DOCUMENT - JULY 2021 PRINTED 1 JULY 2021

# MANUALLY CREATING OPTIMIZED WINDOWS IMAGES FOR VMWARE HORIZON VMS VMwareHorizon

**vm**ware<sup>®</sup>

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- Authors and Contributors

# Manually Creating Optimized Windows Images for VMware Horizon VMs

### Introduction

### **Overview**

Considerations you must take into account when creating a Windows system image are different if you plan to deploy virtual desktops rather than physical desktops:

- **Physical desktops** Resource usage on a physical machine impacts only the user who is using that machine. The operating system on a physical machine determines whether or not resources are available. One-time actions impact the user only the first time they are performed because the machine is never refreshed. For example, a user typically gets a new user profile the first time they log on, and they continue to use that same profile with all subsequent logons.
- Virtual desktops In contrast, in a virtual environment, the guest operating system behaves as if it has exclusive access to the CPU cores, but in reality the cores are shared between 2 to 8 virtual machines. When using nonpersistent VMware Horizon<sup>®</sup> VMs or user profiles, the actions that are intended to run only once could run every time a user logs on.

Therefore, with virtual desktops, one-time system actions must be configured in the base image, and one-time user actions must be configured in the default user profile. In addition, to reach a higher consolidation ratio, increasing the number of VMs hosted on a single VMware vSphere<sup>®</sup> host, VMware recommends turning off features that are not needed.

## **Purpose of This Guide**

Manually Creating Optimized Windows Images for VMware Horizon VMs provides step-by-step procedures for creating optimized images. These procedures include creating a VM, installing and configuring a Windows operating system, optimizing the OS, and installing the various VMware agents required for desktop deployment.

This guide also includes a chapter on day-2 operations, such as updating VMware Tools, in vSphere-based VMs, and updating Windows.

**Important**: The procedures in this guide are sequential and build on one another, so make sure to complete each procedure in each chapter before moving on to the next.

An alternative to manually creating the VM image is to use automation, which is provided by Microsoft Deployment Toolkit (MDT). For step-by-step instructions, see the companion guide Using Automation to Create Optimized Windows Images for VMware Horizon VMs.

### **Intended Audience**

This guide is intended for IT administrators and product evaluators who are familiar with VMware vSphere and VMware vCenter Server<sup>®</sup>. Familiarity with networking and storage in a virtual environment, Active Directory, identity management, and directory services is assumed. Knowledge of other technologies, such as Horizon is also helpful.

### Advantages of an Optimized Image

Optimizing the golden image is well worth the time and effort involved. Savings are returned on a variety of fronts.

# **Initial Deployment Time Savings**

By trimming the image, you can reduce the amount of required disk space by up to 80 percent, which translates to a significant reduction in the time it takes to create desktop pools (up to 3 times faster).



By default, Windows generates native images and performs disk cleanup actions after being idle for 10 minutes, which can use a full core for up to an hour. When deploying a large pool, this means that the cluster might not be usable for up to an hour after deployment. With image optimization, however, this process could be reduced to 30 seconds.

### **User Logon Time Savings**

When a user logs on, the portion of logon time devoted to creating a standard user profile can take up to 30 seconds, but when optimized, this portion of logon time could be reduced to 3.5-10.5 seconds.

### **Host Memory Savings**

A default deployment can use up to 2 GB of active memory, but with optimization, memory requirements can be reduced significantly (up to 50 percent).

### **Host CPU Savings**

An optimized deployment can reduce CPU usage by up to 40 percent, allowing for up to a 40-percent increase in VM density on the physical vSphere host.

### **Storage and IOPS Savings**

Because of the earlier-mentioned disk-space savings, you realize cache-usage improvements as well. Disabling unneeded features and compressing the OS files means a larger portion can fit in the cache, which can reduce the amount of IOPS required by up to 250 percent.

### **Tested Operating Systems**

The following operating systems have been tested using the procedures included in this guide. The table shows the example sizing and login duration that we achieved in our testing.

Only 64-bit operating systems were tested, but any 32-bit operating system that has a corresponding 64-bit version listed should work in the same way. All operating systems were tested with all updates available as of mid-June 2021. For a complete list of supported Windows 10 operating systems, see the VMware knowledge-base article Supported versions of Windows 10 on Horizon Agent Including All VDI Clones (Full Clones, Instant Clones, and Linked Clones on Horizon 7) (2149393).

**Note**: Most screenshots in this guide are from Windows 10 21H1. If you have a different OS version, some screens might look slightly different, but in general they are quite similar.

**Important**: Use an OS version that has a Microsoft Windows volume license key using the Key Management Service (KMS). KMS treats each activated clone as a computer with a newly issued license. In a production environment, you must activate Windows. In an evaluation environment, you can create the VM and log in without activating Windows.

Operating System	Version	Build	Edition	Architecture	Used Space	New Profile Creation Duration
Windows 10	1607	14393.4467 (2021-06-08)	LTSB*	x64	4.84 GB	2.5 S
Windows 10	1809**	17763.1999 (2021-06-08)	LTSC*	x64	5.32 GB	2.5 S
Windows 10	1909**	18362.1621 (2021-06-08)	Education	x64	6.22 GB	4 S
Windows 10	1909**	18363.1621 (2021-06-08)	Enterprise	x64	6.31 GB	4 S
Windows 10	2004**	19041.1052 (2021-06-08)	Education	x64	5.94 GB	4.5 S
Windows 10	2004**	19041.1052 (2021-06-08)	Enterprise	x64	6.00 GB	4.5 S
Windows 10	2004**	19041.1052 (2021-06-08)	Professional	x64	6.10 GB	4.5 S
Windows 10	20H2**	19042.1052 (2021-06-08)	Education	x64	6.22 GB	4.5 S
Windows 10	20H2**	19042.1052 (2021-06-08)	Enterprise	x64	6.00 GB	4.5 S
Windows 10	20H2**	19042.1052 (2021-06-08)	Professional	x64	6.22 GB	4.5 S
Windows 10	21H1**	19043.1052 (2021-06-08)	Education	x64	6.08GB	4 S
Windows 10	21H1**	19043.1052 (2021-06-08)	Enterprise	x64	5.97 GB	4 S
Windows 10	21H1**	19043.1052 (2021-06-08)	Professional	x64	6.06 GB	4 S
Windows Server 2016	1607	14393.4467 (2021-06-08)	Datacenter	x64	6.50 GB	2.5 S
Windows Server 2016	1607	14393.4467 (2021-06-08)	Standard	x64	6.51 GB	2.5 S
Windows Server 2019	1809**	17763.1999 (2021-06-08)	Datacenter	x64	6.41 GB	3.5 S
Windows Server 2019	1809**	17763.1999(2021-06-08)	Standard	x64	6.85GB	3 S

\* *LTSB* means long-term servicing branch. *LTSC* means long-term servicing channel. This edition receives only security updates but no feature updates. OS upgrades are released only once every three years or so. This edition does not include Edge or any Microsoft Store (Universal Windows Platform, or UWP) apps, or Cortana, the voice-activated digital assistant. This edition is meant for specialized systems that perform a single important task—such as PCs that control medical equipment, point-of-sale systems,



and ATMs.

\*\* For 1809+ vSphere 6.5/6.7 U3 or higher is recommended, as there are known problems with earlier versions of vSphere. In general, the latest version is recommended, which, at the time of writing, is 7.0 Update 2b.

### **Infrastructure Prerequisites**

Before you can perform the procedures in this guide, you must have certain infrastructure components installed and configured.

If you are using a VMware vSphere infrastructure, which can reside either on-premises or on one or more cloud platforms, verify that you have the following components installed and configured:

- VMware vSphere and vCenter Server. We used vSphere 7.0 U2b and Horizon 2103 in our testing. For information and installation instructions, see the VMware vSphere documentation.
- VMware ESXi<sup>™</sup> host or hosts configured in the vCenter Server instance.
- An authentication infrastructure that includes Active Directory, DNS, and DHCP.
- If you intend to use VMware App Volumes<sup>™</sup>, you must have the host name or IP address of the server on which App Volumes Manager is installed or the load balancer fronting the server on which App Volumes Manager is installed. You will enter this information when you install the App Volumes Agent on the primary VM image.

If you plan to create Horizon desktop pools or RDSH server farms, ideally at this point you would also have Horizon Connection Server installed and configured. For installation instructions, see the Quick-Start Tutorial for VMware Horizon 8.

If you are using VMware Horizon<sup>®</sup> Cloud Service<sup>™</sup> on Microsoft Azure, rather than a vSphere infrastructure, you must provide your own Microsoft Azure IaaS capacity, and configure the Microsoft Azure prerequisites for a Horizon Cloud Service deployment. The Horizon Cloud Service is a VMware-managed virtual desktop and application solution that provides desktops as a service using a Microsoft Azure public cloud infrastructure. For more information, see the VMware Horizon Cloud Service Documentation.

# **Using Automation**

### **Using Automation to Create an Optimized Windows Image**

This guide you are currently reading describes how to manually create a VM image. However, it is recommended to automate the process of image creation. For step-by-step instructions for using the Microsoft Deployment Toolkit (MDT) to automate the process of image creation, see the companion to this guide, titled Using Automation to Create Optimized Windows Images for VMware Horizon VMs. It also explains how to use the VMware OS Optimization Tool MDT plugin and how to add VMware Agents and VMware Tools using MDT.

# **Creating a vSphere-Based VM**

### **Create a vSphere-Based Virtual Machine**

Each desktop pool or RDSH server farm uses a golden virtual machine (VM) image, which serves as the model for the deployed virtual desktops. For a vSphere-based infrastructure, you use VMware vSphere<sup>®</sup> Web Client to create the golden VM.

For a VMware Horizon Cloud on Microsoft Azure infrastructure, see the chapter Creating a VM in Horizon Cloud and Installing Agents.

### **Prerequisites**

Before you complete this procedure, you will need the following:

• Windows ISO file – You must have uploaded an ISO file to a vSphere datastore. The ISO file must contain a supported version of the Windows operating system. You will point to this file when completing the New Virtual Machine wizard. For a list of the operating systems we tested, see Tested Operating Systems. For a complete list of supported Windows 10 operating systems, see the VMware knowledge-base article Supported versions of Windows 10 on Horizon Agent Including All VDI Clones (Full Clones, Instant Clones, and Linked Clones on Horizon 7) (2149393).



**Important**: Use an OS version that has a Microsoft Windows volume license key using the Key Management Service (KMS). KMS treats each activated clone as a computer with a newly issued license. In a production environment, you must activate Windows. In an evaluation environment, you can create the VM and log in without activating Windows.

• User account – When you log in to vSphere Web Client, the account you use must have the privileges required to create a VM. See the "Prerequisites" section of the product documentation topic Create a Virtual Machine with the New Virtual Machine Wizard.

# **1. Start the New Virtual Machine Wizard in the vSphere Web Client**

vm	Actions - VMware	
([]]	Add Host	
	[[.]] New Cluster	
	New Folder	►
	Distributed Switch	►
	🔂 New Virtual Machine	

1. In vSphere Web Client, right-click a data center, cluster, host, or VM folder.

2. Select New Virtual Machine.

### 2. Select the New Virtual Machine Creation Type

### New Virtual Machine

#### 1 Select a creation type

- 2 Select a name and folder
- 3 Select a compute resour
- 4 Select storage
- 5 Select compatibility
- 6 Select a guest OS
- 7 Customize hardware
- 8 Ready to complete

#### Select a creation type

1

How would you like to create a virtual machine?

#### Create a new virtual machine

Deploy from template Clone an existing virtual machine Clone virtual machine to template Clone template to template Convert template to virtual machine This option guides you through creating a new virtual machine. You will be able to customize processors, memory, network connections, and storage. You will need to install a guest operating system after creation.

CANCEL

NEXT

BAC 2

- 1. Select Create a new virtual machine.
- 2. Click **NEXT**.

# 3. Select a VM Name and Folder

I Select a creation type	Select a name and folder
2 Select a name and folder	Specify a unique name and target location
3 Select a compute resource	
4 Select storage	Virtual machine 21H1ENT
5 Select compatibility	
6 Select a guest OS	Select a location for the virtual machine.
7 Customize hardware	x @ veenter controlbytouch com
8 Ready to complete	> Wenter.com/obytouch.com

- 1. Provide a name in the Virtual machine name field.
- 2. Select a location.
- 3. Click **NEXT**.

