The science behind the report:

Increase your virtual desktop density with Intel Optane persistent memory

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Increase your virtual desktop density with Intel Optane persistent memory.

We concluded our hands-on testing on November 24, 2020. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on October 30, 2020 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

Table 2: Results of our testing. Source: Principled Technologies.

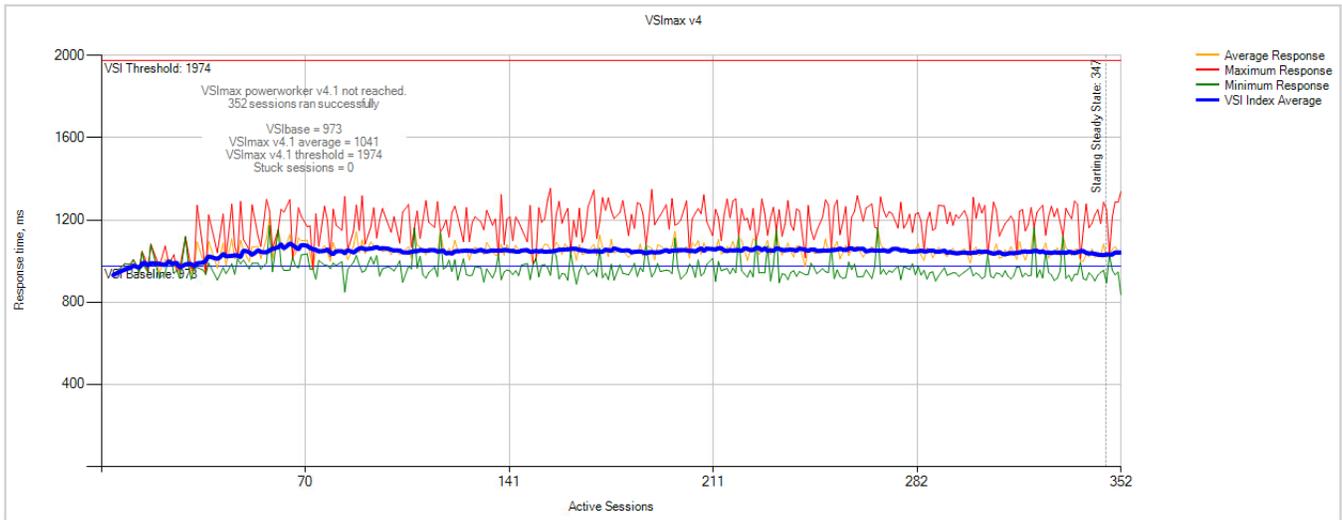|	Four-node Lenovo® ThinkSystem™ SR650 VMware® vSAN™ cluster **with 1.5 TB of Intel® Optane™ persistent memory and 384 GB DRAM per node**	Four-node Lenovo ThinkSystem SR650 VMware vSAN cluster **with 768 GB of DRAM only per node**
Maximum number of VDI users per four-node cluster	708	352
Maximum average CPU usage (percentage)	83.4	37.2
Desktop response time (ms)		
352 users	1,040	1,041
708 users	1,129	N/A (this configuration supported up to only 352 users)

Figure 1: Graph of desktop response time for the DRAM-only server cluster as we added more VDI users up to the maximum it could support (352 users). Login VSI determined the VSI threshold for this test to be 1,974 ms. Source: Principled Technologies.
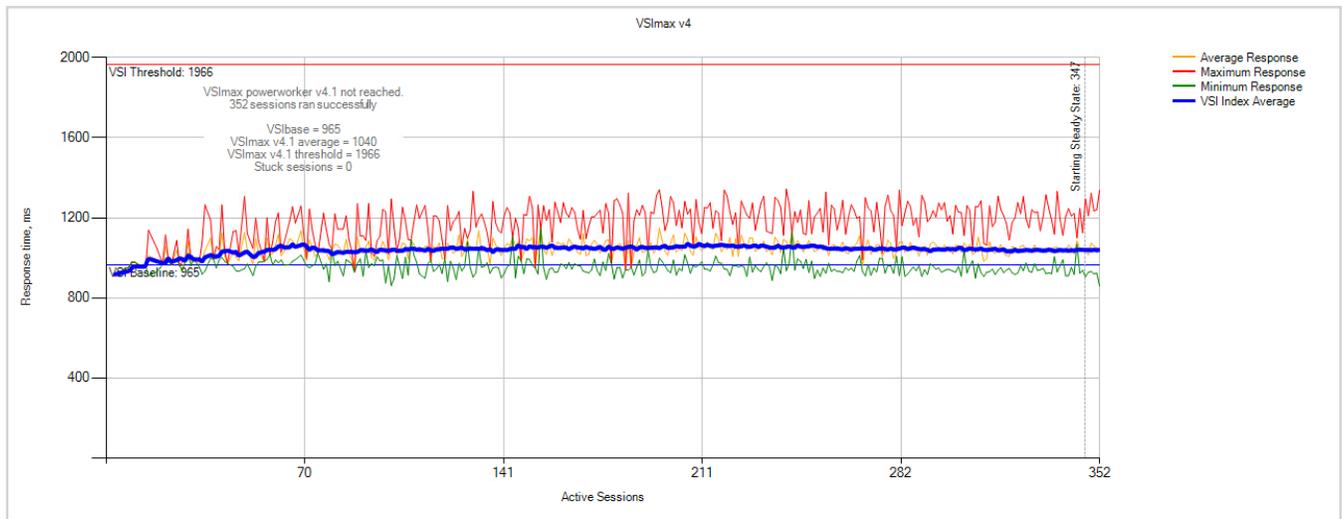

Figure 2: Graph of desktop response time for the server cluster with 1.5 TB of Intel Optane persistent memory as we added more VDI users up to 352. Login VSI determined the VSI threshold for this test to be 1,966 ms. Source: Principled Technologies.
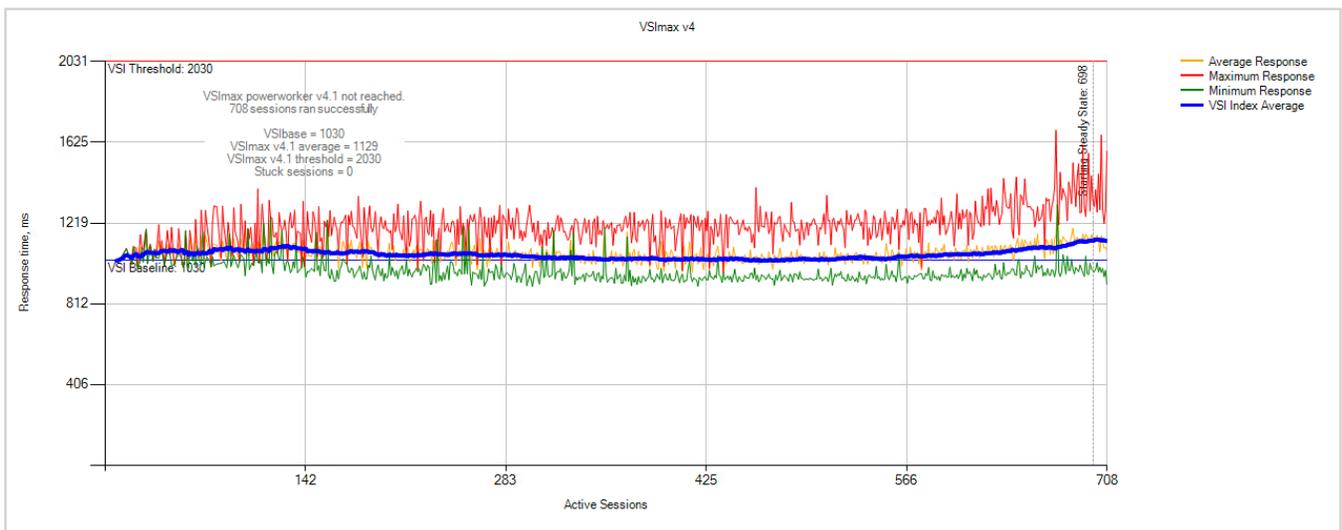

Figure 3: Graph of desktop response time for the server cluster with 1.5 TB of Intel Optane persistent memory as we added more VDI users up to the maximum it could support (708 users). Login VSI determined the VSI threshold for this test to be 2,030 ms. Source: Principled Technologies.

