

# VMmark<sup>®</sup> 3.1 Results

**Vendor and Hardware Platform: Fujitsu Server PRIMERGY RX2540 M5**  
**Virtualization Platform: VMware ESXi 6.7 EP 06 Build 11675023**  
**VMware vCenter Server : VMware vCenter Server Appliance 6.7.0d**  
**Build 9451876**

**VMmark 3.1 Server and Storage PPKW Score =**  
**3.5013 @ 9 Tiles**

|                                                           |                                                               |                                                            |
|-----------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------------------|
| <b>Number of Hosts: 2</b>                                 | <b>Uniform Hosts [yes/no]: yes</b>                            | <b>Total sockets/cores/threads in test: 4/112/224</b>      |
| <b>Tested By: Fujitsu</b>                                 |                                                               | <b>Test Date: 03-09-2019</b>                               |
| <b>Performance Section</b><br><a href="#">Performance</a> | <b>Configuration Section</b><br><a href="#">Configuration</a> | <b>Notes Section</b><br><a href="#">Notes for Workload</a> |

## Performance

|               | weathervane |       |                  | weathervaneE |       |                  | dvdstoreA |       |         | dvdstoreB |       |         | dvdstoreC |       |         |      |
|---------------|-------------|-------|------------------|--------------|-------|------------------|-----------|-------|---------|-----------|-------|---------|-----------|-------|---------|------|
| <b>TILE_0</b> | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| <b>p0</b>     | 3565.20     | 0.99  | 0.41   0.02      | 567.12       | 0.99  | 1.11   0.70      | 956.27    | 1.30  | 812.54  | 659.50    | 1.32  | 976.58  | 448.95    | 1.29  | 1143.13 | 1.17 |
| <b>p1</b>     | 3553.13     | 0.99  | 0.42   0.05      | 564.17       | 0.99  | 0.58   0.28      | 947.10    | 1.29  | 833.86  | 680.50    | 1.36  | 981.63  | 471.93    | 1.36  | 1133.35 | 1.18 |
| <b>p2</b>     | 3544.70     | 0.99  | 0.42   0.10      | 561.62       | 0.98  | 0.55   0.26      | 963.55    | 1.31  | 806.15  | 659.45    | 1.32  | 978.15  | 471.98    | 1.36  | 1126.49 | 1.18 |
| <b>TILE_1</b> | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| <b>p0</b>     | 3578.14     | 0.99  | 0.37   0.00      | 565.33       | 0.99  | 0.59   0.26      | 1004.98   | 1.37  | 687.76  | 708.08    | 1.41  | 813.51  | 485.77    | 1.40  | 940.90  | 1.22 |
| <b>p1</b>     | 3563.20     | 0.99  | 0.39   0.02      | 562.44       | 0.98  | 0.57   0.24      | 980.08    | 1.33  | 733.07  | 718.85    | 1.44  | 841.33  | 523.38    | 1.51  | 959.94  | 1.23 |
| <b>p2</b>     | 3552.15     | 0.99  | 0.40   0.03      | 563.78       | 0.99  | 0.50   0.19      | 1003.77   | 1.37  | 683.02  | 702.15    | 1.40  | 815.93  | 483.52    | 1.39  | 949.55  | 1.21 |
| <b>TILE_2</b> | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| <b>p0</b>     | 3572.44     | 0.99  | 0.40   0.08      | 566.68       | 0.99  | 0.47   0.19      | 966.95    | 1.32  | 784.06  | 698.67    | 1.40  | 908.96  | 485.20    | 1.40  | 1049.20 | 1.20 |
| <b>p1</b>     | 3558.56     | 0.99  | 0.41   0.00      | 567.37       | 0.99  | 0.53   0.39      | 977.17    | 1.33  | 750.27  | 677.38    | 1.35  | 910.79  | 488.75    | 1.41  | 1038.64 | 1.20 |
| <b>p2</b>     | 3541.60     | 0.98  | 0.42   0.00      | 563.13       | 0.98  | 0.61   0.37      | 974.55    | 1.33  | 761.41  | 683.98    | 1.37  | 893.17  | 466.65    | 1.35  | 1035.12 | 1.19 |
| <b>TILE_3</b> | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| <b>p0</b>     | 3573.07     | 0.99  | 0.45   0.03      | 566.26       | 0.99  | 0.75   0.44      | 1025.95   | 1.40  | 621.11  | 756.10    | 1.51  | 710.26  | 563.77    | 1.63  | 789.19  | 1.28 |
| <b>p1</b>     | 3553.75     | 0.99  | 0.43   0.11      | 560.34       | 0.98  | 0.52   0.24      | 1037.10   | 1.41  | 597.58  | 736.23    | 1.47  | 704.56  | 513.38    | 1.48  | 802.89  | 1.24 |
| <b>p2</b>     | 3535.40     | 0.98  | 0.46   0.10      | 556.25       | 0.97  | 0.52   0.24      | 1024.70   | 1.40  | 613.97  | 762.92    | 1.52  | 702.22  | 542.83    | 1.57  | 783.74  | 1.26 |
| <b>TILE_4</b> | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |

