The science behind the report:

Support more users on VMware Horizon virtual desktops with new Intel Xeon Gold 6258R processor-based servers and 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 Support more users on VMware Horizon virtual desktops with new Intel Xeon Gold 6258R processor-based servers and Intel Optane Persistent Memory.

We concluded our hands-on testing on February 26, 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 February 6, 2020 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears. All testing was conducted using VMware ESXi 6.7.0 U1. According to VMware newer ESXi releases include driver enhancements that add queue pairing to optimize CPU efficiency and could affect the results of this testing.[1]

Our results

The following tables present our findings in detail. Please note that we added the data for the configuration with 512GB Intel Optane™ PMem + 192GB DDR DRAM after original publication at Intel's request to reflect 16GB DIMM availability.

Table 1: View Planner results for the Intel® Xeon® Gold 6258R processor-based cluster with different memory configurations

	Configuration with 384GB DDR DRAM	Configuration with 512GB Intel Optane PMem + 96GB DDR DRAM	Configuration with 512GB Intel Optane PMem + 192GB DDR DRAM	Configuration with 1,024GB Intel Optane PMem + 192GB DDR DRAM
Number of supported VDI users	160	200	200	300

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1   VMware, "VMware ESXi 6.7 Update 3 Release Notes," accessed March 26, 2020, https://docs.vmware.com/en/VMware-vSphere/6.7/rn/vsphere-esxi-67u3-release-notes.html.

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Table 2: Resource utilization on the Intel Xeon Gold 6258R processor-based cluster

Measurement	Average	Minimum	Maximum
Configuration with 384GB DDR DRAM (160 users)			
CPU usage (percentage)	41.48	1.92	100.00
CPU core utilization (percentage)	34.08	2.24	97.54
CPU utilization (percentage)	19.01	1.35	68.35
Memory usage (percentage)	95.39	86.03	98.19
Active memory (GB)	156.84	14.73	368.9
Consumed memory (GB)	382.7	345.26	394.03
Memory balloon (GB)	6.08	0	97.03
Configuration with 512GB Intel Optane PMem + 96GB DDR DRAM (200 users)			
CPU usage (percentage)	63.83	2.81	100.00
CPU core utilization (percentage)	53.8	2.99	99.92
CPU utilization (percentage)	32.58	1.75	93.25
Memory usage (percentage)	79.63	58.21	95.13
Active memory (GB)	146.99	29.09	282.93
Consumed memory (GB)	419.85	307.46	502.49
Memory balloon (GB)	0	0	0
Configuration with 512GB Intel Optane PMem + 192GB DDR DRAM (200 users)			
CPU usage (percentage)	53.68	2.75	100.0
CPU core utilization (percentage)	45.86	2.99	98.94
CPU utilization (percentage)	27.47	1.75	85.40
Memory usage (percentage)	84.80	28.59	97.31
Active memory (GB)	187.51	41.18	630.26
Consumed memory (GB)	447.76	151.04	514.02
Memory balloon (GB)	4.24	0.0	130.17
Configuration with 1,024GB Intel Optane PMem + 192GB DDR DRAM (300 users)			
CPU usage (percentage)	86.04	3.34	100.00
CPU core utilization (percentage)	80.16	3.51	100.00
CPU utilization (percentage)	63.01	2.03	100.00
Memory usage (percentage)	69.68	23.41	91.12
Active memory (GB)	265.77	35.52	450.83
Consumed memory (GB)	739.24	247.43	962.92
Memory balloon (GB)	0.24	0	0

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System configuration information

Table 3: Detailed information on the systems we tested. The cluster had four identically configured servers.

