

# VMmark® 3.0 Results

**Vendor and Hardware Platform: HPE Synergy 480 Gen10**  
**Virtualization Platform: VMware ESXi 6.7 EP 03 Build 9484548**  
**VMware vCenter Server : VMware vCenter Server 6.7b Build 8833179**

**VMmark 3.0 Score =**  
**15.25 @ 16 Tiles**

Number of Hosts: 8	Uniform Hosts [yes/no]: yes	Total sockets/cores/threads in test: 16/288/576
Tested By: Hewlett Packard Enterprise		Test Date: 11-20-2018
Performance Section <a href="#">Performance</a>	Configuration Section <a href="#">Configuration</a>	Notes Section <a href="#">Notes for Workload</a>

## Performance

	weathervane			weathervaneE			dvdstoreA			dvdstoreB			dvdstoreC			
TILE_0	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3598.09	1.00	0.33   0.00	574.07	1.00	0.54   0.30	953.05	1.30	806.55	666.83	1.33	943.58	482.80	1.39	1070.04	1.19
p1	3609.82	1.00	0.32   0.00	574.09	1.00	0.43   0.31	953.20	1.30	795.47	666.35	1.33	940.52	461.85	1.33	1067.14	1.18
p2	3602.87	1.00	0.31   0.00	571.86	1.00	0.53   0.29	945.65	1.29	813.73	684.48	1.37	954.71	504.62	1.46	1060.83	1.21
TILE_1	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3601.25	1.00	0.33   0.00	573.51	1.00	0.58   0.35	944.08	1.29	830.41	654.38	1.31	998.37	473.00	1.36	1131.53	1.18
p1	3599.09	1.00	0.43   0.21	572.25	1.00	0.47   0.31	944.00	1.29	830.22	654.42	1.31	992.59	449.12	1.30	1144.65	1.17
p2	3600.38	1.00	0.32   0.00	573.20	1.00	0.48   0.21	933.73	1.27	867.31	667.12	1.33	1029.28	488.50	1.41	1157.29	1.19
TILE_2	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3604.89	1.00	0.34   0.00	574.18	1.00	0.43   0.47	827.35	1.13	1252.69	542.48	1.08	1555.41	366.12	1.06	1776.02	1.05
p1	3607.77	1.00	0.34   0.00	572.84	1.00	0.41   0.55	807.40	1.10	1325.52	538.92	1.08	1578.21	375.75	1.08	1838.13	1.05
p2	3601.62	1.00	0.33   0.00	574.29	1.00	0.49   0.51	820.33	1.12	1278.57	536.17	1.07	1596.66	378.60	1.09	1817.54	1.06
TILE_3	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3599.96	1.00	0.36   0.00	571.75	1.00	0.65   0.52	929.65	1.27	872.00	641.52	1.28	1045.74	440.32	1.27	1197.67	1.16
p1	3603.63	1.00	0.37   0.00	572.03	1.00	0.54   0.59	902.38	1.23	956.55	645.10	1.29	1119.04	449.32	1.30	1276.60	1.15
p2	3600.89	1.00	0.36   0.00	573.79	1.00	0.60   0.64	906.20	1.23	942.10	625.10	1.25	1119.35	447.65	1.29	1275.12	1.15
TILE_4	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
p0	3602.98	1.00	0.32   0.00	575.33	1.01	0.34   0.18	866.73	1.18	1066.28	584.62	1.17	1309.26	402.77	1.16	1471.58	1.10
p1	3606.12	1.00	0.32   0.00	573.31	1.00	0.39   0.16	833.10	1.13	1211.03	583.98	1.17	1442.63	398.12	1.15	1668.36	1.09
p2	3594.86	1.00	0.31   0.00	571.68	1.00	0.49   0.26	851.20	1.16	1131.61	572.73	1.14	1365.78	395.43	1.14	1522.10	1.09
TILE_5	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM

<b>p0</b>	3598.75	1.00	0.33   0.00	573.72	1.00	0.70   0.43	921.23	1.25	891.52	636.98	1.27	1060.97	419.48	1.21	1213.73	1.14
<b>p1</b>	3604.81	1.00	0.35   0.00	572.19	1.00	0.54   0.52	900.90	1.23	950.36	644.45	1.29	1123.91	467.12	1.35	1291.88	1.16
<b>p2</b>	3596.71	1.00	0.36   0.00	573.61	1.00	0.48   0.42	938.25	1.28	839.78	652.70	1.30	999.81	450.23	1.30	1146.92	1.17
<b>TILE_6</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3604.38	1.00	0.35   0.00	572.55	1.00	0.68   0.28	882.73	1.20	1025.91	600.02	1.20	1235.44	411.70	1.19	1400.80	1.11
<b>p1</b>	3601.26	1.00	0.34   0.00	572.62	1.00	0.58   0.29	860.40	1.17	1099.82	603.92	1.21	1304.02	439.23	1.27	1462.23	1.12
<b>p2</b>	3605.54	1.00	0.35   0.00	572.39	1.00	0.47   0.38	867.27	1.18	1074.88	586.15	1.17	1295.24	401.18	1.16	1471.92	1.10
<b>TILE_7</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3600.91	1.00	0.34   0.00	572.59	1.00	0.79   0.63	959.80	1.31	781.62	671.12	1.34	929.68	466.32	1.34	1044.88	1.19
<b>p1</b>	3600.66	1.00	0.34   0.00	574.55	1.00	0.55   0.54	944.60	1.29	823.75	680.65	1.36	971.83	501.93	1.45	1081.37	1.21
<b>p2</b>	3597.70	1.00	0.34   0.00	573.22	1.00	0.73   0.49	957.83	1.30	777.52	666.62	1.33	931.01	462.88	1.33	1067.62	1.18
<b>TILE_8</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3600.90	1.00	0.39   0.00	572.43	1.00	0.57   0.30	886.10	1.21	1010.20	606.73	1.21	1199.21	415.18	1.20	1390.44	1.12
<b>p1</b>	3604.21	1.00	0.41   0.00	573.73	1.00	0.47   0.25	889.05	1.21	1007.70	620.75	1.24	1221.19	432.57	1.25	1379.46	1.13
<b>p2</b>	3602.78	1.00	0.37   0.00	573.64	1.00	0.46   0.41	882.30	1.20	1009.82	584.52	1.17	1212.34	412.35	1.19	1382.16	1.11
<b>TILE_9</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3602.88	1.00	0.35   0.00	573.13	1.00	0.56   0.16	903.23	1.23	954.36	643.25	1.29	1139.91	444.65	1.28	1303.78	1.15
<b>p1</b>	3604.46	1.00	0.35   0.00	571.22	1.00	0.49   0.31	904.17	1.23	956.50	616.83	1.23	1149.09	438.50	1.26	1328.78	1.14
<b>p2</b>	3601.54	1.00	0.33   0.00	573.32	1.00	0.44   0.24	948.27	1.29	827.43	655.08	1.31	988.32	450.60	1.30	1130.46	1.17
<b>TILE_10</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3602.68	1.00	0.34   0.00	574.00	1.00	0.79   0.53	923.38	1.26	890.66	661.85	1.32	1048.03	463.10	1.34	1191.44	1.17
<b>p1</b>	3603.45	1.00	0.34   0.00	573.20	1.00	0.43   0.40	921.55	1.25	900.60	634.17	1.27	1077.23	460.20	1.33	1207.64	1.16
<b>p2</b>	3604.15	1.00	0.31   0.00	573.94	1.00	0.39   0.41	917.73	1.25	901.27	635.62	1.27	1065.69	438.75	1.27	1209.70	1.15
<b>TILE_11</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3605.27	1.00	0.33   0.00	573.89	1.00	0.69   0.49	914.12	1.24	918.55	653.90	1.31	1086.70	466.62	1.35	1187.03	1.17
<b>p1</b>	3602.58	1.00	0.32   0.00	571.95	1.00	0.46   0.33	917.75	1.25	921.41	618.17	1.24	1147.70	447.07	1.29	1282.84	1.15
<b>p2</b>	3599.68	1.00	0.32   0.00	573.04	1.00	0.53   0.38	909.17	1.24	931.34	630.67	1.26	1098.70	435.62	1.26	1228.14	1.14
<b>TILE_12</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3601.90	1.00	0.32   0.00	574.37	1.00	0.83   0.56	866.90	1.18	1048.61	636.60	1.27	1242.41	455.75	1.31	1357.75	1.15
<b>p1</b>	3606.60	1.00	0.32   0.00	572.72	1.00	0.59   0.47	888.23	1.21	1002.43	583.90	1.17	1211.95	416.27	1.20	1353.39	1.11
<b>p2</b>	3600.30	1.00	0.32   0.00	571.64	1.00	0.50   0.44	870.73	1.19	1057.95	615.25	1.23	1241.70	434.02	1.25	1367.12	1.13
<b>TILE_13</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3601.17	1.00	0.33   0.00	573.08	1.00	0.48   0.30	904.65	1.23	942.57	646.70	1.29	1105.92	477.18	1.38	1219.70	1.17
<b>p1</b>	3606.22	1.00	0.34   0.00	572.96	1.00	0.45   0.43	919.42	1.25	898.89	632.98	1.26	1078.77	435.00	1.25	1227.67	1.15

