VMMARK VIRTUALIZATION PERFORMANCE OF MICRON ENTERPRISE PCIE SSD-BASED SAN

Micron® Enterprise PCIe® SSD

excellent performance for virtualized environments

with a VMware® VMmark® score of

12.05

@10 tiles

Corporate data centers use virtualization technologies to save money and boost flexibility and efficiency. To get the most from virtualization, it is important to invest in the storage options that will deliver excellent virtualized performance. To measure the virtualization performance of Micron Enterprise PCIe SSDs, Principled Technologies set up a storage-attached network (SAN) using these drives and ran the VMmark virtualization benchmark.

VMmark calculates its score by showing the number of tiles a server and storage can support as well as how each tile performed. A tile consists of eight virtual machines (VMs) that include database servers, Web servers, a mail server, and an idle server. Two Dell PowerEdge R720 servers, paired with Micron Enterprise PCIe SSD-based SAN, ran 10 VMmark tiles for a total of 80 running VMs, and achieved a score of 12.05@10 tiles.[1] This placed the Micron Enterprise PCIe SSD-based SAN with the top posted VMmark result[2] using VMware ESXi 5.5 for the 32-total-core server configurations as of September 30, 2014.

[1] The official results are online at www.vmware.com/a/assets/vmmark/pdf/2014-09-30-PrincipledTechnologies-DellR720.pdf and a copy appears in Appendix C.
[2] www.vmware.com/a/vmmark/1/core/32/

ABOUT MICRON ENTERPRISE PCIE SSDS

According to Micron, their low-latency, high-IOPS PCIe SSDs provide "the highest read throughput in the industry, combined with extended endurance, exceptional reliability, and remarkable power efficiency. They are ideal solutions for optimizing applications with heavy read access, from web accelerators to media streaming and video-on-demand servers, as well as data warehousing."

The Micron Enterprise PCIe SSDs come in two different models: the P320h and P420m. The P320h comes in 175GB, 350GB, and 700GB capacity. The P420m comes in 1.4TB, 350GB, and 700GB capacity. We used four P320h 700GB cards and four P420m 1.4TB cards for testing.

Learn more about Micron Enterprise PCIe SSDs at www.micron.com/products/solid-state-storage/enterprise-pcie-ssd

The Micron Enterprise PCIe SSD SAN is proof-of-concept design created by combining Micron PCIe SSDs with off-the-shelf server components and a customized Linux kernel. The Linux kernel LIO target infrastructure provides iSER exports. This system can support a steady-state stream of 2M IOPS over iSER. To provide this level of performance, Micron implemented system-level optimizations such as interrupt affinitization, NUMA-aware IO steering, and CPU resource matching for network and storage interfaces; they also patched several Linux kernel bottlenecks.

ABOUT VMMARK

VMmark is a benchmarking tool that measures the performance and scalability of applications running in virtualized environments. With it you can measure virtual datacenter performance accurately and reliably, and view and compare the performance of different hardware and virtualization platforms.

According to the VMmark Web site, "State-of-the-art server consolidation typically collects several diverse workloads onto a virtualization platform - a collection of physical servers accessing shared storage and network resources. Traditional single-workload performance and scalability benchmarks for non-virtualized environments were developed with neither virtual machines nor server consolidation in mind. Even previous virtualization benchmarks have not fully captured the complexities of today's virtualized datacenters. VMmark 2.5.2, the industry's first multi-server datacenter virtualization benchmark, addresses this gap by including as part of the benchmark a variety of common platform-level workloads such as live migration of virtual machines, cloning and deploying of virtual machines, and automatic virtual machine load balancing across the datacenter."

OUR TESTING

To carry out the VMmark testing, we downloaded the benchmark from http://www.vmware.com/products/vmmark/. We followed the test directions in the VMware VMmark Benchmarking Guide (VMmark_Benchmarking_Guide_2.5.2.pdf), included with the download of VMmark 2.5.2. We used the guide's instructions to build the mail server, standby, and deploy template VMs from scratch. For the Oliodb, OlioWeb, DS2DB, and DS2Web VMs, we used the VMmark prebuilt templates.

