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VMware Horizon View on Hitachi Unified Compute Platform HC Virtual Desktop Performance Comparisons

Tech Note

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Revision History

Revision	Changes	Date
MK-SL-101-00	Initial release	August 28, 2018

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Tech Note

This tech note demonstrates the use of VMware Horizon View on Hitachi Unified Compute Platform HC Virtual Desktop performance comparisons. The solution focuses on preparing the VDI environment on Hitachi Unified Compute Platform HC using VMware vSAN.

Many businesses are constrained by legacy IT infrastructure that is not well suited for VDI initiatives. Siloed data centers, composed of independent compute, storage, and networks with distinct administrative interfaces are inherently inefficient, cumbersome, and costly.

Each platform requires support, maintenance, licensing, power, and cooling—not to mention a set of dedicated resources capable of administrating and maintaining these elements. Rolling out a new application such as VDI becomes a manually intensive, time-consuming proposition involving a number of different technology platforms, management interfaces, and operations teams.

Expanding system capacity can take days or even weeks and require complex provisioning and administration. Troubleshooting problems and performing routine data backup, replication, and recovery tasks can be just as inefficient.

While grappling with this complexity, organizations also need to address challenges that are unique to VDI, including the following:

1. Difficulty sizing VDI workloads upfront, due to the randomness and unpredictability of user behavior.
2. Periodic spikes in demand, such as login storms and boot storms, that may significantly degrade performance if not properly handled.
3. High cost of downtime in the event of an outage.

Hitachi Unified Compute Platform HC addresses each of these challenges by providing a scalable, building block style approach to deploying infrastructure for VDI, offering the enterprise predictable cost, and delivering a high-performing desktop experience to end users.

For this Solution, VDI Performance has been captured for Knowledge Users.

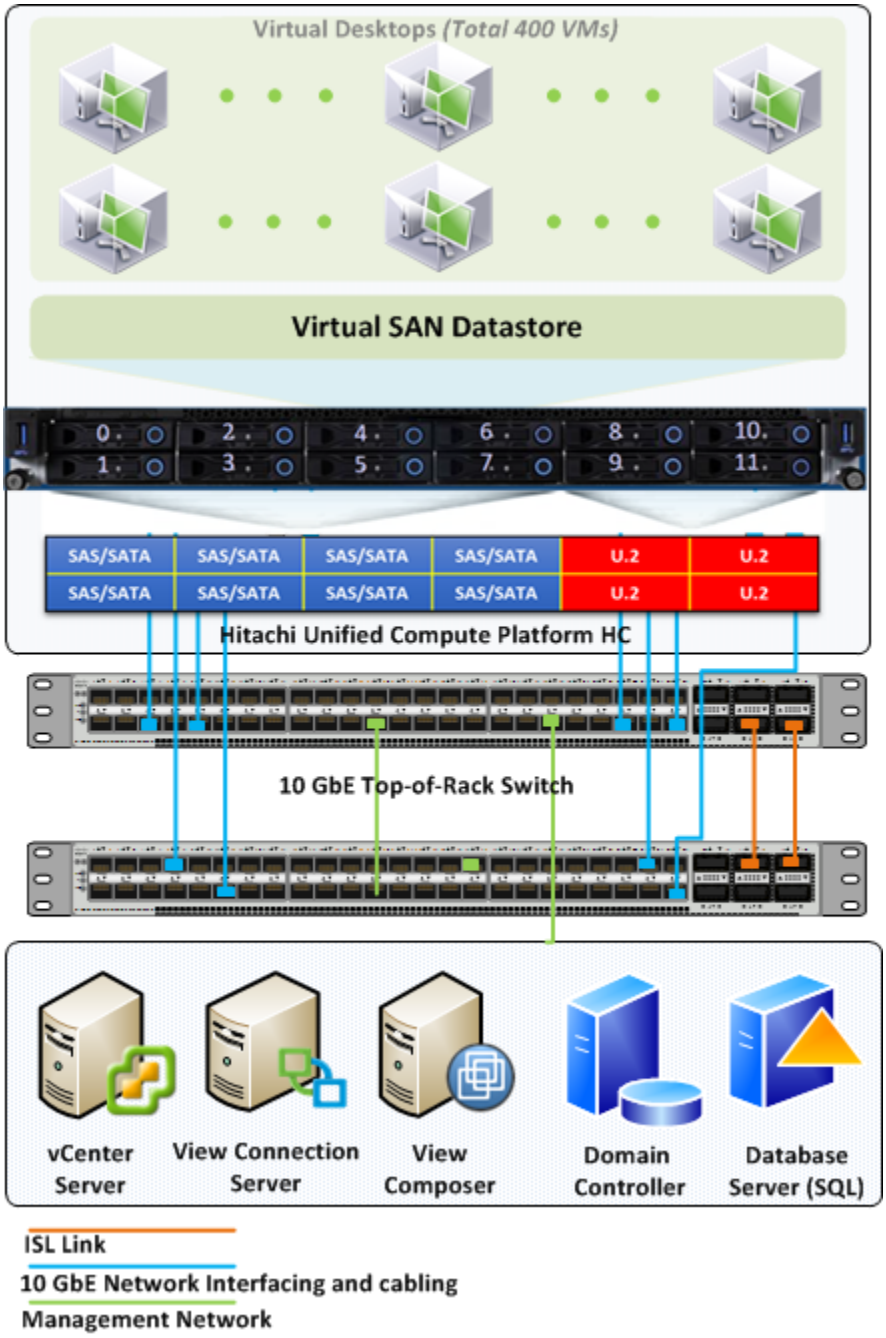
The workloads used for this solution are based on the LoginVSI Knowledge workload test. Please refer to Figure 1 for a VDI Infrastructure overview.