<b>p2</b>	3612.60	1.00	0.36   0.00	573.97	1.00	0.45   0.55	916.67	1.25	897.25	662.20	1.32	1041.58	467.57	1.35	1163.79	1.18
<b>TILE_14</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3604.93	1.00	0.32   0.00	573.25	1.00	0.65   0.51	861.67	1.17	1091.49	599.17	1.20	1335.92	433.73	1.25	1512.49	1.12
<b>p1</b>	3602.87	1.00	0.31   0.00	573.45	1.00	0.46   0.48	868.92	1.18	1090.32	586.58	1.17	1300.40	381.48	1.10	1498.61	1.09
<b>p2</b>	3612.40	1.00	0.33   0.00	572.90	1.00	0.52   0.49	848.80	1.16	1148.70	600.62	1.20	1345.34	430.62	1.24	1521.84	1.12
<b>TILE_15</b>	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(nRTIMaxPctF)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	Actual	Ratio	QoS(ms)	GM
<b>p0</b>	3601.13	1.00	0.32   0.00	573.72	1.00	0.49   0.46	867.35	1.18	1071.50	594.95	1.19	1268.37	423.25	1.22	1428.54	1.11
<b>p1</b>	3604.63	1.00	0.32   0.00	572.34	1.00	0.39   0.53	872.75	1.19	1051.11	596.40	1.19	1255.89	406.45	1.17	1424.02	1.11
<b>p2</b>	3608.99	1.00	0.33   0.00	572.88	1.00	0.60   0.61	864.83	1.18	1068.06	616.80	1.23	1240.92	445.77	1.29	1411.56	1.13
<b>p0_score:</b>	18.29															
<b>p1_score:</b>	18.18															
<b>p2_score:</b>	18.27															

<b>Infrastructure_Operations_Scores:</b>	vMotion	SVMotion	XVMotion	Deploy
<b>Completed_Ops_PerHour</b>	94.00	52.00	44.00	32.00
<b>Avg_Seconds_To_Complete</b>	17.70	229.20	297.90	366.96
<b>Failures</b>	0.00	0.00	0.00	0.00
<b>Ratio</b>	3.62	2.89	2.44	4.00
<b>Number_Of_Threads</b>	4	4	4	4