Table 3: We configured the Lenovo ThinkSystem SR650 server with the two memory configurations and three-year warranty in the online Lenovo store.[1] To determine the per-node cost, we used the price from the store plus the price for VMware HCI Kit Enterprise licenses[2] and support[3] for the two CPUs on each server. To determine the per-cluster cost for each solution, we multiplied the per-node cost by four. For the cost per concurrent user, we divided cluster cost by our tested concurrent user capacity for the clusters. We excluded other costs that would be the same per concurrent user, such as user device costs and license costs for Citrix Virtual Apps and Desktops.

	Four-node Lenovo ThinkSystem SR650 VMware vSAN cluster with 1.5TB Intel Optane persistent memory and 384GB DRAM per node	Four-node Lenovo ThinkSystem SR650 VMware vSAN cluster with 768GB DRAM only per node
Hardware and 3-year hardware support (Four nodes)	$131,463.56	$135,703.64
VMware HCI Kit Enterprise licenses	$53,183.92	$53,183.92
VMware HCI Kit Enterprise Support (3 years)	$62,799.92	$62,799.92
Total	**$247,447.40**	**$251,687.48**
Cost per VDI user at maximum cluster user density	**$349.50**	**$715.02**

---

1   "ThinkSystem SR650 3204 16GB," accessed December 4, 2020,
    https://www.lenovo.com/us/en/p/7X06A0HLNA/customize?dcscGuid=b8539314-6b63-4cb0-90e1-3eea3a710a2d.

2   "VMware HCI   Kit Enerprise (v. 6) license - 1 processor," accessed December 4, 2020,
    https://www.insight.com/en_US/shop/product/7S0600PMWW/LENOVO/7S0600PMWW/VMware-HCI-Kit-Enterprise-v-6--license--1-processor/.

3   "VMware HCI Kit Enterprise (v. 6) - Software Subscription and Support (3 years) - 1 processor," accessed December 4, 2020,
    https://www.insight.com/en_US/shop/product/7S0600PPWW/LENOVO/7S0600PPWW/VMware-HCI-Kit-Enterprise-v-6--Software-Subscription-and-Support-3-years--1-processor/

Summary

Web price:	~~$57,993.01~~
After Instant Savings:	$37,695.46

Coupon Price:

$33,925.91

Add To Cart

⊘ ⓘ 0🔔 Configuration Tree

∨ ThinkSystem SR650 – 3yr Warranty   View Detail >

Category	Quantity
Base	
ThinkSystem SR650 2.5" Chassis with 8, 16 or 24 bays	1
Processors	
Intel Xeon Gold 6240R 24C 165W 2.4GHz Processor	2
Memory	
ThinkSystem 64GB TruDDR4 2666MHz (4Rx4, 1.2V) 3DS RDIMM	12
Storage	
ThinkSystem 2U/Twr 2.5" AnyBay 8–Bay Backplane	2
Select Storage devices – no configured RAID required	1
ThinkSystem RAID 930–24i 4GB Flash PCIe 12Gb Adapter	1
ThinkSystem 1610–4P NVMe Switch Adapter	1
ThinkSystem U.2 Intel P4510 2.0TB Entry NVMe PCIe3.0 x4 Hot Swap SSD	6
ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	2
ThinkSystem M.2 with Mirroring Enablement Kit	1
ThinkSystem M.2 128GB SATA 6Gbps Non–Hot Swap SSD	2
PCI	
ThinkSystem SR550/SR650 x16/x8(or x16) PCIe FH Riser 2 Kit	1
ThinkSystem 1Gb 4–port RJ45 LOM	1
Intel X550–T2 Dual Port 10GBase–T Adapter	1
Power	
ThinkSystem 1600W (230V) Platinum Hot–Swap Power Supply	2
2.8m, 10A/100–250V, C13 to IEC 320–C14 Rack Power Cable	2
Others	
ThinkSystem Toolless Slide Rail	1
ThinkSystem 2U EIA Latch w/ VGA Upgrade Kit	1
Security	
Feature Enable TPM 1.2	1

Resource Tracker

Figure 4: Screenshot of the total hardware, software, and support costs for the DRAM-only cluster configuration we tested. The configuration tool on the Lenovo website automatically applies certain discounts and promotional coupons at the time of purchase. We did not use any coupons ourselves, and have presented the price as it appeared to the public on 12/02/2020.

Summary

Web price:	~~$56,181.01~~
After Instant Savings:	$36,517.66

Coupon Price:

$32,865.89

Add To Cart

⊘ ⓘ 1🔔 Configuration Tree

∨ ThinkSystem SR650 – 3yr Warranty   View Detail >

Category	Quantity
Base	
ThinkSystem SR650 2.5" Chassis with 8, 16 or 24 bays	1
Processors	
Intel Xeon Gold 6240R 24C 165W 2.4GHz Processor	2
Memory	
Intel Optane DC Persistent Memory – Memory Mode only	1
ThinkSystem 128GB TruDDR4 2666MHz (1.2V) Intel Optane DC Persistent Memory	12
ThinkSystem 32GB TruDDR4 2666 MHz (2Rx4 1.2V) RDIMM	12
Storage	
ThinkSystem 2U/Twr 2.5" AnyBay 8–Bay Backplane	2
Select Storage devices – no configured RAID required	1
ThinkSystem RAID 930–24i 4GB Flash PCIe 12Gb Adapter	1
ThinkSystem 1610–4P NVMe Switch Adapter	1
ThinkSystem U.2 Intel P4510 2.0TB Entry NVMe PCIe3.0 x4 Hot Swap SSD	6
ThinkSystem U.2 Intel Optane P4800X 375GB Performance NVMe PCIe 3.0 x4 Hot Swap SSD	2
ThinkSystem M.2 with Mirroring Enablement Kit	1
ThinkSystem M.2 128GB SATA 6Gbps Non–Hot Swap SSD	2
PCI	
ThinkSystem SR550/SR650 x16/x8(or x16) PCIe FH Riser 2 Kit	1
ThinkSystem 1Gb 4–port RJ45 LOM	1
Intel X550–T2 Dual Port 10GBase–T Adapter	1
Power	
ThinkSystem 1600W (230V) Platinum Hot–Swap Power Supply	2
2.8m, 10A/100–250V, C13 to IEC 320–C14 Rack Power Cable	2
Others	
ThinkSystem Toolless Slide Rail	1
ThinkSystem 2U EIA Latch w/ VGA Upgrade Kit	1
Security	
Feature Enable TPM 1.2	1

Resource Tracker

Figure 5: Screenshot of the total hardware, software, and support costs for the server cluster with Intel Optane persistent memory. The configuration tool on the Lenovo website automatically applies certain discounts and promotional coupons at the time of purchase. We did not use any coupons ourselves, and have presented the price as it appeared to the public on 12/02/2020.

