

# VMmark® 3.1.1 Results

**Server Vendor & Model:** Huawei FusionServer 2288H V5  
**Storage Vendor & Model:** VMware vSAN - All Flash  
**Hypervisor:** VMware ESXi 7.0 U2 Build 17630552  
**Datacenter Management Software:** VMware vCenter 7.0 U2 Build 17694817

**VMmark 3.1.1 Score =**  
**15.83 @ 16 Tiles**

|  |  |   |
|--|--|---|
| Number of Hosts: 8                                 | Uniform Hosts [yes/no]: yes                            | Total sockets/cores/threads in test: 16/256/512     |
| Tested By: Huawei                                  |  | Test Date: 04-06-2021                               |
| Performance Section<br><a href="#">Performance</a> | Configuration Section<br><a href="#">Configuration</a> | Notes Section<br><a href="#">Notes for Workload</a> |

## Performance

|        | weathervane |       |                  | weathervaneE |       |                  | dvdstoreA |       |         | dvdstoreB |       |         | dvdstoreC |       |         |      |
|--------|-------------|-------|------------------|--------------|-------|------------------|-----------|-------|---------|-----------|-------|---------|-----------|-------|---------|------|
| TILE_0 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3578.09     | 0.99  | 0.50   0.01      | 565.48       | 0.99  | 0.53   0.13      | 913.83    | 1.24  | 926.04  | 621.80    | 1.24  | 1120.31 | 435.05    | 1.25  | 1241.17 | 1.14 |
| p1     | 3566.22     | 0.99  | 0.46   0.00      | 559.91       | 0.98  | 0.36   0.02      | 890.58    | 1.21  | 989.00  | 631.92    | 1.26  | 1175.96 | 465.18    | 1.34  | 1303.68 | 1.15 |
| p2     | 3556.73     | 0.99  | 0.46   0.00      | 556.73       | 0.97  | 0.39   0.02      | 919.35    | 1.25  | 903.52  | 627.73    | 1.25  | 1097.92 | 437.38    | 1.26  | 1218.17 | 1.14 |
| TILE_1 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3583.65     | 1.00  | 0.43   0.00      | 572.07       | 1.00  | 0.60   0.12      | 889.50    | 1.21  | 1026.94 | 600.12    | 1.20  | 1258.79 | 413.55    | 1.19  | 1411.84 | 1.12 |
| p1     | 3571.49     | 0.99  | 0.48   0.00      | 566.80       | 0.99  | 0.55   0.07      | 933.75    | 1.27  | 871.38  | 669.95    | 1.34  | 1022.16 | 497.07    | 1.43  | 1120.74 | 1.19 |
| p2     | 3552.99     | 0.99  | 0.42   0.00      | 562.07       | 0.98  | 0.41   0.04      | 949.52    | 1.29  | 868.53  | 654.00    | 1.31  | 1056.86 | 451.88    | 1.30  | 1185.89 | 1.16 |
| TILE_2 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3586.76     | 1.00  | 0.49   0.00      | 568.55       | 0.99  | 0.39   0.02      | 968.55    | 1.32  | 795.22  | 668.35    | 1.34  | 975.83  | 464.38    | 1.34  | 1082.10 | 1.18 |
| p1     | 3576.08     | 0.99  | 0.55   0.01      | 569.83       | 1.00  | 0.42   0.01      | 966.80    | 1.32  | 762.62  | 699.95    | 1.40  | 894.07  | 524.42    | 1.51  | 974.22  | 1.22 |
| p2     | 3562.83     | 0.99  | 0.55   0.00      | 565.16       | 0.99  | 0.38   0.00      | 981.35    | 1.34  | 737.47  | 679.17    | 1.36  | 883.58  | 473.05    | 1.36  | 996.86  | 1.19 |
| TILE_3 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3574.41     | 0.99  | 0.39   0.00      | 567.44       | 0.99  | 0.37   0.01      | 973.60    | 1.33  | 765.35  | 677.08    | 1.35  | 930.73  | 476.32    | 1.37  | 1025.28 | 1.19 |
| p1     | 3568.50     | 0.99  | 0.47   0.00      | 563.73       | 0.99  | 0.44   0.08      | 962.27    | 1.31  | 777.56  | 695.65    | 1.39  | 924.22  | 520.35    | 1.50  | 988.92  | 1.22 |
| p2     | 3553.21     | 0.99  | 0.47   0.00      | 559.58       | 0.98  | 0.32   0.02      | 961.27    | 1.31  | 792.76  | 665.42    | 1.33  | 958.42  | 468.43    | 1.35  | 1049.57 | 1.18 |
| TILE_4 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3582.01     | 1.00  | 0.36   0.00      | 573.00       | 1.00  | 0.59   0.14      | 830.50    | 1.13  | 1251.60 | 551.65    | 1.10  | 1521.43 | 378.32    | 1.09  | 1685.46 | 1.06 |
| p1     | 3564.97     | 0.99  | 0.35   0.00      | 567.64       | 0.99  | 0.41   0.02      | 843.65    | 1.15  | 1200.53 | 575.02    | 1.15  | 1488.60 | 399.60    | 1.15  | 1655.92 | 1.08 |
| p2     | 3554.06     | 0.99  | 0.39   0.00      | 565.09       | 0.99  | 0.41   0.01      | 845.05    | 1.15  | 1212.28 | 543.83    | 1.09  | 1472.10 | 374.55    | 1.08  | 1732.86 | 1.06 |
| TILE_5 | Actual      | Ratio | QoS(nRT MaxPctF) | Actual       | Ratio | QoS(nRT MaxPctF) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | Actual    | Ratio | QoS(ms) | GM   |
| p0     | 3584.12     | 1.00  | 0.34   0.00      | 570.87       | 1.00  | 0.54   0.12      | 939.52    | 1.28  | 860.71  | 650.50    | 1.30  | 1010.58 | 468.48    | 1.35  | 1159.04 | 1.17 |

