VMmark® 3.1 Results

Server Vendor & Model: Hitachi Unified Compute Platform HC V124N **Storage Vendor & Model: VMware vSAN – All Flash** **Hypervisor: VMware ESXi 6.7.0 EP 05 Build 10764712** **Datacenter Management Software: VMware vCenter Server 6.7.0 U1 Build 10244857**	**VMmark 3.1 Score =** **9.00 @ 9 Tiles**

Number of Hosts: 4	Uniform Hosts [yes/no]: yes	Total sockets/cores/threads in test: 8/224/448

Tested By: Hitachi Vantara	Test Date: 06-20-2019

Performance Section Performance	Configuration Section Configuration	Notes Section Notes for Workload

Performance

	weathervane			weathervaneE			dvdstoreA			dvdstoreB			dvdstoreC			
TILE_0	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3579.70	0.99	0.41 | 0.09	567.66	0.99	0.55 | 0.08	967.05	1.32	763.94	680.90	1.36	878.77	472.85	1.36	1003.35	1.19
p1	3567.64	0.99	0.46 | 0.00	565.08	0.99	0.58 | 0.14	946.02	1.29	811.12	689.30	1.38	944.03	508.40	1.47	1056.15	1.21
p2	3564.67	0.99	0.47 | 0.09	565.41	0.99	0.45 | 0.07	957.90	1.30	777.25	681.83	1.36	885.86	473.38	1.36	997.49	1.19
TILE_1	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3584.50	1.00	0.41 | 0.00	563.93	0.99	0.41 | 0.06	927.50	1.26	880.07	674.05	1.35	1019.46	468.62	1.35	1164.33	1.18
p1	3569.51	0.99	0.41 | 0.00	566.78	0.99	0.45 | 0.11	933.73	1.27	864.16	645.62	1.29	1034.89	472.55	1.36	1157.12	1.17
p2	3559.79	0.99	0.39 | 0.00	561.20	0.98	0.44 | 0.07	900.60	1.23	981.26	622.35	1.24	1144.43	429.23	1.24	1302.58	1.13
TILE_2	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3584.66	1.00	0.50 | 0.00	567.08	0.99	0.65 | 0.18	962.33	1.31	771.84	705.90	1.41	872.24	521.30	1.50	982.76	1.22
p1	3567.95	0.99	0.48 | 0.00	561.89	0.98	0.44 | 0.05	972.67	1.32	743.05	686.08	1.37	870.81	477.62	1.38	986.43	1.19
p2	3547.79	0.99	0.74 | 0.35	558.39	0.98	0.57 | 0.10	956.95	1.30	772.95	707.05	1.41	879.35	496.43	1.43	997.80	1.20
TILE_3	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3571.59	0.99	0.37 | 0.07	565.27	0.99	0.43 | 0.04	942.83	1.28	843.42	655.98	1.31	992.01	474.48	1.37	1119.72	1.18
p1	3555.70	0.99	0.39 | 0.02	564.63	0.99	0.39 | 0.08	937.20	1.28	844.97	653.85	1.31	1004.46	450.55	1.30	1142.20	1.16
p2	3544.35	0.99	0.37 | 0.05	559.14	0.98	0.42 | 0.04	937.33	1.28	842.01	680.35	1.36	982.61	497.02	1.43	1115.92	1.19
TILE_4	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3584.45	1.00	0.44 | 0.00	560.10	0.98	0.43 | 0.08	986.70	1.34	719.88	695.98	1.39	835.28	482.45	1.39	970.42	1.20
p1	3570.26	0.99	0.42 | 0.00	557.71	0.97	0.49 | 0.06	973.02	1.33	754.24	714.60	1.43	860.17	502.85	1.45	989.09	1.22
p2	3556.35	0.99	0.41 | 0.03	554.93	0.97	0.47 | 0.09	971.02	1.32	758.67	685.25	1.37	881.37	497.80	1.44	996.81	1.20
TILE_5	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM

	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3572.75	0.99	0.35 | 0.00	569.43	1.00	0.58 | 0.17	934.70	1.27	867.40	654.60	1.31	1010.38	450.77	1.30	1149.80	1.16
p1	3572.04	0.99	0.33 | 0.00	566.67	0.99	0.43 | 0.14	939.40	1.28	838.33	683.08	1.36	960.21	503.07	1.45	1076.15	1.20
p2	3562.90	0.99	0.51 | 0.10	559.88	0.98	0.46 | 0.06	940.17	1.28	835.00	658.85	1.32	984.87	459.60	1.33	1111.36	1.17
TILE_6	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3566.61	0.99	0.63 | 0.23	565.86	0.99	0.44 | 0.03	960.48	1.31	766.87	681.48	1.36	871.74	495.75	1.43	997.70	1.20
p1	3565.52	0.99	0.41 | 0.00	563.34	0.98	0.39 | 0.01	955.02	1.30	777.09	679.20	1.36	889.90	492.43	1.42	1006.17	1.20
p2	3552.68	0.99	0.46 | 0.09	560.36	0.98	0.47 | 0.03	957.45	1.30	770.22	676.33	1.35	904.60	471.35	1.36	1008.86	1.18
TILE_7	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3585.38	1.00	0.44 | 0.00	571.91	1.00	0.68 | 0.15	903.02	1.23	945.19	669.80	1.34	1100.65	474.65	1.37	1234.51	1.18
p1	3564.19	0.99	0.32 | 0.11	569.01	0.99	0.61 | 0.15	924.67	1.26	873.24	621.33	1.24	1041.81	442.45	1.28	1194.21	1.14
p2	3546.35	0.99	0.57 | 0.25	562.32	0.98	0.44 | 0.09	921.02	1.25	910.54	663.77	1.33	1045.40	461.57	1.33	1200.84	1.16
TILE_8	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(nRT|MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3579.94	0.99	0.38 | 0.00	569.35	1.00	0.70 | 0.27	955.75	1.30	788.22	690.38	1.38	924.73	488.30	1.41	1028.83	1.20
p1	3570.68	0.99	0.42 | 0.17	566.63	0.99	0.51 | 0.09	970.25	1.32	747.60	659.98	1.32	856.91	480.57	1.39	980.31	1.19
p2	3562.80	0.99	0.41 | 0.08	562.84	0.98	0.46 | 0.06	959.33	1.31	770.78	704.40	1.41	884.23	518.90	1.50	989.37	1.22

p0_score:	10.72
p1_score:	10.68
p2_score:	10.65

Infrastructure_Operations_Scores:	vMotion	SVMotion	XVMotion	Deploy
Completed_Ops_PerHour	56.00	46.00	38.00	19.00
Avg_Seconds_To_Complete	7.58	107.10	133.31	319.53
Failures	0.00	0.00	0.00	0.00
Ratio	2.15	2.56	2.11	2.38
Number_Of_Threads	2	2	2	2

Summary	Run_Is_Compliant		Turbo_Setting:0
	Number_Of_Compliance_Issues(0)*		Median_Phase(p1)
Unreviewed_VMmark3_Applications_Score	10.68		
Unreviewed_VMmark3_Infrastructure_Score	2.29		
Unreviewed_VMmark3_Score	9.00		

Configuration

Virtualization Software

Hypervisor Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware ESXi 6.7.0 EP 05 Build 10764712 / 11-09-2018
Datacenter Management Software Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware vCenter Server 6.7.0 U1 Build 10244857 / 10-16-2018
Supplemental Software	None
Servers	
Number of Servers in System Under Test (all subsequent fields in this section are per server)	4
Server Manufacturer and Model	Hitachi Advanced Server DS120
Processor Vendor and Model	Intel(R) Xeon(R) Platinum 8276L
Processor Speed (GHz) / Turbo Boost Speed (GHz)	2.2 / 4.0
Total Sockets/Total Cores/Total Threads	2 Sockets / 56 Cores / 112 Threads
Primary CPU Cache	32 KiB I + 32 KiB D on chip per core
Secondary CPU Cache	1 MB I+D on chip per core
Other CPU Cache	38.5 MB I+D on chip per chip
BIOS Version	S5BH3B14.T00
Memory Size (in GB, Number of DIMMs)	384,12
Memory Type and Speed	32GB 2Rx4 DDR4 2666MHz RDIMM
Disk Subsystem Type	VMware vSAN, FC SAN
Number of Disk Controllers	N/A
Disk Controller Vendors and Models	N/A
Total Number of Physical Disks for Hypervisor	1
Disk Vendors, Models, Capacities, and Speeds	Innodisk,32G SLC SATADOM
Number of Host Bus Adapters	1
Host Bus Adapter Vendors and Models	Emulex LightPulse LPe31002-M6 2-Port 16Gb Fibre Channel Adapter
Number of Network Controllers	1