System configuration information

Table 4: Detailed information on the systems we tested. The cluster had four identically configured Lenovo ThinkSystem SR650 servers. Source: Principled Technologies.

Server configuration information	Lenovo ThinkSystem SR650	
BIOS version	V2.61	
Operating system name and version/build number	VMware ESXi™ 7.0.1-16850804	
Date of last OS updates/ patches applied	10/10/2020	
Power management policy	Balanced	
Processor		
Number of processors	2	
Vendor and model	Intel Xeon® Gold 6240R	
Core count (per processor)	24	
Core frequency (GHz)	2.4	
Stepping	N/A	
Memory	DRAM-only configuration	Intel Optane persistent memory + DRAM configuration
Memory type 1: Intel Optane persistent memory		
Total memory in system (GB)	N/A	1,536
Number of memory modules	N/A	12
Vendor and model	N/A	Intel NMA1XBD128GQS
Size (GB)	N/A	128
Type	N/A	Optane PMem
Memory type 2: Traditional DRAM		
Total memory in system (GB)	786	384
Number of memory modules	12	12
Vendor and model	Samsung M386A8K40BM2-CTD6Q	SK Hynix HMA84GR7AFR4N-VK
Size (GB)	64	32
Type	DDR4 DRAM	DDR4 DRAM
Speed	2,667	2,667
Local storage – OS		
Number of drives	2	
Drive vendor and model	LITE-ON CV3-8D128	
Drive size (GB)	128	
Drive type	SATA SSD	

Server configuration information	Lenovo ThinkSystem SR650
Local storage – VMware vSAN™ cache tier	
Number of drives	2
Drive vendor and model	Intel Optane SSD DC P4800X Series SSDPE21K375GAL
Drive size (GB)	375
Drive type	NVMe™ SSD
Local storage – VMware vSAN capacity tier	
Number of drives	6
Drive vendor and model	Intel SSD DC P4500 Series SSDPE2KX020T7L
Drive size (TB)	2.0
Drive type	NVMe SSD
Network adapter	
Vendor and model	Ethernet 10G 2P X520 Adapter
Number and type of ports	Dual SFP

How we tested

Testing overview

We used three dual-socket servers equipped with Intel Xeon Gold 6142M CPUs to host infrastructure, and connected these servers to a 10Gbps top-of-rack (TOR) switch. We also connected our four Lenovo ThinkSystem SR650 servers to the TOR switch via 2 x 10Gbps connections per server. We installed VMware ESXi 7.0 u1 on each infrastructure server as well as on the Lenovo ThinkSystem SR650 servers. We configured each server network so that all management, VMotion, and data traffic defaulted to NIC0 and all vSAN traffic defaulted to NIC1. In addition, we separated traffic by vLAN: management, data, vMotion, and vSAN.

We created a VMware vSAN cluster with the four Lenovo servers. Table 5 shows details of the VMs we created for the enterprise environment, which consisted of Windows Active Directory, DNS, and DHCP services, as well as Citrix Virtual Desktop and Apps 7. We cloned out desktops via Citrix MCS (Machine Creation Services).

We ensured that all VMs were equally balanced across the four vSAN nodes, and ran the VDI benchmark Login VSI 4.1 with the Power User workload. We determined the maximum number of supported users for the DRAM-only configuration, refitted each of the nodes with Intel Persistent memory, and reran our test recording the maximum number of users supported. Each of the servers in the DRAM-only cluster configuration contained 768 GB of RAM. The servers in the cluster configuration with Intel Optane persistent memory had 384 GB of RAM and 1.5 TB of Persistent memory. We performed all testing with Windows 10 desktops that used 4 vCPUs and 8 GB of RAM. To recreate a VDI testing environment with strict memory requirements, all 8 GB of RAM on all desktops was reserved.

Physical servers

Table 5: Physical server information. Source: Principled Technologies.

Server	OS	Role(s)
Infra1 – 3	VMware ESXi 7.0 U1	Infrastructure cluster
Lenovo 1 – 4	VMware ESXi 7.0 U1	vSAN – cluster under test

Virtual machines

Table 6: Virtual machine information. Source: Principled Technologies.

VM name	OS / Role	vCPU count	Memory size (GB)	Disk size (GB)	Server host / cluster
DC1	Windows Server 2019 / Domain controller, DNS, DHCP	4	8	C:\40	infra
vCenter	VMware vCenter® Server Virtual Appliance version 7 U1	4	20	Appliance determined	infra
XD1	Windows Server 2019 / Citrix Desktop Delivery controllers	4	8	C:\40 D:\50	infra
CIFS1	Windows Server 2019 / Roaming profiles and redirected folders	2	8	C:\40 D:\200	infra
CIFS2	Windows Server 2019 / LoginVSI content share	2	8	C:\40 D:\200	infra
VSI-MGMT	Windows Server 2019 / LoginVSI management server	N/A	N/A	N/A	N/A
L01-30	Windows 10 x64 Enterprise/ Login VSI launcher	4	8	40	infra
Win10-gold	Windows 10 x64	4	8	50	vSAN cluster under test

Installing ESXi 7.0 U1 on the infrastructure servers

Installing ESXi vSphere 7.0 U1

1. Attach the installation media.
2. Boot the server.
3. Select the installation media.
4. At the VMware Installer screen, press Enter.
5. At the EULA screen, press F11 to Accept and Continue.
6. Under Storage Devices, select the appropriate virtual disk, and press Enter.
7. Select US as the keyboard layout, and press Enter.
8. Enter the root password twice, and press Enter.
9. To start the installation, press F11.
10. After the server reboots, press F2, and enter root credentials.
11. Select Configure Management Network, and press Enter.
12. Select the appropriate network adapter, and click OK.
13. Select IPv4 settings and enter the desired IP address, subnet mask, and gateway for the server.
14. Select OK, and restart the management network.

Installing ESXi 7.0 U1 on the Lenovo ThinkSystem SR650 servers

Installing ESXi 7.0 U1

1. Attach the installation media.
2. Boot the server.
3. At the VMware Installer screen, and press Enter.
4. At the EULA screen, to accept and continue, press F11.
5. Under Storage Devices, select the appropriate virtual disk, and press Enter.
6. Select US as the keyboard layout, and press Enter.
7. Enter the root password twice, and press Enter.
8. To start the installation, press F11.
9. After the server reboots, press F2, and enter root credentials.
10. Select Configure Management Network, and press Enter.
11. Select the appropriate network adapter, and click OK.
12. Select IPv4 settings, and enter the desired IP address, subnet mask, and gateway for the server.
13. Select OK, and restart the management network.

Deploying VMware vCenter 7.0 U1

We deployed the VMware vCenter 7.1 U1 virtual appliance onto an infrastructure server, created our infrastructure VMs, and configured our four Lenovo Think System SR650 servers into a vSAN cluster.

Deploying the VMware vCenter Server 7.0 U1

1. On a Windows machine or VM, locate the VMware-VCSA installer image.
2. Mount the image, navigate to the vcsa-ui-installer folder, and double-click win32.
3. Double-click installer.exe.
4. Click Install.
5. Click Next.
6. Accept the terms of the license agreement, and click Next.
7. Leave the default "vCenter Server with an Embedded Platform Services Controller" selected, and click Next.
8. Enter the FQDN or IP address of the host onto which you will deploy the vCenter Server Appliance.
9. Provide the server credentials, and click Next.
10. At the Configure Network Settings page, configure the network settings for your environment, and click Next.
11. Review your settings, and click Finish.
12. When the deployment completes, click Next.
13. At the Introduction page, click Next.
14. At the Appliance configuration page, select the time synchronization mode and SSH access settings, and click Next. We used a local NTP server and enabled SSH.