Learn more about VMmark at www.vmware.com/products/vmmark/overview.html

CONCLUSION

The storage you use for your virtualization solution can be a significant factor in its performance and effectiveness. Two Dell PowerEdge R720 servers, paired with Micron Enterprise PCIe SSD-based SAN, ran 10 VMmark tiles for a total of 80 running VMs and achieved a score of 12.05@10 tiles, making it the top score running VMware ESXi 5.5 of the 32-core server configurations. For enterprises that need excellent virtualization performance, this makes Micron Enterprise PCIe SSD-based SAN a wise investment.

APPENDIX A – SYSTEM CONFIGURATION

Figure 1 provides configuration information about the servers we used in our tests. We used two Dell PowerEdge R720 servers as systems under test. We used five Dell PowerEdge C8220 servers as clients and one as VCenter management server. See Appendix B for a detailed test bed configuration.

System	Dell PowerEdge R720	Dell PowerEdge C8220
General		
Number of processor packages	2	2
Number of cores per processor	8	8
Number of hardware threads per core	2	2
CPU		
Vendor	Intel®	Intel
Name	Xeon®	Xeon
Model number	E5-2690	E5-2650
Socket type	LGA2011	LGA2011
Core frequency (GHz)	2.90	2.00
Bus frequency	8 GT/s	8 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	20 MB	20 MB
Platform		
Vendor and model	Dell PowerEdge R720	Dell PowerEdge C8220 Compute Node
BIOS name and version	Dell 2.2.3	Dell
BIOS Settings	System Profile set to Performance	Default
Memory module(s)		
Total RAM in system (GB)	256	128
Vendor and model number	HYNIX® HMT42GR7MFR4C	Samsung® M393B1K70DH0-CK0
Type	PC3-12800R	PC3-12800R
Speed (MHz)	1,600	1,600
Speed running in the system (MHz)	1,600	1,600
Size (GB)	16	16
Number of RAM module(s)	16	8
Rank	Dual	Dual
OS/hypervisor		
Name	VMware® ESXi 5.5.0	Microsoft® Windows Server® 2008 R2 Enterprise 64-bit
Build number	Build 1892794	6.1.7601
File system	VMFS	NTFS
Language	English	English
RAID controller		
Vendor and model number	Dell PERC H710P Mini controller	Intel C600
Cache size	1 GB	N/A

System	Dell PowerEdge R720	Dell PowerEdge C8220
Hard drives		
Vendor and model number	Seagate® ST9300653SS	Seagate ST91000640NS
Number of drives	2	2
Size (GB)	300	300
Type	15K SAS	15K SAS
Ethernet adapter (onboard)		
Vendor and model number	Intel X540-AT2 dual-port 10Gbps adapter	Intel I350-BT2
Number of ports	2	2
Type	Integrated	Integrated
Ethernet adapter (Testing)		
Vendor and model number	Intel 82599EB dual-port 10Gbps adapter	Intel I350-BT2
Number of ports	2	2
Type	PCIe	PCIe
Ethernet adapter (Storage)		
Vendor and model number	Mellanox Technologies® MT27500 [ConnectX-3] dual-port 40Gbps	Mellanox Technologies MT27500 [ConnectX-3] dual-port 40Gbps
Number of ports	2	2
Type	PCIe	PCIe

Figure 1: System configuration information for our test servers.

APPENDIX B – TEST BED CONFIGURATION

Figure 2 shows our test bed setup. The two Dell PowerEdge R720 servers were configured in an ESX cluster as required by VMmark run rules. The Micron Enterprise PCIe SSD-based SAN was connected to the R720 servers over a 40GB iSCSI connection and configured as iSER target. The R720 servers connected to the test clients through two dual-port 10 GbE network controllers, for a total of three 10 GbE connections on each server.

We used six Dell PowerEdge C8220 servers for the client test bed. One C8220 was used for the non-virtualized VMmark controller. The other five C8220 servers ran two virtual client VMs running Windows Server 2008 R2 inside each one. All virtual clients had a single 10GbE network connection. One of the C8220 servers ran vCenter Server with a single 10 GbE connection.