|                  |         |       |                  |        |       |                  |         |       |         |        |       |         |        |       |         |      |
|------------------|---------|-------|------------------|--------|-------|------------------|---------|-------|---------|--------|-------|---------|--------|-------|---------|------|
| <b>p0</b>        | 3566.30 | 0.99  | 0.42   0.00      | 566.22 | 0.99  | 0.66   0.33      | 1001.50 | 1.36  | 680.58  | 703.45 | 1.41  | 810.19  | 516.38 | 1.49  | 906.54  | 1.23 |
| <b>p1</b>        | 3560.18 | 0.99  | 0.43   0.09      | 560.38 | 0.98  | 0.53   0.26      | 1002.25 | 1.36  | 684.48  | 703.70 | 1.41  | 813.82  | 487.80 | 1.41  | 929.97  | 1.21 |
| <b>p2</b>        | 3549.72 | 0.99  | 0.43   0.12      | 558.23 | 0.98  | 0.69   0.33      | 990.62  | 1.35  | 719.58  | 719.12 | 1.44  | 838.40  | 529.62 | 1.53  | 941.45  | 1.23 |
| <b>TILE_5</b>    | Actual  | Ratio | QoS(nRT MaxPctF) | Actual | Ratio | QoS(nRT MaxPctF) | Actual  | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>        | 3582.00 | 1.00  | 0.39   0.07      | 562.16 | 0.98  | 0.55   0.21      | 1028.47 | 1.40  | 616.96  | 703.80 | 1.41  | 733.48  | 504.93 | 1.46  | 838.22  | 1.23 |
| <b>p1</b>        | 3558.43 | 0.99  | 0.39   0.00      | 564.50 | 0.99  | 0.57   0.23      | 1023.98 | 1.39  | 627.00  | 753.77 | 1.51  | 729.89  | 535.88 | 1.55  | 813.62  | 1.26 |
| <b>p2</b>        | 3548.53 | 0.99  | 0.39   0.00      | 562.66 | 0.98  | 0.46   0.23      | 1023.88 | 1.39  | 627.68  | 723.27 | 1.45  | 745.72  | 532.38 | 1.54  | 830.83  | 1.25 |
| <b>TILE_6</b>    | Actual  | Ratio | QoS(nRT MaxPctF) | Actual | Ratio | QoS(nRT MaxPctF) | Actual  | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>        | 3579.93 | 0.99  | 0.42   0.10      | 566.98 | 0.99  | 0.83   0.46      | 1003.70 | 1.37  | 683.03  | 704.30 | 1.41  | 818.32  | 483.90 | 1.40  | 947.90  | 1.21 |
| <b>p1</b>        | 3558.04 | 0.99  | 0.47   0.08      | 559.48 | 0.98  | 0.53   0.22      | 985.75  | 1.34  | 733.97  | 714.55 | 1.43  | 864.19  | 521.98 | 1.51  | 968.69  | 1.23 |
| <b>p2</b>        | 3546.70 | 0.99  | 0.46   0.11      | 556.20 | 0.97  | 0.67   0.35      | 995.12  | 1.36  | 707.44  | 695.08 | 1.39  | 846.69  | 478.52 | 1.38  | 987.94  | 1.20 |
| <b>TILE_7</b>    | Actual  | Ratio | QoS(nRT MaxPctF) | Actual | Ratio | QoS(nRT MaxPctF) | Actual  | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>        | 3582.12 | 1.00  | 0.33   0.00      | 564.51 | 0.99  | 0.55   0.32      | 993.12  | 1.35  | 719.38  | 728.33 | 1.46  | 826.38  | 503.00 | 1.45  | 952.04  | 1.23 |
| <b>p1</b>        | 3573.41 | 0.99  | 0.37   0.02      | 562.53 | 0.98  | 0.57   0.30      | 993.80  | 1.35  | 726.52  | 689.23 | 1.38  | 856.72  | 503.05 | 1.45  | 974.30  | 1.21 |
| <b>p2</b>        | 3553.69 | 0.99  | 0.36   0.00      | 562.78 | 0.98  | 0.39   0.17      | 1000.55 | 1.36  | 708.30  | 702.77 | 1.40  | 831.36  | 479.98 | 1.38  | 954.98  | 1.21 |
| <b>TILE_8</b>    | Actual  | Ratio | QoS(nRT MaxPctF) | Actual | Ratio | QoS(nRT MaxPctF) | Actual  | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>        | 3584.75 | 1.00  | 0.45   0.00      | 570.00 | 1.00  | 1.13   0.71      | 947.67  | 1.29  | 815.36  | 680.92 | 1.36  | 958.93  | 497.27 | 1.43  | 1094.43 | 1.20 |
| <b>p1</b>        | 3571.65 | 0.99  | 0.47   0.00      | 566.38 | 0.99  | 0.84   0.49      | 957.45  | 1.30  | 792.09  | 665.50 | 1.33  | 949.92  | 452.95 | 1.31  | 1108.55 | 1.17 |
| <b>p2</b>        | 3558.60 | 0.99  | 0.45   0.00      | 566.04 | 0.99  | 0.46   0.21      | 945.20  | 1.29  | 822.71  | 682.52 | 1.36  | 973.48  | 469.48 | 1.35  | 1128.72 | 1.18 |
| <b>p0_score:</b> | 10.97   |       |                  |        |       |                  |         |       |         |        |       |         |        |       |         |      |
| <b>p1_score:</b> | 10.94   |       |                  |        |       |                  |         |       |         |        |       |         |        |       |         |      |
| <b>p2_score:</b> | 10.91   |       |                  |        |       |                  |         |       |         |        |       |         |        |       |         |      |

