

VMmark® 3.1 Results

Server Vendor & Model: HPE ProLiant DL325 Gen10
Storage Vendor & Model: VMware vSAN - All Flash
Hypervisor: VMware ESXi 6.7 + AMD EPYC™ 7002 Series support
Datacenter Management Software: VMware vCenter 6.7 U3 Build 14002879

VMmark 3.1 Score =
12.23 @ 13 Tiles

Number of Hosts: 4	Uniform Hosts [yes/no]: yes	Total sockets/cores/threads in test: 4/256/512
Tested By: Hewlett Packard Enterprise		Test Date: 07-18-2019
Performance Section Performance	Configuration Section Configuration	Notes Section Notes for Workload

Performance

	weathervane			weathervaneE			dvdstoreA			dvdstoreB			dvdstoreC			
TILE_0	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3583.09	1.00	0.29 0.01	567.39	0.99	0.43 0.26	912.48	1.24	928.68	620.88	1.24	1128.04	421.65	1.22	1305.42	1.13
p1	3565.45	0.99	0.26 0.00	564.03	0.99	0.46 0.26	887.30	1.21	1008.41	626.92	1.25	1185.26	452.07	1.30	1351.49	1.14
p2	3559.32	0.99	0.26 0.00	562.35	0.98	0.51 0.40	902.48	1.23	950.18	616.30	1.23	1136.46	417.55	1.20	1326.61	1.12
TILE_1	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3582.37	1.00	0.25 0.00	563.10	0.98	0.42 0.24	917.90	1.25	909.85	630.17	1.26	1090.67	430.30	1.24	1262.30	1.14
p1	3571.57	0.99	0.26 0.00	561.09	0.98	0.49 0.24	888.58	1.21	993.13	636.95	1.27	1154.71	461.50	1.33	1308.56	1.15
p2	3562.37	0.99	0.27 0.00	557.00	0.97	0.37 0.11	904.33	1.23	955.18	614.33	1.23	1156.06	416.43	1.20	1359.02	1.12
TILE_2	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3591.11	1.00	0.20 0.00	569.52	1.00	0.92 0.61	895.58	1.22	996.45	603.05	1.20	1204.77	410.55	1.18	1395.22	1.12
p1	3572.31	0.99	0.20 0.00	569.20	0.99	0.88 0.59	882.48	1.20	1027.30	623.27	1.25	1208.44	446.10	1.29	1381.56	1.14
p2	3556.74	0.99	0.21 0.00	565.58	0.99	0.72 0.52	901.95	1.23	971.76	610.23	1.22	1184.87	390.73	1.13	1390.90	1.11
TILE_3	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3573.85	0.99	0.22 0.00	562.37	0.98	0.43 0.26	899.27	1.22	953.90	619.70	1.24	1136.09	419.68	1.21	1302.08	1.12
p1	3561.25	0.99	0.22 0.00	558.33	0.98	0.46 0.31	910.33	1.24	941.85	643.98	1.29	1112.24	446.05	1.29	1274.82	1.15
p2	3551.06	0.99	0.22 0.00	557.06	0.97	0.40 0.22	915.27	1.25	928.12	625.70	1.25	1105.01	423.52	1.22	1295.07	1.13
TILE_4	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3580.15	1.00	0.25 0.00	564.63	0.99	0.45 0.28	886.67	1.21	1018.89	624.30	1.25	1224.33	422.57	1.22	1426.31	1.12
p1	3572.60	0.99	0.25 0.00	558.55	0.98	0.43 0.25	891.73	1.21	988.03	604.92	1.21	1196.93	430.07	1.24	1371.63	1.12
p2	3560.16	0.99	0.27 0.00	553.37	0.97	0.48 0.37	885.33	1.21	1017.97	599.58	1.20	1227.61	402.18	1.16	1423.27	1.10
TILE_5	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(nRTI MaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM

Infrastructure_Operations_Scores:	vMotion	SVMotion	XVMotion	Deploy
Completed_Ops_PerHour	57.00	52.00	40.00	22.00
Avg_Seconds_To_Complete	5.60	87.57	113.23	287.23
Failures	0.00	0.00	0.00	0.00
Ratio	2.19	2.89	2.22	2.75
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	14.67			
Unreviewed_VMmark3_Infrastructure_Score	2.49			
Unreviewed_VMmark3_Score	12.23			