Server configuration information	Four-server cluster			
BIOS name and version	SE5C620.86B.02.01.0010.010620200716			
Non-default BIOS settings	Integrated IO configuration: Intel VT for Direct IO set to Enabled			
	Power and performance: CPU Power and performance policy set to Performance			
	Processor configuration: Intel virtualization technology set to Enabled			
	System acoustic and performance configuration set to Performance			
Operating system name and version/build number	VMware ESXi™ 6.7.0 U1 Build 10302608			
Date of last OS updates/ patches applied	10/16/18			
Power management policy	Performance			
Processor				
Number of processors	2			
Vendor and model	Intel Xeon Gold 6258R			
Core count (per processor)	28			
Core frequency (GHz)	2.7			
Stepping	N/A			
Memory	Configuration 1	Configuration 2	Configuration 3	Configuration 4
Memory type 1: Intel Optane PMem				
Total memory in system (GB)	N/A	512	512	1,024
Number of memory modules	N/A	4	4	8
Vendor and model	N/A	Intel NMA1XBD128GQS	Intel NMA1XBD128GQS	Intel NMA1XBD128GQS
Size (GB)	N/A	128	128	128
Type	N/A	Optane PMem	Optane PMem	Optane PMem
Memory type 2: Traditional DRAM				
Total memory in system (GB)	384	96	192	192
Number of memory modules	12	12	12	12
Size (GB)	32	8	16	16
Type	DDR4 DRAM	DDR4 DRAM	DDR4 DRAM	DDR4 DRAM
Speed	2,667	2,667	2,667	2,667
Local storage—OS				
Number of drives	1			
Drive vendor and model	Intel SSD DC S3520 Series SSDSC2BB960G7			
Drive size (GB)	960			
Drive information (speed, interface, type)	SATA			

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Server configuration information	Four-server cluster
Local storage – VMware vSAN™ cache tier	
Number of drives	2
Drive vendor and model	Intel Optane SSD DC P4800X Series SSDPED1K375GA
Drive size (GB)	375
Drive information (speed, interface, type)	NVMe™
Local storage – VMware vSAN capacity tier	
Number of drives	6
Drive vendor and model	Intel SSD DC P4510 Series SSDPE2KX020T8
Drive size	2.0TB
Drive information (speed, interface, type)	NVMe
Network adapter	
Vendor and model	Intel Ethernet Controller XXV710 for 25GbE SFP28
Number and type of ports	Dual SFP

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How we tested

About the environment

Intel provided remote access to their lab and pre-installed all four servers under test (SUT) with VMware vSphere™ 6.7 U1. We installed VMs on the infrastructure server, created a VMware cluster, and configured vSAN on the servers under test. The four servers SUT were configured identically using Intel Optane PMem to increase memory footprint, Optane SSDs for the vSAN caching tier, and 3D NAND SSDs for the capacity tier.
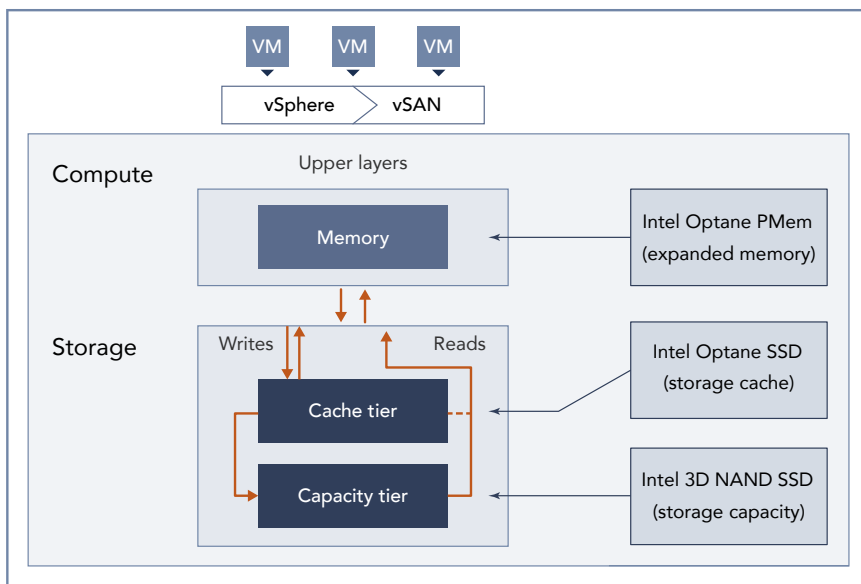