15. Select Create a new SSO domain.
16. Provide a password, and confirm it.
17. Provide an SSO Domain name and SSO Site name, and click Next.
18. At the CEIP page, click Next.
19. At the Ready to complete page, click Finish.
20. When the installation completes, click Close.
21. Using the vSphere web client, log into the vCenter server using the credentials you previously provided.

Creating a datacenter in VMware vCenter and adding hosts

To host the virtual desktops, we created two clusters: *infra* to host the infrastructure VMs necessary for testing, and *SUT* for the servers under test. We configured a vSAN cluster for the servers under test, which consisted of two disk groups: one cache disk and four capacity drives each, for a total of eight NVMe SSDs per compute node.

Creating the datacenter
1. Log into vCenter, and navigate to Hosts and Clusters.
2. Select the primary site-management vCenter.
3. Right-click the vCenter object, and select New Datacenter…
4. Enter a name for the new datacenter, and click OK.
5. Right-click the new datacenter, and click New Cluster…
6. Enter SUT as the name for the new cluster.
7. Click OK.
8. To create an infrastructure cluster, repeat steps 1 through 7.

Adding the hosts
1. Once you have created the cluster, right-click it, and click Add Host.
2. Enter the FQDN or IP address of the first host, and click Next.
3. Enter the root credentials for the server, and click Next.
4. To accept the server's certificate, click Yes.
5. Review the server details, and click Next.
6. Assign the desired license, and click Next.
7. Disable Lockdown mode, and click Next.
8. Click Finish.
9. Repeat steps 8 through 15 for the remaining servers under test and for the client host.

Creating a vSAN cluster for testing on the cluster under test

We created a vSAN cluster with the disks available in each compute node in the cluster under test. We used a separate vLAN for vSAN traffic and a dedicated 10Gbps physical adapter for each node. Our vSAN cluster had two disk groups: 375GB Intel Optane P4800X disks for cache, and 3.48 TB of Intel S4510s memory for capacity

1. In the Hosts and Clusters pane, select the newly created cluster.
2. Click the Configure tab. Under Configuration, select Quickstart.
3. Under Cluster basics, click Edit.
4. Enable vSAN, and click OK.
5. Under Add Hosts, click Add.
6. Enter the IP and credentials for each of the hosts you wish to add to the cluster, and click Next.
7. Under Configure hosts, click Configure.
8. Under Physical adapters, next to the adapters you wish to use for vSAN traffic, click the drop-down, and select DSwitch. Leave the Distributed switches and Port groups options as default. Click Next.
9. Enter the value of the VLAN you wish to use for vSAN.
10. If you wish, change IP type to static, and provide the IP addresses for the hosts. Otherwise, leave the IP type as DHCP. Click Next.
11. On the Advanced options screen, click Next.
12. On the Claim disks screen, select the disks you wish to use for capacity and cache, and click Next.
13. Click Next, and click Finish.

Creating the VM template for Windows Server 2019

We created a simple VM template for all infrastructure VMs.

Deploying a template VM

1. Launch the VMware vCenter HTML5 client.
2. Right-click the infrastructure host, and choose New Virtual Machine…
3. Choose Create a new virtual machine, and click Next.
4. Name the virtual machine, and click Next.
5. Choose the correct host, and click Next.
6. Choose the correct datastore, and click Next.
7. Choose ESXi 7.0 and later, and click Next.
8. Choose Windows for the Guest OS Family, and Microsoft Windows Server 2019 (64-bit) for Guest OS Version. Click Next.
9. Set the vCPU count to 4, the memory to 4GB, and New Hard Disk capacity to 40GB. Change the network adapter to VMXnet3.
10. Click Finish.

Installing and configuring Windows Server 2019 Enterprise on the template VM

1. On the template VM, install a base operating system.
2. In the VMware vCenter HTML5 client, click on the VM you created, and click Launch Remote Console.
3. Attach the Windows Server 2019 Enterprise ISO to the VM, and turn the VM on.
4. When prompted to boot from DVD, press any key.
5. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
6. Click Install now.
7. When prompted, enter the product key.
8. Select Windows Server 2019 Datacenter Edition (Server with a GUI), and click Next.
9. Check I accept the license terms, and click Next.
10. Click Custom: Install Windows only (advanced).
11. Select Drive 0 Unallocated Space, and click Next. This will start the install automatically, and Windows will restart automatically after completing the install.
12. When the Settings page appears, fill in the Password and Reenter Password fields with the password of your choice.
13. Log in with the password you set.
14. In the VMware Remote Console, attach VMware tools to the VM.
15. In Windows, the VMware tools should show up in the CD drive. Double-click to start the install.
16. Choose Typical as the install type, and reboot the VM when the install is finished.
17. Log back into Windows. In Server Manager, set the time zone, enable RDP if you wish, and disable the firewall.
18. Run Windows updates until you have no new updates to install.
19. Power off the template VM. You will use this for all the Windows Server 2019 infrastructure VMs we list in Table 4.

Installing and configuring Microsoft Windows Active Directory Domain Controller and supporting services

We installed and configured a VM to host Microsoft Active Directory services, DNS, DHCP, and NTP. You will need this directory later on, as Login VSI will create several OUs for virtual desktops, launchers and users, and apply group policies to each. This is necessary for testing to execute correctly.

Installing the Domain Controller VM

1. Log into the vSphere client as administrator@vsphere.local
2. On the infrastructure server, deploy a Windows Server 2019 VM from the template using the appropriate specs from Table 5 on page 5. Name this server `DC1`, and log in as an administrator.
3. Launch Server Manager.
4. Click Manage➔Add Roles and Features.
5. At the Before you begin screen, click Next.
6. At the Select installation type screen, leave Role-based or feature-based installation selected, and click Next.
7. At the Server Selection Screen, select the server from the pool, and click Next.
8. At the Select Server Roles screen, select Active Directory Domain Services.
9. When prompted, click Add Features, and click Next.
10. At the Select Features screen, click Next.
11. At the Active Directory Domain Services screen, click Next.
12. At the Confirm installation selections screen, check Restart the destination server automatically if required, and click Install.

Configuring Active Directory and DNS services on the Domain Controller VM

1. After the installation completes, a screen should pop up with configuration options. If a screen does not appear, click the Tasks flag in the upper right-hand section of Server Manager.
2. Click Promote this server to a Domain Controller.
3. At the Deployment Configuration screen, select Add a new forest.
4. In the Root domain name field, type `test.local`, and click Next.
5. At the Domain Controller Options screen, leave the default values, and enter a password twice.
6. Click Next four times to accept default settings for DNS, NetBIOS, and directory paths.
7. At the Review Options screen, click Next.
8. At the Prerequisites Check dialog, allow the check to complete.
9. If there are no relevant errors, check Restart the destination server automatically if required, and click Install.
10. When the server restarts, log on using test\Administrator and the password you chose in step 5.