|                                          |  |  |  |  |  |  |         |          |          |        |
|------------------------------------------|--|--|--|--|--|--|---------|----------|----------|--------|
| <b>Infrastructure_Operations_Scores:</b> |  |  |  |  |  |  | vMotion | SVMotion | XVMotion | Deploy |
| <b>Completed_Ops_PerHour</b>             |  |  |  |  |  |  | 28.00   | 28.00    | 21.00    | 12.50  |
| <b>Avg_Seconds_To_Complete</b>           |  |  |  |  |  |  | 5.85    | 73.60    | 106.47   | 250.61 |
| <b>Failures</b>                          |  |  |  |  |  |  | 0.00    | 0.00     | 0.00     | 0.00   |
| <b>Ratio</b>                             |  |  |  |  |  |  | 1.08    | 1.56     | 1.17     | 1.56   |
| <b>Number_Of_Threads</b>                 |  |  |  |  |  |  | 1       | 1        | 1        | 1      |

|                              |   |
|------------------------------|---|
| <b>PTD_Summary:</b>          |   |
| <b>Number_of_PTD_Daemons</b> | 2 |
| <b>Number_of_PTD_Phases</b>  | 3 |

|                                                |          |                                 |           |          |        |                  |         |
|------------------------------------------------|----------|---------------------------------|-----------|----------|--------|------------------|---------|
| <b>PTD_Phase_Timing</b>                        | 2400secs |                                 |           |          |        |                  |         |
| <b>PtdTiming:</b>                              | ptd0     | ptd1                            |           |          |        |                  |         |
| <b>p0</b>                                      | 0        | 0                               |           |          |        |                  |         |
| <b>p1</b>                                      | 0        | 0                               |           |          |        |                  |         |
| <b>p2</b>                                      | 0        | 0                               |           |          |        |                  |         |
| <b>PTD_Results:</b>                            |          |                                 |           |          |        |                  |         |
| <b>p0</b>                                      | Target   | Avg_Watts                       | Avg_Volts | Avg_Amps | Avg_PF | Samples          | UnCert% |
| <b>ptd0</b>                                    | EXT_STOR | 1150.84                         | 202.85    | 5.73     | 0.99   | 2399.00          | 0.00    |
| <b>ptd1</b>                                    | SERVER   | 1428.57                         | 202.73    | 7.07     | 1.00   | 2399.00          | 0.00    |
| <b>p1</b>                                      | Target   | Avg_Watts                       | Avg_Volts | Avg_Amps | Avg_PF | Samples          | UnCert% |
| <b>ptd0</b>                                    | EXT_STOR | 1150.99                         | 202.60    | 5.74     | 0.99   | 2400.00          | 0.00    |
| <b>ptd1</b>                                    | SERVER   | 1425.14                         | 202.47    | 7.06     | 1.00   | 2400.00          | 0.00    |
| <b>p2</b>                                      | Target   | Avg_Watts                       | Avg_Volts | Avg_Amps | Avg_PF | Samples          | UnCert% |
| <b>ptd0</b>                                    | EXT_STOR | 1151.13                         | 202.81    | 5.73     | 0.99   | 2400.00          | 0.00    |
| <b>ptd1</b>                                    | SERVER   | 1426.23                         | 202.69    | 7.06     | 1.00   | 2400.00          | 0.00    |
| <b>Summary</b>                                 |          | Run_Is_Compliant                |           |          |        | Turbo_Setting:0  |         |
|                                                |          | Number_Of_Compliance_Issues(0)* |           |          |        | Median_Phase(p1) |         |
| <b>Unreviewed_VMmark3_Avg_Watts</b>            |          | 2576.13                         |           |          |        |                  |         |
| <b>Unreviewed_VMmark3_Applications_Score</b>   |          | 10.94                           |           |          |        |                  |         |
| <b>Unreviewed_VMmark3_Infrastructure_Score</b> |          | 1.32                            |           |          |        |                  |         |
| <b>Unreviewed_VMmark3_Score</b>                |          | 9.02                            |           |          |        |                  |         |
| <b>Unreviewed_VMmark3_PPKW</b>                 |          | 3.5013                          |           |          |        |                  |         |