|                |         |       |                   |        |       |                   |        |       |         |        |       |         |        |       |         |      |
|----------------|---------|-------|-------------------|--------|-------|-------------------|--------|-------|---------|--------|-------|---------|--------|-------|---------|------|
| <b>p1</b>      | 3565.08 | 0.99  | 0.33   0.11       | 570.01 | 1.00  | 0.55   0.05       | 952.88 | 1.30  | 802.96  | 682.42 | 1.36  | 977.21  | 485.20 | 1.40  | 1053.38 | 1.20 |
| <b>p2</b>      | 3566.45 | 0.99  | 0.34   0.00       | 567.53 | 0.99  | 0.36   0.05       | 935.58 | 1.27  | 893.53  | 621.02 | 1.24  | 1077.35 | 435.52 | 1.26  | 1253.15 | 1.14 |
| <b>TILE_6</b>  | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3574.11 | 0.99  | 0.45   0.00       | 570.96 | 1.00  | 0.55   0.06       | 938.02 | 1.28  | 870.90  | 672.02 | 1.34  | 1038.47 | 468.45 | 1.35  | 1181.09 | 1.18 |
| <b>p1</b>      | 3569.11 | 0.99  | 0.50   0.01       | 561.94 | 0.98  | 0.38   0.04       | 962.27 | 1.31  | 773.35  | 670.67 | 1.34  | 926.11  | 489.57 | 1.41  | 1035.06 | 1.19 |
| <b>p2</b>      | 3540.42 | 0.98  | 0.45   0.00       | 559.29 | 0.98  | 0.41   0.02       | 972.00 | 1.32  | 765.57  | 676.62 | 1.35  | 915.00  | 476.45 | 1.37  | 1014.14 | 1.19 |
| <b>TILE_7</b>  | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3579.47 | 0.99  | 0.42   0.00       | 567.18 | 0.99  | 0.47   0.04       | 990.25 | 1.35  | 717.12  | 717.73 | 1.43  | 845.62  | 504.62 | 1.46  | 961.83  | 1.23 |
| <b>p1</b>      | 3568.89 | 0.99  | 0.51   0.00       | 564.76 | 0.99  | 0.41   0.02       | 968.52 | 1.32  | 766.74  | 679.42 | 1.36  | 910.23  | 500.27 | 1.44  | 990.13  | 1.20 |
| <b>p2</b>      | 3550.18 | 0.99  | 0.49   0.00       | 564.36 | 0.99  | 0.38   0.02       | 962.48 | 1.31  | 788.16  | 665.88 | 1.33  | 945.53  | 465.82 | 1.34  | 1066.98 | 1.18 |
| <b>TILE_8</b>  | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3580.45 | 1.00  | 0.34   0.00       | 571.05 | 1.00  | 0.57   0.09       | 878.60 | 1.20  | 1091.66 | 617.35 | 1.23  | 1300.83 | 414.15 | 1.19  | 1546.99 | 1.12 |
| <b>p1</b>      | 3570.77 | 0.99  | 0.33   0.00       | 568.09 | 0.99  | 0.41   0.02       | 907.48 | 1.24  | 980.51  | 613.33 | 1.23  | 1190.13 | 434.43 | 1.25  | 1381.28 | 1.13 |
| <b>p2</b>      | 3557.48 | 0.99  | 0.32   0.00       | 564.37 | 0.99  | 0.28   0.03       | 929.33 | 1.27  | 892.34  | 637.40 | 1.27  | 1085.00 | 435.27 | 1.26  | 1239.30 | 1.15 |
| <b>TILE_9</b>  | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3580.92 | 1.00  | 0.42   0.00       | 564.57 | 0.99  | 0.38   0.02       | 874.75 | 1.19  | 1115.27 | 611.08 | 1.22  | 1360.77 | 401.50 | 1.16  | 1631.10 | 1.11 |
| <b>p1</b>      | 3571.66 | 0.99  | 0.45   0.01       | 563.05 | 0.98  | 0.42   0.03       | 924.83 | 1.26  | 920.19  | 637.00 | 1.27  | 1117.10 | 446.38 | 1.29  | 1311.99 | 1.15 |