<b>Summary</b>	Run_Is_Compliant	Turbo_Setting:0
	Number_Of_Compliance_Issues(0)*	Median_Phase(p2)
<b>Unreviewed_VMmark3_Applications_Score</b>	18.27	
<b>Unreviewed_VMmark3_Infrastructure_Score</b>	3.18	
<b>Unreviewed_VMmark3_Score</b>	15.25	

## Configuration

<b>Virtualization Software</b>	
Hypervisor Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware ESXi 6.7 EP 03 Build 9484548 / 08-14-2018
Datacenter Management Software Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware vCenter Server 6.7b Build 8833179 / 06-28-2018

YYYY)	
Supplemental Software	None
<b>Servers</b>	
Number of Servers in System Under Test (all subsequent fields in this section are per server)	8
Server Manufacturer and Model	HPE Synergy 480 Gen10
Processor Vendor and Model	Intel Xeon Gold 6140
Processor Speed (GHz)	2.3
Total Sockets/Total Cores/Total Threads	2 Sockets / 36 Cores / 72 Threads
Primary CPU Cache	32 KB I + 32 KB D on chip per core
Secondary CPU Cache	1 MB I+D on chip per core
Other CPU Cache	24.75 MB I+D on chip per chip
BIOS Version	I42 v1.42 (06/20/2018)
Memory Size (in GB, Number of DIMMs)	768 GB, 12 DIMMs
Memory Type and Speed	64 GB 4Rx4 DDR4 2666 MHz LRDIMM
Disk Subsystem Type	vSAN, FC SAN
Number of Disk Controllers	2
Disk Controller Vendors and Models	HPE Smart Array P204i-c SR Gen10 HPE Smart Array P416ie-m SR Gen10
Total Number of Physical Disks for Hypervisor	1
Disk Vendors, Models, Capacities, and Speeds	HPE 8GB Dual microSD Flash USB Drive
Number of Host Bus Adapters	1
Host Bus Adapter Vendors and Models	HPE Synergy 3820C 10/20Gb CNA
Number of Network Controllers	1
Network Controller Vendors and Models	HPE Synergy 3820C 10/20Gb CNA
Other Hardware	Details in Other Notes
Other Software	HPE OneView version 4.10.03-0364293
Hardware Availability Date (MM-DD-YYYY)	08-16-2017

BIOS Availability Date (MM-DD-YYYY)	06-20-2018
Software Availability Date (MM-DD-YYYY)	09-27-2018
<b>Network</b>	
Network Switch Vendors and Models	2 x HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy 4 x HPE Synergy 20G Interconnect Link Module 1 x HPE 5900AF-48XG-4QSFP+ Switch
Network Speed	Details in Networking Notes
<b>Storage</b>	
Array Vendors, Models, and Firmware Versions	4 x HPE Synergy 480 Gen10 using VMware vSAN 6.7 1 x HPE 3PAR StoreServ 8440 4-node system (3.3.1.410 (MU2))
Fibre Channel Switch Vendors and Models	1 x HPE SN8000B 16Gb SAN Director
Disk Space Used	41.92 TB (VMware vSAN) 16.8 TB (HPE 3PAR)
Array Cache Size	12.5 TB (VMware vSAN) 128 GB (HPE 3PAR)
Total Number of Physical Disks Used	Internal (OS): 8 Internal (VMware vSAN): 16 External (VMware vSAN): 48 External (HPE 3PAR): 64
Total Number of Enclosures/Pods/Shelves Used	VMware vSAN: 12 (8 vSAN nodes plus 4 HPE Synergy D3940 Storage Modules) HPE 3PAR: 8 (1 HPE 3PAR StoreServ 8440 with 4 controller nodes and 8 enclosures)
Number of Physical Disks Used per Enclosure/Pod/Shelf	HPE Synergy 480 Gen10 Compute Module: 3 disks (1 for OS, 2 for VMware vSAN caching tier) HPE Synergy D3940 Storage Module: 24 disks (VMware vSAN capacity tier) HPE 3PAR enclosure: 8 disks
Total Number of Storage Groups Used	0
Number of LUNs Used	14
LUN Size and Number of Disks Per LUN	Details in Storage Notes
RAID Type	VMware vSAN: RAID 1 (default vSAN storage policy) HPE 3PAR: RAID 5
Number of Members per RAID Set	Details in Storage Notes
Disk Vendors, Models, and Speeds	OS: HPE 8GB Dual microSD Flash USB Drive (P/N 741279-B21) VMware vSAN (caching tier): HPE 800GB SAS 12G Write Intensive SFF SC (P/N 873355-B21) VMware vSAN (capacity tier): HPE 960GB SAS 12G Read Intensive SFF SC (P/N 872390-B21) HPE 3PAR: HPE 3PAR 8000 3.84TB+SW SFF SSD (P/N K2P91B)