Network Controller Vendors and Models	Intel(R) Ethernet Connection X722 for 10GbE
Other Hardware	Details in Other Notes
Other Software	None
Hardware Availability Date (MM-DD-YYYY)	07-15-2019
BIOS Availability Date (MM-DD-YYYY)	06-18-2019
Software Availability Date (MM-DD-YYYY)	11-09-2018

Network	
Network Switch Vendors and Models	1 x Cisco Nexus 3048TP 48-port 1GbE for Management 2 x Cisco Nexus 93180YC-EX 48-port 10/25 GbE for Top-of-Rack
Network Speed	10 GbE

Primary Storage	
Storage Category	VMware vSAN (with default vSAN storage policy)
Storage Vendors, Models, and Firmware Versions	4 x Hitachi Advanced Server DS120, with VMware vSAN 6.7.0 Express Patch 05
Storage Configuration Summary	VMware vSAN (caching tier): 8 x Intel® Optane™ SSD DC P4800X Series SSDPE21K375GA (375 GB, 2.5" U.2) (2 x DS120 server) VMware vSAN (capacity tier): 24 x Intel® SSD DC P4510 Series SSDPE2KX040T8 (4.0 TB, 2.5" U.2) (6 x DS120 server) Additional details in Storage Notes

Datacenter Management Server	
System Model	QuantaPlex T41S-2U
Processor Vendor and Model	Intel(R) Xeon(R) E5-2680 v4
Processor Speed (GHz)	2.4
Total Sockets/Total Cores/Total Threads	2 Sockets / 28 Cores / 56 Threads
Memory Size (in GB, Number of DIMMs)	256,8
Network Controller(s) Vendors and Models	Intel Corporation 82599EB 10GbE
Operating System, Version, Bitness, and Service Pack	VMware ESXi 6.7.0 EP 05 Build 10764712
Virtual Center VM Number of vCPUs	8
Virtual Center VM Virtual Memory (in GB)	24

Virtual Center VM Operating System, Version, Bitness, and Service Pack	VMware vCenter Server 6.7.0 U1 Build 10244857
Other Hardware	None
Other Software	None

Clients	
Total Number of Virtual Clients / Virtual Client Hosts	10 / 3
System Model(s)	Hitachi Advanced Server DS120
Processor Vendor(s) and Model(s)	Intel(R) Xeon(R) Gold 6140
Processor Speed(s) (GHz)	2.3
Total Sockets/Total Cores/Total Threads	2 Sockets / 36 Cores / 72 Threads
Memory per Virtual Client Host	256
Network Controller(s) Vendors and Models	Intel(R) Ethernet Connection X722 for 10GbE
Virtual Client Networking Notes	Details in Networking Notes
Virtual Client Storage Notes	Details in Storage Notes
Other Hardware	N/A
Other Software	VMware ESXi 6.7.0 EP 05 Build 10764712/ VMware vSAN 6.7.0 Express Patch 05

Security Mitigations						
Vulnerability	**CVE**	**Exploit Name**	**Public Vulnerability Name**	**Mitigated**		
				Server Firmware	**ESXi**	**Guest OS**
Spectre	2017-5753	Variant 1	Bounds Check Bypass	N/A	Yes	Yes
Spectre	2017-5715	Variant 2	Branch Target Injection	Yes	Yes	Yes
Meltdown	2017-5754	Variant 3	Rogue Data Cache Load	N/A	Yes	Yes
Spectre-NG	2018-3640	Variant 3a	Rogue System Register Read	Yes	N/A	N/A
Spectre-NG	2018-3639	Variant 4	Speculative Store Bypass	N/A	Yes	Yes
Foreshadow	2018-3615	Variant 5	L1 Terminal Fault - SGX	N/A	N/A	N/A
Foreshadow-NG	2018-3620	Variant 5	L1 Terminal Fault - OS	N/A	N/A	Yes
Foreshadow-NG	2018-3646	Variant 5	L1 Terminal Fault - VMM	N/A	Yes	N/A