For the storage server we used a SuperMicro SuperServer 6037R-TXRF server with four P320h 700GB and four P420m 1.4TB PCIe SSD cards installed. We configured the server with CentOS 6.4 and configured the P320h with two 350GB LUNs and the P420m cards with four on each. The LUNs were presented as iSER volumes to the PowerEdge R720.

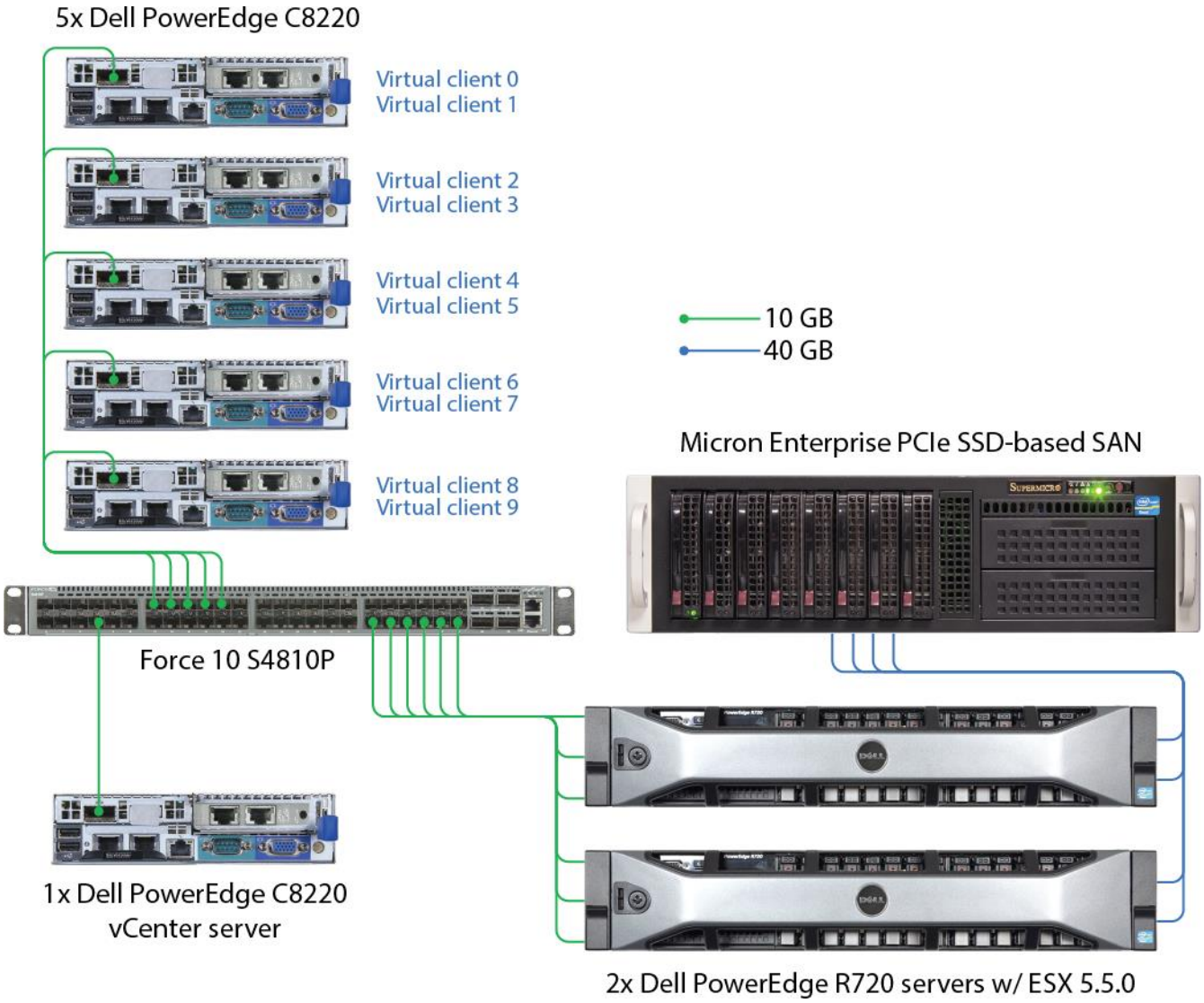

Figure 2: Our test bed setup.