<b>Datacenter Management Server</b>	
System Model	HPE ProLiant DL380 Gen10
Processor Vendor and Model	Intel Xeon Gold 6148
Processor Speed (GHz)	2.4
Total Sockets/Total Cores/Total Threads	2 Sockets / 40 Cores / 80 Threads
Memory Size (in GB, Number of DIMMs)	384 GB, 12 DIMMs
Network Controller(s) Vendors and Models	HPE Ethernet 1Gb 4-port 331i Adapter HPE Ethernet 10Gb 2-port 562FLR-SFP+ Adapter
Operating System, Version, Bitness, and Service Pack	VMware ESXi 6.7 EP 03 Build 9484548
Virtual Center VM Number of vCPUs	8
Virtual Center VM Virtual Memory (in GB)	24 GB
Virtual Center VM Operating System, Version, Bitness, and Service Pack	VMware vCenter Server 6.7b Build 8833179
Other Hardware	None
Other Software	None
<b>Clients</b>	
Total Number of Virtual Clients / Virtual Client Hosts	17 / 8
System Model(s)	HPE Synergy 480 Gen10
Processor Vendor(s) and Model(s)	Intel Xeon 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	768 GB
Network Controller(s) Vendors and Models	HPE Synergy 3820C 10/20Gb CNA
Virtual Client Networking Notes	Details in Networking Notes
Virtual Client Storage Notes	Details in Storage Notes
Other Hardware	Details in Other Notes

## Notes for Workload

### Virtualization Software Notes

- Logging was disabled for all VMs (default enabled)
- Cluster DRS Automation Level set to Fully Automated
- DRS Migration Threshold set to level 2

Advanced Settings (for all SUT and client hosts):

- Cpu.CreditAgePeriod = 1000 (default 3000)
- Cpu.HTWholeCoreThreshold = 0 (default 800)
- DataMover.HardwareAcceleratedInit = 0 (default 1)
- DataMover.HardwareAcceleratedMove = 0 (default 1)
- Disk.IdleCredit = 64 (default 32)
- Disk.ReqCallThreshold = 1 (default 8)
- Mem.CtlMaxPercent = 0 (default 65)
- Mem.ShareScanGHz = 0 (default 4)
- Net.MaxPortRxQueueLen = 160 (default 80)
- Numa.LTermFairnessInterval = 0 (default 5)
- Numa.MigImbalanceThreshold = 57 (default 10)
- Numa.PageMigEnable = 0 (default 1)
- Numa.PreferHT = 1 (default 0)
- Numa.RebalancePeriod = 60000 (default 2000)
- Numa.SwapLoadEnable = 0 (default 1)
- Numa.SwapLocalityEnable = 0 (default 1)
- Power.CpuPolicy = High Performance (default Balanced)
- UserVars.SupressShellWarning = 1 (default 0)
- Virsto.DedupSpaceReclaim = 2 (default 0)

### Server Notes

Server BIOS settings:

- HPE Workload Profile set to 'Virtualization - Max Performance' (default: General Power Efficient Compute)
- Intel Turbo Boost Enabled (frequency boost to 3.70 GHz) (default: Enabled)