Note — Testing of this configuration was done in a lab environment. Many factors affect production environments beyond prediction or duplication in a lab environment. Follow the recommended practice of conducting proof-of-concept testing for acceptable results in a non-production, isolated, test environment that matches your production environment before your production implementation of this solution.

VDI Infrastructure Overview

Figure 1 shows the VMware Horizon View on Hitachi Unified Compute Platform HC infrastructure for this tech note.

Figure 1



Test Environment Configuration

Key Hardware Components

Table 1 lists the key hardware components used for this testing.

TABLE 1. HARDWARE COMPONENTS

Hardware component	Hardware	Description	Version	Quantity
Hitachi Unified Compute Platform HC	Advanced Server DS120	■ 4 node cluster with Esxi 6.5 u1 ■ DS120 Server (per host) ■ Intel Xeon Gold 6140 CPU (18C, 2.3GHz, 135W) ■ Memory: 256 GB DDR4 2666Mhz (per host) ■ 2 × 10GbE NIC ports SFP 28 Mellanox MT27630 [ConnectX-4LX] ■ 1GbE Base-T RJ45 port for remote (out-of-band) management ■ 1 × Intel SSD DC P3600 Series NVMe (1.6TB, 2.5”, U.2), for cache ■ 2 fully redundant power supplies ■ 3 × Intel SSD DC S4500 Series (1.92 TB, 2.5”), for capacity ■ Fault-tolerant Virtual SAN datastore	BIOS Version: 3A08.H2 BMC: 3.16.06	1
Cisco	Top-of-Rack 10GbE switch	■ Cisco Nexus 93180YC-EX NX-OS Version	Firmware: 7.0(3)I4(6)	2

Hitachi Unified Compute Platform HC

Combining compute, storage, and virtualization into a hyperconverged infrastructure, Hitachi Unified Compute Platform HC (UCP HC) answers challenges of growing demands of faster delivery of business services while facing rising costs managing disparate technology resources. Using VMware Virtual SAN with software from Hitachi Vantara, this software-defined storage extends the agility and simplicity of the Hitachi Unified Compute Platform family.

Hitachi Unified Compute Platform HC provides a comprehensive dashboard to view virtual machines. There are health monitors for CPU, memory, storage, and virtual machine usage for the all clusters, including individual appliances and individual nodes.

You need minimal IT experience to deploy, configure, and manage the Unified Compute Platform HC appliance. Leveraging VMware's core products, your administrators can apply existing VMware knowledge, best practices, and processes.

Unified Compute Platform HC provides the following for your infrastructure:

- Entry-level converged infrastructure solution.
- Flexible, customizable with the ability to grow.
- Pretested, preconfigured, and prebuilt to meet your converged infrastructure needs.

Key Software Components

Table 2 describes the key software components used for testing.

TABLE 2. SOFTWARE COMPONENTS

Software	Version	Function
VMware vCenter server	6.5. U1, Build 5973321	Management console
VMware ESXi	6.5. U1, Build 7388607	Operating system
VMware vSphere Web Client	6.5. U1, Build 5973321	Management console
Microsoft Windows Server 2012	Datacenter, R2	Operating system
Microsoft SQL Server	2012 SP1	Database server
Microsoft Windows 10	Enterprise Edition, SP1	Operating system
VMware Horizon View	VMware Horizon View 7.4, GA	Management console
VMware Horizon Client	4.7.0, Build Version	Management console
LoginVSI	4.1.32.1	Benchmarking tool

Unified Compute Platform HC

Unified Compute Platform

UCP HC is integrated compute, storage, virtualization and high availability in a simple, scalable, easy-to-manage hyperconverged infrastructure powered by VMware vSphere and Virtual SAN (VSAN).