# 4. Select a Cluster or Host

1 Select a creation type	Select a compute resource
2 Select a sompute resource	
4 Select storage	✓ ■ VMware
5 Select compatibility	> []] AMD EPYC Milan 1
6 Select a guest OS	> []] AMD EPYC Rome
7 Customize hardware	> []] Intel Cascade Lake R
8 Ready to complete	
	Compatibility
	✓ Compatibility checks succeeded.

- 1. Select a cluster or host as the compute resource.
- 2. Click **NEXT**.

### 5. Select a Datastore for the VM

New Virtual Machine					
<ul> <li>✓ 1 Select a creation type</li> <li>✓ 2 Select a name and folder</li> <li>Select the storage for the configuration and disk files</li> </ul>					
<ul> <li>3 Select a compute resource</li> </ul>	Encrypt this virtual machine	(Requires Key Manage			
4 Select storage	VM Storage Policy	Datastor	e Default		
5 Select compatibility	Disable Storage DRS for this	virtual machine			
6 Select a guest OS					
7 Customize hardware	Name	▼ Storage Con ▼	Capacity <b>T</b>	Provisione <b>T</b>	Fre
8 Ready to complete 1	💽   🗏 ESXi4-P5800X-800	GB	617 GB	538.61 GB	49
				11	tem
			CANCEL	ва	NEXT

1. Select a datastore or datastore cluster where you would like to store the VM.

2. Click **NEXT**.

# 6. Select the vSphere Compatibility Level



- 1. Select the lowest version of ESXi that this VM would be deployed to.
- **Tip**: See Hardware Features Available with Virtual Machine Compatibility Settings.
- 2. Click **NEXT**.

# 7. Select the Windows Version and Architecture

e the guest OS that will be installed on the virtual machine	<ul> <li>✓ 1 Select a creation type</li> <li>✓ 2 Select asname and folder</li> </ul>
ying the guest operating system here allows the wizard to provide the appropriate ts for the operating system installation.	<ul> <li>3 Select a compute resource</li> <li>4 Select storage</li> <li>5 Select compatibility</li> </ul>
OS Family: Windows 🛊	6 Select a guest OS
OS Version: Microsoft Windows 10 (64-bit)	7 Customize hardware 8 Ready to complete
Compatibility: ESXi 7.0 U2 and later (VM version 19)	
Compatibility: ESXi 7.0 U2 an	

- Select the Guest OS Version with the correct architecture (32- or 64-bit) and, when required, enable VBS. (Choose Microsoft Windows Server 2016 when deploying Windows Server 2019 on ESXi 6.x.)
- 2. Click **NEXT**.

# 8. Specify Virtual Hardware Settings

#### New Virtual Machine



- 1. Select 2 CPUs. (This should be tested and adjusted to real production values later.)
- 2. Select 2.5 GB of memory. (This should be tested and adjusted to real production values later.)
- 3. Expand the Memory section.
- 4. Select Reserve all guest memory (All locked).
- 5. Choose an appropriate hard disk size.
- 6. Expand the **New SCSI controller** section.
- 7. Select VMware Paravirtual.
- 8. From the VM Network list, select the appropriate network.
- 9. Expand New Network.
- 10. Select VMXNET3.
- 11. Click on ADD NEW DEVICE.
- 12. Select **CD/DVD Drive**.
- 13. Scroll down

# 9. Continue Specifying Hardware Settings

New Virtual Machine		
1 Select a creation type		
<ul> <li>Select a creation type</li> <li>2 Select a name and folder</li> </ul>	Status	Connect At Power On
<ul> <li>3 Select a compute resource</li> <li>4 Select storage</li> </ul>	Adapter Type	<u>VMXNET 3 ~</u>
<ul> <li>5 Select compatibility</li> <li>6 Select a guest OS</li> <li>7 Customize hardware</li> </ul>	DirectPath I/O	✓ Enable
	MAC Address	Automatic ~
8 Ready to complete	> New CD/DVD Drive *	Datastore ISO File
	> New CD/DVD Drive *	Client Device
	> New USB Controller	USB 3.1 ~ 3 🛞
	Video card 4	Specify custom settings ~
	Number of displays	
	Total video memory	32 6 MB
	3D Graphics	Enable 3D Support
	> Security Devices	Not Configured
	VMCI device	
	New SATA Controller	New SATA Controller
	> Other	Additional Hardware
		Compatibility: ESXi 7.0 U2 and later (VM version 19)
		CANCEL BACK NEXT

- 1. Select **Datastore ISO File** and browse to the Windows ISO file.
- 2. Select Connect.
- 3. Delete the **New USB Controller**.
- 4. Expand the Video card section.
- 5. Select the maximum **Number of Displays** that will be used.
- 6. Use the following table to determine which number to enter in the **Total amount of video memory** field.

**Note**: The table that follows describes the small amount of RAM on the ESXi host that is required for video overhead in addition to system memory. This VRAM size requirement depends in on the display resolution and number of monitors configured for end users.

Display Resolution Standard	Width, in Pixels	Height, in Pixels	1-Monitor Overhead	2-Monitor Overhead	3-Monitor Overhead	4-Monitor Overhead
VGA	640	480	1.20 MB	3.20 MB	4.80 MB	5.60 MB
WXGA	1280	800	4.00 MB	12.50 MB	18.75 MB	25.00 MB
1080p	1920	1080	8.00 MB	25.40 MB	38.00 MB	50.60 MB
WQXGA	2560	1600	16.00 MB	60.00 MB	84.80 MB	109.60 MB
UHD (4K)	3840	2160	32.00 MB	78.00 MB	124.00 MB	Not supported

**Important**: You are not yet finished with the Customize Hardware wizard page. Now that you have edited the virtual hardware settings, you can configure the VM options.

# **10. Specify VM Options**

New Virtual Machine				
<ul> <li>1 Select a creation type</li> <li>2 Select a name and folder</li> <li>3 Select a compute resour</li> <li>4 Select storage</li> <li>5 Select compatibility</li> <li>6 Select a guest OS</li> <li>7 Customize hardware</li> </ul>	Virtual Hardw 1 VM Options			
	> General Options	VM Name: 21H1ENT		
	VMware Remote Console Options	Lock the guest operating system when the last remote user disconnects		
8 Ready to complete	> Encryption	Expand for encryption settings		
	> Power management	Expand for power management settings Expand for VMware Tools settings		
	> VMware Tools			
	> Boot Options	Expand for boot options		
	Advanced 2	Y		
	Settings			
	Debugging and statistics	Run normally ~		
	Swap file location	Oefault Use the settings of the cluster or host containing the virtual machine.		
		CANCEL BACK NEXT		

- 1. At the top of the page click on **VM Options**.
- 2. Expand the **Advanced** section.
- 3. Scroll down.

### **11. Edit the Configuration Parameters**

New Virtual Machine		
<ul> <li>1 Select a creation type</li> <li>2 Select a name and folder</li> <li>3 Select a compute resour</li> </ul>	Settings	Disable acceleration Inable logging
<ul> <li>4 Select storage</li> <li>5 Select compatibility</li> <li>6 Select a guest OS</li> <li>7 Customize hardware</li> </ul>	Debugging and statistics	Run normally ~
	Swap file location	Default Use the settings of the cluster or host containing the virtual machine.
8 Ready to complete		Virtual machine directory Store the swap files in the same directory as the virtual machine.
		Datastore specified by host Store the swap files in the datastore specified by the host to be used for swap files. If not possible, store the swap files in the same directory as the virtual machine. Using a datastore that is not visible to both hosts during vMotion might affect the vMotion performance for the affected virtual machines.
	Configuration Parameters	EDIT CONFIGURATION
	Latency Sensitivity	Normal ~
	> Fibre Channel NPIV	Expand for Fibre Channel NPIV settings
		CANCEL BACK NEXT

Click EDIT CONFIGURATION.

**Note**: In the next step, you are going to disable the hotplug feature. With hotplug enabled, NICs and SCSI controllers appear as removable devices, and the *Safely Remove Hardware* option for the virtual hardware appears in the Windows System Tray (notification area). To prevent this option from appearing, you will disable the capability. When using VMware App Volumes, you must either add enough controllers for the maximum number of disks you will be using or not set this option.

# **12. Disable the Ability to Add and Remove Virtual Hardware While the VM Is Running**

Configuration Parameters		>
Modify or add configuration parameters as needed Empty values will be removed (supported on ESXi 6.0 a	d for experimental fea and later).	atures or as instructed by technical support.
Add New Configuration Params		add configuration params
Name	Value	
devices.hotplug	false	2
Name	<b>∀</b> Value	Ţ
	$\overline{\mathbf{v}}$	
		CAN 3 OK

- 1. Click ADD CONFIGURATION PARAMS.
- 2. For **Name**, type devices.hotplug, and for **Value**, type false.
- 3. Click **OK**. You are returned to the Customize Hardware **> VM Options** tab of the wizard.
- 4. Click **NEXT** on the wizard page.

## **13. Complete the Wizard**

✓ 1 Select a creation type	Virtual machine name			
<ul> <li>2 Select a name and folder</li> <li>3 Select a compute resour</li> </ul>	Folder	VMware		
<ul> <li>4 Select storage</li> <li>5 Select compatibility</li> </ul>	Cluster	AMD EPYC Milan		
✓ 6 Select a guest OS	Datastore	ESXi4-P5800X-800GB		
<ul> <li>7 Customize hardware</li> <li>8 Ready to complete</li> </ul>	Guest OS name	Microsoft Windows 10 (64-bit)		
	Virtualization Based Security	Disabled		
	CPUs	2		
	Memory	2.5 GB		
	NICs			
	NIC 1 network	VM Network		
	NIC 1 type	VMXNET 3		
	SCSI controller 1	VMware Paravirtual		
	Create hard disk 1	New virtual disk		
	Capacity	43 GB		
			CANCEL	BACK

Click FINISH.

### **Install Windows**

After you boot the VM, installation of the Windows OS begins automatically. You will accept most of the default settings and specify that you are doing a new installation rather than an update.

## **1.** Open a Remote Console for the VM



1. Using the vSphere Web Client, from the inventory list, select the newly created Windows VM.

Launch a console for the VM by clicking either Launch Web Console or Lauch Remote Console.
 Note: To launch a remote console, you must have downloaded and installed the VMware Remote Console. If necessary, you can click the "i" button to download and install it.

### 2. Power on the VM



Click the play icon, which is a small triangle-shaped button at the top of the window.

# **3. Boot the VM from the Virtual CD**



Press a key on your keyboard.

# 4. Select Settings for Your Region

орона 21Н1ЕМТ ОО	& ⊳
🖆 Windows Setup	
Languag <u>e</u> to install <mark>English (United States)</mark>	
Time and currency format English (United States)	
Enter your language and other preferences and click "Next" to continue.	
© 2020 Microsoft Corporation. All rights reserved.	

- 1. Select the correct regional options.
- 2. Click Next.

# **5. Begin Installing Windows**

<b>•</b> •	21H1ENT	a 🔿
	🖆 Windows Setup	
		k
	Renair your computer	
	© 2020 Microsoft Corporation. All rights reserved.	

Click Install now.

# 6. Select the Edition

**vm**ware<sup>®</sup>

<b>0</b> 0		21H1ENT		₹,  >
	I Select the operating system you wan Select the operating system you wan Operating system Windows 10 Education Windows 10 Enterprise Windows 10 Enterprise N Windows 10 Pro Windows 10 Pro Windows 10 Pro Windows 10 Pro Windows 10 Enterprise Windows 10 Enterprise	t to install Architecture x64	Date modified 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021 2/5/2021	
1 Collecting information	2 Installing Windows			

This screen is only shown for an ISO that contains multiple editions.

1. Select the Windows edition.

Important: For Windows Server 2016/2019, select one of the following "Desktop Experience" editions:

- Windows Server 2016 Standard (Desktop Experience)
- Windows Server 2016 Datacenter (Desktop Experience)
- Windows Server 2019 Standard (Desktop Experience)
- Windows Server 2019 Datacenter (Desktop Experience)
- 2. Click Next.