## Configuration

| <b>PTD Configuration</b>                             |                  |
|------------------------------------------------------|------------------|
| Number of Power Meters                               | 2                |
| Power Meter Vendors and Models                       | 2 x Hioki-3336   |
| Power Meter PTD Target(s) (SERVER/EXT_STOR)          | SERVER, EXT_STOR |
| Power Meter Connection Type(s) (Eth/GPIB/Serial/USB) | Serial           |
| Power Meter Calibration Date(s) (MM-DD-YYYY)         | 02-25-2019       |

|                                                       |                                                                     |
|-------------------------------------------------------|---------------------------------------------------------------------|
| Power Meter Calibration Info (Calibrated By/Duration) | FUJITSU FACILITIES Ltd. / one year / H06400085-1902, H06400088-1902 |
| Power Meter(s) Volt/Amp Range                         | 300 / 10                                                            |
| Power Source Voltage/Frequency/Phase                  | 200V / 50Hz / 1-phase                                               |
| <b>PTD Client Configuration</b>                       |                                                                     |
| Number of Power Meter Clients                         | 2                                                                   |
| System Model(s)                                       | PrimeClient, details in client configuration section                |
| Processor Vendor(s) and Model(s)                      | PrimeClient, details in client configuration section                |
| Processor Speed(s) (GHz)                              | PrimeClient, details in client configuration section                |
| Total Sockets/Total Cores/Total Threads               | PrimeClient, details in client configuration section                |
| Memory Per Power Meter Client                         | PrimeClient, details in client configuration section                |
| Network Controller(s) Vendors and Models              | PrimeClient, details in client configuration section                |
| Operating System, Version, and Service Pack           | PrimeClient, details in client configuration section                |
| Other Hardware                                        | 2 x BUFFALO BSUSRC0605BS USB2.0 > 1 x Serial                        |
| Other Software                                        | None                                                                |