VMware Horizon

VMware Horizon transforms static desktops into secure, virtual workspaces that can be delivered on demand. Provision virtual or remote desktops and applications through a single VDI platform to streamline management and easily entitle end users.

LoginVSI

Login VSI successfully predicts, validates, and manages the performance of virtualized desktop environments.

Login VSI makes it easy to load test, benchmark, and plan capacity to improve end user experience and productivity for even the most complex virtualized desktop environments. Login VSI tests performance using virtual users, so your real users benefit from consistently great performance.

With Login VSI, you can gain performance insights that enable you to:

- Predict the performance impact of necessary updates and upgrades
- Know the maximum user capacity of your current infrastructure
- Understand the end users' perspective on performance

VMware Virtual SAN 6.6.1 (vSAN)

vSAN is the industry-leading software that powers hyperconverged Infrastructure solutions.

VMware hyperconverged software combines compute, networking, storage, and management resources into a hyperconverged infrastructure appliance to create a simple, easy to deploy, all-in-one solution.

Cisco

Cisco Nexus 9000 Series are designed to tune datacenter networks into modern, automated environments that deliver exceptional application performance and effective IT operations. Cisco Nexus 9000 Series Switches provide the foundation for the Cisco Application Centric Infrastructure (ACI) and deliver savings in capital expenditures (CapEx) and operating expenses (OpEx) to achieve an agile IT environment. As you plan your Cisco ACI implementation, Cisco Nexus 9000 Series Switches can be deployed in standalone mode.

Hitachi Unified Compute Platform HC Test Environment

The compute nodes on Hitachi Unified Compute Platform HC were configured as follows:

- **Hitachi Unified Compute Platform HC Cluster —** The test environment used all four VMware ESXi 6.5 u1 nodes (Hitachi UCP HC DS 120) for creating the Horizon View VDI environment by using a VMware vSAN automated node with a vSAN datastore size of 27 TB.
- **VMware Horizon View VMs** — View Connection Server, View Administrator, View Client, View Agent VMs are installed and configured.
- **LoginVSI with Knowledge Workload Profile** — The LoginVSI benchmarking tool with a Knowledge Worker workload profile was configured and used for this test environment.
- **Windows 10 Golden Image** — Windows 10 golden image with 2 GB vRAM, 2 vCPU, 1 vNIC, 42 HDDs was used for preparing Instant clone, Linked clone virtual desktops.
- **APP VOLUMES 2.11** - A Single Application stack was configured with a Windows 10 Parent image to assign the application stack to each clone virtual desktop by using the VMware APP VOLUME solution.
- **Window Server 2016 for RDSH** — Windows Server 2016 as a golden image with 2 GB vRAM, 2 vCPU, 1 vNIC, 42 HDDs was used for preparing Windows Servers 2016 remote desktop sessions (RDS) by using instant clone features

Test Methodology

The series of tests that were run for this tech note were designed to capture the performance capabilities of Hitachi Unified Compute Platform HC for Windows 10 VDI users and Windows Server 2016 remote desktop sessions (RDS). Test results are captured for below five scenarios with 400 virtual desktops each.

- **Test scenario 1 - Instant Clone with single APP stack - Dedup and Compression "OFF"**
- **Test scenario 2 - Linked Clone with Dedup and compression "ON"**
- **Test scenario 3 - Full Clone with Dedup and compression "OFF"**
- **Test scenario 4 - Full Clone with Dedup and compression "ON"**
- **Test scenario 5 - RDSH with Dedup and compression "ON"**

Test Virtual Machine Configuration and Workload

The following parent virtual machine configurations were used to perform the tests.

Windows 10 VDI Golden Image

- 2 vCPU
- 2 GB vRAM
- 1 vNIC
- 40 GB OS VMDK Thick
- RAID 5 with FTT=1 with vSAN datastore

Microsoft Server 2016 (RDSH) Golden Image

- 2 vCPU
- 2GB vRAM
- 1 vNIC
- 40 GB OS VMDK Thick
- RAID 5 with FTT=1 with vSAN datastore

Cloning Technology

A clone is a copy of a master virtual machine with a unique identity of its own, including a MAC address, UUID, and other system information. Instant clones represent the newest generation of cloning technology, after full clones and View Composer linked clones. The following cloning technology was used in this tech note.

