4. On the Add screen, click Choose File.
5. Navigate to the target application, and select the target file. Click Okay.
6. Click Save.
7. On the Application screen, click Save & Assign.
8. On the Assignment screen, click Next. (We did not create an assignment at this time.)
9. On the View Assignment screen, click Publish.

Creating the Office 365 application package for Workspace ONE

1. On the Deployment server, create a working folder. We used `C:\Office`.
2. Navigate to config.office.com, and create an XML file. We provide our example configuration.xml file below. Copy the configuration.xml file to the root of the working folder.
3. Download the Office Deployment Tool from https://www.microsoft.com/en-us/download/details.aspx?id=49117.
4. Extract the files to the working folder.
5. Create a new file named `Download.cmd`, and add the following code:

```
@echo off
pushd %~dp0
echo Downloading Office 365 Pro Plus Retail x64 source files
setup.exe /download configuration.xml
```

6. To begin the download, double-click Download.cmd.
7. Create a new file named `uninstall.xml`, and include the following code:

```
<Configuration>
<Remove>
<Product ID="O365ProPlusRetail">
<Language ID="en-us"/>
</Product>
</Remove>
<Display Level="None" AcceptEULA="TRUE"/>
</Configuration>
```

8. Once complete, compress the working folder into Office.zip.

Adding Office 365 to Workspace ONE

1. From the Workspace ONE UEM console, navigate to Apps and Books → Applications → Native.
2. Click Add → Application File.
3. Click Upload.
4. On the Add screen, click Add.
5. Navigate to and select the Office.zip file. Click Okay.
6. Click Save.
7. On the Application screen, configure the following application details, and click Save & Assign:

    - For the Supported Processor Architecture, select 64-bit.
    - For App Uninstall Process in Files, select Input for the Custom script type. For Uninstall Command, type `setup.exe / CONFIGURE uninstall.xml`.
    - For Install Command in Deployment Options, type `setup.exe /CONFIGURE configuration.xml`.
    - In When To Call Install Complete section, choose the following:

        - Identify Application By: Defining Criteria
        - Criteria Type: File Exists
        - Path: C:\Program Files\Microsoft Office\root\Office16\OUTLOOK.EXE

8. In Assignment, click Next. (We did not create an assignment at this time.)
9. In View Assignment, click Publish.

Timing activities

Factory Provisioning with Workspace ONE

Our timing includes a meeting with the Dell Engineering team. Meeting length will not be consistent between companies, and for our calculations, we have used estimated values in place of actual values.

Completing the Export Compliance Form

1. We completed a separate Export Compliance form for Factory Provisioning. We received the form via email from our Dell project manager. We reviewed and signed the form digitally, and we then sent the form back to the project manager via email.

Preparing the PPKG file

1. From the Workspace ONE UEM console, navigate to Devices → Lifecycle → Staging → Windows.
2. In Windows, click New.
3. In New Provisioning Package, enter a name for the package.
4. In Onboarding Methods, select Drop Ship Provisioning – Offline.
5. In Configurations, enter the following values, and click Next:

   - Active Directory

       - Active Directory type: Workgroup

   - OOBE configuration

       - EULA page: Hide
       - Privacy settings: Hide
       - Online account settings: Hide
       - Operating system language: English
       - Region and keyboard settings: Hide
       - Region and keyboard settings: English – US

   - System configuration

       - Workgroup: PTlabs
       - Remove Windows 10 consumer apps: Yes
       - Product key: [Enter a valid Windows 10 Product Key]
       - Create local user: Yes
       - Local username: ptuser
       - Local user password: [Enter a valid password]
       - Make administrator: Yes
       - Administrator password: [Enter a valid password]
       - User account control: Disabled

   - Workspace ONE enrollment

       - Enrollment server: [Enter the web address of the Enrollment server]
       - Enrollment OG: [Enter the value of your Enrollment OG]
       - Staging account: [Enter the staging account]
       - Staging password: [Enter the staging account password]

6. In Application, select the applications that you added during setup, and click Next: We used the following:

   - Chrome for Business 64-bit
   - Notepad++(64-bit)
   - Office
   - Slack (Machine – MSI)
   - VLC media player 3.0.16 (64-bit)
   - Zoom

7. In Summary, click Save and Export.
8. In Overwrite Confirmation, click Yes, Export.

Downloading the PPKG file

1. Once available, click Downlaod Provisioning Files, and select PPKG.
2. Once the PPKG download has started, click Download Provisioning Files, and select Unattend XML/.

Copying the PPKG to the Validation VM

1. Copy the PPKG, unattend.xml, and VMware Workspace ONE Provisioning Tool to the Validation VM.

Validating the PPKG validation

1. Run the VMwareWS1ProvisioningTool.msi file.
2. From the root of C:\, double-click VMwareWS1ProvisioningTool.
3. In the VMware Workspace ONE Provisioning Tool, select the PPKG and configuration file locations.
4. Once the PPKG finishes copying, disconnect from the remote session, and connect via the vSphere client.
5. Open network adapter settings, and disable the network adapter.
6. In the VMware Workspace ONE Provisioning Tool, click Apply Full Process. We stopped our first timer at this point, and started our second timer.
7. After the previous step completes, in OOBE, click Next.
8. Click Limited Setup.
9. Click Continue with limited setup.
10. Reenable the network adapter, and using RDP, connect to the device.
11. Copy C:\ProgramData\Airwatch\UnifiedAgent\Logs\PPKGFinalSummary to the same folder as the PPKG on your local device.