Figure 1: How Intel Optane storage and persistent memory work together

Table 4: Physical servers

Server	OS	Role(s)
1 x Infra	VMware ESXi 6.7 U1	ADDS, SQL. DNS, DHCP, NTP, vCenter, View connection and composer, View Planner harness
4 x SUT	VMware ESXi 6.7 U1	Server under test

Table 5: Virtual machines

VM name	OS	vCPU count	Memory size (GB)	Disk size (GB)	Server host/cluster
DC1	Windows Server 2016	2	8	C:\40	infra
SQL01	Windows Server 2016 R2	4	8	C:\40 D:\50	infra
vCenter	VMware vCenter® Server Virtual Appliance	8	24	Appliance determined	infra
Composer	Windows Server 2016 R2	8	16	C:\40 D:\50	infra
view	Windows Server 2016 R2	8	16	C:\40	infra
VP-harness	Virtual Appliance	8	8	64	infra
Win10	Windows 10 x 64	2	16	C:\50	SUT

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Deploying VMware vCenter Server 6.7

1. On a Windows server 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's username and password, and click Next.
10. To accept the certificate of the host you chose to connect to, click Yes.
11. Provide a name and password for the vCenter Appliance, and click Next.
12. Set an appropriate Appliance Size, and click Next.
13. Select the appropriate datastore, and click Next.
14. At the Configure Network Settings screen, configure the network settings as appropriate for your environment, and click Next.
15. Review your settings, and click Finish.
16. When the deployment completes, click Next.
17. At the Introduction screen, click Next
18. At the Appliance configuration screen, select the time synchronization mode and SSH access settings, click Next.
19. Select Create a new SSO domain.
20. Provide a password, and confirm it.
21. Provide an SSO Domain name and SSO Site name, and click Next.
22. At the CEIP screen, click Next.
23. At the Ready to complete screen, click Finish.
24. When installation completes, click Close.
25. Using the vSphere web client, log into the vCenter server using the credentials previously provided.

Creating a cluster in VMware vCenter

1. Log into the 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 vSAN as the name for the new cluster.
7. Click OK.

Configuring the vSAN cluster and adding hosts using Quickstart

1. In the Hosts and Clusters pane, select the newly created vSAN cluster.
2. Click the Configure tab, and 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, click the drop-down next to the adapters you wish to use for vSAN traffic, select DSwitch, and click Next.
   a. Leave the Distributed switches and Port groups options as default.
9. Enter the value of the VLAN you wish to use for vSAN.
10. If you wish, change IP type to static and type in IP addresses for the hosts. Otherwise, leave the IP type as DHCP, and 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

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Creating the Windows Server Master VM for template creation

1. In VMware vCenter, navigate to Virtual Machines.
2. To create a new VM, click the icon.
3. Leave Create a new virtual machine selected, and click Next.
4. Enter a name for the virtual machine, and click Next.
5. Place the VM on the desired host with available CPUs, and click Next.
6. Select the appropriate datastore to host the VM, and click Next.
7. Select the appropriate guest OS, and click Next.
8. In the Customize Hardware section, use the following settings:
   - Set the vCPU count to 8
   - Set the Memory to 16GB
   - Provision lazy zeroed
   - Attach the OS ISO to the CD/DVD drive
9. Click Next.
10. Click Finish.