## Configuration

|                                                                                                           |                                                                    |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| <b>Virtualization Software</b>                                                                            |                                                                    |
| Hypervisor Vendor,<br>Product, Version, and Build /<br>Availability Date (MM-DD-YYYY)                     | VMware ESXi 6.7 EP 06, Build 11675023 / 01-17-2019                 |
| Datacenter Management Software Vendor,<br>Product, Version, and Build /<br>Availability Date (MM-DD-YYYY) | VMware vCenter Server Appliance 6.7.0d, Build 9451876 / 08-14-2018 |
| Supplemental Software                                                                                     | None                                                               |
| <b>Servers</b>                                                                                            |                                                                    |
| Number of Servers in System Under Test<br>(all subsequent fields in this section are per server)          | 2                                                                  |
| Server Manufacturer and Model                                                                             | Fujitsu Server PRIMERGY RX2540 M5                                  |
| Processor Vendor and Model                                                                                | Intel Xeon Platinum 8280                                           |
| Processor Speed (GHz)                                                                                     | 2.7                                                                |
| Total Sockets/Total Cores/Total Threads                                                                   | 2 Sockets / 56 Cores / 112 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                                       | 38.5 MB I+D on chip per chip                                                              |
| BIOS Version                                          | V5.0.0.14 R1.2.0 for D3384-B1x                                                            |
| Memory Size (in GB, Number of DIMMs)                  | 768, 24                                                                                   |
| Memory Type and Speed                                 | 32GB 2Rx4 DDR4 2933MHz RDIMM                                                              |
| Disk Subsystem Type                                   | FC SAN                                                                                    |
| Number of Disk Controllers                            | 1                                                                                         |
| Disk Controller Vendors and Models                    | Fujitsu PRAID EP420i                                                                      |
| Total Number of Physical Disks for Hypervisor         | 1                                                                                         |
| Disk Vendors, Models, Capacities, and Speeds          | Micron, MTFDDAK960TDC, 960GB, SATA 3.0 6Gb/S SSD                                          |
| Number of Host Bus Adapters                           | 2                                                                                         |
| Host Bus Adapter Vendors and Models                   | Emulex LightPulse LPe31002-M6 2-Port 16Gb                                                 |
| Number of Network Controllers                         | 3                                                                                         |
| Network Controller Vendors and Models                 | 2 x Intel(R) Ethernet Controller X710 for 10GbE SFP+<br>Intel I350 Dual Port 1GbE Adapter |
| Other Hardware                                        | None                                                                                      |
| Other Software                                        | None                                                                                      |
| Hardware Availability Date (MM-DD-YYYY)               | 04-30-2019                                                                                |
| BIOS Availability Date (MM-DD-YYYY)                   | 02-28-2019                                                                                |
| Software Availability Date (MM-DD-YYYY)               | 04-09-2019                                                                                |
| <b>Network</b>                                        |                                                                                           |
| Network Switch Vendors and Models                     | 1 x Fujitsu SR-X340TR1<br>1 x Fujitsu ET-7648BFERA-FOS                                    |
| Network Speed                                         | 1Gbps for SUT management, 10Gbps for VMotion, 30Gbps for Clients and VMs                  |
| <b>Storage</b>                                        |                                                                                           |
| Array Vendors, Models, and Firmware Versions          | 4 x Fujitsu Server PRIMERGY RX2540 M4, Firmware V5.0.0.12 R1.22.0 for D3384-A1x           |
| Fibre Channel Switch Vendors and Models               | Brocade 6510                                                                              |
| Disk Space Used                                       | 14.7TB                                                                                    |
| Array Cache Size                                      | 1GB for storage server OS; no cache used for SUT datastores                               |
| Total Number of Physical Disks Used                   | 8 x SAS-SSD(2 per Storage Server OS), 16 x PCIe-SSD                                       |
| Total Number of Enclosures/Pods/Shelves Used          | 4                                                                                         |
| Number of Physical Disks Used per Enclosure/Pod/Shelf | 4 x Enclosure(PRIMERGY RX2540 M4): 2 x SAS-SSD and 4 x PCIe-SSD                           |

|                                      |                                                                                                                                            |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Total Number of Storage Groups Used  | 0                                                                                                                                          |
| Number of LUNs Used                  | 40                                                                                                                                         |
| LUN Size and Number of Disks Per LUN | Details in section Storage Notes                                                                                                           |
| RAID Type                            | RAID 1 for OS drives                                                                                                                       |
| Number of Members per RAID Set       | 2                                                                                                                                          |
| Disk Vendors, Models, and Speeds     | 8 x Micron MTFDDAK480TDC 480GB SATA-SSD<br>8 x Intel P4800X 750GB PCIe SSD<br>4 x Intel P4600 2TB PCIe SSD<br>4 x Intel P4600 4TB PCIe SSD |

### Datacenter Management Server

|                                                                        |                                                      |
|------------------------------------------------------------------------|------------------------------------------------------|
| System Model                                                           | Fujitsu Server PRIMERGY RX2530 M2                    |
| Processor Vendor and Model                                             | Intel Xeon E5-2698 v4                                |
| Processor Speed (GHz)                                                  | 2.2                                                  |
| Total Sockets/Total Cores/Total Threads                                | 1 Sockets / 20 Cores / 40 Threads                    |
| Memory Size (in GB, Number of DIMMs)                                   | Hypervisor: 64GB, 8                                  |
| Network Controller(s) Vendors and Models                               | Emulex OneConnect Oce14000 1GbE Dual Port Adapter    |
| Operating System, Version, Bitness, and Service Pack                   | Hypervisor: VMware ESXi 6.7 EP 02a Build 9214924     |
| Virtual Center VM Number of vCPUs                                      | 4                                                    |
| Virtual Center VM Virtual Memory (in GB)                               | 16                                                   |
| Virtual Center VM Operating System, Version, Bitness, and Service Pack | VMware vCenter Server Appliance 6.7.0d Build 9451876 |
| Other Hardware                                                         | None                                                 |
| Other Software                                                         | None                                                 |

