### SPEC CPU®2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10 Plus  
(2.90 GHz, Intel Xeon Gold 6326)

<table>
<thead>
<tr>
<th>CPU2017 License: 3</th>
<th>Test Date: Jun-2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor: HPE</td>
<td>Hardware Availability: Jun-2021</td>
</tr>
<tr>
<td>Tested by: HPE</td>
<td>Software Availability: Jun-2021</td>
</tr>
</tbody>
</table>

**SPECrater®2017_int_base = 263**  
**SPECrater®2017_int_peak = 272**

![Graph showing SPEC CPU 2017 Integer Rate results](image)

#### Hardware

<table>
<thead>
<tr>
<th>CPU Name: Intel Xeon Gold 6326</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max MHz: 3500</td>
</tr>
<tr>
<td>Nominal: 2900</td>
</tr>
<tr>
<td>Enabled: 32 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td>Ordinal: 1, 2 chip(s)</td>
</tr>
<tr>
<td>Cache L1: 32 KB I+48 KB D on chip per core</td>
</tr>
<tr>
<td>L2: 1.25 MB I+D on chip per core</td>
</tr>
<tr>
<td>L3: 24 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Other: None</td>
</tr>
<tr>
<td>Memory: 2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R)</td>
</tr>
<tr>
<td>Storage: 1 x 400 GB SAS SSD, RAID 0</td>
</tr>
<tr>
<td>Other: None</td>
</tr>
</tbody>
</table>

#### Software

<table>
<thead>
<tr>
<th>OS: Red Hat Enterprise Linux 8.3 (Ootpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kernel 4.18.0-240.el8.x86_64</td>
</tr>
<tr>
<td>Classic Build 20201112 for Linux; C/C++: Version 2021.1 of Intel C/C++ Compiler</td>
</tr>
<tr>
<td>Classic Build 20201112 for Linux</td>
</tr>
<tr>
<td>Parallel: No</td>
</tr>
<tr>
<td>Firmware: HPE BIOS Version U46 v1.42 05/16/2021 released May-2021</td>
</tr>
<tr>
<td>File System: xfs</td>
</tr>
<tr>
<td>System State: Run level 3 (multi-user)</td>
</tr>
<tr>
<td>Base Pointers: 64-bit</td>
</tr>
<tr>
<td>Peak Pointers: 32/64-bit</td>
</tr>
<tr>
<td>Other: jemalloc memory allocator V5.0.1</td>
</tr>
<tr>
<td>Power Management: BIOS set to prefer performance at the cost of additional power usage</td>
</tr>
</tbody>
</table>
### Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>500.perlbench_r</td>
<td>64</td>
<td>578</td>
<td>176</td>
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<td>505.mcf_r</td>
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<td>520.omnetpp_r</td>
<td>64</td>
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<td>174</td>
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<td>523.xalanbenchmr</td>
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<td>531.deepsjeng_r</td>
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<td>541.leea_r</td>
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<td>557.xz_r</td>
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<td>143</td>
<td>482</td>
<td>143</td>
<td>482</td>
<td>143</td>
</tr>
</tbody>
</table>

**Submit Notes**

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

**Operating System Notes**

Stack size set to unlimited using "ulimit -s unlimited"
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesystem page cache synced and cleared with:
sync; echo 3 > /proc/sys/vm/drop_caches

**Environment Variables Notes**

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
"/home/cpu2017_1.1.8/lib/intel64:/home/cpu2017_1.1.8/lib/ia32:/home/cpu2017_1.1.8/je5.0.1-32"
MALLOCS_CONF = "retain:true"

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1

(Continued on next page)
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| SPECrate®2017_int_base = 263 |
| SPECrate®2017_int_peak = 272 |

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

General Notes (Continued)

runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown) is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1) is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2) is mitigated in the system as tested and documented.

Submitted by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon Jun 21 10:21:12 EDT 2021
Submission: cpu2017-20210621-27540.sub

Platform Notes

The system ROM used for this result contains Intel microcode version 0xd0002a0 for the Intel Xeon Gold 6326 processor.

BIOS Configuration:
- Workload Profile set to General Throughput Compute
- Memory Patrol Scrubbing set to Disabled
- Advanced Memory Protection set to Advanced ECC
- XPT Remote Prefetcher set to Enabled
- Last Level Cache (LLC) Dead Line Allocation set to Disabled
- Enhanced Processor Performance set to Enabled
- Enhanced Processor Performance Profile set to Aggressive
- Thermal Configuration set to Maximum Cooling
- Intel UPI Link Frequency set to Minimum
- Intel UPI Link Enablement set to Single Link
- D2K set to Disabled
- Workload Profile set to Custom
  - DCU Stream Prefetcher set to Disabled
  - Energy Efficient Turbo set to Enabled
  - Adjacent Sector Prefetcher set to Disabled
  - Intel UPI Link Power Management set to Enabled

Sysinfo program /home/cpu2017_1.1.8/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16aca6c64d running on localhost.localdomain Tue Jun 8 16:22:36 2021

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see
https://www.spec.org/cpu2017/Docs/config.html#sysinfo

(Continued on next page)
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Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021

Platform Notes (Continued)