## 7. Accept the License Agreement

<b>0</b>	21H1ENT	₹ >
	🚱 🔬 Windows Setup	
	Applicable notices and license terms	
	Your use of this software is subject to the terms and conditions of the license agreement by which you acquired this software. If you are a volume license customer, use of this software is subject to your volume license agreement. You may not use this software if you have not validly acquired a license for the software from Microsoft or its licensed distributors.	
		k
	2 Next	
1 Collecting information	2 Installing Windows	

1. Select the I accept the license terms check box.

2. Click Next.

## 8. Select the Custom Installation

<b>0</b> 0	21H1ENT	₹}  >
	Windows Setup	
	Which type of installation do you want?	
	<u>Upgrade: Install Windows and keep files, settings, and applications</u> The files, settings, and applications are moved to Windows with this option. This option is only available when a supported version of Windows is already running on the computer.	
	<b>Custom: Install Windows only (advanced)</b> The files, settings, and applications aren't moved to Windows with this option. If you want to make changes to partitions and drives, start the computer using the installation disc. We recommend backing up your files before you continue.	
1 Collecting information 2	Installing Windows	

Select Custom: Install Windows only (advanced).

# 9. Load the PVSCSI Driver from the VMware Tools Disk Image

00			21H1ENT			જી ⊳
9	🔏 Windows Setup				<b>x</b>	
	Where do you wa	nt to install Wind	lows?			
	Name		Total size	Free space Type		ļ
	Refresh	Delete	<b>F</b> ormat	₩ N <u>e</u> w		
	We couldn't find any dr	ives. To get a storage	driver, click Load driver.			ľ
					Next	
1 Collecting information 2	nstalling Windows					

When this page is displayed go back to the vSphere Client.

### 9.1. Access the VMware Tools Disk Image from vSphere Web Client

🕹 21H1ENT   ▷ 🗆 🗳 🛷		ns ∽
Summary Monitor Configure	Permissions	Datastores Networks Snapshots Updates
▲ VMware Tools is not installed on th	is virtual machine.	Install VMware Tools
Guest OS		ACTIONS ~
	Device Otober	
	Power Status	تي Powered On
Contraction Contraction	Guest OS	Microsoft Windows 10 (64-bit)
	VMware Tools	Not running, not installed (j)
	DNS Name	
	IP Addresses	
LAUNCH REMOTE CONSOLE	Encryption	Not encrypted
LAUNCH WEB CONSOLE		

Click Install VMware Tools.

9.2. Mount the VMware Tools Disk Image on a Virtual Drive of the VM



Click on **MOUNT** and go back to the the remote console.

### 9.3. Open the Load Driver Dialog Box

• • • aa	21H1ENT	$\mathcal{S} \Rightarrow$
		)
	Windows Setup Where do you want to install Windows?	
	Name         Total size         Free space         Type	
	Refresh Delete Format # New	
	Image: Construction of the storage driver, click Load driver.         Image: Construction of the storage driver, click Load driver.	
	Next	
1 Collecting information	2 Installing Windows	

Click Load driver.

9.4. Open the File Browser

• • • 00	21H1ENT	€)  >
	C Windows Setup	
	Select the driver to install          Load driver         To install the device driver for your drive, insert the installation media containing the driver files, and then click OK.         Note: The installation media can be a CD, DVD, or USB flash drive.         Browse       OK         Cancel         Hide onvers that aren't compatible with this computer's naroware.	
	Browse Rescan Next	
1 Collecting information	2 Installing Windows	

Click Browse.

9.5. Browse to the Correct PVSCSI Driver

• • • 00	21H1ENT	€  >
	🚱 🔬 Windows Setup	
	Select the driver to install	
1 Collecting information	2 Installing Windows	

1. Go to E:\Program Files\VMware\VMware Tools\Drivers\pvscsi\Win8\amd64.

2. Click **OK**.

### 9.6. Select the Driver

• • • 00	21H1ENT	€)  >
	🚱 🔬 Windows Setup	
	Select the driver to install	
	VMware PVSCSI Controller (E:\Program Files\VMware\VMware Tools\Drivers\pvscsi\Win8\amd64\	
	< >	
	✓ Hide drivers that aren't compatible with this computer's hardware.	
	Browse Rescan	
1 Collecting information	2 Installing Windows	

With the VMware PVSCSI driver selected, click **Next**.

# **10. Use the Default Installation Location**

• • • aa	21	H1ENT		€  >
_			X	
	🔏 Windows Setup			
	Where do you want to install Window	s?		
	Name	Total size Free space	Туре	
	Drive 0 Unallocated Space	48.0 GB 48.0 GB		
	<u>Refresh</u> <u>D</u> elete <u>D</u> elete <u>D</u> elete	✓ Format ★ New		
			Next	
1 Collecting information 2	nstalling Windows			

Click Next.

# **11. Monitor Installation Progress**

• • • 00	21H1ENT	& ⊳
	Windows Setup Installing Windows Status	
	Copying Windows files Getting files ready for installation (5%) Installing features Installing updates Finishing up	
		*
1 Collecting information	2 Installing Windows	

Wait for Windows to be installed.

# **12. Enter Audit Mode by Pressing CTRL+SHIFT+F3**

After the Windows operating system is installed, you need to enter audit mode.

The screen at which you enter audit mode depends on which Windows operating system you are using. For example, some operating systems will automatically log in to Windows after a restart operation, while others will prompt for user credentials. If prompted, use **Administrator** for the user name and leave the password field blank.

When you are prompted with Let's start with a region or Get going fast, or Personalize, or Customize Settings, or Setup Windows, press CTRL+SHIFT+F3 to switch to audit mode.

**Note**: Different Windows operating systems provide different prompts after the initial installation. The following screenshot shows the prompt after you install Windows 10 21H1. You would press CTRL+SHIFT+F3 to switch to audit mode in Windows 10 21H1 when you see this prompt.


The following screenshot shows the prompt after you install Windows Server 2016/2019. You would press CTRL+SHIFT+F3 to switch to audit mode in Windows Server 2016/2019 when you see this prompt.

## Customize settings

Type a password for the built-in administrator account that you can use to sign in to this computer.

User name	Administrator
Password	
Reenter password	

Finish

### 13. Power Off

¢,



- 1. Click the **Start** icon.
- 2. Click the **Power** icon.
- 3. Select Shut down.

#### **Install VMware Tools**

VMware Tools is a set of services and modules that enable several features in VMware products for better management of, and seamless user interactions with, guests operating systems.

For example, VMware Tools can run scripts that automate OS operations and can synchronize the time in the guest operating system with the time on the vSphere host. You must install VMware Tools in vSphere-based VMs used for desktop and application



pools.

At the end of the previous exercise, Install Windows, you powered off the VM, which left the remote VM console dark, as shown in the following screenshot. If you closed that console, you need to open it again before you can begin this exercise. If you did not power off the VM, you must do so or the Install VMware Tools link will not be available in the second screenshot.

## **1. From the Remote VM Console Start the VM**



Click on the play icon, which is a triangle-shaped icon at the top of the VM console.

## 2. Access the VMware Tools Disk Image

🗗 21H1ENT   🖻 🗆 🗳 🚳 🖄   астіоля м	
Summary Monitor Configure Permissions Datastores Networks S	hapshots Updates
⚠️ VMware Tools is not installed on this virtual machine.	nstall VMware Tools
Guest OS	ACTIONS ~ 💠
Power Status 🔂 Powered On	
Guest OS 🎒 Microsoft Windows	0 (64-bit)
VMware Tools Not running, not installed	ĺ.
DNS Name	
IP Addresses	
LAUNCH REMOTE CONSOLE	
LAUNCH WEB CONSOLE	

# **3. Mount the VMware Tools Disk Image**



Click **MOUNT** and go back to the vSphere remote console for the VM.

# 4. Select the VMware Tools Virtual Drive in the AutoPlay Window



Click Select to choose what happens with this disc.

# 5. Start the Installation Wizard

# DVD Drive (E:) VMware Tools

Choose what to do with this disc.

#### Install or run program from your media

vm	Run setup64.exe Published by VMware, Inc.	
Other	choices	
-	Open folder to view files File Explorer	
0	Take no action	

#### Click Run setup64.exe.

## 6. Click Next on the Welcome Page



#### Click Next.



# 7. Select the Custom Setup Type



1. Select Custom.

2. Click Next.

# 8. Disable the Carbon Black Helper Component If Not Required

👷 VMware Tools Setup	- 🗆 X
Custom Setup Select the way you want features to be instal	vmware <sup>.</sup>
Click the icons in the tree below to change the	way features will be installed.
Toolbox       VMware Carbon Black)       WMI Performance Logg       WMare Time Provider       VMware Device Drivers       VMCI Driver       NSX File Introsp       X Y NSX Neth	Helper for install of VMware Carbon Black Sensor on this virtual machine. 2 This feature requires 0KB on your hard drive.
	Browse
Help Disk Usage	< Back Next > Cancel

1. Deselect **VMware Carbon Black Helper**, unless you use Carbon Black.

2. Scroll down.

**Note**: If you leverage NSX enable the NSX File and Network Introspection drivers.

# 9. Exclude the Service Discovery Component

🛃 VMware Tools Set	up				—		×
Custom Setup Select the way yo	u want features to be instal	ed.				vmv	vare <sup>.</sup>
Click the icons in t	ne tree below to change the	way	features v	vill be ir	istalled.		
	VMCI Driver VMCI Driver X VMCI Driver X VMCI Driver X VMCI Driver NSX File Introsp Service Discov Device Helper Shared Folders SVGA Driver		Enable the services tchine. This feat hard driv	ne disco running aure req	overy of ) inside t Juires 0K	various his virtual B on your	
	>					Browse	
Help	Disk Usage	<	< Back	Ne	xt >	Cano	el

1. Deselect **Service Discovery**, which enables the discovery of various services running inside a virtual machine. This component is not necessary.

2. Scroll down.

## **10. Exclude the Volume Shadow Copy Component**



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- 1. Deselect **Volume Shadow Copy Services Support**. This component is not necessary.
- 2. Click Next.

# **11. Begin Installation of VMware Tools**

🖟 VMware Tools Setup	10 <del></del> 21		×
Ready to install VMware Tools		vmv	vare <sup>.</sup>
Click Install to begin the installation. Click Back to review or cha installation settings. Click Cancel to exit the wizard.	inge any of yo	bur	
< Back Ins	tall	Cano	el

Click Install.

# **12. Exit the Installation Wizard**

😾 VMware Tools Setup	- 🗆 ×
	Completed the VMware Tools Setup Wizard
	Click the Finish button to exit the Setup Wizard.
<b>vm</b> ware <sup>,</sup>	
	< Back <b>Finish</b> Cancel

Click Finish.

### **13. Do Not Restart the VM**



Click No.

#### Install .Net Framework 3.5

Open a command prompt and run the following command:

DISM /Online /Enable-Feature /FeatureName:NetFx3 /All /LimitAccess
/Source:D:\sources\sxs

Install any required component that leverages Windows Update, such as C++ runtimes, Office, and so on. The following screenshot shows an example of successfully running this command.



#### **Update Windows**

Install the latest Windows OS updates.

# **1. Select the Update & Security Settings in Windows Settings**

Settings						- 0 ×
	口	<b>System</b> Display, sound, notifications, power		<b>Devices</b> Bluetooth, printers, mouse		<b>Phone</b> Link your Android, iPhone
		Network & Internet Wi-Fi, airplane mode, VPN	<b>A</b>	<b>Personalization</b> Background, lock screen, colors		<b>Apps</b> Uninstall, defaults, optional features
	8	<b>Accounts</b> Your accounts, email, sync, work, other people	。 A字	Time & Language Speech, region, date	$\bigotimes$	<b>Gaming</b> Xbox Game Bar, captures, Game Mode
	Ģ	Ease of Access Narrator, magnifier, high contrast	Q	<b>Search</b> Find my files, permissions	≙	<b>Privacy</b> Location, camera, microphone
	$\bigcirc$	<b>Update &amp; Security</b> Windows Update, recovery, backup				

Press Windows Key+I, to open Windows Settings, and click **Update & Security**.