Configuration

Virtualization Software	
Hypervisor Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware ESXi 6.7 + AMD EPYC™ 7002 Series support / 10-15-2019
Datacenter Management Software Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware vCenter 6.7 + AMD EPYC™ 7002 Series support / 10-15-2019
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	HPE ProLiant DL325 Gen10
Processor Vendor and Model	AMD EPYC 7702
Processor Speed (GHz) / Turbo Boost Speed (GHz)	2.0 / 3.35
Total Sockets/Total Cores/Total Threads	1 Sockets / 64 Cores / 128 Threads
Primary CPU Cache	32 KB I + 32 KB D on chip per core
Secondary CPU Cache	512 KB I+D on chip per core

Other CPU Cache	256 MB I+D on chip per chip, 16 MB shared / 4 cores
BIOS Version	A41 v2.00 (07/04/2019)
Memory Size (in GB, Number of DIMMs)	512, 8
Memory Type and Speed	64 GB 2Rx4 PC4-2933 MHz RDIMM
Disk Subsystem Type	vSAN, FC SAN
Number of Disk Controllers	0
Disk Controller Vendors and Models	N/A
Total Number of Physical Disks for Hypervisor	1
Disk Vendors, Models, Capacities, and Speeds	HPE 1.6TB NVMe (P/N P10222-B21)
Number of Host Bus Adapters	1
Host Bus Adapter Vendors and Models	HPE StoreFabric SN1100Q 16Gb dual port FC HBA
Number of Network Controllers	2
Network Controller Vendors and Models	Mellanox ConnectX-5 EN 100Gb/s Ethernet Adapter (dual port) HPE Ethernet 1Gb 4-port 331i Adapter (disabled in BIOS)
Other Hardware	None
Other Software	None
Hardware Availability Date (MM-DD-YYYY)	10-15-2019
BIOS Availability Date (MM-DD-YYYY)	08-29-2019
Software Availability Date (MM-DD-YYYY)	10-15-2019
Network	
Network Switch Vendors and Models	Mellanox SN2700 32-port 100GbE Open Ethernet Switch
Network Speed	100 Gbps - SUT hosts 25 Gbps - Client hosts
Primary Storage	
Storage Category	VMware vSAN, FC SAN Storage
Storage Vendors, Models, and Firmware Versions	HPE Nimble Storage AF80-2QF-46T, NimbleOS 5.0.7.200
Storage Configuration Summary	VMware vSAN <ul style="list-style-type: none"> • 2 Disk Groups per host

- 2 x HPE 1.6TB NVMe Disks per host for cache (P/N P10222-B21)
- 4 x HPE 3.2TB NVMe Disks per host for capacity (P/N P10224-B21)

FC SAN switches:

- HPE SN6000B 48 port FC SAN Switch

HPE Nimble Storage AF80

- 2 controller nodes
- 1 disk enclosure
- 24 x HPE Nimble Storage 1.92TB SFF (2.5in) SSD
- 6 LUNs (Triple+ Parity RAID)

Datacenter Management Server

System Model	HPE ProLiant DL385 Gen10
Processor Vendor and Model	AMD EPYC 7601
Processor Speed (GHz)	2.2 GHz
Total Sockets/Total Cores/Total Threads	2 Sockets / 64 Cores / 128 Threads
Memory Size (in GB, Number of DIMMs)	256 GB
Network Controller(s) Vendors and Models	1 x Mellanox ConnectX-5 EN 100Gb/s Ethernet Adapter (dual port)
Operating System, Version, Bitness, and Service Pack	VMware ESXi 6.7 U2 build 13006603
Virtual Center VM Number of vCPUs	16
Virtual Center VM Virtual Memory (in GB)	32
Virtual Center VM Operating System, Version, Bitness, and Service Pack	VMware vCenter Appliance 6.7 + AMD EPYC™ 7002 Series support
Other Hardware	Details in Client Notes and Other Notes
Other Software	None