Notes for Workload

Template deployed with disk type: Thin

Virtualization Software Notes

- All the settings on VMs are default
- vSphere DRS Migration Threshold set to Fully Automated level 2
- Client and SUT hosts' software modules:
    - i40en version 1.7.17-1OEM.670.0.0.8169922
    - intel-nvme-vmd version 1.6.0.1003-1OEM.670.0.0.8169922
    - int-esx-intel-vmd-user version 1.4-03
    - intel_ssd_data_center_tool version 3.0.19-400
    - lsi-mr3 version 7.704.07.00-1OEM.650.0.0.4598673
    - lsi-msgpt3 version 16.00.00.00-1OEM.650.0.0.4598673
    - lpfc version 11.4.341.0-1OEM.670.0.0.7535516
    - nmlx5-core version 4.17.14.2-1OEM.670.0.0.8169922
    - nmlx5-rdma version 4.17.14.2-1OEM.670.0.0.8169922
    - vmware-esx-sas3flash version 14.00.00.00-03
    - vmware-esx-sas3ircu version 12.00.00.00-03
- All VMs with virtual hardware version 14
- Client and SUT hosts' Power Management Settings: High Performance (default: balanced)
- Client and SUT hosts configured per VMmark User Guide to mitigate CVE-2018-3646, and HTAwareMitigation-1.0.0.19 (KB56931).

Client and SUT hosts' advanced settings:

- /adv/Misc/ShellPort = com2 (Default String Value: none), this is the same setting as /vmkernel/tty1Port = com2
- /adv/Net/TcpipHeapSize = 32 (Default 0)
- /adv/Net/TcpipHeapMax = 1536 (Default 512)
- /adv/UserVars/SuppressShellWarning = 1 (Default 0)
- /adv/Virsto/DedupSpaceReclaim = 2 (Default 0)

Server Notes

Server BIOS Setting:

- Intel® Volume Management Device (Intel VMD) Enabled (default: Disabled)
- Intel® Hyper Threading Technology Enabled (default: Enabled)
- Intel® Turbo Boost Technology Enabled (default: Enabled)
- Intel® Speed Shift Technology: Hardware P-states (HWP) native
- C-States: Disabled (default: Disabled)
- Power Management Settings: High Performance (default: Balanced)
- Intel® TXT Enabled (default: Disabled)
- LLC prefetch enabled
- TPM 2.0 Enabled (default: Disabled)

Networking Notes

SUT Cluster Network configuration:

- Distributed vSwitch with two 10GbE uplinks per host (vmnic0 as Uplink1, and vmnic1 as Uplink2)
- Distributed Port Groups and Uplinks failover order configuration:

- Distributed port group for Management (active Uplink1/ standby Uplink2)
    - Distributed port group for vMotion (active Uplink1/ standby Uplink2)
    - Distributed port group for VMs (active Uplink1/ standby Uplink2)
    - Distributed port group for vSAN (active Uplink2/ standby Uplink1)
- Each distributed port group configured with different VLAN, 4 VLANs used in total
- Only the vSAN Distributed Port Groups configured with load balancing "Use Explicit Failover Order", all the other Port Groups configured with default "Route based on originating virtual port"
- Distributed port group for VMs configured with Ephemeral port binding (as indicated on VMmark User Guide)
- MTU set to 9000 on Distributed vSwitch and Cisco Nexus ToR Switches

Client Cluster Network configuration:

- Distributed vSwitch with two 10GbE uplinks per host (vmnic0 as Uplink1, and vmnic1 as Uplink2)
- Distributed Port Groups and Uplinks failover order configuration:
    - Distributed port group for Management (active Uplink1/ standby Uplink2)
    - Distributed port group for vMotion (active Uplink1/ standby Uplink2)
    - Distributed port group for VM Network (active Uplink1/ standby Uplink2)
    - Distributed port group for vSAN (active Uplink2/ standby Uplink1)
- Each distributed port group configured with different VLAN, 4 VLANs used in total
- MTU set to 9000 on Distributed vSwitch and Cisco Nexus ToR Switches