### Networking Notes

VMware ESXi 6.7 EP 03								HPE OneView Server Profile				
Virtual Switch Name	Virtual Switch Type	Virtual Switch MTU	vmnic	vmnic MTU	vmknic	Port Groups	Purpose	Speed	Physical Port	Requested Bandwidth	Allocated Bandwidth	Max Bandwidth
vSANDSwitch	distributed vSwitch	9000	vmnic6	9000	vmk1	vSANPortGroup	vSAN	20 Gb/s	Mezzanine 3 Port 1-d	5 Gb/s	5 Gb/s	20 Gb/s
			vmnic7	9000				20 Gb/s	Mezzanine 3 Port 2-d	5 Gb/s	5 Gb/s	20 Gb/s

vSwitch0	standard vSwitch	1500	vmnic0	1500	vmk0	Management Network VM Network (unused*)	management vMotion	20 Gb/s	Mezzanine 3 Port 1-a	2.5 Gb/s	2.5 Gb/s	20 Gb/s
			vmnic1	1500				20 Gb/s	Mezzanine 3 Port 2-a	2.5 Gb/s	2.5 Gb/s	20 Gb/s
vSwitch1	standard vSwitch	1500	vmnic4	1500	N/A	PrivateNW	virtual machines	20 Gb/s	Mezzanine 3 Port 1-c	5 Gb/s	5 Gb/s	20 Gb/s
			vmnic5	1500				20 Gb/s	Mezzanine 3 Port 2-c	5 Gb/s	5 Gb/s	20 Gb/s
N/A	N/A	N/A	vmnic2	1500	N/A	N/A	FCoE	8 Gb/s	Mezzanine 3 Port 1-b	2.5 Gb/s	2.5 Gb/s	8 Gb/s
			vmnic3	1500				8 Gb/s	Mezzanine 3 Port 2-b	2.5 Gb/s	2.5 Gb/s	8 Gb/s

(\* The 'VM Network' port group is automatically created by ESXi and was not used on all SUT/client hosts except for client host 8, which hosted the primeclient VM. The primeclient had one of its two NICs connected to the 'VM Network' port group to provide remote access to the VM's guest OS from the management network.)

Each HPE Synergy 3820C 10/20Gb CNA has 2 physical ports capable of 20 Gb/s. When combined with HPE Synergy Virtual Connect modules, each physical port of the HPE Synergy 3820c NIC can be configured to have up to 4 virtual ports with configurable bandwidth speeds. The total bandwidth speeds of all virtual ports of a physical port cannot exceed 20 Gb/s. Each virtual port can be configured for use as ethernet or fiber channel connections. Virtual port configuration is achieved by configuring server profiles in the HPE OneView management software.

VMware ESXi 6.7 is identifying the max bandwidth from the HPE OneView Server Profile as the detected port speed for each vmnic.

The setup had 2 LAGs configured with the HPE 5900AF-48XG-4QSFP+ network switch.

- First LAG:
  - Configured between the distributed vSwitch and the HPE 5900AF-48XG-4QSFP+ network switch.
  - LAG was enabled at connection level in the HPE OneView Server Profiles.
  - LACP was enabled in the distributed vSwitch.
  - Used two 10 Gb/s uplinks:
    - 1 x 10 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 1
    - 1 x 10 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 2
- Second LAG:
  - Used for the PrivateNW port group.
  - Configured between the Logical Interconnect Group in the HPE Synergy frames and the HPE 5900AF-48XG-4QSFP+ network switch, which allowed VMware ESXi hosts to use a standard vSwitch.
  - Used 4 x 10 Gb/s uplinks:
    - 2 x 10 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 1
    - 2 x 10 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 2

## Storage Notes

OS storage (SUT hosts, client hosts):

- VMware ESXi 6.7 was installed on 1 x HPE 8GB Dual microSD Flash USB Drive for each host. One 400 GB LUN (RAID5) on the HPE 3PAR storage was used to store the persistent scratch location for each host by following the instructions found at <https://kb.vmware.com/s/article/1033696>.