APPENDIX C – VMWARE VMMARK V2.5.2 RESULT FILE

One the following pages, we include a copy of the official VMware VMmark V2.5.2 result file. The original is online at the following location: www.vmware.com/a/assets/vmmark/pdf/2014-09-30-PrincipledTechnologies-DellR720.pdf

VMware® VMmark® V2.5.2 Results		
Vendor and Hardware Platform: Dell PowerEdge R720 Virtualization Platform: VMware ESXi 5.5.0 Update 1 Build 1892794 VMware vCenter Server 5.5.0b Build 1476327		VMmark V2.5.2 Score = 12.05 @ 10 Tiles
Number of Hosts: 2	Uniform Hosts [yes/no]: no	Total sockets/cores/threads in test: 4/32/64
Tested By: Principled Technologies, Inc.		Test Date: [09-03-2014]
Performance Section Performance	Configuration Section Configuration	Notes Section Notes for Workload

Performance

	mailserver			olio			dvdstoreA			dvdstoreB			dvdstoreC			
TILE_0	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	324.73	0.98	92.75	4754.07	1.02	86.53	3923.47	1.78	68.05	2903.97	1.91	71.20	2111.47	2.00	71.26	1.47
p1	322.93	0.98	92.25	4714.10	1.02	101.79	3790.57	1.72	73.77	2965.60	1.95	72.95	2153.95	2.04	75.46	1.47
p2	329.95	1.00	94.00	4720.48	1.02	122.83	3598.88	1.64	82.00	2883.00	1.90	77.63	2153.07	2.03	82.69	1.45
TILE_1	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	323.60	0.98	106.50	4750.55	1.02	81.25	3909.22	1.78	68.92	2980.25	1.96	66.98	2092.30	1.98	73.26	1.47
p1	321.55	0.97	95.25	4741.48	1.02	95.89	3795.20	1.73	73.25	2977.53	1.96	77.42	2147.05	2.03	83.44	1.47
p2	329.65	1.00	103.75	4730.27	1.02	123.65	3675.62	1.67	78.80	2627.97	1.73	88.14	1924.88	1.82	95.38	1.40
TILE_2	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	327.48	0.99	60.75	4752.70	1.02	83.42	3890.00	1.77	69.57	2982.32	1.96	71.37	2166.72	2.05	74.25	1.49
p1	327.35	0.99	69.25	4727.00	1.02	101.11	3803.03	1.73	73.32	2894.05	1.91	75.69	2202.05	2.08	78.53	1.47
p2	329.43	1.00	88.75	4701.62	1.01	142.11	3663.25	1.67	79.53	2698.35	1.78	82.23	1931.67	1.83	86.30	1.40
TILE_3	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	328.98	1.00	101.50	4760.90	1.03	73.80	3998.40	1.82	66.38	3092.70	2.04	70.86	2346.53	2.22	68.24	1.53
p1	326.88	0.99	94.00	4740.85	1.02	94.45	4016.62	1.83	65.44	2888.12	1.90	71.44	2193.62	2.07	72.09	1.49
p2	326.27	0.99	98.00	4699.95	1.01	137.84	3909.95	1.78	69.84	2818.10	1.86	75.48	2002.08	1.89	79.77	1.44
TILE_4	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	327.43	0.99	61.42	4748.05	1.02	81.85	3954.32	1.80	67.24	2927.90	1.93	69.30	2222.40	2.10	70.66	1.49
p1	326.18	0.99	69.20	4745.20	1.02	92.78	3840.22	1.75	71.60	2997.07	1.97	70.78	2169.38	2.05	74.11	1.48
p2	322.35	0.98	87.25	4733.93	1.02	109.40	3653.90	1.66	79.90	2930.12	1.93	74.44	2064.22	1.95	82.41	1.44
TILE_5	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	325.65	0.99	63.27	4770.50	1.03	74.28	4129.12	1.88	61.56	2943.10	1.94	68.12	2145.85	2.03	69.49	1.50