# 2. Select Check for Updates

← Settings	— @ ×
命 Home	Windows Update
Find a setting	Re'll continue to check daily for newer updates.
Update & Security	Check for updates
$\mathbb{C}$ Windows Update	Pause updates for 7 days
변 Delivery Optimization	Visit Advanced options to change the pause period
Windows Security	Change active hours Currently 8:00 AM to 5:00 PM
→ Backup	View update history           See updates installed on your device
A Troubleshoot	Advanced options
윤 Recovery	
<ul> <li>Activation</li> </ul>	
۹	Looking for info on the latest updates?

**Note**: For earlier non-LTSB/LTSC Windows 10 versions, click **Advanced options** first and select **Defer feature upgrades** so that new features are not downloaded and installed. Deferring feature upgrades does not affect security updates.

Click **Check for updates** and wait for the updates to be installed.

## 3. Restart the VM



Click **Restart now**. Run Windows Update again until no more updates are available and no restarts are required.

# Installing Virtual Desktop Agents and Applications in a vSphere-Based VM

#### **Install Horizon Agent**

If you plan to create VMware Horizon desktop or application pools or server farms, you must install Horizon Agent on the golden VM image so that VMware Horizon servers can communicate with and manage the VMs that you deploy. The Horizon Agent also communicates with VMware Horizon<sup>®</sup> Client<sup>™</sup> on end users' computers to provide features such as connection monitoring, virtual printing, access to the local file system, and access to locally connected USB devices.

**Note**: This procedure describes running the Horizon Agent installer in the guest operating system of a vSphere-based VM. If instead you are using Horizon Cloud on Microsoft Azure, installing the Horizon Agent is included in the process of importing a VM from the Azure Marketplace, as described in the exercise Import a VM in Horizon Cloud on Microsoft Azure.

## **Prerequisites for Installing Horizon Agent**

To perform this procedure, you need the following:

- **User account** When you log in to the OS of the golden image to run the installer, the account you use must have local administrative privileges.
- Installer Horizon Agent installer (.exe) files are available from the Download VMware Horizon page. You must download the file and copy it to the system where it will run or to a location accessible to the system.
- VM with supported Windows OS The virtual machine must be running a Windows operating system that Horizon Agent supports. For a list of the systems we tested, see Tested Operating Systems. For a complete list of supported Windows 10 operating systems, see the VMware knowledge-base article Supported versions of Windows 10 on Horizon Agent Including All VDI Clones (Full Clones, Instant Clones, and Linked Clones on Horizon 7) (2149393).

**Important**: If you install Horizon Agent on a Windows Server machine on which the Remote Desktop Services (RDS) role is not installed, the wizard will prompt you to **Install VMware Horizon Agent in 'desktop mode'**.

Selecting this option configures the Windows Server machine as a single-user virtual desktop rather than as an RDS host. If you



intend the machine to function as an RDS host, cancel the Horizon Agent installation, install the RDS role on the machine, and restart the Horizon Agent installation.

## **1. Start the Horizon Agent Wizard**



Log in to the OS of the VM as an Administrator, double-click the installer file to start the wizard, and click **Next** on the Welcome page.

# **2. Accept the License Agreement**

🛃 VMware Horizon Agent	×
License Agreement Please read the following license agreement carefully.	
VMWARE END USER LICENSE AGREEMENT	^
PLEASE NOTE THAT THE TERMS OF THIS END USER LICENSE AGREEMENT SHALL GOVERN YOUR USE OF THE SOFTWARE, REGARDLESS OF ANY TERMS THAT MAY APPEAR DURING THE INSTALLATION OF THE SOFTWARE.	
IMPORTANT-READ CAREFULLY: BY DOWNLOADING, INSTALLING, OR USING THE SOFTWARE, YOU (THE INDIVIDUAL OR LEGAL ENTITY) AGREE TO BE BOUND BY THE TERMS OF THIS END USER LICENSE AGREEMENT ("EULA"). IF YOU DO NOT AGREE TO THE TERMS OF THIS	~
I accept the terms in the license agreement     I do not accept the terms in the license agreement	
< Bac Next > Cancel	

1. Select I accept the terms in the license agreement.

2. Click Next.

## 3. Select the Mode



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- When you install Horizon Agent on Windows Server 2016 or 2019, you must select either **RDS Mode**, for shared multi-user sessions, or **Desktop Mode**, for single-user (VDI) desktops. If you select **RDS Mode** the RDS role is installed and you are prompted to restart, after which you can launch the agent installer again.
- 2. Click Next.

# 4. Select Whether to Use IPv4 or IPv6

🛃 VMware Horizon Agent 🛛 🕹	
Network protocol configuration	
Select the communication protocol	
Specify the protocol to be used to configure this Horizon Agent instance:	
Pv4 gent will be configured to choose the IPv4 protocol for establishing Pv6 nections.	
< Bac Next > Cancel	

- 1. Select IPv4 or IPv6.
- 2. Click Next.

The environment must be either IPv6 only or IPv4 only. Horizon does not support a mixed IPv6 and IPv4 environment.

# **5. Select Required Features**



1. Select only the features that will be used. For most environments these are **Core**, **VMware Horizon Instant Clone Agent**, **VMware Audio**, and **VMware Integrated Printing**.

2. Click Next.

## 6. Enable Remote Desktop support



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Click Next

# 7. Click Install

₩VMware Horizon Agent ×
Ready to Install the Program The wizard is ready to begin installation.
VMware Horizon Agent will be installed in: C:\Program Files\VMware\VMware View\Agent\
Click Install to begin the installation or Cancel to exit the wizard.
NOTE: The RDS role is not enabled on this OS. VMware Horizon Agent will support only single desktop connections.
NOTE: The VDS SAN policy will be set to "Online All" as required by the VMware Horizon Instant Clone Agent (NGVC) feature.
< Back Install Cancel

This screenshot shows an example of the screen that might appear when installing the agent on Windows Server. The following screenshot shows an example of a screen for Windows 10.

₩VMware Horizon Agent ×
Ready to Install the Program
The wizard is ready to begin installation.
VMware Horizon Agent will be installed in:
C:\Program Files\VMware\VMware View\Agent\
Click Install to begin the installation or Cancel to exit the wizard.
NOTE: The VDS SAN policy will be set to "Online All" as required by the VMware Horizon Instant Clone Agent (NGVC) feature.
< Back Install Cancel

Now that all the correct components are configured to be installed, click **Install**.

# 8. Click Finish When Installation Is Complete

👷 VMware Horizon Agent	×
<b>vm</b> ware <sup>,</sup>	Installer Completed
	The installer has successfully installed VMware Horizon Agent. Click Finish to exit the wizard.
v™ware Horizon®	
	< Back Finish Cancel

Click **Finish** to close the installer.



## 9. Restart the VM



When prompted to restart, click Yes.

#### **Install the Dynamic Environment Manager Agent**

VMware Dynamic Environment Manager<sup>™</sup> (formerly called *User* Environment Manager) provides profile management by capturing user settings for the operating system and applications. Unlike traditional application profile management solutions, Dynamic Environment Manager captures only the settings that the administrator specifies. This reduces login and logout time because less data needs to be loaded. User data is managed through folder redirection.

FlexEngine, the Dynamic Environment Manager Agent component, applies the policies that the IT administrator creates with the Dynamic Environment Manager Management Console. To install this component, you run the same VMware Dynamic Environment Manager Setup wizard that you run to install the management console.

**Notes**: Installing the Dynamic Environment Manager Agent is an optional step. Install this agent only if you plan to use this functionality.

This procedure describes running the FlexEngine installer in the guest operating system of a vSphere-based VM. If instead you are using Horizon Cloud on Microsoft Azure, installing the agent is included in the process of importing a VM from the Azure Marketplace, as described in the exercise Import a VM in Horizon Cloud on Microsoft Azure.

## **Prerequisites for FlexEngine Installation**

To perform this exercise, you need the following:

- User account When you log in to the OS to run the installer, the account you use must have administrative privileges.
- Installer If necessary, you can download the installer from the VMware Downloads page. The installer is included in a ZIP file. You must download the file, extract the Dynamic Environment Manager MSI file, and copy it to the system where it will run or to a location accessible to the system.
- Internet access The installation process includes a certificate revocation check to verify the digital signature of the MSI file. This check requires Internet access.

**Note**: When you install the Dynamic Environment Manager Agent on a VM where Horizon Agent is already installed, you are not required to specify a Dynamic Environment Manager license file. However, you are required to have purchased Dynamic Environment Manager Enterprise is included with Horizon Enterprise, and Dynamic Environment Manager Standard is included with Horizon Standard.

## **1. Start the Installer**



Log in to the OS of the VM as an Administrator, double-click the installer file to start the wizard, and click **Next** on the Welcome page.

# 2. Accept the License Agreement

🕼 VMware Dynamic Environment Manager Enterprise Setup 🛛 🗌	×
End-User License Agreement	
Please read the following license agreement carefully	
VMWARE END USER LICENSE AGREEMENT	^
PLEASE NOTE THAT THE TERMS OF THIS END USER LICENSE AGREEMENT SHALL GOVERN YOUR USE OF THE SOFTWARE, REGARDLESS OF ANY TERMS THAT MAY APPEAR DURING THE INSTALLATION OF THE SOFTWARE.	
IMPORTANT-READ CAREFULLY: BY DOWNLOADING, INSTALLING, OR USING THE SOFTWARE, YOU (THE INDIVIDUAL OR LEGAL ENTITY) AGREE TO BE BOUND BY THE TERMS OF THIS END USER LICENSE AGREEMENT ("EULA"). IF YOU DO NOT AGREE TO THE TERMS OF THIS EULA. YOU MUST NOT	~
I accept the terms in the License Agreement	
Print Bac Next Canc	el

1. Select I accept the terms in the License Agreement.

2. Click Next.

# 3. Choose the Typical Setup Type

🕼 VMware Dynamic Environment Manager Enterprise Setup 🛛 🗌 🛛 🗙
Choose Setup Type
Choose the setup type that best suits your needs
Typical Installs the most common program features. Recommended for most users.
Custom Allows users to choose which program features will be installed. Recommended for advanced users.
Complete
All program features will be installed. Requires the most disk space.
Back Next Cancel

Click **Typical**.

The typical setup installs the **VMware DEM FlexEngine** agent component, along with the optional components: Application Migration and Self-Support.

# 4. Click Next on the License File Page

🕼 VMware Dynamic Environment Manager Enterprise Setup 🛛 🗌 🗙	
Choose License File	
Selected features require a valid license file before they can be used	
Choose a license file that you received with this product.	
To select the license file, click the Browse button, and browse to the file location.	
If you don't have a valid license file, click the Back button, and select features that don't require a license file.	
License File	
No license file necessary on VMware Horizon	
Back Next Cancel	

Click Next.

# 5. Begin Installation

1 VN	/Iware Dynamic Environm	ent Manager Enterp	rise Setup	—	
Re	eady to install VMware	Dynamic Environn	nent Manage	r Enterpris	e
	Click Install to begin the inst installation settings. Click Car	allation. Click Back to r ncel to exit the wizard.	eview or change	any of your	
		Back	Instal		Cancel

Click Install.



#### Install Applications in the Base Image

Although our primary application-delivery mechanism is App Volumes, it might be desirable to install select applications in the primary VM so that all clones get those applications in their base disk.

Many applications have integrated auto-update functionality. Install these applications and update them to the latest version, and then turn off or disable the auto-update functionality to prevent the clones from updating individually.

After you install any applications and drivers that you want to have in the base image, proceed to Running the OS Optimization Tool to Optimize, Generalize, and Finalize the OS.

## **Creating a VM in Horizon Cloud and Installing Agents**

#### Import a VM in Horizon Cloud on Microsoft Azure

### Introduction

Horizon Cloud delivers feature-rich virtual desktops and applications using a purpose-built cloud platform that is scalable across multiple deployment options, including fully managed infrastructure from VMware and public cloud infrastructure from Microsoft Azure. The service supports a cloud-scale architecture that makes it easy to deliver virtualized Windows desktops and applications to any device, anytime. And, with a flexible subscription model, organizations can easily get up and running quickly.