VMware vSAN storage (SUT hosts, client hosts):

- NOTE: The SUT hosts are in an eight node vSAN cluster. The client hosts are in an eight node vSAN cluster. Both clusters are configured identically.
- VMware vSAN 6.7
  - Capacity: 41.92 TB
  - Cache: 12.5 TB
  - Hardware Configuration:
    - Each host had two storage groups. Each storage used:
      - Caching Tier: 1 x HPE 800GB SAS 12G Write Intensive SFF SC in internal drive bay connected to HPE Smart Array P204i-c SR Gen10.



- Capacity Tier: 3 x HPE 960GB SAS 12G Read Intensive SFF SC in HPE Synergy D3940 Storage Module connected to HPE Smart Array P416ie-m SR Gen10
  - Software Configuration:
    - vSAN Default Storage Policy used for all disk objects
- SUT vSAN datastore was used for all SUT VMs and all template VMs.
- Client vSAN datastore was used for all client VMs and primeclient VM.

HPE 3PAR storage:

- NOTE: All LUNs were exported and accessible to all SUT and client hosts.
- HPE 3PAR StoreServ 8440
- Physical Configuration:
  - HPE 3PAR Operating System 3.3.1.410 (MU2)
  - 4 x HPE 3PAR StoreServ 8440 Controller Nodes
  - 128 GB cache
  - 8 x HPE 3PAR StoreServ 8000 SFF(2.5in) SAS drive enclosures
  - 64 x HPE 3PAR 8000 3.84TB+SW SFF SSD
    - 8 x SSDs in each drive enclosure
- Virtual Configuration
  - All LUNs were configured as RAID5 and striped across all SSDs.
  - Total LUNs: 13
    - 4 LUNs (1400 GB) used for deploy target LUNs
    - 4 LUNs (1400 GB) used for svMotion target LUNs
    - 4 LUNs (1400 GB) used for xvMotion target LUNs
    - 1 LUN (400 GB) used for permanent scratch location for all client and SUT hosts

The HPE Synergy frames were connected to the HPE SN8000B 16Gb SAN Director via 2 x QSFP+ to 4 FC splitter cables to provide a total of 8 x 8 Gb connections to the fiber switch.

- 4 x 8 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 1
- 4 x 8 Gb/s uplink from the HPE Virtual Connect SE 40Gb F8 Module in frame 2

ESXi storage settings (applies to all SUT and client hosts):

- All disks in HPE Synergy D3940 Storage Module were configured with round robin path policy. (default most recently used)
- All HPE 3PAR LUNs were configured with round robin path policy. (default most recently used)
  - The IOPS limit set to 1. (default 1000)

## **Datacenter Management Server Notes**

VMware vCenter Server Appliance 6.7 build 8833179 was hosted on a HPE ProLiant DL380 Gen10 system that was not part of the client or SUT clusters.

## **Operating System Notes**

All hosts (clients, SUTs, vCenter) originally had VMware ESXi 6.7 build 8169922 using the HPE custom image download named 'VMware-ESXi-6.7.0-8169922-HPE-Gen9plus-670.10.3.0.30-Jun2018.iso'. Later, all hosts were upgraded to VMware ESXi 6.7 EP 03 Build 9484548 using the HPE custom image download named 'VMware-ESXi-6.7.0-9484548-HPE-Gen9plus-670.10.3.5.6-Sep2018.iso'.

## **Software Notes**

None

## **Client Notes**

The client storage and network configuration details are described in the Storage Notes and Networking Notes sections.