| <b>p2</b>      | 3555.81 | 0.99  | 0.35   0.00       | 559.30 | 0.98  | 0.39   0.05       | 911.25 | 1.24  | 1004.72 | 619.30 | 1.24  | 1219.03 | 409.25 | 1.18  | 1471.36 | 1.12 |
| <b>TILE_10</b> | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3578.05 | 0.99  | 0.45   0.00       | 571.26 | 1.00  | 0.54   0.04       | 941.92 | 1.28  | 870.34  | 688.30 | 1.38  | 1011.61 | 470.15 | 1.36  | 1186.82 | 1.19 |
| <b>p1</b>      | 3569.58 | 0.99  | 0.40   0.00       | 564.56 | 0.99  | 0.36   0.02       | 963.02 | 1.31  | 833.83  | 655.42 | 1.31  | 1040.97 | 463.68 | 1.34  | 1220.30 | 1.18 |
| <b>p2</b>      | 3556.60 | 0.99  | 0.42   0.00       | 560.21 | 0.98  | 0.35   0.01       | 961.33 | 1.31  | 806.62  | 679.60 | 1.36  | 934.71  | 459.73 | 1.33  | 1099.81 | 1.18 |
| <b>TILE_11</b> | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3581.43 | 1.00  | 0.33   0.00       | 568.72 | 0.99  | 0.62   0.04       | 961.08 | 1.31  | 833.01  | 700.58 | 1.40  | 984.32  | 476.45 | 1.37  | 1156.74 | 1.20 |
| <b>p1</b>      | 3568.86 | 0.99  | 0.43   0.01       | 565.42 | 0.99  | 0.52   0.07       | 965.15 | 1.31  | 787.96  | 669.40 | 1.34  | 963.76  | 456.35 | 1.32  | 1126.11 | 1.18 |
| <b>p2</b>      | 3556.80 | 0.99  | 0.44   0.00       | 561.74 | 0.98  | 0.46   0.08       | 968.85 | 1.32  | 767.67  | 686.05 | 1.37  | 896.63  | 486.85 | 1.40  | 1058.67 | 1.20 |
| <b>TILE_12</b> | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3576.32 | 0.99  | 0.39   0.00       | 564.99 | 0.99  | 0.38   0.04       | 845.27 | 1.15  | 1240.28 | 612.02 | 1.22  | 1471.69 | 414.30 | 1.19  | 1740.07 | 1.11 |
| <b>p1</b>      | 3560.64 | 0.99  | 0.40   0.00       | 562.34 | 0.98  | 0.42   0.03       | 888.80 | 1.21  | 1039.37 | 574.20 | 1.15  | 1296.22 | 397.52 | 1.15  | 1520.08 | 1.09 |
| <b>p2</b>      | 3545.30 | 0.99  | 0.41   0.00       | 562.17 | 0.98  | 0.41   0.07       | 882.83 | 1.20  | 1071.03 | 620.50 | 1.24  | 1277.51 | 419.95 | 1.21  | 1489.16 | 1.12 |
| <b>TILE_13</b> | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3587.18 | 1.00  | 0.46   0.00       | 565.86 | 0.99  | 0.45   0.05       | 903.40 | 1.23  | 985.08  | 667.35 | 1.33  | 1151.31 | 462.88 | 1.33  | 1346.15 | 1.17 |
| <b>p1</b>      | 3581.91 | 1.00  | 0.41   0.00       | 561.32 | 0.98  | 0.40   0.04       | 920.17 | 1.25  | 946.45  | 604.27 | 1.21  | 1158.11 | 423.00 | 1.22  | 1352.27 | 1.13 |
| <b>p2</b>      | 3566.82 | 0.99  | 0.34   0.00       | 557.73 | 0.97  | 0.41   0.10       | 904.02 | 1.23  | 1005.34 | 639.67 | 1.28  | 1193.87 | 432.38 | 1.25  | 1421.00 | 1.14 |
| <b>TILE_14</b> | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>      | 3575.95 | 0.99  | 0.41   0.01       | 567.87 | 0.99  | 0.36   0.01       | 932.20 | 1.27  | 877.26  | 670.55 | 1.34  | 1035.17 | 482.02 | 1.39  | 1203.54 | 1.18 |