- Instant clone with APPSTACK
- View composer Linked clone
- Full Clone
- Remote Desktop Host Session (RDSH)

Test Results

Test Scenario 1 - Instant Clone with Single APP Stack - Dedup and Compression "OFF"

TABLE 3. INSTANT CLONE WITH SINGLE APP STACK [DEDUP COMPRESS ''OFF''] - 400 DESKTOPS

Windows 10 Knowledge Worker Desktops	Time in Seconds to Complete	vSAN Datastore Utilization on First Run	vSAN Datastore Utilization on Nth Run (2nd Run)	CPU Utilization	RAM Utilization (4 Node Cluster)	vSAN Utilization (Replicas, Parent VMs)
Boot Storm	3 Min 20 Sec	3.55 TB	3.55 TB	81%	798 GB	252 GB
Login Storm	48 Min	3.60 TB	3.60 TB	92.66%	843 GB	252 GB
Steady State	20 Min	3.60 TB	3.60 TB	75.87%	720 GB	252 GB
Recompose	7 Min 10 sec	3.67 TB	3.67 TB	79.87%	740 GB	253 GB

**Floating desktop pool*

The Table 3 results show that instant clone vSAN storage utilization was 3.55 TB for 400 Virtual desktops and the boot storm took 3 minutes and 20 seconds, which is less than the linked clone desktop boot storm. For this test the Login storm and steady state time is kept same for both instant and Linked clone. The recompose time is 7 minutes and 10 seconds which is faster compared to linked, full, and RDSH desktops.

CPU and RAM utilization for instant clone during all cases under knowledge workload was moderate. The maximum CPU utilization was 92.66% and RAM usage was 843 GB during Login storm.

Test Scenario 2 - Linked Clone with Dedup and Compression "ON"

TABLE 4. LINKED CLONE WITH DEDUP COMPRESSION - 400 DESKTOPS

Windows 10 Knowledge Worker Desktops	Time in Seconds to Complete	vSAN Datastore Utilization on First Run	vSAN Datastore Utilization on Nth Run (2nd Run)	CPU Utilization	RAM Utilization (4 Node Cluster)	vSAN Utilization (Replicas, Parent VMs)
Boot Storm	5 Min 20 Sec	3.60 TB	3.60 TB	81%	802 GB	42 GB
Login Storm	48 Min	3.62 TB	3.62 TB	92.66%	920 GB	42 GB
Steady State	20 Min	3.62 TB	3.62 TB	75.87%	832 GB	42 GB
Recompose	12 Min 10 Sec	3.65 TB	3.65 TB	79.87%	870 GB	42 GB

**Floating desktop pool*

Linked clones allow you to provision multiple virtual machines that share a single baseline image, saving storage space and accelerating provisioning (Good for non-persistent desktops).

This test scenario shows that the linked clone takes more time to boot and become available compared to instant, full and RDSH in view administrator. vSAN datastore usage was 3.65 TB for 400 desktops. Linked clone also took more time to recompose the parent virtual machine with an upgrade patch. Please refer to Table 4 on page 7.

CPU usage for 400 linked clone desktops was moderate. Maximum CPU utilization was 92.66% which is “Good”. RAM utilization reached a maximum peak value of 920 GB when all 400 users were logged in during login storm.

Test Scenario 3 - Full Clone with Dedup and Compression “OFF”

A full clone is an independent copy of a virtual machine (VM). It shares nothing with its master VM, and it operates entirely separately from the master VM used to create it.

TABLE 5. FULL CLONE WITH DEDUP COMPRESSION “OFF” - 400 DESKTOPS

Windows 10 Knowledge Worker Desktops	Time in Seconds to Complete	vSAN Datastore Utilization on First Run	vSAN Datastore Utilization on Nth Run (2nd Run)	CPU Utilization	RAM Utilization (4 Node Cluster)	vSAN Utilization
Boot Storm	4 Min 4 Sec	14.41 TB	14.41 TB	72%	852 GB	NA
Login Storm	48 Min	14.49 TB	14.49 TB	76.01%	965 GB	NA
Steady State	20 Min	14.49 TB	14.49 TB	73.12%	820 GB	NA
Recompose	14 Min 10 sec	14.80 TB	14.80 TB	79.56%	847 GB	NA

**Dedicated desktop pool*

Full clone without dedup and compression utilized a lot of space on the vSAN datastore. It utilized 14.49 TB out of 21 TB. However, CPU and RAM utilization were moderate. Please refer to Table 5.