### Clients

|                                                        |                                                                                                                                             |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Total Number of Virtual Clients / Virtual Client Hosts | 10 / 3                                                                                                                                      |
| System Model(s)                                        | Fujitsu PRIMERGY RX2530 M2                                                                                                                  |
| Processor Vendor(s) and Model(s)                       | Intel Xeon E5-2699 v4                                                                                                                       |
| Processor Speed(s) (GHz)                               | 2.2                                                                                                                                         |
| Total Sockets/Total Cores/Total Threads                | 2 Sockets / 44 Cores / 88 Threads                                                                                                           |
| Memory per Virtual Client Host                         | 256 GB                                                                                                                                      |
| Network Controller(s) Vendors and Models               | Emulex OneConnect Oce14000 1GbE Dual Port Adapter<br>Emulex OneConnect Oce14000 10GbE Dual Port Adapter                                     |
| Virtual Client Networking Notes                        | 1 virtual adapter for management, 2 virtual adapter for workload traffic                                                                    |
| Virtual Client Storage Notes                           | 1x300GB SAS 10K TOSHIBA AL14SEB03EN HDD with RAID 0 for Client Host OS<br>2x400GB SAS 12G TOSHIBA PX02SMF040 SSD with RAID 0 for Client VMs |

|                |                                   |
|----------------|-----------------------------------|
| Other Hardware | None                              |
| Other Software | VMware ESXi 6.7 U1 Build 10302608 |

## Notes for Workload

### Virtualization Software Notes

- CDROM removed for all VMs (default enabled)
- CPU and Memory shares set to high for all DS3DB VMs (default normal)
- Logical CPU configuration changed for multi-cpu VMs to 1 socket with multiple cores (default: Single core per socket)
- All memory reserved for DS3DB VMs
- CPU set to high for all ElasticDB VMs (default normal)
- CPU shares set to low for all Standby VMs (default normal)
- vSphere DRS Migration Threshold set to Fully Automated level 1

Changes in esx.conf:

- /adv/Cpu/CreditAgePeriod = 1000 (default 3000)
- /adv/Cpu/HTWholeCoreThreshold = 0 (default 800)
- /adv/DataMover/HardwareAcceleratedInit = 0 (default 1)
- /adv/DataMover/HardwareAcceleratedMove = 0 (default 1)
- /adv/Mem/CtlMaxPercent = 0 (default 65)
- /adv/Mem/ShareScanGHz = 0 (default 4)
- /adv/Numa/LTermFairnessInterval = 0 (default 5)
- /adv/Numa/MigImbalanceThreshold = 57 (default 10)
- /adv/Numa/PageMigEnable = 0 (default 1)
- /adv/Numa/RebalancePeriod = 60000 (default 2000)
- /adv/Numa/SwapLoadEnable = 0 (default 1)
- /adv/Numa/SwapLocalityEnable = 0 (default 1)
- /adv/Disk/ReqCallThreshold = 1 (default 8)
- /adv/Disk/IdleCredit = 64 (default 32)
- /adv/Power/CpuPolicy = High Performance (default balanced)
- /adv/VMFS3/HardwareAcceleratedLocking = 0 (default 1)
- /adv/UserVars/HostClientCEIPOptIn = 1 (default 0)
- /vmkernel/hyperthreadingMitigation = TRUE (default FALSE)

### Server Notes

- Server BIOS settings:
  - Turbo Boost Technology: enabled (Intel Turbo Boost up to 4.0GHz, default enabled)

- DCU Streamer Prefetcher: Disabled (default Enabled)
- DCU Ip Prefetcher: Disabled (default Enabled)
- Stale AtoS: Enabled (default Disabled)
- Patrol Scrub: Disabled (default Enabled)
- WR CRC feature Control: Disabled (default Enabled)
- Fan Control: Full (default Auto)

## Networking Notes

- vSwitch Configuration:
  - vSwitch0 for Service Console on vmnic1 at 1Gb/s
  - vSwitch1 for all workload on vmnic3,vmnic4,vmnic5 at 10Gb/s
  - vSwitch2 for vMotion connection on vmnic6 at 10Gb/s
    - 9000 MTU (default 1500)