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

- Client host 1: Client0, Client8
- Client host 2: Client1, Client9
- Client host 3: Client2, Client10
- Client host 4: Client3, Client11
- Client host 5: Client4, Client12
- Client host 6: Client5, Client13
- Client host 7: Client6, Client14
- Client host 8: Client7, Client15, PrimeClient

The primeclient was modified as follows:

- 2 virtual NICs
  - 1 virtual NIC connected to 'VM Network' port group for access from management network
  - 1 virtual NIC connected to 'PrivateNW' port group for communication with VMmark 3.0 VMs
- second virtual disk
  - Size: 1 TB
  - Mounted as /root/VMmark3/results

## Other Notes

VMmark3.properties changes:

- TileDelay was set to 20 (default 60).
- VCscratchDir was set to '/root/VMmark3/results/scratch/' (default /root/VMmark3/samples/).

This result used 3 x HPE Synergy 12000 frames in a master/satellite configuration.

- Frame 1 (master frame, SUT hosts)
  - 1 x HPE Synergy Composer Module
  - Interconnect Modules
    - 2 x HPE Synergy 12Gb SAS Connection Module
    - 1 x HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy
    - 1 x HPE Synergy 20G Interconnect Link Module
  - Compute and Storage Modules
    - 8 x HPE Synergy 480 Gen10 Compute Module
    - 2 x HPE Synergy D3940 Storage Module
- Frame 2 (satellite frame, client hosts)
  - 1 x HPE Synergy Composer Module
  - Interconnect Modules
    - 2 x HPE Synergy 12Gb SAS Connection Module
    - 1 x HPE Virtual Connect SE 40Gb F8 Module for HPE Synergy
    - 1 x HPE Synergy 20G Interconnect Link Module
  - Compute and Storage Modules
    - 8 x HPE Synergy 480 Gen10 Compute Module
    - 2 x HPE Synergy D3940 Storage Module
- Frame 3 (satellite frame)
  - Interconnect Modules

- 2 x HPE Synergy 12Gb SAS Connection Module
- 2 x HPE Synergy 20G Interconnect Link Module
- Compute and Storage Modules (not used)
  - 8 x HPE Synergy 480 Gen10 Compute Module
  - 2 x HPE Synergy D3940 Storage Module
- All HPE Synergy 480 Gen10 Compute Modules were configured as follows:
  - 2 x Intel Xeon Gold 6140
  - 12 x 64 GB 4Rx4 DDR4 2666 MHz LRDIMM
  - 1 x HPE 8GB Dual microSD Flash USB Drive (for OS)
  - 1 x HPE Smart Array P204i-c SR Gen10 (connected to internal bays)
  - 1 x HPE Smart Array P416ie-m SR Gen10 (connected to D3940 Storage Modules)
  - 1 x HPE Synergy 3820C 10/20Gb CNA
  - 2 x HPE 800GB SAS 12G Write Intensive SFF SC (in internal bays for vSAN caching tier)
- All HPE Synergy D3940 Storage Modules were configured as follows:
  - 24 x HPE 960GB SAS 12G Read Intensive SFF SC (for vSAN capacity tier)
    - Each HPE Synergy 480 Gen10 Compute Module was assigned a total of 6 x disks from the 2 x HPE Synergy D3940 Storage Modules within the same frame.

Additional HPE Synergy details:

- Each HPE Virtual Connect SE 40Gb F8 Module has 6 x QSFP+ uplink ports available for use. Using splitter cables, the uplink ports can provide up to 24 uplinks connections that can be used for ethernet and fibre channel.

## Meltdown/Spectre Mitigations

CVE-2017-5754 (aka "Meltdown")

- ESXi: mitigation present (VMware ESXi 6.7 EP 03 Build 9484548)
- Guest OS: no mitigation present

CVE-2017-5753 (aka "Spectre variant 1")

- ESXi: mitigation present (VMware ESXi 6.7 EP 03 Build 9484548)
- Guest OS: no mitigation present

CVE-2017-5715 (aka "Spectre variant 2")

- Server Firmware: mitigation present (I42 v1.42 (06/20/2018))
- ESXi: mitigation present (VMware ESXi 6.7 EP 03 Build 9484548)
- Guest OS: no mitigation present

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