Configuring the Windows time service on the Domain Controller VM

1. To ensure reliable time, we pointed our Active Directory server to a physical NTP server.
2. Open a command prompt.
3. Type the following:

```
W32tm /config /syncfromflags:manual /manualpeerlist:"us.pool.ntp.org"
W32tm /config /reliable:yes
W32tm /config /update
W32tm /resync
Net stop w32time
Net start w32time
```

Setting up DHCP services on the Domain Controller VM

1. Open Server Manager.
2. Select Manage, and click Add Roles and Features.
3. Click Next twice.
4. Select DHCP Server, and click Next.
5. At the Introduction to DHCP Server screen, click Next.
6. At the Specify IPv4 DNS Settings screen, type `test.local` for the parent domain.
7. Type the preferred DNS server IPv4 address, and click Next.
8. At the Specify IPv4 WINS Server Settings screen, select WINS is not required for applications on the network, and click Next.
9. At the Add or Edit DHCP Scopes screen, click Add.
10. At the Add Scope screen, enter the Name DHCP Scope name.
11. Set the following values, and click OK.
    a. Start IP address = 172.16.10.1
    b. End IP address = 172.16.100.254
    c. Subnet mask = 255.255.0.0
12. Check the Activate This Scope box.
13. At the Add or Edit DHCP Scopes screen, click Next.
14. Click the Enable DHCP v6 Stateless Mode radio button, and click Next.
15. Leave the default IPv6 DNS Settings, and click Next.
16. At the Authorize DHCP server dialog box, select Use current credentials.
17. At the Confirm Installation Selections screen, click Next. If you have set up the installation correctly, a screen displays saying that DHCP server install succeeded.
18. Click Close.

Installing the Login VSI 4.1 benchmark

The Login VSI 4.1 installation has several parts: the Active directory setup, a CIFS media share, and a management console and target agent setup. We deployed each according to the Login VSI 4.1 documentation at https://www.loginvsi.com/documents/documentation/Login-VSI-Installation-Guide.pdf.

Installing and setting up the Login VSI 4.1 management VM

To create users and coordinate testing, we first set up a VM named VSI-MGMT, and ran the Login VSI Dataserver install media. This installed the Login VSI management console.

1. On the infrastructure server cluster, deploy a Windows Server 2019 VM from the template using the appropriate specs (Page 5, Table 5). Name this VM `VSI-MGMT`, and log in as test\administrator.
2. Create a folder named `D:\share`
3. Right-click the D:\share folder, and click Properties.
4. Click the Sharing tab, and click Share…
5. Add everyone, system, and administrators to the Read/Write group, and click Share.
6. Unpack the Login VSI install media.
7. Open Datacenter setup\setup.exe.
8. At the welcome screen, click Next.
9. Select the share named \\vsi-mgmt\share, and click Next.
10. To start the management console when setup is complete, check the box for Start Login VSI Management Console. Click Finish.
11. At the management console, enter the path to your Login VSI license file, and click Save.

Configuring Login VSI: setting up AD and creating users and default group policy objects (GPOs)

Login VSI management console creates a Windows Powershell script that automates the creation of users and GPOs to ensure successful testing. We used this functionality to create a .ps1 file, and then copy and execute it on our Domain controller DC1.

1. On the VM named VSI-MGMT, open the VSI management console and click 1. AD setup.
2. Enter the following:
   - **Base OU:** `DC=test,DC=local`
   - **Username:** `LoginVSI`
   - **Password:** `[choose a password]`
   - **Domain:** `(auto detect checked)`
   - **Number of users:** `2000`
   - **Formatting length:** `4`
   - **Launcher user:** `Launcher-v4`
   - **Launcher password:** `[choose a password]`
3. Click Save to .sp1.
4. Copy the VSIADSetup.ps1 file to \\DC1\c$.
5. Log into DC1 as administrator, and execute the c:\VSIADSetup.ps1 file you created earlier.

Setting up the Active Directory Roaming Profiles and folder redirection

We chose to use Microsoft Windows Active directory roaming profiles and folder redirection. This way, all Virtual desktop users keep their profile information, regardless of the desktop VM to which they were assigned at logon.

Deploying a VM for roaming profiles and folder redirection.

1. Log into the vSphere client as administrator@vsphere.local.
2. On the infrastructure server cluster, deploy a Windows Server 2019 VM from the template using the appropriate specs from Page 5, Table 5. Name this VM `CIFS1`, and log in as an administrator.
3. Launch Server Manager.
4. Click Manage→Add Roles and Features.
5. At the Before you begin screen, click Next.
6. At the Select installation type screen, leave Role-based or feature-based installation selected, and click Next.
7. At the Server Selection Screen, select the server from the pool, and click Next.
8. At the Select Server Roles screen, select Active Directory Domain Services.
9. When prompted, click Add Features, and click Next.
10. At the Select Features screen, click Next.
11. At the Active Directory Domain Services screen, click Next.
12. At the Confirm installation selections screen, check Restart the destination server automatically if required, and click Install.

Setting up Microsoft Active Directory Roaming Profiles CIFS shares on CIFS1

1. Log onto the VM named CIFS1, open Windows Explorer, and create two folders: D:\user_profiles, and D:\user_folders. Add read/write permissions to the test.local/everyone group.
2. Right-click the folders you just created, and select Properties for each.
3. Click the Sharing tab, and select Share…
4. Add everyone, system, and administrators to the read/write group, and click Share.
5. Click OK.
6. Click Apply.
7. Click OK.
8. Click Close.

Assigning Login VSI user profiles to the user_profiles share

1. Log onto the VM named DC1 as test\administrator.
2. Open Active Directory Users and Computers.
3. Browse to test.local→Login_VSI→Users→Target.
4. Select all Login VSI users, and right-click Properties.
5. Click Profile, and enter profile path `\\cifs1\user_profiles\%username%`

Configuring folder redirection for Login VSI users

1. Log onto the VM named DC1 as test\administrator.
2. Open the Group Policy Editor.
3. Open Forest→Domains→test.local, right-click Group Policy Objects, and select New.
4. Type folder_redirection, leave source starter GPO as None, and click OK.
5. Right-click the folder redirection GPO, and click Edit.
6. Browse User Configuration→Policies→Windows Settings→Folder Redirection, and right-click AppData (roaming).
7. In the AppData (roaming) Properties, target-tab select the following:

    • Setting = select Basic = Redirect everyone's folders to the same location
    • Target folder location = Create a folder for each user under the root path
    • Root Path = \\CIFS1\user_folders

8. In the AppData (roaming) Properties→Setting tab, remove the checkbox for Grant the user exclusive right to AppData (roaming), and click OK.
9. Repeat steps 6 through 8 for all subfolders in the folder redirection tree.
10. Close the Folder Redirection group policy.
11. In the Group Policy Editor, right-click the folder redirection policy, and select GPO Status→Computer Configuration Settings Disabled.
12. In the Group Policy Editor, drag the folder redirection GPO to Forest→Domains→test.local→Login_VSI→Users→Target.

Distributing Login VSI media content and downloading the Login VSI Pro Library

Login VSI recommends creating a dedicated content share separate from the management console server. We created a VM named CIFS2 and copied the _VSI_Websites directory and the _VSI_Content folder it. Because we ran the Power user workload, we also downloaded the Login VSI Pro Library and added it to the CIFS 2 share. You can download the library named Login_VSI_Pro_Lib.exe from https://www.loginvsi.com/downloads/login-vsi.

Deploying a VM for the Login VSI Pro library

1. Log into the vSphere client as administrator@vsphere.local.
2. On the infrastructure server, deploy a Windows Server 2019 VM from the template using the appropriate specs from Page 5, Table 5. Name this VM `CIFS2`, and log in as an administrator.
3. Launch Server Manager.
4. Click Manage→Add Roles and Features.
5. At the Before you begin screen, click Next.
6. At the Select installation type screen, leave Role-based or feature-based installation selected, and click Next.
7. At the Server Selection Screen, select the server from the pool, and click Next.
8. At the Select Server Roles screen, select Active Directory Domain Services.
9. When prompted, click Add Features, and click Next.
10. At the Select Features screen, click Next.
11. At the Active Directory Domain Services screen, click Next.
12. At the Confirm installation selections screen, check Restart the destination server automatically if required, and click Install.