## Storage Notes

- First Fujitsu Server PRIMERGY RX2540 M4 configured as a Fibre Channel Target:
  - Hardware details:
    - 2 x Intel Xeon Gold 6134M@3.2GHz processors
    - 64GB RAM (2 x 32 GB dual rank PC4-2666 Registered DDR4 / 2666 MHz DIMMs)
    - 1 x QLogic QLE2672 Dual Port 16Gb FC HBA used as FC target controller
    - 1 x Fujitsu RAID SAS Controller with 1GB Cache (D3108)
    - 2 x 480GB SATA-SSD Micron MTFDDAK480TDC
    - 2 x Intel P4800X 750GB PCIe SSD
    - 1 x Intel P4600 2TB PCIe SSD
    - 1 x Intel P4600 4TB PCIe SSD
  - Software details:
    - Operating System: SUSE Linux Enterprise Server 12 SP3 - 4.4.162-94.72-default (64-bit)
    - Fibre Channel Target SW: LIO (part of SUSE Linux Enterprise Server 12 SP3)

### RAID configuration:

- SATA-SSD 1,2 (RAID 1):
  - LUN 1: Storage system OS (480GB, this LUN is not counted in the Storage section)
- First PCIe-SSD:
  - LUN 1: DS3DB for tiles 0 (600GB)
- Second PCIe-SSD:

- LUN 1: DS3DB for tiles 1 (600GB)
- Third PCIe-SSD:
  - LUN 1: AuctionNoSQL, ElasticDB for tile 0 (300GB)
  - LUN 2: AuctionNoSQL, ElasticDB for tile 1 (300GB)
  - LUN 3: AuctionDB, ElasticLB for tile 0 (300GB)
  - LUN 4: AuctionDB, ElasticLB for tile 1 (300GB)
  - LUN 5: AuctionNoSQL, ElasticDB for tile 8 (300GB)
- Fourth PCIe-SSD:
  - LUN 1: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 0 (300GB)
  - LUN 2: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 1 (300GB)
  - LUN 3: vmmark3.1-template-020419 (300GB)
- Second Fujitsu Server PRIMERGY RX2540 M4 configured as a Fibre Channel Target:
  - Hardware details:
    - 2 x Intel Xeon Gold 6134M@3.2GHz processors
    - 64GB RAM (2 x 32 GB dual rank PC4-2666 Registered DDR4 / 2666 MHz DIMMs)
    - 1 x QLogic QLE2672 Dual Port 16Gb FC HBA used as FC target controller
    - 1 x Fujitsu RAID SAS Controller with 1GB Cache (D3108)
    - 2 x 480GB SATA-SSD Micron MTFDDAK480TDC
    - 2 x Intel P4800X 750GB PCIe SSD
    - 1 x Intel P4600 2TB PCIe SSD
    - 1 x Intel P4600 4TB PCIe SSD
  - Software details:
    - Operating System: SUSE Linux Enterprise Server 12 SP3 - 4.4.162-94.72-default (64-bit)
    - Fibre Channel Target SW: LIO (part of SUSE Linux Enterprise Server 12 SP3)

#### RAID configuration:

- SATA-SSD 1,2 (RAID 1):
  - LUN 1: Storage system OS (480GB, this LUN is not counted in the Storage section)
- First PCIe-SSD:
  - LUN 1: DS3DB for tiles 2 (600GB)
- Second PCIe-SSD:
  - LUN 1: DS3DB for tiles 3 (600GB)

- Third PCIe-SSD:
  - LUN 1: AuctionNoSQL, ElasticDB for tile 2 (300GB)
  - LUN 2: AuctionNoSQL, ElasticDB for tile 3 (300GB)
  - LUN 3: AuctionDB, ElasticLB for tile 2 (300GB)
  - LUN 4: AuctionDB, ElasticLB for tile 3 (300GB)
- Fourth PCIe-SSD:
  - LUN 1: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 2 (300GB)
  - LUN 2: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 3 (300GB)
  - LUN 3: Deploy Lun (300GB)
  - LUN 4: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 8 (300GB)
- Third Fujitsu Server PRIMERGY RX2540 M4 configured as a Fibre Channel Target:
  - Hardware details:
    - 2 x Intel Xeon Gold 6134M@3.2GHz processors
    - 64GB RAM (2 x 32 GB dual rank PC4-2666 Registered DDR4 / 2666 MHz DIMMs)
    - 1 x QLogic QLE2672 Dual Port 16Gb FC HBA used as FC target controller
    - 1 x Fujitsu RAID SAS Controller with 1GB Cache (D3108)
    - 2 x 480GB SATA-SSD Micron MTFDDAK480TDC
    - 2 x Intel P4800X 750GB PCIe SSD
    - 1 x Intel P4600 2TB PCIe SSD
    - 1 x Intel P4600 4TB PCIe SSD
  - Software details:
    - Operating System: SUSE Linux Enterprise Server 12 SP3 - 4.4.162-94.72-default (64-bit)
    - Fibre Channel Target SW: LIO (part of SUSE Linux Enterprise Server 12 SP3)