Installing Windows Server 2016

1. Attach the Windows Server 2016 ISO to the virtual machine (VM).
2. Open the VM console, and start the VM.
3. When prompted to boot from DVD, press any key.
4. When the installation screen appears, leave language, time/currency format, and input method as default, and click Next.
5. Click Install Now.
6. When the installation prompts you, enter the product key.
7. Select Windows Server 2016 Datacenter Edition (Server with a GUI), and click Next.
8. Check I accept the license terms, and click Next.
9. Select Custom: Install Windows only (advanced).
10. Select Drive 0 Unallocated Space, and click Next. This starts Windows automatically, and Windows will restart automatically after completing.
11. When the Settings screen appears, fill in the Password and Reenter Password fields with the name password. Log in with the password you set up previously.
12. Install VMware Tools in the VMs hosted on the ESXi servers.
13. From Server Manager, disable Windows Firewall.
14. Run Windows Updates
15. Shutdown the VM
16. In vCenter, right click, select template -> convert to template

Installing Active Directory and DNS services on the DC1 VM

1. Log into the vSphere client as `administrator@vsphere.local`
2. On the infra server, deploy a Windows Server 2016 VM from the template using the appropriate specs in the above table, named DC1, and log in as an administrator.
3. Launch Server Manager.
4. On the Welcome screen, click Manage, and click 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.

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Configuring Active Directory and DNS services on DC1

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 section of Server Manager.
2. At the Configuration Options screen, 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 DC1

To ensure reliable time, we pointed our Active Directory server to a physical NTP server.

1. Open a command prompt.
2. Type the following:

```
W32tm /config /syncfromflags:manual /manualpeerlist:"<ip address of a NTP server>"
W32tm /config /reliable:yes
W32tm /config /update
W32tm /resync
Net stop w32time
Net start w32time
```

Setting up DHCP services on DC1

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 the installation is set up correctly, a screen displays saying that DHCP server install succeeded.
18. Click Close.

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Installing and configuring the SSL certificate in Microsoft Active Directory

Before configuring View Planner, you need to setup the Active Directory server as a certificate authority. To do this, follow the guide at
https://social.technet.microsoft.com/wiki/contents/articles/2980.ldap-over-ssl-ldaps-certificate.aspx

1. Log onto DC1 as `administrator@test.local`
2. Open server manager.
3. Select Manage, and click Add roles and features.
4. When the Add roles and features Wizard begins, click Next.
5. Select Role-based or feature-based installation, and click Next.
6. Select DC1.test.local, and click Next.
7. At the server rolls menu, select Active Directory Certificate Services, and click Next.
8. Leave server features as is, and click Next.
9. Select Certificate authority and certificate authority web interface, click Add features to add the IIS web server, and click Next.
10. Click Install, and close.
11. In server manager, click the yellow triangle titled Post-deployment configuration.
12. On the destination server, click Configure Active Directory certificate services.
13. Leave credentials as test\administrator, and click Next.
14. Select Certificate authority, click certificate authority web Enrollment, and click Next.
15. Select Enterprise CA, and click Next.
16. Select Root CA, and click Next.
17. Select Create a new private key, and click Next.
18. Select SHA256 with a 2048 Key length, and click Next.
19. Leave the names fields and defaults as is, and click Next.
20. Change expiration to 10 years, and click Next.
21. Leave Certificate database locations as default.
22. Click Next.
23. Click Configure.
24. Open a command prompt, and type ldp
25. Click Connection.
26. Type dc1`.test.local` for server.
27. Change the port to `636`
28. Check SSL, and click OK.

Configuring a secure LDAP on DC1.test.local

1. Open administrative tools, and click Certification authority
2. Click Test-DC1-CA➔ Certificate Templates
3. Right-click Manage.
4. Right-click Kerberos authentication, and select Duplicate template.
5. Click Request handling.
6. Check the box for Allow private key to be exported, and click OK.
7. Right-click the new template, and rename it `LDAPoverSSL`
8. Return to the Certificates console. In the right pane, right-click New➔Certificate Template to issue.
9. Select LDAPoverSSL, and click OK.

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Configuring AD GPOs for target VMs

To run the tests correctly, we created an OU-named target in the test.local domain. We then created assigned group policies objects for the following:

- Autologin as a domain admin user
- Disable windows updates
- Disable screen lock
- Disable firewall
- Accept defaults Windows media player
- Suppress Office first time user messages

You can change these settings individually on the gold Windows 10 VM, but we found it easier to make ad hoc changes by using GPOs. You will need the Office 2016 Administrative Template files (ADMX/ADML) and the Office Customization Tool for Microsoft Active Directory to configure these settings. The software is available at Microsoft.com.