Copying the Login VSI media from the management server to CIFS2

1. Log into the VM named CIFS2 as test\administrator
2. Open Windows Explorer, and create the following folders: d:\vsishare.
3. Add read.write permissions to the test.local/everyone group.
4. Right-click the d:\share, and select Properties.
5. Click the Sharing tab, and select Share…
6. Add everyone, system, and administrators to the read/write group, and click Share.
7. Click OK.
8. Click Apply, and click OK.
9. Click Close.
10. Copy \\vsi-mgmt\vsishare_VSIwebsites_ to D:\vsishare.
11. Copy \\vsi-mgmt\vsi_VSI_Content to D:\vsishare.

Installing the Login VSI Pro media library

1. Log into the VM named CIFS2 as test\administrator
2. Click on the downloaded library named Login_VSI_Pro_Lib.exe.
3. To start the installation, click Next.
4. Specify the path as `//CIFS2/vsishare`, and click Next.
5. Click Finish.

Creating the Windows 10 Enterprise (x64) Login VSI Launcher image

We created a Microsoft Windows 10 Enterprise (x64) template VM named Launcher and cloned out VMs according to Table 5, Page 5. Each Launcher can launch up to a maximum of 25 virtual desktop sessions.

Deploying the Launcher VM

1. Log into vCenter via the VMware Web client.
2. Right-click the Virtual Machines tab, and select New Virtual Machine.
3. Select Create a new virtual machine.
4. Choose Custom, and click Next.
5. Assign the name launcher, and click Next.
6. Select the infrastructure cluster, and click Next.
7. Select the local DAS.
8. Choose compatible with ESXi 7.0, and click Next.
9. Choose Windows, choose Microsoft Windows 10 (64-bit), and click Next.
10. For CPUs, select 4 CPUs, 8 GB RAM, and 50 GB Disk. Click Next.
11. Click Finish.
12. Click the Hardware tab.
13. Click CD/DVD Drive.
14. Select Connect the VM virtual CD-ROM to the Microsoft Windows 10 x64 installation disk.
15. Click OK.
16. Power on the Microsoft Windows 10 VM.

Installing Windows 10 Enterprise (x64) on the Launcher VM

1. When the installation prompts you, press any key to begin setup.
2. Enter your language preferences, and click Next.
3. Click Install.
4. Accept the license terms, and click Next.
5. Select Custom, and select the drive that will contain the OS.
6. Click Install.
7. Type `user` for the username, and click Next.
8. Do not enter a password. Click Next.
9. At the system protection screen, select Use recommended settings, and click Next.
10. Enter your time zone, and click Next.
11. Select the Work Network setting, and click Next.
12. Install VMware Tools, and select Complete Installation. For more information, visit http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
13. Reboot the server.
14. Connect the machine to the internet, and install all available Windows updates. Restart as necessary.
15. Join the domain, and restart the VM.

Installing the Citrix Workspace client on Launcher VM

1. Log into the Launcher VM as test\administrator.
2. Mount the Citrix install media (ver 2009.0.0.27084).
3. Open Windows Explorer. Browse to /Citrix Receiver and Plug-ins/Windows/Receiver/CitrixWorkspaceApp.exe, and run the executable.
4. Click Start
5. Agree to the license agreement and click Next.
6. Do **not** select Enable single sign-on. Click Next.
7. Do **not** click Enable App protection. Click Install.
8. Click Finish, and power off the Launcher VM. It is now ready to be cloned.

Creating the Windows 10 Enterprise (x64) gold image VM

We created a Microsoft Windows 10 Enterprise (x64) template VM named Win10-gold, and added applications for testing.

Creating the Win10-gold VM

1. Log into vCenter via the VMware Web client.
2. Right-click the Virtual Machines tab, and select New Virtual Machine.
3. Select Create a new virtual machine.
4. Choose Custom, and click Next.
5. Assign the name win10-gold, and click Next.
6. Select the cluster under test, and click Next.
7. Select the vSAN datastore.
8. Choose compatible with ESXi 7.0, and click Next.
9. Choose Windows, choose Microsoft Windows 10 (64-bit), and click Next.
10. For CPUs, select 4 CPUs, 8 GB RAM (8 GB Reserved), and 50 GB Disk. Click Next.
11. Click Finish.
12. Click the Hardware tab.
13. Click CD/DVD Drive.
14. Select Connect the VM virtual CD-ROM to the Microsoft Windows 10 x64 installation disk.
15. Click OK.
16. Power on the Microsoft Windows 10 VM.

Installing Windows 10 Enterprise (x64) on the gold image VM

1. When the installation prompts you, press any key to begin setup.
2. Enter your language preferences, and click Next.
3. Click Install.
4. Accept the license terms, and click Next.
5. Select Custom, and select the drive that will contain the OS.
6. Click Install.
7. Type `user` for the username, and click Next.
8. Do **not** enter a password. Click Next.
9. At the system protection screen, select Use recommended settings, and click Next.
10. Enter your time zone, and click Next.
11. Select the Work Network setting, and click Next.
12. Install VMware Tools, and select Complete Installation. For more information, visit http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=340.
13. Reboot the server.
14. Connect the machine to the internet, and install all available Windows updates. Restart as necessary.
15. Join the domain, and restart the VM.

Installing Microsoft Office Professional Plus 2019 on the gold image VM

1. Log onto the Win10-gold VM as test\administrator.
2. Mount the Microsoft Office 2019 media to D:\.
3. Open to d:\office\setup64.exe.
4. Wait for Office 2019 Professional Pro to install.

Installing the Citrix Virtual Desktop Agent on the gold image VM

1. Log onto the Win10-gold VM as test\administrator.
2. Mount the Citrix install media (ver 2009.0.0.27084).
3. Click AutoSelect.exe.
4. Click the start button next to Virtual Apps and Desktops.
5. Click prepare Machines and images.
6. Click create a master MCS image, and click Next.
7. Leave core components as default and click Next.
8. Leave Additional components as default and click Next.
9. Change the Delivery Controller configuration to Llet Machine Creation Services do it automatically, and click Next.
10. Leave features as default, click Next.
11. Leave firewall as automatic, click Next.
12. Review the summary and click Install.
13. Deselect the check box next to "Collect diagnostic information", click Next.
14. To restart the VM, click Finish.

Installing the Login VSI 4.1 agent on the Windows 10 gold image VM

1. Log onto the Win10-gold as test\administrator.
2. Mount the Login VSI media, and run \LoginVSI4140\2.Target Setup\Target setup.exe.
3. Click Next.
4. Keep all defaults, and click Next.
5. Click Finish.

Disabling Windows Defender Antivirus scanning on the Windows 10 gold image VM

To ensure the fastest possible testing, we disabled Windows Defender Antivirus. scanning. If this setting is not disabled, a considerable amount of I/O will occur for several hours after system reboots.

1. Log onto the win10-gold VM as test\administrator.
2. Click the Windows Start icon.
3. Click the Settings icon.
4. In Windows Settings, click Updates and Security.
5. Click Windows Security.
6. Click Open Windows Security.
7. Click Virus & Threat Protection.
8. Click Virus & Threat Protection Settings.
9. To turn off Real-time protection, click the slider.