#### RAID configuration:

- SATA-SSD 1,2 (RAID 1):
  - LUN 1: Storage system OS (480GB, this LUN is not counted in the Storage section)
- First PCIe-SSD:
  - LUN 1: DS3DB for tiles 5 (600GB)
- Second PCIe-SSD:
  - LUN 1: DS3DB for tiles 4 (600GB)
- Third PCIe-SSD:

- LUN 1: AuctionNoSQL, ElasticDB for tile 4 (300GB)
  - LUN 2: AuctionNoSQL, ElasticDB for tile 5 (300GB)
  - LUN 3: AuctionDB, ElasticLB for tile 4 (300GB)
  - LUN 4: AuctionDB, ElasticLB for tile 5 (300GB)
  - LUN 5: AuctionDB, ElasticLB for tile 8 (300GB)
- Fourth PCIe-SSD:
    - LUN 1: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 4 (300GB)
    - LUN 2: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 5 (300GB)
    - LUN 3: SvMotion Target Lun (300GB)
- Fourth Fujitsu Server PRIMERGY RX2540 M4 configured as a Fibre Channel Target:
    - Hardware details:
      - 2 x Intel Xeon Gold 6134M@3.2GHz processors
      - 64GB RAM (2 x 32 GB dual rank PC4-2666 Registered DDR4 / 2666 MHz DIMMs)
      - 1 x QLogic QLE2672 Dual Port 16Gb FC HBA used as FC target controller
      - 1 x Fujitsu RAID SAS Controller with 1GB Cache (D3108)
      - 2 x 480GB SATA-SSD Micron MTFDDAK480TDC
      - 2 x Intel P4800X 750GB PCIe SSD
      - 1 x Intel P4600 2TB PCIe SSD
      - 1 x Intel P4600 4TB PCIe SSD
    - Software details:
      - Operating System: SUSE Linux Enterprise Server 12 SP3 - 4.4.162-94.72-default (64-bit)
      - Fibre Channel Target SW: LIO (part of SUSE Linux Enterprise Server 12 SP3)

#### RAID configuration:

- SATA-SSD 1,2 (RAID 1):
  - LUN 1: Storage system OS (480GB, this LUN is not counted in the Storage section)
- First PCIe-SSD:
  - LUN 1: DS3DB for tiles 7 (600GB)
- Second PCIe-SSD:
  - LUN 1: DS3DB for tiles 6 (600GB)
- Third PCIe-SSD:
  - LUN 1: AuctionNoSQL, ElasticDB for tile 6 (300GB)
  - LUN 2: AuctionNoSQL, ElasticDB for tile 7 (300GB)

- LUN 3: AuctionDB, ElasticLB for tile 6 (300GB)
- LUN 4: AuctionDB, ElasticLB for tile 7 (300GB)
- Fourth PCIe-SSD:
  - LUN 1: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 6 (300GB)
  - LUN 2: AuctionWebA, AuctionWebB, AuctionAppA, AuctionAppB, AuctionLB, AuctionMSQ, Standby, ElasticWebA, ElasticWebB, ElasticAppA, ElasticAppB for tile 7 (300GB)
  - LUN 3: XvMotion Target Lun (300GB)
  - LUN 4: DS3DB for tiles 8 (600GB)

## Datacenter Management Server Notes

- Virtual Center realized as a VM running on a dedicated Hypervisor system:
  - Number of vCPUs: 4 (Four vSocket)
  - Size of vRAM: 16GB
- The host operating system VMware ESXi 6.7.0 EP 02a Build 9214924 was installed using 'Fujitsu Custom Image for VMware ESXi 6.7.0 EP 02a' named VMware-ESXi-6.7.0-9214924-Fujitsu-v451-1.iso

## Operating System Notes

VMware ESXi 6.7.1 EP 06 Build 11675023 was installed using 'Fujitsu Custom Image for VMware ESXi 6.7.1 EP 06' named VMware-ESXi-6.7.0-11675023-Fujitsu-v461-1.iso

- VMware ESXi 6.7.1 EP 06 Build 11675023 was released by VMware on 01-17-2019
- The Fujitsu customized ISO image will be released by Fujitsu on 04-09-2019

## Software Notes

None

## Client Notes

Client Host1: Client0,Client2,Client5,Client8

Client Host2: Client1,Client4,Client7

Client Host3: Client3,Client6,PrimeClient

Changes in esx.conf:

- /adv/Power/CpuPolicy = High Performance (default balanced)
- /adv/UserVars/HostClientCEIPOptIn = 1 (default 0)

## Other Notes

None

## Security Mitigations

| 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      |

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