|                  |         |       |                   |        |       |                   |        |       |         |        |       |         |        |       |         |      |
|------------------|---------|-------|-------------------|--------|-------|-------------------|--------|-------|---------|--------|-------|---------|--------|-------|---------|------|
| <b>p1</b>        | 3561.42 | 0.99  | 0.39   0.00       | 565.83 | 0.99  | 0.45   0.19       | 972.30 | 1.32  | 780.57  | 677.58 | 1.35  | 936.81  | 460.98 | 1.33  | 1097.33 | 1.18 |
| <b>p2</b>        | 3553.73 | 0.99  | 0.43   0.00       | 563.11 | 0.98  | 0.33   0.00       | 974.27 | 1.33  | 788.89  | 704.92 | 1.41  | 919.15  | 484.73 | 1.40  | 1094.70 | 1.20 |
| <b>TILE_15</b>   | Actual  | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(nRTI MaxPctF) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | Actual | Ratio | QoS(ms) | GM   |
| <b>p0</b>        | 3579.06 | 0.99  | 0.40   0.00       | 559.86 | 0.98  | 0.34   0.03       | 976.12 | 1.33  | 759.48  | 709.62 | 1.42  | 892.46  | 514.40 | 1.48  | 1030.93 | 1.22 |
| <b>p1</b>        | 3568.12 | 0.99  | 0.33   0.00       | 558.84 | 0.98  | 0.38   0.03       | 974.10 | 1.33  | 778.75  | 674.10 | 1.35  | 949.67  | 449.70 | 1.30  | 1152.92 | 1.18 |
| <b>p2</b>        | 3551.67 | 0.99  | 0.34   0.00       | 554.02 | 0.97  | 0.37   0.02       | 917.50 | 1.25  | 945.15  | 656.90 | 1.31  | 1124.54 | 442.88 | 1.28  | 1331.64 | 1.15 |
| <b>p0_score:</b> | 18.57   |       |                   |        |       |                   |        |       |         |        |       |         |        |       |         |      |
| <b>p1_score:</b> | 18.67   |       |                   |        |       |                   |        |       |         |        |       |         |        |       |         |      |
| <b>p2_score:</b> | 18.49   |       |                   |        |       |                   |        |       |         |        |       |         |        |       |         |      |