Optimizing the Windows 10 gold image VM

1. Log onto the Win10-gold VM as test\administrator.
2. Download the Windows optimization tool from https://flings.vmware.com/vmware-os-optimization-tool.
3. Extract the zip file, and run VMwareOSOptimizationTool_b1170_16669532.exe.
4. Click Template, and select VMware\Windows 10.
5. Click Analyze.
6. Select all suggestions, and click Optimize.
7. When settings finish applying, reboot the VM.

Finalizing the Windows 10 gold image VM and taking a snapshot

Citrix Virtual Desktops and Apps 7 requires a VM snapshot to create a Machine Catalog.

1. In vCenter, shut down the Windows 10 gold image.
2. Right-click the win10-gold VM, and select Take a snapshot.
3. Name each snapshot, and click OK.

Setting up a Citrix Virtual Desktops and Apps 7 infrastructure

We installed a Microsoft Windows 2019 VM named XD1 from the template, installed Citrix Virtual Desktop and Apps version 7, and configured the Citrix Store and licenses required.

Deploying Citrix Delivery Controller

1. On the infrastructure server, deploy a Windows Server 2019 VM from the template using the appropriate specs from Table 5 on Page 5. Name the VM `XD1`, and log in as test\administrator.
2. Mount the Citrix installation media, and launch AutoSelect.exe.
3. Click Start Virtual Apps and Desktops.
4. Click Getting Started Delivery Controller.
5. Accept the license agreement. Click Next.
6. Keep all components checked (Delivery Controller, Studio, Director, and License server), and click Next.
7. Keep both features checked (Install Microsoft SQL Server 2017 Express CU16 and Windows remote assistance), and click Next.
8. Leave firewall ports as default and click Next.
9. Click Install.
10. To reboot, click Close.
11. Log in, and let the installation complete.
12. Deselect Collect diagnostic information, and click Next.
13. To launch the studio, click Finish.

Installing and configuring Citrix Desktops and Apps on the XD1 VM

1. At the Citrix Studio welcome screen, click Deliver applications and desktops to your users.
2. Name the site `XD1`, and click Next.
3. In the database menu, leave the defaults values, and click Next.
4. In the licensing menu, click Use existing license. Browse to the licensing file, and click Next.
5. In the connection menu, select VMware vSphere, and type `https://<ipaddress of the vcenter>/sdk`. Enter the appropriate credentials, and click Next.
6. Select trust certificate, and click OK.
7. Select the vDT vSAN cluster, choose Local storage, and click Next.
8. Select the vSAN storage. Check the boxes for OS, person, vDisk, and temporary, and click Next.
9. Name the network resources `network`, and click Next.
10. Leave additional features unchecked, and click Next.
11. At the summary menu, click Finish.

Configuring the Citrix Storefront

1. Open Citrix Studio→Storefront. Right-click, and select Create storefront.
2. At the Getting Started menu, click Next.
3. Name the store the same as the Desktop delivery controller (example XD1 = XD1), and click Next.
4. To add a desktop delivery controller, click Add, and enter the following:

    • The display name (Example - XD1)
    • Add the local deliver controller (example XD1 = XD1).
    • Transport type = select "HTTP"

5. Click OK, and click Next.
6. For remote access, leave defaults, and click Next.
7. Select User name and password for authentication methods, and click Next.
8. Check the box for Make this the default Store for PNAgent, and click Create and Finish.

Deploying virtual desktops with Citrix Virtual Desktops and Apps 7

With Citrix Studio on the XD1 VM, we used Citrix Machine Creation Services to create a Machine Catalog. We created and configured a delivery and added machines from the Machine Catalog to the new Delivery Group.

Creating a Citrix Machine Catalog

1. Log onto the XD1 VM as test/administrator.
2. Open Citrix Studio.
3. Click Machine Catalog. In the right-hand pane, click Create Machine Catalog.
4. In the introduction screen, click Next.
5. For Operating system, select single-session OS, and click Next.
6. For Machine Management, leave the default (machines that are power managed and Citrix MCS), and click Next.
7. Select the gold master image you created, along with the snapshot. Select 2003 for minimum functional level for this catalog, and click Next.
8. Select the appropriate number of VMs, and click Next.
9. Select LoginVSI➔Computers➔Target OU. Name the VMs, and click Next.
10. Name the catalog.
11. Click Finish.

Create a Citrix Delivery Group

1. Log onto XD1 as test/administrator.
2. Open Citrix Studio.
3. Right-click Delivery Group, and select Create new Delivery Group.
4. Click Next.
5. Select the catalog from step 10 in the previous section. Add the appropriate number of machines, and click Next.
6. Select Restrict use to this delivery group, and add the test\LoginVSI group. Click Next.
7. Do not add any applications. Click Next.
8. To add the desktop, click Add. Select a name, select restrict to group, and add test\LoginVSI group to the desktop assignments. Click OK, and click Next.
9. Name the delivery group, and click Finish.
10. By default, Citrix automatically powers desktops on and off as needed to be as power efficient as possible. To ensure all desktops powered on and were idle, we opened a Powershell command window, and ran the following (substitute the **name** string with the group name you chose earlier):

```
Set-BrokerDesktopGroup -Name "name" -AutomaticPowerOnForAssigned $False
Set-BrokerDesktopGroup -Name "name" -AutomaticPowerOnForAssignedDuringPeak $False
Set-BrokerDesktopGroup -Name "name" -OffPeakBufferSizePercent 100
Set-BrokerDesktopGroup -Name "name" -PeakBufferSizePercent 100
Set-BrokerDesktopGroup -Name "name" -ShutdownDesktopsAfterUse $False
```

Cloning VSI Launcher VMs and configuring the LoginVSI 4.1 management console for testing

We cloned out our Launchers and configured the management console.

Converting the Launcher VM to a template and cloning the template

1. In vSphere Client, right-click the Launcher VM, and select Template➔Convert to Template.
2. Right-click the Launcher template to deploy a virtual machine from the template.
3. Type `launcher_1` as the new VM name, and click Next.
4. Click Datacenter, and click Next.
5. Click the Launcher server, and click Next.
6. Select the appropriate storage, and click Next.
7. Select Customization using existing customization specifications, select the appropriate file, and click Next.
8. To deploy the new VM, click Finish.
9. Repeat steps 2 through 8 to deploy all the launchers.

Configuring the LoginVSI console for testing

1. Log onto the VSI-MGMT VM as test\administrator.
2. Open the LoginVSI management console.
3. Click Infrastructure➔Data servers.
4. Right-click, select Add server, and enter `UNC path= \\CIFS2\vsishare\_VSI_Content`
5. Click Infrastructure ➔Web Servers.
6. Right-click, select Add server, and enter `UNC path= \\CIFS2\vsishare\_VSI_Content`
7. Click Add Launchers.
8. At the Add launchers wizard, click Next.
9. Click batch entry, and enter the following:

   - Name = `L`
   - Start number = `1`
   - Increment = `1`
   - Count= `32`
   - Maximum capacity = `25`
   - Formatting length = `2`

10. Click Next, and click Finish.

Running the Login VSI benchmark

We created a profile by creating the files outlined in the Login VSI configuration files section on page 17. Afterwards, we created a profile by copying the files to the vsi-mgmt VM.

1. Log into the VSI-MGMT VM as test/administrator.
2. Create a folder called `//vsi-mgmt/vsishare/_VSI_Configuration/testing_profile`.
3. Create a folder called `//vsi-mgmt/vsishare/_VSI_Configuration/testing_profile/_CurrentTest`.
4. Copy launchers to //vsi-mgmt/vsishare/_VSI_Configuration/testing_profile.
5. Copy DataLocations, Global, and VSIlauncher to //vsi-mgmt/vsishare/_VSI_Configuration/testing_profile/_CurrentTest.