Storage Notes

- VMware ESXi installed on SATADOM
- System Under Test (SUT) configuration:
    - VMware vSAN:
        - Capacity : 87.36TB
        - Cache : 3 TB
    - Hardware Configuration:
        - Each host configured with two disk groups; each disk group configured as follows:
        - Caching Tier : 1 x Intel® Optane™ SSD DC P4800X Series (375 GB, 2.5" U.2) NVMe SSD
        - Capacity Tier : 3 x Intel® SSD DC P4510 Series (4.0 TB, 2.5" U.2) NVMe SSD
    - Software Configuration:
        - vSAN Default Storage Policy used
    - LUN/VM Distribution:
        - LUN1 (vsanDatastore) contains all the following:
        -DS3DB*,DS3WebB*,DS3WebC*,AuctionLB*,AuctionNoSQL*,AuctionAppA*,AuctionAppB*,AuctionDB*,
        AuctionMSQ*,AuctionWebA*,AuctionWebB*,ElasticLB*,ElasticAppA*,ElasticAppB*,ElasticDB*,
        ElasticWebA*,ElasticWebB*,Standby* for 9 tiles
        - Template VMs
    - Hitachi VSP F900 (used by SUT hosts)
        - Hitachi Virtual Storage Platform F Series (VSP F900)
        - Dual-controller
        - Software Version: 88-03-22-60/00 (SVOS 8.3.1)
        - 392GB total cache memory
        - Drive quantity/Type/Capacity: 5 x Hitachi Flash Module (FMD) 1.6TB
        - Configuration:
        - RAID 5 (4D+1P)
        - One DP Pool with 6.4TB capacity
        - All LUNs were configured to be accessible only by SUT hosts.

- Total SUT LUNs : 6
                  . 2 x LUNs (1 TB) used for deploy targets LUNs
                  . 2 x LUNs (1 TB) used for svMotion targets LUNs
                  . 2 x LUNs (1 TB) used for xvMotion targets LUNs
     - The VSP F900 was connected to Brocade G620 fiber switch via 32GB FC ports
     - ESXi storage settings (SUT hosts):
        - All VSP F900 LUNs were configured with Round Robin Path Policy (Default Fixed)
        - Each host configured with one "Emulex LightPulse LPe31002-M6 2-Port 16Gb Fibre Channel Adapter"

Datacenter Management Server Notes

VMware vCenter Server Appliance 6.7.0 U1 Build 10244857 hosted on a system that was not part of the client or SUT clusters.

Operating System Notes

All hosts (Management, Client and SUT) configured with VMware ESXi 6.7.0 EP 05 Build 10764712 using the Hitachi UCP custom image "UCP_Installer_vSphere6.7U1-10764712.iso" released on 03/04/2019. Custom ISOs used on Hitachi UCP solutions are available for download on the Hitachi Vantara Support Connect website under Product Downloads (https://support.hitachivantara.com/en_us/user/downloads/list.html).

Software Notes

None

Client Notes

- 3-node vSAN Cluster
- VMware ESXi 6.7U1 installed on SATADOM
- PrimeClient boot drive expanded to 100GB for the reporter post-processing operation
- Client hosts configuration:
    - VMware vSAN:
        - Capacity : 10.48 TB
        - Cache : 4.38 TB
    - Hardware Configuration: Each host configured with one SAS controller and one disk group as follows:
        - SAS Controller: 1 x QS-3216 : Avago (LSI Logic) Fusion-MPT 12GSAS SAS3216 PCI-Express
        - Caching Tier : 1 x Intel® SSD DC P4610 Series (1.6 TB, 2.5" U.2) NVMe SSD
        - Capacity Tier : 2 x Intel® SSD S4510 Series (1.92 TB, 2.5" U.2)
    - Software Configuration: vSAN Default Storage Policy used
    - Client VM Distribution:
        - Client host0: Clien1/ Client3/ Client6
        - Client host1: Clien2/ Client5/ Client8/ Prime Client
        - Client host2: Clien0/ Client4/ Client7
    - Advanced ESXi Settings: Power Management Settings: High Performance (default: balanced)
    - vSphere DRS Migration Threshold set to Fully Automated level 2

Other Notes

- Servers show one device on Intel Corporation Lewisburg SATA AHCI Controller, this is the SATADOM which is used for boot

- The SUT servers had a second NIC "Intel(R) Ethernet Controller XXV710 for 25GbE" installed; however, this NIC was not used for this VMmark benchmark report

- 3 of the SUT hosts had one ESXi ISO mounted via the virtual media of the remote console. However, nothing from this iso was used during the benchmark test

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