Installing Microsoft SQL Server 2012 on SQL01

We used a SQL Server 2012 VM to host the VMware View Composer database.

1. Log onto the vSphere client as `administrator@vsphere.local`
2. On the infra server, deploy a Windows Server 2016 VM from template using the appropriate specs in the above table.
3. Name the VM you created SQL01.
4. Log in as an administrator.
5. Add the .NET Framework 3.5 feature to the server.
6. Mount the installation DVD for SQL Server 2012.
7. Click Run SETUP.EXE. If autoplay does not begin the installation, navigate to the SQL Server 2012 DVD, and double-click it.
8. In the left-hand pane, click Installation.
9. Click New SQL Server stand-alone installation or add features to an existing installation.
10. Select the Enter the product key radio button, enter the product key, and click Next.
11. Click the checkbox to accept the license terms, and click Next.
12. Click Use Microsoft update to check for updates, and click Next.
13. Click Install to install the setup support files.
14. If there no failures display, click Next.
15. At the Setup Role screen, choose SQL Server Feature Installation, and click Next.
16. At the Feature Selection screen, select Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tools Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete, and click Next.
17. At the Installation rules screen, after the check completes, click Next.
18. At the Instance configuration screen, leave the default selection of default instance, and click Next.
19. At the Server Configuration screen, choose NT Service\SQLSERVERAGENT for SQL Server Agent, select NT Service\MSSQLSERVER for SQL Server database engine, change the startup type to Automatic, and click Next.
20. At the Database engine configuration screen, select the authentication method you prefer. For our testing purposes, we selected Mixed Mode.
21. Enter and confirm a password for the system administrator account.
22. Click Add current user. This may take several seconds.
23. Click the Data directories tab to relocate the system, user, and temp db files.
24. Change the location of the root directory to the D:\volume.
25. Click Next.
26. At the Error and usage reporting screen, click Next.
27. At the Installation configuration rules screen, check that there are no failures or relevant warnings, and click Next.
28. At the Ready to install screen, click Install.
29. After installation completes, click Close.
30. Close the installation window.
31. Open SQL Server 2012 configuration manager, and expand Protocols for MSSQLSERVER.
32. Right-click Named Pipes, and choose Enabled.
33. Click OK, and restart the SQL service.
34. Add SQL server management studio v18.1.
35. Download and open SSMS-Setup-ENU.exe.
36. At the welcome screen, select the default install location, and click install.
37. Click Restart to complete the Microsoft SQL Management Studio setup.

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Setting up databases for VMware vCenter and VMware View® Composer™

1. Log onto SQL01 as TEST\administrator.
2. From the server desktop, open SQL Server configuration manager.
3. Click SQL Server network configuration→Protocols for MSSQLSERVER.
4. Right-click TCP/IP, and select Enabled.
5. Click SQL services, right-click SQL Server browser, and select Properties.
6. In the SQL Server browser properties, select the Services tab, change the Start mode to Automatic, and click OK. Repeat this step for the SQL Server agent service.
7. Start the SQL Server browser service and the SQL Server Agent service.
8. From the SQL Server desktop, open SQL Server management studio, and click Connect.
9. Select the Databases folder, right-click, and select New Database.
10. Provide the name vCenter for the new database.
11. Select the Databases folder, right-click, and select New Database.
12. Provide the name composer for the new database.
13. Click Options, change the recovery model from full to simple, and click OK.