| <b>Infrastructure_Operations_Scores:</b> | vMotion | SVMotion | XVMotion | Deploy |
|--|---------|----------|----------|--------|
| <b>Completed_Ops_PerHour</b>             | 114.00  | 104.00   | 80.00    | 40.00  |
| <b>Avg_Seconds_To_Complete</b>           | 5.28    | 86.55    | 105.01   | 296.04 |
| <b>Failures</b>                          | 0.00    | 0.00     | 0.00     | 0.00   |
| <b>Ratio</b>                             | 4.38    | 5.78     | 4.44     | 5.00   |
| <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(p0) |
| <b>Unreviewed_VMmark3_Applications_Score</b>   | 18.57                           |                  |
| <b>Unreviewed_VMmark3_Infrastructure_Score</b> | 4.87                            |                  |
| <b>Unreviewed_VMmark3_Score</b>                | 15.83                           |                  |

## Configuration

| <b>Virtualization Software</b>  |   |
|---|---|
| Hypervisor Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY)                     | VMware ESXi 7.0 U2 Build 17630552 / 03-09-2021    |
| Datacenter Management Software Vendor, Product, Version, and Build / Availability Date (MM-DD-YYYY) | VMware vCenter 7.0 U2 Build 17694817 / 03-09-2021 |
| Supplemental Software   | None  |
| <b>Servers</b>  |   |
| Number of Servers in System Under Test  | 8   |

|  |  |
|--|--|
| (all subsequent fields in this section are per server) |  |
| Server Manufacturer and Model                          | Huawei FusionServer 2288H V5   |
| Processor Vendor and Model                             | Intel Xeon Gold 6226R CPU @ 2.90GHz  |
| Processor Speed (GHz) / Turbo Boost Speed (GHz)        | 2.90 / 3.90  |
| Total Sockets/Total Cores/Total Threads                | 2 Sockets / 32 Cores / 64 Threads  |
| Primary CPU Cache                                      | 32KB I+32KB D on chip per core   |
| Secondary CPU Cache                                    | 1MB I+D on chip per core   |
| Other CPU Cache  | 22MB I+D on chip per chip  |
| BIOS Version   | 7.58 (U47)   |
| Memory Size (in GB, Number of DIMMs)                   | 384GB, 12*32GB   |
| Memory Type and Speed                                  | 32GB, 2933MHz, 2Rank (2G*8bit)   |
| Disk Subsystem Type                                    | VMware vSAN, NFS   |
| Number of Disk Controllers                             | 1  |
| Disk Controller Vendors and Models                     | LSI SAS3004  |
| Total Number of Physical Disks for Hypervisor          | 2  |
| Disk Vendors, Models, Capacities, and Speeds           | SSSTC ER2-GD480, 480GB, 6Gb/S  |
| Number of Host Bus Adapters                            | 0  |
| Host Bus Adapter Vendors and Models                    | none   |
| Number of Network Controllers                          | 3  |
| Network Controller Vendors and Models                  | Huawei LOM X722 2*10GE+2*GE (unused),<br>Huawei SM380 2*25GE SFP+ (1 port unused),<br>Huawei SP382 2*25GE SFP+ |
| Other Hardware   | none   |
| Other Software   | none   |
| Hardware Availability Date (MM-DD-YYYY)                | 02-24-2020   |
| BIOS Availability Date (MM-DD-YYYY)                    | 05-30-2020   |
| Software Availability Date (MM-DD-YYYY)                | 03-09-2021   |