Clients

Total Number of Virtual Clients / Virtual Client Hosts	14 / 2
System Model(s)	HPE DL385 Gen10
Processor Vendor(s) and Model(s)	AMD EPYC 7702
Processor Speed(s) (GHz)	2.0 GHz

Total Sockets/Total Cores/Total Threads	2 Sockets / 128 Cores / 256 Threads
Memory per Virtual Client Host	512 GB
Network Controller(s) Vendors and Models	HPE Ethernet 10/25Gb 2-port 640FLR-SFP28 Adapter
Virtual Client Networking Notes	Details in Other Notes
Virtual Client Storage Notes	Details in Client Notes
Other Hardware	<ul style="list-style-type: none"> • 1 x HPE 1.6TB NVMe (P/N P10222-B21) • 1 x HPE Smart Array P408i-a SR Gen10 • 1 x HPE Smart Array P408i-p SR Gen10
Other Software	VMware ESXi 6.7 + AMD EPYC™ 7002 Series support

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	Not Vulnerable	Not Vulnerable
Spectre	2017-5715	Variant 2	Branch Target Injection	Not Vulnerable	Not Vulnerable	Not Vulnerable
Meltdown	2017-5754	Variant 3	Rogue Data Cache Load	N/A	Not Vulnerable	Not Vulnerable
Spectre-NG	2018-3640	Variant 3a	Rogue System Register Read	Not Vulnerable	N/A	N/A
Spectre-NG	2018-3639	Variant 4	Speculative Store Bypass	N/A	Not Vulnerable	Not Vulnerable
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	Not Vulnerable
Foreshadow-NG	2018-3646	Variant 5	L1 Terminal Fault - VMM	N/A	Not Vulnerable	N/A

Notes for Workload

Template deployed with disk type: Thick Provision Eager Zeroed

Virtualization Software Notes

- vSphere DRS Migration Threshold level set to 1
- vSphere DRS Advanced Option AggressiveCPUActive set to 1
- Logging was disabled for all SUT VMs (Default is Enabled)
- CDROM & Floppy removed for all SUT VMs (Default is Enabled)
- sched.mem.pin set to TRUE for all DS3DB VMs (Default FALSE)
- CPU and Memory shares set to high for all DS3DB VMs (Default is Normal)
- Disk shares set to high for all DS3DB VMs (Default is Normal)
- All Memory Reserved for DS3DB VMs (Default is Not reserved)

- CPU shares set to Low for all Standby VMs (Default is Normal)
- Third virtual disk removed from DS3DB0 before cloning DS3DB VMs for other tiles.

Advanced settings:

- Numa.LocalityWeightActionAffinity = 0 (default 130)
- Numa.PreferHT = 1 (default 0)
- Power.CpuPolicy = High Performance (default Balanced)
- VMkernel.ipmiEnabled = false (default true)
- UserVars.HostClientCEIPOptin = 2 (default 0)
- UserVars.SuppressShellWarning = 1 (default 1)
- Virsto.DedupSpaceReclaim = 2 (default 0)

Server Notes

Server BIOS Settings

- HPE Workload Profile set to 'Virtualization Max Performance' (default : General Power Efficient Compute)
 - After changing to 'Virtualization Max Performance' which modifies other settings, changed to 'Custom' to unlock settings to allow for modifications
- Performance Determinism set to Power Deterministic (default : Performance Deterministic)
- Maximum Memory Bus Frequency set to 2933 MHz (default : Auto)
- Last-Level Cache (LLC) as NUMA Node set to Enabled (default : disabled)
- HPE Ethernet 1Gb 4-port 331i Adapter Device Disabled
- Thermal configuration set to Enhanced CPU Cooling (default : Optimal Cooling)

Networking Notes

vSwitch Configuration

- vSwitch0 on vmnic0 for Management Network, vSAN, and all VMs
 - MTU 9000 configured on vSwitch0, vmnic0 and vmk0
- vSwitch1 on vmnic1 for vMotion traffic
 - MTU 9000 configured on vSwitch1, vmnic1 and vmk1
- Each physical NIC is connected to the switch at 100Gbps