If you are using Horizon Cloud on Microsoft Azure rather than Horizon 8, instead of creating a VM (as described in Creating a vSphere-Based VM) and then manually running various agent installers on that VM (as described in Installing Virtual Desktop Agents and Applications in a vSphere-Based VM), you import the VM from the Azure Marketplace. When completing the import wizard, you select various check boxes in order to automatically install Horizon Agent and the App Volumes Agent. The Dynamic Environment Manager Agent and vRealize Operations Desktop Agent are not listed as the options but will also be installed. The following procedure describes the process.

## **1. Log In to the Horizon Universal Console**

Welcome to VMware Horizon Cloud	
My VMware Credentials	
Nantinga@vmware.com	
) Remember me	
LOGIN Forgot password?	
Use as default login	
VMWARE CLOUD LOGIN	

Go to the Horizon Universal Console with the URL from the welcome email and log in with your My VMware credentials. When prompted, log in with your AD credentials.



# 2. Navigate to the Imported VMs Page

vmw Horizon Cloud	
	«
Monitor	>
Assignments	>
Inventory 1	$\sim$
Applications	
Farms	
Images (Microsoft Azure	∋)
Images (VMware)	
Imported VMs 2	
Settings	>
1. Click Inventory.	

Click Imported VMs.

# 3. Start the VM Import Wizard

vmw Horizon Cloud		Q Users ∽ Search here
	~	
Monitor	>	Imported VMs (1)
ổ Assignments	>	IMPORT RESTART MORE ~
🗄 Inventory	~	
Applications		Status Y Name Y IP Address Y Agent Status Y Location Y OS Y Pod Y Description Y
Farms		
Imported VMs		
Settings	>	
		**
		` · · · · · · · · · · · · · · · · · · ·
		You don't have any VMs.
		Click import to add a VM.
		0 Imported VM(s)

Click IMPORT.

# 4. Specify the Destination, VM Details, and Admin Credentials

Import Virtual Machine	×					
Destination Pod						
Location *	×					
Pod *	~	12				
Virtual Machine Details						
OS *	Windows 10 Enterprise, 1903 🔹	£3				
Inlcude GPU	<b>i</b>					
Domain Join						
Domain *	Ý	35				
Enable Public IP Address						
Optimize Windows Image		8				
Remove Windows Store Apps	<b>(i)</b>					
Admin Credentials for the Virtual Machine						
Username *	localadmin	<u>(</u> )				
Password *		í <b>7</b>				
Verify Password *		1				

- 1. Select a **Location**.
- 2. Select a **Pod**.
- 3. Select an **OS**.
- 4. Enable **Domain Join**.
- 5. Select a **Domain**.
- 6. Enable **Public IP Address** when you do not have direct access to the VNET.
- 7. Provide a local administrator **Username** and **Password**.



8. Scroll down.

# **5. Specify the Machine Name and Select Horizon Agent** Features



- 1. Provide a Name and optionally a Description.
- 2. Click Advanced Options.
- 3. Choose only the Horizon Agent Features that are required.

4. Click IMPORT.

# 6. Select Reset Agent Pairing

Imported VMs	í
IMPORT RESTAF 2	MORE Y
Status T Nam	Power On
	Power Off
	Convert to Image
	Delete
3	Reset Agent Pairing

After the import is finished:

- 1. Select the VM.
- 2. Click MORE.
- 3. Select Reset Agent Pairing.

### 7. Install Applications

Imported VMs (1)								
IMPORT RESTART MORE ~								
Status y Name y	IP Address	Agent Status 🕎 Loc	ation T OS	T Pod	T Description	Ŧ		
	17:	Active (20.3.0)	Windows 10 64 Bit	ŀ-	-			

RDP to the machine using the IP address listed and install any applications and drivers that you want to have in the base image. Next, proceed to Running the OS Optimization Tool to Optimize, Generalize, and Finalize the OS.

# **Running the OS Optimization Tool to Optimize, Generalize, and Finalize the OS**

#### Introduction to OSOT

The VMware OS Optimization Tool (OSOT) fling helps optimize Windows 7/8/10 and Windows Server 2008 R2/2012/2016/2019 systems for use as VDI or RDSH server VMs. OSOT includes customizable templates to enable or disable Windows system services and features, according to VMware recommendations and best practices, across multiple systems. Because most Windows system services are enabled by default, OSOT can be used to easily disable unnecessary services and features to improve performance.

OSOT also includes the ability to run commonly used Windows tools for image creation and optimization, including the Native Image Generator (Ngen.exe), NTFS Compression (compact.exe), and Deployment Image Servicing Management (DISM.exe). These tools can now be run from the new **Finalize** tab of OSOT.



**Note**: This version of this document does not include instructions for using Windows mandatory profiles. we found that this feature does not work reliably when used with Windows 10 version 1809 and later. We decided that, for consistency's sake, we would remove the recommendation for all versions. We found that login times are nearly equivalent if you use default user profiles instead of mandatory user profiles.

#### Analyze and Optimize the OS Using Customizable Templates

In this procedure, you download the OSOT, check for template updates, analyze the list of recommended optimizations, and select and apply those optimizations.

## **1. Download the OS Optimization Tool**



- 1. Select I have read and agree to the Technical Preview License on the VMware OS Optimization Tool Flings page.
- 2. Click DOWNLOAD.
- Extract the files to a non-profile location (for example c:\0S0T), and start the executable (VMware0S0ptimizationTool.exe).

# 2. Analyze Recommended System Optimizations to Apply

2 Where 05 Optimization Tool 2021 - 🗗 🗙		
Contemporation of the second s	on Tool	
Cymene Generalize Frankie	makay Emplates	2106
System Information		
G Microsoft Windows 12 Enterprise	System Name VM00AEV-3L00UTG	
E Version 21H1 (19043.1952)	& User Name Administrator	
AMD EPIC 7543 32-Core Processor	Windows Directory C/windows	
(j) System Type 64-bit	Physical Memory 3 G8	
Windows Locale United States	E Display Controller VMaster SVGA3D	
25 Display Adapter RAM INA	Setwork Adapter Internet Adapter	
Template VMware/Windows 10 and Server 2016 or later v	Common Options	C Oper Analysis Result 11 Impert Selections III Oper Selections Search Q
	Click Analyze button to r	eview optimization items

Click Analyze.

# **3. Select Common Options**

VMware OS Optimization Tool 2021			- o ×
Content of the test of tes	i Tool		
Comman Generalize Finalize Update	Tankary Tangkidas References		2106
System Information		Analysis Summary	
i os Microsoft Windows 10 Enterprise	System Name VMWATEV-3L08UTG	600	
😢 Version 21H1 (19043.1852)	& User Name Administrator	400	
AMD EPIC 7543 32-Care Processor	Windows Directory Classifications	200 484 483	
() System Type 64-bit	Physical Memory 1 G8		12
Windows Locale United States	EB Display Controller VMasser SVGA JD	Total Hecommenced (	ștora
C Deplay Adapter KAM	So Network Adapter Internet Rodpiter	Character with different character with the	
Template Whene/Windows 10 and Server 2016 or later v	Common Dytions	🕼 Export Analysis Result 👕 Import Selections	III Expert Selections Search Q
Optimizations	ExpectedValue	Actual Value	Description
V 🔽 Modifications to Standard Image ( 509 items )		Select "Disable" in the Options tab of	any Task to bypess processing. Disable this entire section in the same manner.
V 🔽 Security (108 items)			
Defender Antivirus ( 16 items )			
Firewall (1 items)			
> V HVCI(7 items)			
Security Center (6 items)			
SmartScreen (5 items)			
Telemetry and Privacy ( 37 items )			
> 👿 Windows Update (36 items)			
V 🔽 User Experience (149 items)			
Background (11 items)			
Notifications (9 items)			
> 😼 Sounds (28 items)			
V 🔽 Features (49 itams.)			
> 🖬 Autorum (5 items)			
Content Delivery Manager (23 items)			
4			
			🗇 Analyse 🗸 Optimize

Click the **Common Options** button.

# 4. Review the Tabs to Determine Which Options to Set

🔯 Select Option	×
Overview Visual Effect	The common options tabs allow you to quickly and easily choose and set preferences to control common functionality. These options normally involve configuring multiple individual settings. By grouping the actions together, the individual settings get configured as necessary to give the desired outcome.
Notification Update	Where settings can be applied at the profile level, there are also options to control which ones the settings get applied to.
Search	After clicking OK, the common options settings will be applied to the main list of modifications and can be changed as normal there.
Store Apps	Apply current user registry keys to default user profile
Background	
Security	
	ок

Here you can select alternate defaults that will change the selection of optimizations. As an example for a persistent VM, you probably want to make changes to Windows **Update**, **Search**, and **Security**, or you might want to keep certain **Store Apps**.

# 5. (Optional) Revert to Security Defaults Used in Older Versions of OSOT

Select Option		×
Overview	Choose Security Options	
Visual Effect	🕑 Disable Firewall	
Notification	Windows Firewall protects your computer from unauthorized access. Consider disabling to improve performance.	
Update 🕢	🔽 Disable Antivirus	
Search	Windows Antivirus and Threat Protection protects your computer by scanning for malware, viruses and security threats. This can autorun in the background and lead to higher CPU usage. Consider disabling to improve performance.	
Store Apps	re Apps	
Store Apps	Windows Security Center monitors the security and maintenance status of the computer.	
Background	Enable SmartScreen	
Security	SmartScreen is a cloud-based anti-phishing component. It scans user browser behavior which can consume more resources. To improve performance, OSOT turns this off by default.	•
	Enable Hypervisor-protected code integrity (HVCI)	
	HVCI protects the OS from compromise by bad drivers and malicious system files. To improve performance OSOT turns this off by default.	,
	ОК	

**Note**: The default behavior of Windows Security Center, Antivirus, and Firewall have changed since OSOT 2106. If you prefer, you can revert to the old behavior in the Common Options:

- 1. Click Security.
- 2. Select Disable Firewall, Disable Antivirus, and Disable Security Center, and click OK.

# 6. Select the Optimizations to Apply

	n Tool	- σ
Contrast Contrast Contrast	Natury Emplates	2106
System Information           Ot         Microsoft Windows 13 Estangetas           Vanias         2181 (1994) 2052           Processor         AND PPC 7543 32-Core Processor           System Type         64-bit           Windows Lando         United States           Windows Lando         United States		Analysis Summary
Template Whisert/Windows 10 and Server 2016 or later v Optimizations	C Communityperson Expected/Whue	Contract Analysis Result     Statement Selections     The Expert Selections     Search Q      Actual Value     Description
V @ Socialty (10) Items)       > @ Socialty (10) Items)       > @ An official items)       > @ An official items)       > @ Socialty (10) Items)       > @ An official items)       > @ Socialty (10) Items)       > @ Note (10) Items)		
		2

- 1. Select the appropriate optimizations from the extensive list. For most VDI environments, use the default selection.
- 2. Click Optimize.
- 3. Monitor the optimization results, until the process is complete:
  - If using Horizon Cloud on Microsoft Azure, reboot the VM, and you are ready to publish the image from within the Horizon Universal Console.
  - Otherwise, continue on to the next step and generalize the image.

#### Use the OSOT Generalize Tab to Run Sysprep

Generalizing a Windows image means removing computer-specific information so that the image can be deployed throughout an enterprise. Use the **Generalize** tab of the OSOT to run the system preparation tool (Sysprep) with a supplied and editable unattend.xml answer file.

**Note**: This procedure pertains to vSphere-based VMs. If you are using Horizon Cloud on Microsoft Azure, you will instead use the Horizon Universal Console to publish the image, which is when Sysprep is run on VMs in Horizon Cloud.

# **1. Set Generalize Options**
WMware OS Optimization Tool	l 2021 — 🗇	$\times$
🔯 <b>vm</b> wa	I'C <sup>®</sup> OS Optimization Tool	
Optimize	Ize     Ize <td></td>	
Instruction Generalizing the Wi deployed throughou	<b>NS</b> Vindows image removes computer-specific information so that the image can be safely cloned and but the enterprise.	
Time Zone	(UTC-05:00) Eastern Time (US & Canada)	
Input Locale	English - United States Y	
System Locale	English (United States)	
Autologon		
User Name	Administrator	
Password	@	
Copy Profile		
Automatic Restart		
	View Answer File 5 Generaliz	

- 1. Click Generalize.
- 2. Select the correct **Time Zone**.
- 3. Select the correct **Locale**.
- 4. Select Automatic Restart.
- 5. Click Generalize.