**Network**

|  |  |
|--|--|
| Network Switch Vendors and Models                                      | Huawei CE6865-48S8CQ-EI<br>Huawei CE5855-48T4S2Q-EI  |
| Network Speed  | 3*25GE   |
| <b>Primary Storage</b>   |  |
| Storage Category   | vSAN   |
| Storage Vendors, Models, and Firmware Versions                         | 8*Huawei FusionServer 2288H V5   |
| Storage Configuration Summary  | VMware vSAN(caching tier): Huawei ES3610P V5 1.6TB (HWE52P431T6M005N)<br>VMware vSAN(capacity tier): Huawei ES3510P V5 1.92TB (HWE52P431T9L005N) |
| <b>Datacenter Management Server</b>                                    |  |
| System Model   | Huawei FusionServer 2288H V5   |
| Processor Vendor and Model   | Intel Xeon Gold 6152 CPU @ 2.10GHz   |
| Processor Speed (GHz)  | 2.10   |
| Total Sockets/Total Cores/Total Threads                                | 2 Sockets / 44 Cores / 88 Threads  |
| Memory Size (in GB, Number of DIMMs)                                   | 384GB, 12*32GB   |
| Network Controller(s) Vendors and Models                               | Huawei LOM X722 2*10GE+2*GE,<br>Huawei SM380 2*25GE SFP+   |
| Operating System, Version, Bitness, and Service Pack                   | VMware ESXi 7.0 U2 Build 17630552  |
| Virtual Center VM Number of vCPUs                                      | 8  |
| Virtual Center VM Virtual Memory (in GB)                               | 28   |
| Virtual Center VM Operating System, Version, Bitness, and Service Pack | VMware vCenter 7.0 U2 Build 17694817   |
| Other Hardware   | none   |
| Other Software   | none   |
| <b>Clients</b>   |  |
| Total Number of Virtual Clients / Virtual Client Hosts                 | 17 / 4   |
| System Model(s)  | Huawei FusionServer 2288H V5   |
| Processor Vendor(s) and Model(s)                                       | Intel Xeon Gold 6230 CPU @ 2.10GHz   |
| Processor Speed(s) (GHz)   | 2.10   |

|  |   |
|--|---|
| Total Sockets/Total Cores/Total Threads  | 2 Sockets / 40 Cores / 80 Threads   |
| Memory per Virtual Client Host           | 384GB, 12*32GB  |
| Network Controller(s) Vendors and Models | Huawei LOM X722 2*10GE+2*GE, Huawei SM380 2*25GE SFP+   |
| Virtual Client Networking Notes          | All management traffic and workload traffic running on one vmnic4 and vSAN traffic running on one vmnic5. |
| Virtual Client Storage Notes             | All clients stored on vSAN datastore.   |
| Other Hardware                           | none  |
| Other Software                           | VMware ESXi 7.0 U2 Build 17630552   |

#### Security Mitigations

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

## Notes for Workload

Template deployed with disk type: Thin

### Virtualization Software Notes

- PrimeClient VM configured with a 500GB sized second disk and a 500GB sized third disk for scratch.
- Cluster DRS Automation level set to Fully Automated.
- DRS Migration threshold set to level 2.
- Logging was disabled for all VMs (default: enabled).
- Logical CPU configuration changed for all multi-cpu VMs to one socket with multiple cores (default: Single core per socket).
- The CPU Shares of PrimeClient and Client\* are "high" (default: normal).
- VMkernel.Boot.hyperthreadingMitigation = true set on all ESXi hosts (default: false).

### Server Notes

- NUMA enabled (default).

- Intel Hyper Threading enabled (default).
- Power Management Setting: Performance.
- VMX enabled (default).
- SATA Controller disabled on host1, host2, host3, host4, host5, host6, host8.
- sSATA Controller disabled on host1, host2, host3, host4, host5, host6, host8.
- SATA Controller enabled but unused on host7.
- sSATA Controller enabled but unused on host7.
- MONITOR/MWAIT enabled.