p1	326.82	0.99	73.72	4727.48	1.02	91.21	3866.57	1.76	71.69	2953.35	1.94	72.50	2098.97	1.98	80.49	1.47
p2	327.95	0.99	83.00	4694.68	1.01	128.13	3660.88	1.66	81.06	2853.70	1.88	78.10	2074.60	1.96	90.08	1.44
TILE_6	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	326.40	0.99	78.00	4779.35	1.03	80.79	4016.82	1.83	65.44	2866.75	1.89	72.09	2083.45	1.97	73.64	1.47
p1	325.70	0.99	89.25	4737.00	1.02	100.45	3952.75	1.80	68.14	2968.97	1.96	76.86	2219.22	2.10	77.41	1.49
p2	328.77	1.00	106.25	4703.25	1.01	137.43	3885.32	1.77	71.21	2648.15	1.74	85.31	2028.40	1.92	85.49	1.43
TILE_7	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	325.25	0.98	73.25	4764.07	1.03	77.41	4038.50	1.84	64.18	3076.90	2.03	66.31	2233.53	2.11	70.12	1.51
p1	323.50	0.98	74.50	4739.80	1.02	86.99	3858.93	1.75	71.02	2957.75	1.95	72.45	2334.15	2.21	70.01	1.50
p2	327.95	0.99	86.00	4738.55	1.02	114.55	3698.90	1.68	78.33	2741.05	1.81	80.14	2086.50	1.97	74.22	1.43
TILE_8	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	327.45	0.99	131.50	4752.00	1.02	81.28	3891.62	1.77	69.28	2967.60	1.95	72.24	2237.18	2.11	76.42	1.49
p1	329.73	1.00	118.75	4755.52	1.02	89.51	3796.00	1.73	73.15	2868.20	1.89	78.54	2043.58	1.93	84.28	1.45
p2	327.38	0.99	119.75	4727.07	1.02	105.23	3655.80	1.66	79.39	2598.65	1.71	89.21	1830.60	1.73	95.80	1.38
TILE_9	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	Actual	Ratio	QoS	GM
p0	324.30	0.98	137.90	4755.93	1.02	78.25	3964.15	1.80	66.79	2922.93	1.92	69.52	2191.38	2.07	72.43	1.49
p1	323.05	0.98	114.67	4759.00	1.03	87.59	3878.75	1.76	70.35	2939.62	1.94	73.54	2127.22	2.01	77.32	1.47
p2	327.62	0.99	114.00	4700.60	1.01	112.53	3752.05	1.71	75.77	2841.65	1.87	79.16	2045.08	1.93	83.74	1.44

p0_score:	14.91
p1_score:	14.76
p2_score:	14.26

Infrastructure_Operations_Scores:	vmotion	svmotion	deploy
Completed_Ops_PerHour	17.50	11.00	5.50
Avg_Seconds_To_Complete	19.95	14.20	289.84
Failures	0.00	0.00	0.00
Ratio	1.09	1.22	1.38
Number_Of_Threads	1	1	1

Summary	Run_Is_Compliant	Turbo_Setting:0
	Number_Of_Compliance_Issues(0)*	Median_Phase(p1)
Unreviewed_VMmark2_Applications_Score	14.76	
Unreviewed_VMmark2_Infrastructure_Score	1.22	
Unreviewed_VMmark2_Score	12.05	