#### Use the OSOT Finalize Tab to Perform Final Cleanup Tasks

The OSOT can perform the following tasks, which you were previously required to do manually for VMs that you plan to use in a vSphere infrastructure:

- Clear KMS settings
- Release the IP address
- Delete unnecessary files
- Zero empty disk space

With the OSOT, you can also use the **Finalize** tab to run the following tools:

- Native Image Generator (Ngen.exe) Improves the performance of managed applications.
- NTFS Compression (compact.exe) Saves space on the Windows image by running the operating system and other system files from compressed files. This strategy reduces the number of IOPS required for storage with cache and has a negligible impact on the CPU.
- **Deployment Image Servicing Management** (DISM. exe) Cleans unused files from the Side by Side component store.
- Local Group Policy Object Utility (LGP0.exe) Manages local group policy.
- Secure Delete (sdelete64.exe) Provides the ability to overwrite empty space with zeros.

Note: If you are using Horizon Cloud on Microsoft Azure, you can skip this procedure.



## **1. Download Third-Party Tools**

- Local Group Policy Object Utility can be downloaded as a zip file, as part of the Microsoft Security Compliance Toolkit, from https://www.microsoft.com/en-us/download/details.aspx?id=55319.
- Secure Delete can be downloaded by clicking https://download.sysinternals.com/files/SDelete.zip.

## 2. Unblock and Copy the Tools to the OSOT Folder

Security	Details	Previous versions	
General	Compatibility	Digital Signatures	
	sdelete64		
Type of file:	Application (.exe)		
Description:	Secure file delete		
Location:	C:\Users\Administrator\Downlo	ads\SDelete	
Size:	240 KB (246,528 bytes)		
Size on disk:	244 KB (249,856 bytes)		
Created:	Thursday, November 15, 2018	, 6:33:42 AM	
Modified:	Today, September 10, 2020, 2	:51:14 AM	
Accessed:	Today, September 10, 2020, 2	:51:14 AM	
Attributes:	Read-only Hidden	Advanced	
Security:	This file came from another computer and might be blocked help protect this computer.	d to Unblock	

After downloading and extracting the executables, right-click each file (sdelete64.exe and lgpo.exe), select **Properties**, and in the Properties dialog box, select **Unblock** and click **OK**. Then move the executables to the same folder as the OS Optimization Tool and launch the OS Optimization Tool.

## **3. Execute Final Cleanup Tasks**



- 1. In the OSOT, click the **Finalize** tab.
- 2. Click Finalize.
- 3. When all steps are completed, click  ${\bf OK}$  .

#### Install the App Volumes Agent in vSphere-Based VMs

App Volumes delivers applications that are not in the golden VM image. Application containers, called AppStacks (in App Volumes 2.x) or application packages (in App Volumes 4), are assigned to a user, group, OU, or machine and mounted each time the user logs in to a desktop. With this strategy, user changes can persist between sessions.

App Volumes can also provide user-writable volumes, which allow users to install their own applications and have those applications follow the user as they connect to different virtual desktops.

Administrators install the App Volumes Agent on the golden VM image so that the App Volumes Manager can communicate with the cloned desktops that are deployed and attach the correct applications when a user logs in.

**Notes**: Installing the App Volumes Agent is an optional step for VMs that you plan to use in a vSphere infrastructure. Install this agent only if you plan to use this functionality.

This procedure describes running the App Volumes Agent installer in the guest operating system of a vSphere-based VM. If instead you are using Horizon Cloud on Microsoft Azure, installing the agent is an option you can select in the process of importing a VM from the Azure Marketplace, as described in the exercise Import a VM in Horizon Cloud on Microsoft Azure.

### **Prerequisites for Installing the App Volumes Agent**

To perform this exercise, you need the following:

- **User account** When you log in to the OS of the golden image to run the installer, the account you use must have local administrative privileges.
- **Installer** App Volumes is included with Horizon Enterprise Edition, available from the Download VMware Horizon page. The App Volumes installer is distributed as an ISO file. You can mount the ISO on the machine where you want to create the App Volumes component, or you can also extract the ISO contents to a shared folder. This option allows you to install each component without mounting the ISO each time.
- VM with a supported Windows OS The machine must be running a supported Windows version. For a list of the



systems we tested, see Tested Operating Systems. For a complete list of supported Windows 10 operating systems, see the VMware knowledge-base article Supported versions of Windows 10 on Horizon Agent Including All VDI Clones (Full Clones, Instant Clones, and Linked Clones on Horizon 7) (2149393).

• App Volumes Manager server information – During agent installation, you will be prompted to enter the host name or IP address and port number of the App Volumes Manager that this agent will communicate with.

## **1. Run the Installer**



Double-click the App Volumes ISO file, start the setup.msi file in the installation folder, and click **Next** on the Welcome page.

## **2. Accept the License Agreement**

🕵 App Volumes Installer Setup	_		×
End-User License Agreement			
Please read the following license agreement carefully			
VMWARE END USER LICENSE AGREEMENT			î
PLEASE NOTE THAT THE TERMS OF THIS END U AGREEMENT SHALL GOVERN YOUR USE OF THE	SER LI	CENSE WARE.	
REGARDLESS OF ANY TERMS THAT MAY APPEA	R DUR	NG	
THE INSTALLATION OF THE SOFTWARE.			
IMPORTANT-READ CAREFULLY: BY DOWNLOADI	NG,		
OR LEGAL ENTITY) AGREE TO BE BOUND BY THE	TERMS	S OF	
THIS END USER LICENSE AGREEMENT ("EULA"). IN NOT AGREE TO THE TERMS OF THIS EULA. YOU N	F YOU JUST N	DO OT	~
I accept the terms in the License Agreement		Prir	nt
App Volumes 4, version 2103 (4.4.1) Bac 2 Net	xt	Cano	cel

1. Select the check box to accept the License Agreement.

2. Click Next.

## 3. Select the App Volumes Agent Component

🕼 App Volumes Installer Setup	_		×
App Volumes Install Screen			
App Volumes Component Selection			
Specify which App Volumes component installer you want to launch:			
<ul> <li>Install App Volumes Agent</li> </ul>			
O Install App Volumes Manager			
O Install App Volumes Tools			
App Volumes 4, version 2103 (4.4.1) Back Insta		Cano	el

Click Install.

## 4. Allow the Windows Installer to Make Changes



Click Yes.

## 5. Click Next on the Agent Setup Welcome Page



Click Next.

## 6. Supply App Volumes Manager Information

🖶 App Volumes Agent	×
Server Configuration	
Enter server information.	
App Volumes Manager <u>A</u> ddress:	
Ann Volumes Manager Port:	
443	
Disable certificate validation with App Volu	mes Manager
App Volumes 4, version 2103 (4.4.1)	Bac Next Cancel

- 1. Provide the App Volumes Manager Address and ensure that Disable certificate validation with App Volumes Manager is not selected.
- 2. Click Next.

## 7. Begin Installation

App Volumes Agent Setup			_		×
Ready to install App Volumes	Agent				
Click Install to begin the installation installation settings. Click Cancel to	on. Click Back to re o exit the wizard.	wiew or change	any of you	r	
- Veloce 4 and - 2402 (4.4.4)		_			
p Volumes 4, version 2103 (4.4.1)	Back	Install		Cano	e

Click Install.

#### 8. Exit the Wizard



Click Finish.

## 9. Do Not Restart the VM



Click No.

#### **Use the Shutdown Command**

Run the following command:

shutdown /s /t 0 /c "Image Ready"

shutdown /s /t 0 /c "Image Ready" shuts down the local computer, with 0 seconds between the time the command is given and the time the shutdown occurs, and leaves the comment "Image Ready."

#### **Optimizing the Virtual Machine Hardware**

#### **Remove Virtual Hardware Devices That You Do Not Plan to Use**

Because we no longer need the virtual CD/DVD drives, we can remove those. Likewise, we can remove the SATA controller.

**Note**: If you are using Horizon Cloud on Microsoft Azure, you can skip this procedure.

## **1. Use vSphere Web Client to Open the Edit Settings** Dialog Box

団 Actions - 21H1ENT	
Power	►
Guest OS	►
Snapshots	►
🖵 Open Remote Console	
न्द्रि Migrate	
Clone	►
Fault Tolerance	►
VM Policies	►
Template	►
Compatibility	►
Export System Logs	
石 Edit Settings	

In the vSphere Web Client, right-click the VM and select **Edit Settings**.

## 2. Remove the CD/DVD Drives

Edit Settings   21H1ENT	×
Virtual Hardware VM Options	
	ADD NEW DEVICE ~
> CPU	<u>2 ~</u> (i)
> Memory	2.5 v <u>GB v</u>
> Hard disk 1	48 <u>GB ~</u>
> SCSI controller 0	VMware Paravirtual
> Network adapter 1	VM Network ~ Connect
> CD/DVD drive 1	Datastore ISO File → Cor 1. 🛞
> CD/DVD drive 2	Client Device ~ Cor 2.
> Video card	Specify custom settings 🗸
> Security Devices	Not Configured
VMCI device	
SATA controller 0	AHCI
> Other	Additional Hardware
	CAN (3) OK

To remove the virtual CD/DVD drive from the VM, click the X that appears when you hover your pointer over CD/DVD drive 1 row.

- 2. Do the same with  $\ \mbox{CD/DVD}\ \mbox{drive}\ \mbox{2}.$
- 3. Click **OK** and edit the VM again.

## **3. Remove the SATA Controller**

Edit Settings   21H1ENT	×
Virtual Hardware VM Options	
	ADD NEW DEVICE ~
> CPU	<u>2 v</u> (j)
> Memory	2.5 × <u>GB ×</u>
> Hard disk 1	48 <u>GB v</u>
> SCSI controller 0	VMware Paravirtual
> Network adapter 1	VM Network V
> Video card	Specify custom settings ~
> Security Devices	Not Configured
VMCI device	
SATA controller 0	AHCI (1 🛞
> Other	Additional Hardware

 To remove the virtual SATA controller from the VM, click the X that appears when you hover your pointer over the SATA Controller 0 row.

2. Click **OK**.

#### Export the VM to Adjust Disk Size

If you used the same settings as shown in Specify Virtual Hardware Settings when you created the golden VM image, your VM has 48 GB of disk space. The storage usage of the VM can amount to the size of the disk as specified plus the amount of RAM.

Capacity and Usa Last updated at 10:45 AM	age :: 1
CPU	
O MHz used	2 CPUs allocated
Memory	
$\boldsymbol{\wedge}$	2.5 GB
<b>O</b> MB used	allocated
Storage	
10	48.38 GB
<b>40</b> GB used	allocated
VIEW STATS	

Using the export/import process described in this section, we can select the thin-disk option and shrink the size of the VM according to the number of zeroes written during the finalize procedure, when the Secure Delete tool (sdelete64.exe) was run to overwrite empty space with zeros.

# **1. Export to OVF (Open Virtualization Format)**

🔂 Actions - 21H1ENT	Search in all environment
Power	
Guest OS	▶ 21H1ENT   ▷
Snapshots	▶ ummary Monitor
🖵 Open Remote Console	
न्रि Migrate	Guest OS
Clone	•
Fault Tolerance	
VM Policies	
Template	▶ ① Convert to Template
Compatibility	2 🕏 Export OVF Template

1. Using vSphere Web Client, right-click the VM in the inventory list, and select **Template**.

2. Select Export OVF Template.

## 2. Supply OVF Template Information



1. Optionally provide an Annotation; for example, you could specify the Windows build number.

- 2. Select Enable advanced options.
- 3. Select Include extra configuration.
- 4. Click **OK**.

## 3. Delete the VM



#### **vm**ware<sup>®</sup>

Right-click the VM in the inventory list, and select **Delete from Disk**.

## **4. Confirm the Deletion**

Conf	firm Delete   21H1ENT
	Delete the selected virtual machine and its associated disks? If other VMs are sharing their disks, the shared disks will not be deleted and the VMs will continue to have access to the shared disks.
	NO YES

Click YES.