Setting up a database and ODBC DSN for VMware View Composer

1. Deploy a Windows Server 2012 R2 VM, and name it `Composer`
2. Log onto the composer VM as `TEST\administrator`
3. From the desktop of the Composer server, click Start.
4. Select Run, and type `odbcad32.exe.`
5. Click Enter.
6. Click the system DSN tab.
7. Click Add.
8. Click SQL Server native client 10.0, and click Finish.
9. In the Create a new data source to SQL Server text box, type the connection name `composer`
10. For Server, select SQL, and click Next.
11. Change authentication to With SQL Server authentication using a login ID and password entered by the user.
12. Type `sa` as the Login ID, and use the password you defined in SQL Server setup for the SA account.
13. Click Next.
14. Select Change the default database to…
15. Choose Composer from the pull-down menu, and click Next.
16. Click Finish.
17. Click Test data source…
18. To create the Composer ODBC connection, click OK.

Setting up VMware Horizon® View Composer 7

1. On the infra server, deploy a Windows Server 2016 VM from template using the appropriate specs in the above table.
2. Name the VM `Composer`
3. Log in as an administrator.
4. Open the View 7 media folder, and run VMware-viewcomposer-7.9.0-13810618.exe.
5. At the Welcome screen, click Next.
6. At the Patents screen, click Next.
7. Accept the VMware end user license agreement, and click Next.
8. Leave the Destination folder as default, and click Next.
9. In the Database information box, type `composer` as the source name, `sa` as the user name, enter the password, and click Next.
10. Leave the default SOAP port, and click Next.
11. Click Install, and click Finish.
12. Restart the server.

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Installing VMware View Connection Server 7

1. On the infra server, deploy a Windows Server 2016 VM from template using the appropriate specs in the above table.
2. Name the VM `view`
3. Log in as an administrator.
4. Browse to VMware View installation media, and click VMware-viewconnectionserver-x86_64-7.9.0-13956742.exe.
5. Click Run.
6. At the Welcome screen, click Next.
7. Agree to the End User License Agreement, and click Next.
8. Keep the default installation directory, and click Next.
9. Select View Standard Server, and click Next.
10. At the Data Recovery screen, enter a backup password, and click Next.
11. Allow View Server to configure the Windows firewall automatically, and click Next.
12. Authorize the local administrator to administer View, and click Next.
13. Choose whether to participate in the customer experience improvement program, and click Next.
14. Complete the installation wizard to finish installing View Connection Server.
15. Click Finish.
16. Reboot server.

Configuring the VMware Horizon View Connection Server

1. Open a Web browser, and navigate to http://<view connection1 FQDN>/admin.
2. Log in as administrator.
3. Under Licensing, click Edit license…
4. Enter a valid license serial number, and click OK.
5. Open View Configuration→Servers.
6. In the vCenter Servers tab, click Add…
7. Enter vCenter server credentials, and edit the following settings:
    a. Max concurrent vCenter provisioning operations: 20
    b. Max concurrent power operations: 50
    c. Max concurrent View Composer maintenance operations: 20
    d. Max concurrent View Composer provisioning operations: 20
    e. Max concurrent Instant Clone Engine provisioning operations: 20
8. Click Next.
9. At the View Composer screen, select View Composer co-installed with vCenter Server, and click Next.
10. At the View Composer domains screen, click Add…
11. Enter full domain name and user credentials.
12. Do not use Reclaim VM disk space or Enable view storage accelerator.
13. At the ready to complete screen, click Finish.

Deploying the VMware View Planner 4.3 test harness

1. Download the viewplanner-harness-4.3.0.0-15336908_OVF10.ova file from VMware.
2. From the vCenter client, select the infra host, and right-click Deploy OVF Template…
3. In the deploy OVF Template wizard, select local file, and click Browse…
4. Select viewplanner-harness-4.3.0.0-15336908_OVF10.ova, click Open, and click Next.
5. Select a DataCenter, and click Next.
6. Select the Infra host, and click Next.
7. Review details, and click Next.
8. Accept the license agreements, and click Next.
9. Select the local DAS datastore, and click Next.
10. Select the priv-net network, and click Next.
11. Click Next, and click Finish to deploy the harness.
12. Power on the new VM, note the IP address.