Configuration

Virtualization Software	
Hypervisor Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware ESXi 5.5.0 Update 1 Build 1892794 / 07-01-2014
Datacenter Management Software Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)	VMware vCenter Server 5.5.0b Build 1476327 / 12-22-2013
Supplemental Software	None
Servers	
Quantity	2
Server Manufacturer and Model	Dell PowerEdge R720
Processor Vendor and Model	Intel Xeon E5-2690
Processor Speed (GHz)	2.9
Total Sockets/Total Cores/Total Threads	2 Sockets / 16 Cores / 32 Threads
Primary Cache	32 KB I + 32 KB D on chip per core
Secondary Cache	256KB I+D on chip per core
Other Cache	20MB I+D on chip per core L3
BIOS Version	2.2.3
Memory Size (in GB, Number of DIMMs)	256GB, 16
Memory Type and Speed	16GB DIMMs 2Rx4 DDR3-1600MHz Registered ECC
Disk Subsystem Type	iSER SAN
Number of Disk Controllers	1
Disk Controller Vendors and Models	Dell PERC H710P Mini controller
Number of Host Bus Adapters	None
Host Bus Adapter Vendors and Models	None
Number of Network Controllers	4
Network Controller Vendors and Models	Mellanox Technologies MT27500 Family [ConnectX-3] dual-port 40Gbps adapter, Intel X540-AT2 dual-port 10Gbps adapter, (2 x Intel 82599EB dual-port 10Gbps adapter in Host 1), (Host 2 had 1 x Intel 82599EB dual-port 10Gbps adapter and 1 x QLogic Corp HP NC523SFP 10GbE 2-port Ethernet Server Adapter)
Other Hardware	None
Other Software	VMware ESXi 5.5 driver for Mellanox dual-port adapter version 1.9.10.0

Hardware Availability Date (MM-DD-YYYY)	05-20-2014
Software Availability Date (MM-DD-YYYY)	07-01-2014
Network	
Network Switch Vendors and Models	1 x Dell Force10 S4810P
Network Speed	10/40GbE
Storage	
Array Vendors, Models, and Firmware Versions	Micron Enterprise PCIe SSD-based SAN
Fibre Channel Switch Vendors and Models	None (hosts were directly cabled to the iSER storage)
Disk Space Used	7824
Array Cache Size	N/A
Total Number of Physical Disks Used	5 (2 per system under test for OS, 1 for CentOS storage host), 8 PCI-e Flash
Total Number of Enclosures/Pods/Shelves Used	1
Number of Physical Disks Used per Enclosure/Pod/Shelf	1 disk for storage host OS, 8 PCI-e SSD
Total Number of Storage Groups Used	0
Number of LUNs Used	24
LUN Size and Number of Disks Per LUN	Details in section Storage Notes
RAID Type	Details in section Storage Notes
Number of Members per RAID Set	Details in section Storage Notes
Disk Vendors, Models, and Speeds	• 4 x Seagate ST9300653SS, 300GB 15k RPM SAS (ESXi Host OS) • 1 x Seagate ST1000DM003, 1TB 7.2k RPM SATA (Storage Server OS) • 4 x Micron P320h, 700GB Enterprise PCIe SSD • 4 x Micron P420m, 1.4TB Enterprise PCIe SSD
Datacenter Management Server	
System Model	PowerEdge C8220 Compute GPU Node
Processor Vendor and Model	Intel Xeon E5-2650
Processor Speed (GHz)	2.0

Total Sockets/Total Cores/Total Threads	2 Sockets / 16 Cores / 32 Threads
Memory	128GB
Network Controller(s) Vendors and Models	Intel I350 Gigabit Network Adapter
Operating System, Version, Bitness, and Service Pack	Microsoft Windows Server 2008 R2 Enterprise 64-bit
Other Hardware	None
Other Software	None

Clients	
Total Number of Clients / Total Physical Clients / Total Virtual Client Hosts	11/1/5
System Model(s)	PowerEdge C8220 Compute GPU Node
Processor Vendor(s) and Model(s)	Intel Xeon E5-2650
Processor Speed(s) (GHz)	2.0
Total Sockets/Total Cores/Total Threads	2 Sockets / 16 Cores / 32 Threads
Memory per Physical Client	128GB
Network Controller(s) Vendors and Models	10Gbps dual-port Intel I350 Gigabit Network Adapter
Operating System, Version, Bitness, and Service Pack	• Microsoft Windows Server 2008 R2 Enterprise 64-bit (prime client) • VMware ESXi 5.5.0 Update 1 Build 1892794 (virtual client hosts) • Microsoft Windows Server 2008 R2 Enterprise 64-bit (virtual client)
Number of Virtual Clients	10
Number of vCPUs Per Virtual Client	4
Number of vMem (GB) Per Virtual Client	4
Virtual Client Networking Notes	None
Virtual Client Storage Notes	All clients stored on virtual client hosts' two disk RAID 1 volume.
Other Hardware	None
Other Software	None