Installing the Dell File Transfer software

1. Navigate to https://delivery.dell.com/download/download.html, and download the Dell File Transfer Application (.exe).
2. Download the VMware Workspace ONE® Provisioning Tool™ 3.2 for Windows from VMware Workspace ONE® Provisioning Tool™ 3.2 for Windows
3. Run the downloader, and accept the default location.

Starting the PPKG File Transfer

1. In the File Transfer EULA in the Dell File Transfer tool, accept the EULA, and click Next.
2. Sign in using your Dell TechDirect credentials.
3. In Project Selection, select the project number corresponding to your order, and click next. Note: You should have received an email with the project number from your Dell point of contact.
4. Select the files to upload, including the PPKG, the PPKG validation log, and the unattend.xml files. Click Next.
5. Click scan.
6. Click Upload.

We then ended the Starting the PPKG File Transfer timer and started the Completing the PPKG File Transfer timer. Once the file showed as successful, we alerted our Dell representative that we had uploaded the file.

Approving the Technical Specifications document

After we uploaded our PPKG files, the Dell engineering team sent us a Technical Specifications document to review and approve. We timed how long it took our administrator to review the documentation and respond to the email.

Traditional process

Unboxing and plugging in the laptop

1. Open and remove the system packaging. Return packaging materials to the original box.
2. Unwrap the power cord, and plug it into a power strip near the deployment switch.
3. Plug the system into the power cord and wired networking. Open the laptop lid.

Starting the OS installation on each laptop

1. Boot the target system.
2. To bring up the boot menu during boot, press F12.
3. Select the BIOS Setup menu.
4. In BIOS setup, select storage.
5. Select AHCI/NVME instead of RAID. Click Apply, and exit.
6. During reboot, press F12.
7. Select boot to IPv4.

Deploying Windows 10 and applications via task sequence

Allow the system to boot to the boot image and load the task sequence. To skip the 180-second countdown before starting the task sequence, click OK when prompted. We did not count this as admin time because the task did not take significant time and the administrator can continue working on other systems while the task sequence media loads.

Initiating the first-time boot and applying updates

Once you've completed the system deployment, log into each system. We did not count this as admin time because the task did not take significant time and the administrator can continue working on other systems while the task sequence media loads.

Repackaging the laptop

1. Once complete, shut down the target laptop.
2. Unplug all cables, and wrap the power cord.
3. Repackage the laptop to match how it arrived. To seal the box, apply tape.

Weighing the laptop

1. For one of the target laptops, record the weight and box dimensions.

Creating a shipping label

We captured the time to create the shipment and corresponding labels on FedEx.com to ship each system in the scenario to the same address.

Printing and applying shipping labels

1. Print the label created in the previous task, and attach it to the target system.
2. Place the target system in a designated shipping area.

Calculating the estimated shipping schedule

We used the following assumptions to estimate the best-case shipping time for the traditional environment. This schedule helps us determine when the last user receives their system.

- We assume that our administrator spends the first day receiving the shipment of 1,000 systems from Dell. This is due to the logistics of accepting a 1,000 laptop-shipment and moving it to a provisioning location. Additionally, shipments can arrive late in the day. Therefore, we assume system provisioning begins on the second day.
- We estimated that an administrator can provision 165 systems in under 8 hours with no interruptions. We use this as the best-case scenario to calculate the number of systems provisioned in one day, beginning on day 2.
- We assume that the administrator can ship all provisioned systems the same day they complete the provisioning, provided provisioning completes in the first half of the day.
- We calculate the time in shipment using two-day shipping to transport the laptops beginning on the eighth day. We assume there are no shipping delays. Therefore, we conclude that our systems will arrive with our users on the tenth workday at the earliest. Additionally, we consider an inefficiency of rate of 20 percent. A variety of factors can cause these inefficiencies, such as provisioning failures, delays in setting up new devices on the provisioning switch, transportation logistics, etc. We estimate that with 20 percent inefficiency, administrators will prepare 132 systems per day. See Table 11.

Table 11: Estimated time to prepare and ship 1,000 systems.

Day	With no inefficiency	With 20 percent inefficiency
1	Receive laptops	Receive laptops
2	Total of 165 systems prepared by end of day	Total of 132 systems prepared by end of day
3	Total of 330 systems prepared by end of day	Total of 264 systems prepared by end of day
4	Total of 495 systems prepared by end of day	Total of 396 systems prepared by end of day
5	Total of 660 systems prepared by end of day	Total of 528 systems prepared by end of day
6	Total of 825 systems prepared by end of day	Total of 660 systems prepared by end of day
7	Total of 990 systems prepared by end of day	Total of 792 systems prepared by end of day
8	Final systems prepared and shipped	Total of 924 systems prepared by end of day
9	Systems en route	Final systems prepared and shipped
10	Shipments arrive	Systems en route
11	-	Shipments arrive

Therefore, we estimate that shipping 1,000 systems would require between 10 and 11 workdays from the time systems arrive at the provisioning center to the time the end users receive them.

Read the report at https://facts.pt/2BI1dJI ▶

This project was commissioned by Dell and VMware.

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