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Configuring the VMware View Planner 4.3 test harness

1. Open a browser, and navigate to http://<ip address of the harness>/vp-ui/
2. Log in as follows:
    a. User name: `vmware`
    b. Password = `viewplanner`
3. Click Log in.
4. Click Servers
5. Select infra, and click Add new.
6. Enter the following information:
    a. Name = `vCenter`
    b. IP = `<ip of vcenter>`
    c. Type = `vcenter`
    d. DataCenter = `DataCenter`
    e. Domain = `vsphere.local`
    f. Username = `administrator`
    g. Password = `<SSO password for vcenter >`
7. Click Save.
8. Click Identity server.
9. Click Add new.
10. Enter the following information:
    a. Name = `test.local`
    b. IP = `<IP of DC1>`
    c. Type = `microsoft_ad`
    d. Username = `administrator`
    e. Password = `<password for administrator@test.local>`
11. Click Save.

Deploying the Windows 10 Enterprise (x64) gold image 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. Select Custom, and click Next.
5. Assign the name `View-gold`, and click Next.
6. Select the appropriate SUT cluster, and click Next.
7. Select the local DAS.
8. Select Virtual Machine Version 14, and click Next.
9. Select Windows, choose Microsoft Windows 10 (64-bit), and click Next.
10. For CPUs, select one virtual processor socket and two cores per virtual socket, and click Next.
11. Choose 16 GB RAM, and click Next.
12. Click 1 for the number of NICs.
13. Select E1000E.
14. Select Priv-net, and click Next.
15. Leave the default virtual storage controller, and click Next.
16. Select Create a new virtual disk, and click Next.
17. Make the OS virtual disk size 50 GB.
18. Select Thin Provision.
19. Specify the OS datastore on the external storage, and click Next.
20. Keep the default virtual device node (0:0), and click Next.
21. Click Finish.
22. Click the Hardware tab.
23. Click CD/DVD Drive.
24. Select Connect the VM virtual CD-ROM to the Microsoft Windows 10 x64 installation disk.
25. Click OK.
26. Open the Microsoft Windows 10 .vmx file, and add the following text to the end:

    `monitor_control.pseudo_perfctr = "1"`

27. Power on the Microsoft Windows 10 VM.

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Installing Windows 10 Enterprise (x64) on the ESXi base 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. Enter no password, and 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.
16. Install Microsoft Office Professional Plus 2016.

Installing the VMware Horizon View agent

1. Navigate to the VMware Horizon View 6 media, and run the VMware-viewagent file.
2. Click Run.
3. At the Welcome screen, click Next.
4. Accept the VMware end user license agreement, and click Next.
5. Select defaults, and click Next.
6. Click Install.

Installing Google Chrome™ version 75.0.3770.80

Please note that View Planner 4.3 requires specific versions of Chrome. ver 75.0.3770.80 was specified in the view planner release notes

1. Download the offline 75.0.3770.80_chrome_installer.exe.
2. Double-click the 75.0.3770.80_chrome_installer.exe file, click run.
3. Close Chrome.

Installing Adobe® Reader®

1. Download and install Adobe Reader from http://acrobat.adobe.com. Do not install any McAfee add-ons.

Installing VMware View Planner agent

1. Double-click viewplanner-agent-4.1.0.0-13984256.exe.
2. Click Next.
3. Accept the End user license agreement.
4. Click Next.
5. Enter the IP address of the view planner harness, and click Next.
6. Wait for the installer to complete, and click Finish.
7. Reboot the VM.

Configuring Regedit for QuickPrep

1. Click Start→Run, and type `regedit`
2. Browse to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\vmware-viewcomposer-ga.
3. Right-click Skip License Activation, and click Modify…
4. Change the value from 0 to 1.

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Optimizing the Windows 10 master image

1. Download the Windows optimization tool from VMware.
2. Extract the zip file, and run VMwareOSOptimizationTool_b1084.exe.
3. Click Template, and select VMWare\Windows 10.
4. Click Analyze.
5. Select all suggestions, and click Optimize.
6. When settings finish applying, reboot the VM.