Storage Notes

OS storage (SUT hosts):

- VMware ESXi 6.7 was installed to a local HPE 1.6TB NVMe (P/N P10222-B21) and only used for OS boot

VMware vSAN storage (SUT hosts):

- VMware vSAN 6.7 + AMD EPYC™ 7002 Series support
- Capacity: 30.72 TB
- Cache: 6.4 TB
- Hardware Configuration:
 - Each host had two disk groups. Each disk group used:
 - Caching Tier: 1 x HPE 1.6TB NVMe (P/N P10222-B21)
 - Capacity Tier: 2 x HPE 3.2TB NVMe (P/N P10224-B21)
- Software Configuration:

- Custom vSAN Storage Policy applied
 - Object Checksum Disabled
- SUT vSAN datastore was used for all SUT VMs and template VMs

HPE Nimble Storage

- HPE Nimble Storage AF80-2QF-46T
- Physical Configuration
 - NimbleOS 5.0.7.200
 - 2 x Nimble Storage Controller Nodes
 - 4 x Nimble Storage 4-port 16Gb Fibre Channel Host Bus Adapters
 - 24 x HPE Nimble Storage 1.92TB SFF (2.5in) SSD
 - Compression was enabled across the entire array
 - Deduplication was disabled across the entire array
 - Each LUN
 - configured with a 32K Storage Block Size Performance Policy
 - Triple+ Parity RAID
 - striped across all SSDs
 - deduplication was enabled
 - The Nimble Storage is VAAI capable and enabled
- Virtual Configuration
 - 6 x 256GB LUNs were configured to be used as infrastructure operation targets
 - 2 LUNs were used exclusively for Standby VM Storage vMotion operations
 - 2 LUNs were used exclusively for DS3WebA VM XvMotion operations
 - 2 LUNs were used exclusively for Deploy VM operations
- All FC LUNs were configured with
 - Round Robin Path Policy (Default : Most Recently Used)
 - IO Operations Limit 1 (Default : 1000)

Datacenter Management Server Notes

VMware vCenter Appliance 6.7 + AMD EPYC™ 7002 Series support was hosted on a HPE ProLiant DL385 Gen10 system that was not part of the client or SUT clusters.

Operating System Notes

All Client and SUT hosts were installed with VMware ESXi 6.7 + AMD EPYC™ 7002 Series support and were updated with the HPE Gen9 Plus Custom Image for ESXi 6.7 + AMD EPYC™ 7002 Series support offline bundle.

Software Notes

None

Client Notes

VMware ESXi 6.7 was installed to an HPE 1.6TB NVMe on each Client Host and used for primary storage for the Prime Client VM and all Client VMs

Advanced ESXi Settings:

- VMkernel.ipmiEnabled = false (default true)

- VMkernel.disableHwrng = true (default false)
- UserVars.SuppressShellWarning = 1 (default 1)
- UserVars.HostClientCEIPOptin = 2 (default 0)

The client VMs were modified as follows:

- Total memory set to 32 GB (default 20 GB)
- Total vCPUs set to 16 (default 12)

The Client VMs were distributed across the client hosts as follows:

- Client Host 1 : PrimeClient, Client0, Client2, Client4, Client6, Client8, Client10, Client12
- Client Host 2 : Client1, Client3, Client5, Client7, Client9, Client11

The PrimeClient virtual machine was modified to have a 400GB second virtual disk

Client hosts vSwitch configuration:

- vSwitch0 on vmnic4 for Management Network and the VM Network portgroup
 - PrimeClient, Client0, Client1, Client4, Client5, Client8, Client9, and Client 12 were connected to the VM Network portgroup
- vSwitch1 on vmnic5 for the VM Network 2 portgroup
 - Client2, Client3, Client6, Client7, Client10, Client11 were connected to the VM Network 2 portgroup
- Each physical NIC is connected to the switch at 25Gbps

Client hosts' storage configuration:

- All client VMs were stored on the local boot drive default datastore.

Other Notes

VMmark3.properties changes:

- TileDelay was set to 15 (default 60).
- ScrubConfigFile was set to true (default false).
- ErrorImmediate was set to true (default false).

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