Notes for Workload

Virtualization Software Notes

- Virtual hardware for all VMs was set to V10
- Ethernet adapter type set to vmxnet3 for all VMs (default vmxnet2)
- CD and floppy were removed from all VMs (default attached)
- Logging was disabled for all VMs (default enabled)
- All VMs (except for Deploy Template) had VMware tools version 9344 installed and running
- All VMs configured as single virtual socket with multiple cores (default one core per multiple virtual sockets)
- SCSI adapter type PVSCSI used for all Standby VMs (default LSI Logic parallel)
- SCSI adapter type PVSCSI used for all MailServer and Linux VMs (default LSI Logic SAS)
- Multiqueue was disabled in the vmxnet3 driver on all Linux VMs
- MTU size 9000 set for the iSCSI vSwitches
- Driver qlcnic installed on host2, not installed on host1
- Cluster DRS Automation Level was set to "Fully Automated", Level 2
- CPU shares set to high for all DS2DB VMs

Advanced Settings:

- Cpu.CoschedCrossCall = 0 (default 1)
- Cpu.CreditAgePeriod = 1000 (default 3000)
- Cpu.HTWholeCoreThreshold =0 (default 200)
- DataMover.HardwareAcceleratedInit = 0 (default 1)
- DataMover.HardwareAcceleratedMove = 0 (default 1)
- Irq.BestVcpuRouting = 1 (default 0)
- Mem.BalancePeriod = 0 (default 15)
- Mem.SamplePeriod = 0 (default 60)
- Mem.ShareScanGHz = 0 (default 4)
- Misc.TimerMaxHardPeriod = 4000 (default 100000)
- Net.MaxNetifRxQueueLen =500 (default 100)
- Net.MaxNetifTxQueueLen =1000 (default 500)
- Net.NetTxCompletionWorldlet = 0 (default 1)
- Net.NetTxWorldlet = 1 (default 2)
- Numa.LargeInterleave = 0 (default 1)
- Numa.LTermFairnessInterval = 0 (default 5)
- Numa.MigImbalanceThreshold = 57 (default 10)
- Numa.MonMigEnable = 0 (default 1)
- Numa.PageMigEnable = 0 (default 1)
- Numa.PreferHT = 1 (default 0)
- Numa.RebalancePeriod = 60000 (default 2000)
- Numa.SwapInterval = 1 (default 3)
- Numa.SwapLoadEnable =0 (default 1)
- Numa.SwapLocalityEnable =0 (default 1)
- Power.CpuPolicy = static (default balanced)
- VMFS3.HardwareAcceleratedLocking =0 (default 1)

Server Notes

- System Profile set to Performance in BIOS (default Performance Per Watt Optimized (DAPC))

Networking Notes

vSwitch Configuration for Host 1:

- vSwitch0 on vmnic7 (10Gb) for Service Console and VMotion
- vSwitch1 on vmnic6 (10Gb) for all Olio, DS2, Standby and Deploy VMs
- vSwitch2 on vmnic8 (40Gb) for one of two paths for iSER traffic
- vSwitch3 on vmnic10000802 (40Gb) for one of two paths for iSER traffic
- vSwitch4 on vmnic5 (10Gb) for all Mail VMs
- vmnic0 connection is up on host2, down on host1

vSwitch Configuration for Host 2:

- vSwitch0 on vmnic5 (10Gb) for Service Console and VMotion
- vSwitch1 on vmnic4 (10Gb) for all Olio, DS2, Standby and Deploy VMs
- vSwitch2 on vmnic10000602 (40Gb) for one of two paths for iSER traffic
- vSwitch3 on vmnic6 (40Gb) for one of two paths for iSER traffic
- vSwitch4 on vmnic7 (10Gb) for all Mail VMs