From /proc/cpuinfo
    model name : Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
        2 "physical id"s (chips)
        64 "processors"
        cores, siblings (Caution: counting these is hw and system dependent. The following
        excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
        cpu cores : 16
        siblings : 32
        physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
        physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu from util-linux 2.32.1:
    Architecture:        x86_64
    CPU op-mode(s):      32-bit, 64-bit
    Byte Order:          Little Endian
    CPU(s):              64
    On-line CPU(s) list: 0-63
    Thread(s) per core:  2
    Core(s) per socket:  16
    Socket(s):           2
    NUMA node(s):        4
    Vendor ID:           GenuineIntel
    CPU family:          6
    Model:               106
    Model name:          Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
    Stepping:            6
    CPU MHz:             2847.794
    BogoMIPS:            5800.00
    Virtualization:      VT-x
    L1d cache:           48K
    L1i cache:           32K
    L2 cache:            1280K
    L3 cache:            24576K
    NUMA node0 CPU(s):   0-7,32-39
    NUMA node1 CPU(s):   8-15,40-47
    NUMA node2 CPU(s):   16-23,48-55
    NUMA node3 CPU(s):   24-31,56-63

Flags:                fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
                       pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
                       lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
                       aperfclock pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
                       xtrunc pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
                       avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat��13 invpcid_single ssbd
                       mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnoi flexpriority ept vpid ept_ad
                       fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw
                       avx512vl xsaveopt xsave xsetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbb_total

(Continued on next page)
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Hardware Availability: Jun-2021  
Tested by: HPE  
Software Availability: Jun-2021  

Test Date: Jun-2021  
Platform Notes (Continued)  

From numactl --hardware  
WARNING: a numactl 'node' might or might not correspond to a physical chip. 
available: 4 nodes (0-3)  
node 0 cpus: 0 1 2 3 4 5 6 7 32 33 34 35 36 37 38 39  
node 0 size: 507046 MB  
node 0 free: 515383 MB  
node 1 cpus: 8 9 10 11 12 13 14 15 40 41 42 43 44 45 46 47  
node 1 size: 507773 MB  
node 1 free: 515556 MB  
node 2 cpus: 16 17 18 19 20 21 22 23 48 49 50 51 52 53 54 55  
node 2 size: 507811 MB  
node 2 free: 515845 MB  
node 3 cpus: 24 25 26 27 28 29 30 31 56 57 58 59 60 61 62 63  
node 3 size: 507365 MB  
node 3 free: 515797 MB  

node distances:  
node 0 1 2 3  
0: 10 20 30 30  
1: 20 10 30 30  
2: 30 30 10 20  
3: 30 30 20 10  

From /proc/meminfo  
MemTotal: 2113488200 kB  
HugePages_Total: 0  
Hugepagesize: 2048 kB  

From /etc/*release* /etc/*version*  
os-release:  
NAME="Red Hat Enterprise Linux"  
VERSION="8.3 (Ootpa)"  
ID="rhel"  
ID_LIKE="fedora"  
PLATFORM_ID="platform:el8"  
PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"  
ANSI_COLOR="0;31"  

(Continued on next page)
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Platform Notes (Continued)

redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

uname -a:
Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2017-5715 (Spectre variant 2):
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Jun 8 16:21

SPEC is set to: /home/cpu2017_1.1.8
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel00-home xfs 372G 216G 157G 58% /home

From /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL360 Gen10 Plus
Product Family: ProLiant
Serial: CN701108CQ

Additional information from dmidecode 3.2 follows. WARNING: Use caution when you interpret this section. The 'dmidecode' program reads system data which is "intended to allow hardware to be accurately determined", but the intent may not be met, as there are frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.

Memory:
32x Micron 36ASF8G72PZ-3G2B2 64 GB 2 rank 3200

BIOS:
BIOS Vendor: HPE
BIOS Version: U46

(Continued on next page)
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Tested by: HPE

Platform Notes (Continued)

BIOS Date: 05/16/2021
BIOS Revision: 1.42
Firmware Revision: 2.42

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C       | 500.perlbench_r(peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C       | 502.gcc_r(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC+/C++ Compiler for applications running on IA-32, Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
                        | 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC+/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
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**Compiler Version Notes (Continued)**

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<table>
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<th>C</th>
<th>500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base, peak)</th>
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<tr>
<td></td>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113</td>
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Compiler Version Notes (Continued)

Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------------------------------------------

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Base Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

(Continued on next page)
SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen10 Plus
(2.90 GHz, Intel Xeon Gold 6326)

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021

SPECrate®2017_int_base = 263
SPECrate®2017_int_peak = 272

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Base Optimization Flags (Continued)

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-auto -mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icx

500.perlbench_r: icc

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64
SPEC CPU®2017 Integer Rate Result
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Hewlett Packard Enterprise
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SPECrate®2017_int_base = 263
SPECrate®2017_int_peak = 272

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-strict-overflow
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

502.gcc_r: -m32
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/ia32_lin
-std=gnu89 -Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto
-Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc32-5.0.1/lib -ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto
-O3 -ffast-math -qopt-mem-layout-trans=4 -fno-alias
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: basepeak = yes

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.html
### SPEC CPU®2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10 Plus  
(2.90 GHz, Intel Xeon Gold 6326)

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You can also download the XML flags sources by saving the following links:

- [http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.xml](http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.xml)

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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