## 5. Deploy the OVF Template

Actions - VMware	
Add Host	
[.] New Cluster	
New Folder	►
Distributed Switch	►
🔂 New Virtual Machine	
🔂 Deploy OVF Template	

Right-click a VM folder, host, or cluster and select **Deploy OVF Template**.

## 6. Select the OVF Template You Just Exported



- 1. Select Local file.
- 2. Click **UPLOAD FILES** (**Browse** with older versions of vSphere) and select all files you have just downloaded when exporting to OVF.
- 3. Click NEXT.

## 7. Select a Folder



- 1. Select a folder.
- 2. Click **NEXT**.

### 8. Select a Compute Resource

Deploy OVF Template	Select a compute resource	×
<ol> <li>Select an OVF template</li> <li>Select a name and folder</li> <li>Select a compute resource</li> <li>Review details</li> </ol>	Select the destination compute resource for this operation	
5 Select storage 6 Ready to complete		
	Compatibility Compatibility checks succeeded. CANCEL B2	XT

- 1. Select a compute resource.
- 2. Click NEXT.

## 9. Review Details

Deploy OVF Template	Review d	Review details	
1 Select an OVF template	A The OVF advanced	package contains advanced configuration options, which might pose a security risk. Review the configuration options below. Click next to accept the advanced configuration options.	
2 Select a name and folder	Publisher	No certificate present	η
3 Select a compute resource	Description	19043.985	
4 Review details	Download size	Unknown	
5 Select storage	Size on disk	Unknown (thin provisioned) 48.0 GB (thick provisioned)	
	Extra configuration	toolsInstallManager.lastInstallError = 0 sched.swap.derivedName = /vmfs/volumes/6058ad9c-928a6d40-42d6- b42e99alcf5c/2lH1ENT/2lH1ENT-db6437da.vswp usb_xhci:4.present = TRUE nvram = ovf:/file/file2 pciBridge5.present = TRUE pciBridge6.pciSlotNumber = 23 usb_xhci:4.port = 4 scsi0.sasWWID = 50 05 05 6d f5 5d 78 90 pciBridge7.present = TRUE pciBridge6.virtualDev = pcieRootPort migrate.hostLog = 21H1ENT-6eOc1618.hlog	
		CANCEL BACK	T

Click **NEXT**.

## **10. Select Storage**

Deploy OVF Template	Select storage						×
1	Select the storage for the con	figuration and disk files					
1 Select an OVF template	Encrypt this virtual machin	e (Requires Key Manag	ement Server)				
2 Select a name and folder	VM Storage Policy Disable Storage DRS for th	Data Data	astore Default				
3 Select a compute resource							
	Name	T Storage Cor T	Capacity <b>T</b>	Provisionec <b>T</b>	Free <b>T</b>	Туре	<b>T</b>
4 Review details	●   🗏 ESXi4-P5800X-80	0	617 GB	604.96 GB	430.91 GB	VMFS 6	
5 Select storage							
6 Select networks							
7 Ready to complete							
							item
	Compatibility						
	✓ Compatibility checks suc	ceeded.					
					CANCEL B	3	XT

- 1. Select a datastore.
- 2. When using storage without storage policies, select **Thin Provision**; otherwise, select an item from the **VM Storage Policy** list that has thin provisioning.
- 3. Click **NEXT**.

## **11. Select Networks**

Deploy OVF Template	Select networks Select a destination network for each source net	twork.	×
1 Select an OVF template			
2 Select a name and folder	Source Network VM Network	Destination Network	
3 Select a compute resource		0	1 item
4 Review details	IP Allocation Settings		
5 Select storage	IP allocation:	Static - Manual	
6 Select networks	IP protocol:	IPv4	
7 Ready to complete			

1. Select a VM Network.

2. Click NEXT.

### 12. Click Finish on the Ready to Complete Page

Deploy OVF Template	Ready to complete		×	
1 Select an OVF template		1001.		
2 Select a name and folder	Name	21HIENT-2		
	Template name	21H1ENT-2		
3 Select a compute resource	Download size	Unknown		
4 Review details	Size on disk	Unknown		
5 Select storage	Folder	VMware		
5 Select stolage	Resource	AMD EPYC Milan		
6 Select networks	Storage mapping			
7 Ready to complete	All disks	Datastore: ESXi4-P5800X-800GB; Format: Thin provision		
	Network mapping			
	VM Network	VM Network		
	IP allocation settings			
	IP protocol	IPV4		
			CANCEL BACK	ISH

Click **FINISH**.

## **13. Verify the Storage Savings**

Capacity and Usage Last updated at 11:39 AM	ge ii
CPU	
O MHz used	2 CPUs allocated
Memory	
O MB used	2.5 GB allocated
Storage	
12 05	48.38 GB
IZ.OJ GB used	allocated
VIEW STATS	

For example, in this screenshot, the value for **Storage** usage is 12.05 GB. The VM **Summary** tab from the screenshot at the beginning of this section, before the VM underwent the export/import process, showed 48.38 GB.

### **Preparation for Deployment**

#### Take a VM Snapshot

To create a desktop pool of cloned VMs, or to create a farm of cloned RDSH server VMs, you need to create a frozen state, or base image, from which the clone can be derived.

- For instant-clone pools and server farms, you achieve this state by taking a VM snapshot of the primary VM.
- For full-clone pools, you achieve this state by cloning the primary VM to a VM template.

This procedure describes taking a VM snapshot. For information about cloning a VM to a VM template, see Clone a Virtual Machine to a Template.

**Note**: If you are using Horizon Cloud on Microsoft Azure, you can skip this procedure.

## **Prerequisites for Taking a Snapshot**

Although it is possible to take a snapshot of a VM that is powered on, for the purposes of creating a base image for a Horizon desktop pool or server farm, the VM must be shut down and powered off.

## **1. Open the Take Snapshot Dialog Box**



1. Using vSphere Web Client, right-click the VM in the inventory list, and select **Snapshots**.

2. Select Take Snapshot.

### 2. Take the Snapshot



1. Provide a descriptive name; for example, the name might include the date of the snapshot.

2. Click CREATE.

#### **Create OUs and User Groups in Active Directory**

Much of the initial configuration and ongoing management of virtual desktops, RDSH server farms, feature enablement, and enduser experience is performed by creating and applying group policies in Active Directory. Some standard Microsoft Group Policy Object settings are required to configure virtual desktops and applications, as described later in this guide.

If you use Horizon, you can also use VMware-provided GPO administrative templates for fine-grained control of access to features. See Using Horizon Group Policy Administrative Template Files.

### **OUs for VMs**

You should create an organizational unit (OU) specifically for your virtual desktops and an OU for your RDSH server VMs. An OU is a subdivision in Active Directory that contains users, groups, computers, or other OUs.

To prevent group policy settings from being applied to other Windows servers or workstations in the same domain as your desktops or server farms, you can create a GPO for group policies and link it to the OU that contains your VMs.

You can also delegate control of the OU to subordinate groups, such as server operators or individual users.



### **User Groups**

You should also create groups for different types of users in Active Directory. For example, you can create a group called End Users for your end users and another group called Horizon Administrators for users that will administer virtual desktops and applications.

Later in this guide, you will add a user group containing end users to the local Remote Desktop Users group in AD. Then members of the group will be able to connect to any VM that is joined to the domain.

#### **Set Other Common Group Policies**

For both virtual desktop VMs and RDSH server VMs, create a GPO for the OU in Active Directory, and use the Group Policy Management Editor to apply the following GPO settings.

Setting	Value	
Computer Configuration > Policies > Administrative Templates > System > Group Policy		
Configure user Group Policy loopback processing modeEnabled Set Mode to Replace		
Computer Configuration > Policies > Administrative Templates > System > Logon		
Always wait for the network at computer startup and logon	Enabled	

## **Disable the Local Administrator User Account**

Next, edit the GPO to disable the local administrator account.

#### **1. Navigate to Local Users and Groups**



In Group Policy Management Editor, edit the GPO and navigate to **Computer Configuration** > **Preferences** > **Control Panel Settings** > **Local Users and Groups**.

#### 2. Create a New Policy for a Local User Account



- 1. Click New.
- 2. Click Local User.



3. Specify New Properties for the Administrator Account

New Local User Properties	$\times$
Local User Common	
Action: Update	~
User name: 1 (Administrator (built-in)	
Rename to:	
Full name:	
Description:	
Password:	
Confirm Password:	
User must change password at next logon	
User cannot change password	
Password never expires	
Account is disabled	
Account never expires	
Account expires: 1/21/2020	
3 OK Cancel Apply Hel	p

- 1. Select Administrator (built-in).
- 2. De-select User must change password at next logon.
- 3. Select Account is disabled.
- 4. Click **OK**.

If you use Horizon, you can also use VMware-provided GPO administrative templates for fine-grained control of access to features. See Using Horizon Group Policy Administrative Template Files.

#### **Set Policies for RDSH Server VMs**

If you plan to use the image for creating RDSH server VMs, create a GPO for the RDSH server OU in Active Directory, and use the Group Policy Management Editor to apply the following GPO settings.

Setting	Value	
Computer Configuration > Policies > AdministrativeTemplates > Windows Components > Remote Desktop Services > Remote Desktop Sessio > Licensing		
Use the specified Remote Desktop license server	Enabled (Comma-separated list of license servers to use)	
Set the Remote Desktop license mode	Enabled (Choose the correct <b>Per Device</b> or <b>Per User</b> mode for your CALs)	
Computer Configuration > Policies > Administrative Templates > System > User Profiles		
Delete cached copies of roaming profiles	Enabled	



If you use Horizon 8, review the settings listed in the RDSH Server OU-Level Settings section of the "Horizon Configuration" chapter in the VMware Workspace ONE and VMware Horizon Reference Architecture.

If you use Horizon 7, be sure to review the VMware-provided administrative templates for RDSH server management. See Using Remote Desktop Services Group Policies.

#### Add Users to the Local Remote Desktop Users Group

To connect to a remote desktop or RDSH server, users must belong to the local Remote Desktop Users group of the virtual desktop or RDSH server. You can use the Restricted Groups policy in Active Directory to add users or groups to the Remote Desktop Users group.

The members of the Remote Desktop Users group are always added to the *local* Remote Desktop Users group of every virtual desktop or RDSH server that is joined to your domain. When adding new users, you need only add them to the Remote Desktop Users group.

## Prerequisites for Adding Users to the Restricted Groups Policy

Before you can perform the procedure in this article, you must have created one or more user groups in Active Directory that contain the end users who will connect to the virtual desktops and RDSH servers.

### **1. Open Group Policy Management**



On the domain controller (AD machine), click the Start button, and navigate to **Windows Administrative Tools** > **Group Policy Management**.

## 2. Edit the Default Domain Policy

📕 Group Policy Management
😹 File Action View Window Help
🗢 🔿 📶 🗙 🍳 📓 🖬
🔜 Group Policy Management
✓ A Forest: com
🗸 🙀 Domains
1 Com
AllowRDP
2 Default Domain Policy
DisableFirewall
> 📓 Domain Controllers

- 1. Expand your domain.
- 2. Right-click **Default Domain Policy**.
- 3. Select Edit.

### 3. Open the Add Group Dialog Box



- 1. In the Group Policy Management Editor, expand Computer Configuration.
- 2. Expand Windows Settings.
- 3. Expand Security Settings.
- 4. Right-click Restricted Groups.
- 5. Select Add Group.



### 4. Add the Remote Desktop Users Group



- 1. In the Add Group dialog box, enter Remote Desktop Users.
- 2. Click **OK**.

#### 5. Add User Groups to the Remote Desktop Users Group



- 1. Right-click the **Remote Desktop Users** group that you just added to **Restricted Groups**.
- 2. Select Properties.
- 3. Click Add.
- 4. Add a group of end users.



- 5. Click **OK** in the Add Member dialog box.
- 6. Click **OK** in the Remote Desktop Users Properties dialog box.

#### **Turn Off Hardware Graphics Acceleration in Commonly Used Applications**

If the VMs are not using a physical GPU in the ESXi hosts, you can reduce CPU usage by not emulating hardware graphics in applications. We recommend using Dynamic Environment Manager configuration files to control these application settings. Office, Internet Explorer and Adobe Reader are already done by OSOT, unless you deselected them.