Test Scenario 4 - Full Clone with Dedup and Compression “ON”

TABLE 6. FULL CLONE WITH DEDUP COMPRESSION “ON” - 400 DESKTOPS

Windows 10 Knowledge Worker Desktops	**Time in Seconds to Complete**	**vSAN Datastore Utilization on First Run**	**vSAN Datastore Utilization on Nth Run (2nd Run)**	**CPU Utilization**	**RAM Utilization (4 Node Cluster)**	**vSAN Utilization**
Boot Storm	4 Min 4 Sec	3.63TB	3.63TB	72%	776 GB	NA
Login Storm	48 Min	3.63TB	3.63TB	72.29%	820 GB	NA
Steady State	20 Min	3.63TB	3.63TB	73.12%	770 GB	NA
Recompose	14 Min 10 sec	3.65TB	3.65TB	79.56%	760 GB	NA

To get better performance with full clone in this test scenario, we deployed full clone dedicated virtual desktops with dedup and compression "ON" for vSAN datastore. Please refer to Table 6.

vSAN uses the LZ4 compression mechanism. The compression algorithm is applied after deduplication has occurred and just before the data is written to the capacity tier. In this test scenario vSAN utilization was 3.63 TB, which is very little compared to dedup and compression being “OFF” in test scenario 4. The dedup and compression ratio achieved in this case is 3.94x and space saving was 10.65 TB which is nearly 50% savings.

Test Scenario 5 - RDSH with Dedup and Compression “ON”

TABLE 7. FULL CLONE WITH DEDUP COMPRESSION “ON” - 400 DESKTOPS

Windows 10 Knowledge Worker Desktops	Time in Seconds to Complete	vSAN Datastore Utilization on First Run	vSAN Datastore Utilization on Nth Run (2nd Run)	CPU Utilization	RAM Utilization (4 Node Cluster)	vSAN Utilization (Replicas, Parent VMs)
Boot Storm	4 Min	3.55 TB	3.55 TB	81%	864 GB	252 GB
Login Storm	48 Min	3.60 TB	3.60 TB	92.66%	912 GB	252 GB
Steady State	20 Min	3.60 TB	3.60 TB	75.87%	847 GB	252 GB
Recompose	8 Min 10 Sec	3.67 TB	3.67 TB	79.87%	858 GB	253 GB

** Instant cloned RDS*

In this test scenario RDS Server 2016 with instant clone feature was deployed and vSAN storage utilization was moderate (3.60 TB); however, the recompose time for the upgrade patch was 8 minutes and 10 seconds which is more compared to Windows 10 virtual desktops with a similar configuration. Boot storm time was 4 minutes, which is better than Linked clone and higher than Instant clone Window 10 virtual desktops. Please refer to Table 7.CPU and Memory utilization for RDS server 2016 was moderate and behavior was similar to other virtual desktops utilization.

Please refer to Table 8 on page 10 for VMware vSAN storage utilization details for all five test scenarios. This information will help you plan the vSAN datastore capacity depending upon the desktop pool type for the datacenter.

VMware vSAN Storage Utilization for all Test Scenarios

TABLE 8. VMWARE VSAN STORAGE UTILIZATION FOR ALL FIVE TEST SCENARIOS

Storage Utilization	Instant Clones with 1 App stack	Full Clones	Linked Clones	RDSH
Datastore Used and Free Capacity (for each of the various roles — Replica, Linked Clones, Golden Image, AppVolumes components)	4 Parent Images occupied 65.02 MB each 1 replica = 36.36 GB 1 template = 1.55 GB	NA	1 replica = 36.36 GB	4 Parent Images = 65.02 MB each 1 replica = 36.36 GB 1 template = 1.55 GB
Dedupe Ratio and savings (again, for each of the various roles)	Dedup Compression OFF	3.94	4.12	4.32
Replica size (initial after Gold Image refresh)	1 replica = 37.54 GB	NA	1 replica = 33.54 GB	1 replica = 37.64 GB
Replica size (steady state)	1 replica = 37.54 GB	NA	1 replica = 34.54 GB	1 replica = 37.88 GB
Linked Clone Size (Initial Prior to Power On)	NA	NA	32 GB	RDSH Deployed as Instant Clone Automated Pool
Linked Clone Size (Steady State)	NA	NA	32.67 GB	RDSH Deployed as Instant Clone Automated Pool
AppVolumes Components (AppStack Volumes, Writable Volumes, AppStack Template) Sizes, Initial and Steady State	20 GB VMDK attached to each IC desktop	NA	NA	NA

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