Storage Notes

- ESX was installed on two internal 300GB SAS hard drives configured as RAID 1 in each system under test.
- The servers were connected to the storage over iSCSI.
- The systems under test were directly connected to the storage host using 40Gbps connections.
- All LUNs were spread across eight Micron Technology Inc RealSSD PCI-e Flash cards within a single SuperMicro X9DRX+-F.
- Physical Configuration for Micron Enterprise PCIe SSD based SAN:
  - SuperMicro SuperServer 6037R-TXRF
  - 2 x Intel Xeon E5-2690 2.90 GHz processors
  - 64 GB Memory (8 x 8 GB DIMMs dual rank PC3-12800 Registered DDR3)
  - 4 x Micron Technology Inc RealSSD P320h (rev 03)
  - 4 x Micron Technology Inc RealSSD P420m (rev 03)
  - 2 x Mellanox Technologies ConnectX-3 NICs (firmware 2.31.5050)
    - Driver version 1.9.10.0 (Feb-16-2014)
  - Linux-IO Target (LIOT) based storage controller
  - 1 x 1 TB SAS drive for OS installation
  - Based on CentOS release 6.4 (Final)
- Virtual Configuration for 24x 326GB LUNs on Micron Enterprise PCIe SSD based SAN:
  1. The Standby source targets and the Deploy template VMs
  2. The Standby VMs and the Deploy cloning target location
  3. The DS2DB VMs for tiles 0,2,4
  4. The OlioWeb VMs for tiles 1,3
  5. The DS2Web VMs for tiles 0
  6. The DS2Web VMs for tiles 1
  7. The Mail VMs for tiles 0,2,4
  8. The DS2Web VMs for tiles 2,3
  9. The DS2DB VMs for tiles 1,3
  10. The OlioWeb VMs for tiles 0,2,4
  11. The DS2Web VMs for tiles 4

12. The DS2DB VMs for tiles 5,7,9
13. The DS2Web VMs for tiles 5
14. The DS2Web VMs for tiles 6
15. The Mail VMs for tiles 6,8
16. The OlioWeb VMs for tiles 5,7,9
17. The DS2Web VMs for tiles 9
18. The OlioWeb VMs for tiles 6,8
19. The Mail VMs for tiles 5,7,9
20. The DS2Web VMs for tiles 7,8
21. The OlioDB VMs for tiles 5,6,7,8,9
22. The DS2DB VMs for tiles 6,8
23. The OlioDB VMs for tiles 0,1,2,3,4
24. The Mail VMs for tiles 1,3

- All LUNs were distributed across 8 Micron Technology Inc RealSSDs.
- All LUNs were configured as block devices and no system memory was used for write caching.

Datacenter Management Server Notes

- None

Operating System Notes

- All Mailservers ran Microsoft Windows Server 2008 R2 Enterprise 64-bit.

Software Notes

- None

Client Notes

- Microsoft Windows Server 2008 R2 Enterprise 64-bit installed on client virtual machines and updated through Windows Update
- Prime client was running Microsoft Windows Server 2008 R2 Enterprise 64-bit and VMware vSphere PowerCLI 5.5 Release 2 build 1671586
- All clients ran as virtual machines that were each defined with 4 virtual CPUs, 4GB of memory, 1 vmxnet3 network, and 36GB of disk space
- Prime client ran on physical client 1
- Virtual clients 0, and 1 were hosted on physical client 2
- Virtual clients 2 and 3 were hosted on physical client 3
- Virtual clients 4 and 5 were hosted on physical client 4
- Virtual clients 6 and 7 were hosted on physical client 5
- Virtual clients 8 and 9 were hosted on physical client 6
- Clients ran with default ESX settings

Other Notes

None

This is a full disclosure report for a VMmark benchmark result. All published VMmark results must be from fully-compliant tests for which a full disclosure report is publicly available.

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ABOUT PRINCIPLED TECHNOLOGIES

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Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.