Creating desktop user profiles and changing the default file association for PDFs

Before you can begin testing in earnest, you must create desktop user profiles for each desktop user. Additionally, Login VSI requires that each desktop opens PDFs with Adobe Reader; however, by default, Windows 10 associates PDFs with Microsoft Edge. You will need to change this default file association using a program we describe in the steps below.

1. Open the console manager, and run a test.
2. To create user profiles, on the Basic test configuration screen, select Enable profile create mode.
3. You will need to run the profile creator twice: once to create the profiles, and again with a script to change the default file association for PDFs. Download the following program (https://kolbi.cz/SetUserFTA.zip), and continue with the steps below:
4. Log onto the VSI MGMT VM.
5. Create the directory `\\vsi-mgmt\vsishar_VSI_tools`
6. Extract setuserfta to the directory you just created.
7. Open \\DC1\sysvol\test.local\scripts\V4-VSI_Login.bat.
8. Add the following to the first line of V4-VSI_Login.bat:

   `Call|\\vsi-mgmt\vsishare\_VSI_tools\setuserfta.exe||\\vsi-mgmt\vsishare\_VSI_tools\setuserfta\ loginvsiconfig`

9. Save the new file.
10. Create a file named `\\vsi-mgmt\vsishare\_VSI_tools\LoginVSIConfig`
11. Add the following text:

    `.pdf, AcroExch.Document.11`

12. Once you have created the profiles and the PDF associations have been changed, remove the line in \\DC1\sysvol\test.local\scripts\V4-VSI_Login.bat you added in step 8.

Login VSI configuration files

This section contains the configuration information for four files: Launchers, DataLocations, Global, and VSIlauncher. We created each file using Windows Notepad, and saved each file without specifying a file extension. Please note that we truncated the repetitious and redundant nature of some of the files by typing […]. This requires duplication of the session for the file to work correctly. Also, note that you must edit NumberOfSessions in the VSIlauncher file to reflect the testing scenario you desire.

Launchers

```
[l01]
Capacity=50
Disabled=0
CMLaunch=0
Notes=
[l02]
Capacity=50
Disabled=0
CMLaunch=0
Notes=
[…]
[l50]
Capacity=50
Disabled=0
CMLaunch=0
Notes=
```

DataLocations

```
[Dataservers]
Server1=\\CIFS2\vsishare\_VSI_Content
[Server1]
name=Default
enabled=1
[WebServers]
WebServer1=\\CIFS2\vsishare\_VSI_Websites
[WebServer1]
name=Default
enabled=1
[Server2]
[WebServer2]
[Library]
doc=1000
docx=1000
jpg=1000
mm=1000
pdf=1000
ppt=1000
pptx=1000
pst=1000
txt=1
xlsx=1
[Websites]
BBC=20
ENGADGET=20
PINTEREST=20
Player=20
THEVERGE=20
```

Global

```
[Settings]
Use_SessionM=1
LauncherHeartbeat=10
UserHome=H:
Groupdrive=M:
LauncherPollInterval=5
EngineWorkloadIndexPollInterval=5
EngineProcessPollInterval=5
TimerInterval=360
```

```
PublishedAppsLogFileShare=
RelaunchAppsOnSubsequentLoops=1
WorkloadIndexDebug=0
LogoffAt=segment
Logoff_Action=shutdown /l /f
logout_on_fatal_error=0
EsxtopEnabled=0
EsxtopServer=
EsxtopUsername=
EsxtopPassword=
EsxtopIntervalRecording=30
EsxtopAmountRecording=120
EsxtopFileKeepDuration=never
Pause={Pause}
MashupBehavior=Calculated
Workload_Loops=99999
SegmentBehavior=Calculated
SBC_timer_detect=0
PDFPrinting=1
ZIPLocation=%TEMP%\VSI\Zip
Verify_runtime_files=1
RandomInitialWait=5
DisableVideoViewing=0
IEVideoOption=Auto
Workload_Language=English
IEVersion=11
Office_code=2019
Office_version=16
Office_Language=English
office_print_sequence={altdown}fppp{altup}
log_category_AppStart=True
log_category_ShellExecuteWait=True
log_category_WebStart=False
log_category_LoopTimer=False
log_category_RandomCopy=False
log_category_SegmentTimer=False
SegmentsPerFile=20
Engine_Debug=0
Workload_Debug=0
winwait_timeout=120
winwaitactive_timeout=120
timer_timeout=60
ShellExecuteWaitTimeout=0
Workload=powerworker
[GUI]
AgentRunLoop=1
Fancy=1
CheckShareWritable=1
Mode=Normal
[Logon]
MapUserHome=1
MapGroupDrive=1
ImportOfficeReg=1
CopyPST=1
SetFreemindFTA=1
EngineStartup=Shell
```

VSIlauncher

```
[Scenario]
CPUEnabled=disabled
NumberOfCPU=0
CoresEnabled=disabled
NumberOfCores=0
HyperThreadingEnabled=disabled
HostsEnabled=disabled
NumberOfHosts=0
[Launcher]
BaseLinePhase=0
```

```
Servername=
Username=
Password=enc:BD177557C81239CED1:enc
ShowPassword=C04033148B4E
Domain=
useCSV=1
MultipleResources=0
CCL={VSISHARE}\_VSI_Binaries\Connectors\SFConnect.exe /url http://%CSV_DDC%/Citrix/%CSV_DDC% /user
test.local\%CSV_UserName% /password Password1 /resource "%CSV_resource%" /desktopviewer true /display
absolute /displayabsolute 1920x1080
CSV=\\vsi-mgmt\vsishare\ccv.csv
AgentRunLoop=1
PhasesCount=1
NumberOfSessions=1200
NumberOfWindows=3600
SequentialInterval=30
AutoLogoff=1
LogoffTimeOut=120
CreateProfile=0
TSDiscon=0
PreTestScript=
PostTestScript=
[Launcher_FD]
Servername=
Username=
Password=
ShowPassword=
Domain=
useCSV=1
MultipleResources=0
CCL={VSISHARE}\_VSI_Binaries\Connectors\SFConnect.exe /url http://%CSV_DDC%/Citrix/%CSV_DDC% /user
test.local\%CSV_UserName% /password Password1 /resource "%CSV_resource%" /desktopviewer true /display
absolute /displayabsolute 1920x1080
CSV=\\vsi-mgmt\vsishare\singleserver.csv
AgentRunLoop=1
[VSI]
SkipAddLaunchersScreen=0
SkipCommandLineScreen=0
Increment=0
TestNamePattern=
SkipStartTestScreen=0
SkipAllWelcomeScreens=1
[Phase1]
Name=Phase 1
Sessions=
PhaseTime=3600
Pause=False
[LauncherWorkload]
launcherUsername=launcher
launcherDomain=test
launcherPassword=
launcherWorkflow=0
limitConcurrent=25
launcherResolution=1920x1080
launcherDisconnectAfterLaunch=0
```

Custom CCV-

```
UserName,DDC,resource
loginvsi001,XD1,p1
loginvsi002,XD1,p1
loginvsi003,XD1,p1
loginvsi004,XD1,p1
loginvsi005,XD1,p1
[…]
```

Read the report at http://facts.pt/ADMMVck ▶

This project was commissioned by Lenovo.

Principled Technologies®

Facts matter.®