Finalizing the Windows 10 master image

1. In vCenter, shut down the Windows 10 gold image, and copy it to the other two servers under test.
2. For all three gold images, right-click, and select Take a snapshot.
3. Name each snapshot, and click OK.

Deploying virtual desktops using VMware Horizon View

1. Open View Administrator.
2. Log in as an administrator.
3. Under Inventory, click Pools, and click Add…
4. Select Automatic Pool, and click Next.
5. Select Dedicated.
6. Select Enable automatic assignment, and click Next.
7. Select View Composer linked clones.
8. Select the vCenter and composer, and click Next.
9. Type pool for the pool ID and display name, and click Next.
10. Leave the pool settings as defaults, and click Next.
11. Under Naming Pattern, enter an appropriate name pattern for the pool. Note this for the view planner testing settings in the next section.
12. Under Pool Sizing, type the max number of desktops and the number of spare (power on) desktops.
13. Select Provision all desktops up-front, and click Next.
14. Select the defaults under View Composer Disks, and click Next.
15. Under Storage Optimization, click Next.
16. Under vCenter Settings, select the following depending on where you are deploying virtual machines:
    a. Parent VM
    b. Snapshot
    c. VM folder location
    d. Host or cluster
    e. Resource pool
    f. Data stores (Local DAS)
17. Under Guest customization, select the following:
    a. Domain: test.local
    b. AD container: OU=targets
    c. Use Quick Prep
18. Click Next.
19. Click Finish. (Note: Because this testing is local, you do not need to specify any entitlements.)

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Running the VMware View Planner benchmark

View Planner scripts VDI users to make URL requests to public websites, rather than creating a dedicated web server and accessing these URLs locally. The nature of testing is repetitive and also at scale, and we inadvertently created an unusually high volume of page requests to several websites. One of the websites that is typically included in the benchmark blacklisted our clients' IP and was therefore inaccessible throughout testing. We discussed this error with a team at VMware and they agreed that this error should not invalidate our testing. However, this means that our results are also not directly comparable to other published View Planner results. In addition, because some pages would not open correctly we estimate that memory usage for VMs was slightly lower and the total number of desktops supported could be slightly higher than it would be otherwise had that site been included.

Although View Planner has a user interface, we ran our testing via the command line using the following steps:

1. Open a putty session and log in as root to the View Planner harness.
2. Log into the View Planner command line tool as follows: `vpcmd -u vmware -p viewplanner`
3. Run the following commands to create then run a work profile (for 160 users):

    ```
    runProfile -a c3-160vdt --runMode local --VMcount 160 --iterCount 5 --thinkTime 15 --description
    160vdt_HiMEM

    workGroup -a  c3-160vdt --runProfile c3-160vdt --workProfile highMemoryTestProfile --percent 100

    workGroup --addDesk  c3-160vdt --runProfile c3-160vdt --prefix c3 --infraServer vCenter

    run --start c3-160vdt --instance <unique name>

    run -status
    ```

4. Run the following commands to create and run a work profile (for 200 users):

    ```
    runProfile -a c3-200vdt --runMode local --VMcount 200--iterCount 5 --thinkTime 15 --description
    200vdt_HiMEM

    workGroup -a  c3-200vdt --runProfile c3-200vdt --workProfile highMemoryTestProfile --percent 100

    workGroup --addDesk  c3-200vdt --runProfile c200 --prefix c3 --infraServer vCenter

    run --start c3-200vdt --instance <unique name>

    run -status
    ```

5. Run the following commands to create and run a work profile (for 300 users):

    ```
    runProfile -a c3-300vdt --runMode local --VMcount 300--iterCount 5 --thinkTime 15 --description
    300vdt_HiMEM

    workGroup -a  c3-300vdt --runProfile c3-300vdt --workProfile highMemoryTestProfile --percent 100

    workGroup --addDesk  c3-200vdt --runProfile c3-3000vdt --prefix c3 --infraServer vCenter

    run --start c3-300vdt --instance <unique name>

    run -status
    ```

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

This project was commissioned by VMware.

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