- **ESXi settings of SUT hosts:**

- o CPU performance policy = High Performance (default: balanced)
- o /vmkernel/hyperthreadingMitigation = true (default: false)
- o /UserVars/HostClientSessionTimeout = 7200 (default: 900)
- o /UserVars/HostClientCEIPOptIn = 1 (default: 0)
- o /adv/Virsto/DedupSpaceReclaim = 2 (default: 0)
- o /adv/Misc/VsanPeriodicTimerInterrupt = 1 (default: 0)

## Networking Notes

- MTU was set to 9000 for vmnic4, vmnic5 and vmnic6 (For host6, MTU was set to 9000 for vmnic7 instead of vmnic6).
- MTU was set to 9000 for vSwitch0, vSAN and vMotion vSwitches.
- Three Standard vSwitches were set up: vSwitch0, vSAN and vMotion.
- These three switches were backed by vmnic4, vmnic5 and vmnic6 respectively (host6 used vmnic7 instead of vmnic6).
- vSwitch0 contains the following portgroups: VM Network, Management Network.
- vSAN contains the following portgroups: vSAN.
- vMotion contains the following portgroups: vMotion.
- All virtual machines used VM Network for traffic.
- All vSAN traffic is only run on vSAN on its only dedicated vSwitch.
- All vMotion traffic is only run on vMotion on its only dedicated vSwitch.

## Storage Notes

- All client hosts OS installed on a RAID1 of 2 m.2 drives via SSSTC ER2-GD480.
- All SUT hosts OS installed on a RAID1 of 2 m.2 drives via SSSTC ER2-GD480.

- **NFS Folder configuration**

- o All folders are backed by two physical servers acted as NFS on a single striped zfs array, mounted storage device detailed in the "Secondary Shared Storage Device" section.
- o deploy1 is /data/deploy1 from 192.168.211.9 mounted available.
- o deploy2 is /data/deploy2 from 192.168.211.9 mounted available.
- o deploy3 is /data/deploy3 from 192.168.211.10 mounted available.
- o deploy4 is /data/deploy4 from 192.168.211.10 mounted available.
- o vmotion1 is /data/vmotion1 from 192.168.231.9 mounted available.
- o vmotion2 is /data/vmotion2 from 192.168.231.9 mounted available.
- o vmotion3 is /data/vmotion3 from 192.168.231.10 mounted available.
- o vmotion2 is /data/vmotion4 from 192.168.231.10 mounted available.

- **System under Test configuration**

- o 8 x 2 x Intel(R) Xeon(R) Gold 6226R CPU @ 2.90GHz
- o 8 x 12 x 32GB Memory, 2933MHz, 2Rank (2G\*8bit)
- o 8 x 2 x Huawei ES3610P V5 1.6TB NVMe
- o 8 x 6 x Huawei ES3510P V5 1.92TB NVMe
- o 8 x Huawei LOM X722 2\*10GE+2\*GE (unused)
- o 8 x Huawei SM380 2\*25GE SFP+
- o 8 x Huawei SP382 2\*25GE SFP+
- o 8 x 2 x SSSTC ER2-GD480
- o 8 x LSI SAS3004

• **Software configuration**

- o All Flash vSAN.
- o Two disk groups per host.
- o Each disk group contains 1 x Huawei ES3610P V5 1.6TB for caching and 3 x Huawei ES3510P V5 1.92TB for capacity.
- o vSAN Default Storage Policy used.

• **Virtual Machine LUN Distribution:**

o vsanDatastore contains the following workloads:

- ◆ AuctionAppA\*
- ◆ AuctionAppB\*
- ◆ AuctionDB\*
- ◆ AuctionLB\*
- ◆ AuctionMSQ\*
- ◆ AuctionNoSQL\*
- ◆ AuctionWebA\*
- ◆ AuctionWebB\*
- ◆ DS3DB\*
- ◆ DS3WebA\*
- ◆ DS3WebB\*
- ◆ DS3WebC\*
- ◆ ElasticAppA\*
- ◆ ElasticAppB\*
- ◆ ElasticDB\*
- ◆ ElasticLB\*
- ◆ ElasticWebA\*
- ◆ ElasticWebB\*
- ◆ Standby\*

• **Secondary Shared Storage Device:**

- o Hardware: Huawei FusionServer 2288H V5
- ◆ 2 x Huawei FusionServer 2288H V5
- ◆ 2 x 2 x Intel(R) Xeon(R) Gold 6242R CPU @ 3.10GHz
- ◆ 2 x 12 x 32GB Memory, 2933MHz, 2Rank (2G\*8bit)
- ◆ 2 x Huawei LOM X722 2\*10GE+2\*GE