For more information about having VMs use physical GPUs, see Deploying Hardware-Accelerated Graphics with VMware Horizon.

#### **1. Internet Explorer**

Internet Options	? ×
General Security Privacy Content	Connections Pr. 2 Advanced
Settings	
Accelerated graphics	tead of GPU rendering*
Accessionity     Always expand ALT text fo     Enable Caret Browsing for r     Move system caret with foc     Play system sounds     Reset text size to medium f     Reset zoom level for new w     Browsing     Always record developer cc     Close unused folders in Hist     Disable script debugging (Ir     Disable script debugging (O     <	r images new windows and tabs cus/selection changes for new windows and tabs vindows and tabs onsole messages tory and Favorites* nternet Explorer) ther)  v
Takes effect after you restart you	Restore advanced settings
Reset Internet Explorer settings	
Resets Internet Explorer's settings to condition.	o their default Reset
You should only use this if your brow	ser is in an unusable state.
<b>4 –</b> ok	Cancel Apply

- 1. To turn off hardware graphics acceleration for Internet Explorer, open the Internet Options dialog box by clicking the Tools icon and selecting **Internet Options**.
- 2. Click the **Advanced** tab.
- 3. From the Accelerated graphics list, select Use software rendering instead of GPU rendering.
- 4. Click **OK**.

#### 2. Microsoft Office

ieneral	Display 3
Display	Chausthia sumhar of Decumentar 25
Proofing	
Save	Quickly access this number of Recent Documents: 4
	Show this number of unpinned Recent <u>F</u> olders: 20
Language	Show measurements in units of:
Advanced 2	Style area pane width in Draft and Outline views: 0"
Customize Ribbon	Show pixels for HTML features
Ouick Access Toolbar	Show shortcut keys in ScreenTips
	Show horizontal scroll bar
Add-Ins	Show vertical scroll bar
Trust Center	Show vertical ruler in Print Layout view
	Optimize character positioning for layout rather than readability
	Disable hardware graphics acceleration
	✓ Wpdate document content while <u>d</u> ragging ①
	Use subpixel positioning to smooth fonts on screen

- To turn off hardware graphics acceleration for Microsoft Office, open the Options dialog box by selecting File > Options in the application (in this example, Microsoft Word).
- 2. Select Advanced.
- 3. Scroll down to the Display section.
- 4. Select Disable hardware graphics acceleration.

## 3. Adobe Reader

Preferences	
Categories:	Default Layout and Zoom
Commenting Documents Full Screen General Page Display	Page Layout:     Automatic     Zoom:     Automatic       Resolution     Outcom resolution:     Outcom resolution:
3D & Multimedia Accessibility Adobe Online Services Email Accounts Forms Identity Internet JavaScript Language Measuring (2D) Measuring (3D) Measuring (3D) Measuring (Geo) Multimedia (legacy) Multimedia Trust (legacy) Reading Reviewing Search Security Security (Enhanced) Signatures	Rendering   Smooth Text:   Smooth line art   Smooth line art   Smooth line art   Smooth lines   Use local fonts
	Page Content and Information         Show large images       Use smooth zooming         Show art, trim, & bleed boxes       Show transparency grid         Use logical page numbers       Always show document page size         Use Overprint Preview:       Only For PDF/X Files         Default Transparency Blending Color Space:       Working RGB

1. To turn off hardware graphics acceleration and disable other CPU-intensive display options for Adobe Reader, open the Preferences dialog box by selecting **Edit** > **Preferences**.

- 2. Select **Page Display**.
- 3. In the Rendering section, deselect the following options:
  - Smooth imaging
  - $\circ~$  Smooth line art
  - Use page cache
  - Enhance thin lines

4. In the Page Content and Information section, deselect **Use smooth zooming**.

For more information, see the Adobe documentation about General Application Settings in the Windows Registry.

## 4. Google Chrome

🗘 Settings 🗙 🔼	Θ -	
← -1)		☆ :
		٩
System		^
2 ontinue running background apps when Google C	-	
Use hardware acceleration when available RELAUNCH		
Open proxy settings		

1. To turn off hardware graphics acceleration for Chrome, navigate to chrome://settings.

2. Scroll down to the System section, in the Advanced settings, and turn off **Use hardware acceleration when available**.

## **Day-2 Updates**

#### **Update VMware Tools**

When new versions of VMware Tools are released, use this procedure to update VMware Tools in the golden image.

**Note**: If you are using Horizon Cloud on Microsoft Azure, you can skip this procedure.

#### **1. Open the Edit VM Settings Dialog Box**

Actions - 21H1 Enterprise 1	
Power	•
Guest OS	•
Snapshots	•
🖵 Open Remote Console	
न्रि Migrate	
Clone	•
Fault Tolerance	•
VM Policies	►
Template	•
Compatibility	•
Export System Logs	
🖓 Edit Settings 2	

Make sure the VM is powered off and then use vSphere Web Client to:

1. Right-click the VM.

2. Select Edit Settings.

## 2. Add a Virtual CD/DVD Drive Back to the VM


- 1. Click **ADD NEW DEVICE**.
- 2. Select CD/DVD Drive.
- 3. Click **OK**.

# 3. Power On the VM



- 1. Right-click the VI
- 2. Select **Power**.
- 3. Select **Power On**.



# 4. Click Upgrade VMware Tools on the Summary Tab

🔂 21H1 Enterprise   🖻 🗖 🛱 🔯   астіоня						
Summary	Monitor	Configure	Permissions	Datastores	Networks	Snapshots
A newer version of VMware Tools is available for this virtual machine.						

On the **Summary** tab for the VM, click **Upgrade VMware Tools**.

### 5. Use the Interactive Upgrade



1. Select Interactive Upgrade.

2. Click **UPGRADE**.

Now repeat the steps from Install VMware Tools.



#### **Update Windows as Part of Day-2 Operations**

**Important**: Updating Windows in the VM image is not recommended. Rather, it is better to generate a new image. An alternative to manually creating a new VM image each time you want to update Windows is to use automation. For step-by-step instructions, see the companion to this guide, titled **Using Automation to Create Optimized Windows Images for VMware Horizon VMs**.

If, however, you want to update Windows in the VM image, you can do so. If you have followed the instructions in this guide and used the OSOT as directed, some of the Windows Update facilities have been disabled. Before you can update Windows, you must re-enable Windows Update. After you update Windows, the best practice is to run the OSOT again.

### **1. Re-enable Windows Update**

WWware OS Optimization Tool 2021	- 8 ×
Optimize         Generalize         Image: Constraints         Image: Constraints	2106
Instructions This allows a previously optimized image to allow Windows Updates to be run. Follow the steps in order. You can reboot after running a WindowsUpdate and you can also run the update process multiple times. Remember to relaunch the OS Optimization Tool and use step 3 to restore the original settings. It is also highly recommended that you run an optimize task again and then a Generalize task.	
Step	
2 Defer Feature Updates Defer Quality Updates Skip Office Click-to-Run Updates	
3 Run Windows Update	
Restore to Original Settings	
Recommendation: Run an Optimize task, using your original selections, to ensure that the image is fully optimized and that an update has not re-enabled a previously disabled setting. Run a Finalize task again to ensure that the image is clean. This is especially important where the image has updated components like .NET Framework.	

- 1. Run OSOT again and click on the **Update** tab.
  - If you are using a vSphere-based VM, run the OSOT on the VM you used to create the golden image.
  - If you are using Horizon Cloud on Microsoft Azure, use the Horizon Universal Console to duplicate the image, which creates a new VM with the same configuration, and run the OSOT on that VM.
- 2. Click Enable Windows Update.
- 3. Click Run Windows Update.

### 2. Update Windows

To update Windows, follow the instructions from the earlier Update Windows procedure in this guide.

### 3. Run the OSOT Again to Optimize and Finalize

Follow the instructions for the following tasks from the chapter Running the OS Optimization Tool to Optimize, Generalize, and Finalize the OS:

- Analyze and Optimize the OS Using Customizable Templates
- Use the OSOT Finalize Tab to Perform Final Cleanup Tasks if you are using a vSphere-based VM



# Conclusion

#### **In Conclusion**

With the image optimization procedures in this guide, you are able to achieve a significant reduction in the amount disk space, CPU, and memory used by virtual desktop and RDSH server VMs and their vSphere hosts. The result is a corresponding savings in initial deployment time, user logon times, and IOPS.

Image optimization techniques included:

- Disabling unneeded Windows services and features
- Deleting unnecessary files and folders, such as event logs and temporary files
- Compressing OS files
- Zeroing out free disk space and shrinking the disk

Using the VMware OS Optimization Tool fling greatly simplifies many of these tasks.

This guide also provided step-by-step instructions for configuring the Windows image to perform optimally in a virtual environment, where CPU cores are shared among many VMs, and where users might be accessing a new VM every time they log in, though they probably will not realize it.

Seventeen discreet versions of the Windows OS were tested using the procedures in this guide, including thirteen versions of Windows 10.

The procedures in this guide help you create an optimized Windows image that you can use in a VMware Horizon implementation or in other types of deployments. End users will have a great experience, whether they access their personalized virtual desktops or remote applications from company laptops, their home PCs, thin-client devices, Macs, tablets, or smartphones.

#### **Additional Resources**

For more information about the VMware products mentioned in this guide, you can explore the following resources:

- Using Automation to Create Optimized Windows Images for VMware Horizon VMs
- Evaluate VMware Products
- Horizon Support Center
- Horizon 7 Documentation
- Horizon 8 Documentation
- Dynamic Environment Manager Documentation
- App Volumes Documentation
- VMware Product Guide
- VMware Product Interoperability Matrices
- VMware Professional Services
- VMware vSphere documentation

#### Changelog

The following updates were made to this guide.

Date	Description of Changes			
2021-07-01	<ul> <li>Added links to Using Automation to Create Optimized Windows Images for VMware Horizon VMs.</li> <li>Changed storage controller to PVSCSI for future compatibility.</li> <li>Removed SVGA driver deselection from VMware Tools install, as it is no longer order dependent with the Horizon Agent with latest VMware Tools.</li> <li>Added Windows 21H1 Education/Enterprise/Professional to the list of tested operating systems.</li> <li>Removed all Windows 10 1709/1803/1809 (besides LTSC)/1903 editions and 1909 Pro from the list of tested operating systems as they are no longer supported.</li> <li>Retested all supported operating systems with 2021-06-08 updates.</li> <li>Updated for VSDHER 7.0 U2.</li> <li>Updated for OSOT 2106 and higher.</li> <li>Updated links to product documentation topics.</li> </ul>			
2020-09-10	<ul> <li>Added Horizon Cloud on Azure.</li> <li>Added Windows 2004/20H2 Education/Enterprise/Professional to the list of tested operating systems.</li> <li>Retested all operating systems with 2020-09-08 updates.</li> <li>Updated for vSphere 7.</li> <li>Updated for OSOT 1170 and higher.</li> <li>Updated for Horizon/AppVolumes/Dynamic Environment Manager 2006.</li> </ul>			
2020-01-30	<ul> <li>Removed Windows 7/8.1, Server 2012R2, Windows 10 1709/1803 Pro from the list of tested operating systems.</li> <li>Added Windows Server 2019 and .NET Framework 3.5.</li> <li>Retested all operating systems with 2020-01-14 updates.</li> <li>Added a new chapter for day-2 updates for VMware Tools and Windows Update.</li> <li>Added new sections that correspond to the Generalize and Finalize tabs of the OS Optimization Tool (January 2020 release), and removed the procedures that told how to do these tasks manually.</li> </ul>			
2019-10-10	<ul> <li>Removed mention of Windows mandatory profiles because this feature does not work reliably when used with Windows 10 version 1809 and later. Also, we found that login times are nearly equivalent if you use default user profiles instead of mandatory user profiles.</li> <li>Removed the section "Configure Local Group Policies" because this task is now done by the OS Optimization Tool (as of the September 2019 release).</li> <li>Renamed User Environment Manager to Dynamic Environment Manager.</li> <li>Updated links to product documentation topics.</li> </ul>			

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