- ◆ 2 x Huawei SM380 2\*25GE SFP+
- ◆ 2 x 5 x Huawei ES3510P V5 1.92TB NVMe
- ◆ 2 x SSSTC ER2-GD240
- ◆ 2 x LSI SAS3004

o Firmware:

- ◆ BIOS - 7.58 (U47)
- ◆ BMC - 5.20 (U4282)
- ◆ X722 - 3.33
- ◆ SM380 - 14.28.1300
- ◆ 1.92TB Huawei ES3510P V5 1.92TB (HWE52P431T9L005N) -3248
- ◆ SSSTC ER2-GD240 - E4N6404

o Software:

- ◆ CentOS-7-x86\_64-DVD-1810/ Updates as of 06/20/2019

o Configuration:

- ◆ Disks installed into Bays 1, 2, 3, 5, 6 per host
- ◆ All 5 disks mount to the path /data per host
- ◆ Huawei SM380 set to MTU 9000 per host
- ◆ ufw disabled per host

o Virtual Machine LUN Distribution:

- ◆ deploy1 contains the following workload: deploy1, belongs to "NFS1"
- ◆ deploy2 contains the following workload: deploy2, belongs to "NFS1"
- ◆ deploy3 contains the following workload: deploy3, belongs to "NFS2"
- ◆ deploy4 contains the following workload: deploy4, belongs to "NFS2"
- ◆ vmotion1 contains the following workload: vmotion1, belongs to "NFS1"
- ◆ vmotion2 contains the following workload: vmotion2, belongs to "NFS1"
- ◆ vmotion3 contains the following workload: vmotion3, belongs to "NFS2"
- ◆ vmotion4 contains the following workload: vmotion4, belongs to "NFS2"

## **Datacenter Management Server Notes**

The datacenter management server was hosted on a separate vCenter Server Appliance from the Clients and SUT.

## **Operating System Notes**

- none

## **Software Notes**

- none

## **Client Notes**

- Cluster DRS Automation level set to Fully Automated.
- DRS Migration threshold set to level 2.
- MTU was set to 9000 for vmnic4 and MTU was set to 9000 for vSwitch of VM Network and Management.

- MTU was set to 9000 for vmnic5 and MTU was set to 9000 for vSwitch of vSAN.
- The CPU Shares of PrimeClient and Client\* are "high" (default: normal).

- **ESXi settings of Client hosts:**

- o CPU performance policy = High Performance (default: balanced)
- o /vmkernel/hyperthreadingMitigation = true (default: false)
- o /UserVars/HostClientSessionTimeout = 7200 (default: 900)
- o /UserVars/HostClientCEIPOptIn = 1 (default: 0)
- o /adv/Virsto/DedupSpaceReclaim = 2 (default: 0)
- o /adv/Misc/VsanPeriodicTimerInterrupt = 1 (default: 0)

- **vSAN configuration**

- o All Flash vSAN.
- o One disk group per host.
- o Each disk group contains 1 x Huawei ES3610P V5 1.6TB for caching and 3 x Huawei ES3610P V5 1.6TB for capacity.
- o vSAN Default Storage Policy used.

- o **vsanDatastore contains the following Client VMs:**

- ◆ Client0
- ◆ Client1
- ◆ Client2
- ◆ Client3
- ◆ Client4
- ◆ Client5
- ◆ Client6
- ◆ Client7
- ◆ Client8
- ◆ Client9
- ◆ Client10
- ◆ Client11
- ◆ Client12
- ◆ Client13
- ◆ Client14
- ◆ Client15
- ◆ PrimeClient

## Other Notes

- VMmark3.properties - DebugLevel = 3 (default: 0)
- VMmark3.properties - VCscratchDir = /root/VMmark3/results/scratch
- VMmark3.properties - VCsupportTimeOut = 4800 (default: 2400)
- VMmark3.properties - TileDelay = 10 (default: 60)

For information about VMmark and the rules regarding its usage visit [www.vmware.com/products/vmmark](http://www.vmware.com/products/vmmark).

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