**SPEC CPU®2017 Integer Rate Result**

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL360 Gen10  
(2.20 GHz, Intel Xeon Gold 5220)  

<table>
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<th>Test Date:</th>
<th>Jul-2019</th>
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### Hardware

- **CPU Name:** Intel Xeon Gold 5220  
  - Max MHz: 3900  
  - Nominal: 2200  
  - Enabled: 36 cores, 2 chips, 2 threads/core  
  - Orderable: 1, 2 chip(s)  
  - Cache L1: 32 KB I + 32 KB D on chip per core  
  - L2: 1 MB I+D on chip per core  
  - L3: 24.75 MB I+D on chip per chip  
  - Other: None  
- **Memory:** 384 GB (24 x 16 GB 2Rx8 PC4-2666V-R)  
- **Storage:** 1 x 400 GB SAS SSD, RAID 0  
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 15 (x86_64)  
  - Kernel 4.12.14-23-default  
- **Compiler:** C/C++: Version 19.0.2.187 of Intel C/C++  
  - Compiler Build 20190117 for Linux;  
  - Fortran: Version 19.0.2.187 of Intel Fortran  
  - Compiler Build 20190117 for Linux  
- **Parallel:** No  
- **Firmware:** HPE BIOS Version U32 05/21/2019 released Apr-2019  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** None  
- **Power Management:** --

### SPECrate®2017 int_base = 201

### SPECrate®2017 int_peak = Not Run

| Copies | 0 | 20.0 | 40.0 | 60.0 | 80.0 | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 400 | 410 |
|--------|---|------|------|------|------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 500.perlbench_r | 72 | 153  | 502.gcc_r | 72 | 169  | 505.mcf_r | 72 | 271  | 520.omnetpp_r | 72 | 139  | 523.xalancbmk_r | 72 | 226  | 525.x264_r | 72 | 407  | 531.deepsjeng_r | 72 | 166  | 541.leela_r | 72 | 152  | 548.exchange2_r | 72 | 346  | 557.xz_r | 72 | 135  |
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Results Table

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SPECrate®2017_int_base = 201
SPECrate®2017_int_peak = Not Run

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

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
runcpu command invoked through numactl i.e.:
   numactl --interleave=all runcpu <etc>

General Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017_u2/lib/ia32:/home/cpu2017_u2/lib/intel64"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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)
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Test Sponsor: HPE
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Test Date: Jul-2019
Hardware Availability: Apr-2019
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General Notes (Continued)

is mitigated in the system as tested and documented.

Platform Notes

BIOS Configuration:
Thermal Configuration set to Maximum Cooling
Memory Patrol Scrubbing set to Disabled
LLC Prefetch set to Enabled
LLC Dead Line Allocation set to Disabled
Enhanced Processor Performance set to Enabled
Workload Profile set to General Throughput Compute
Workload Profile set to Custom
Energy/Performance Bias set to Balanced Performance

Sysinfo program /home/cpu2017_u2/bin/sysinfo
Rev: r5974 of 2018-05-19 9b5c8f2999c336f61f64985e45859ea9
running on linux-pe3i Tue Jul 2 02:21:05 2019

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

From /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 5220 CPU @ 2.20GHz
  2. "physical id"s (chips)
    72 "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 : 18
siblings : 36
physical 0: cores 0 1 2 3 8 9 10 11 16 17 18 19 20 24 25 26 27
physical 1: cores 0 1 2 3 8 9 10 11 16 17 18 19 20 24 25 26 27

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 72
On-line CPU(s) list: 0-71
Thread(s) per core: 2
Core(s) per socket: 18
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220 CPU @ 2.20GHz

(Continued on next page)
### Platform Notes (Continued)

- Stepping: 6
- CPU MHz: 2200.000
- BogoMIPS: 4400.00
- Virtualization: VT-x
- L1d cache: 32K
- L1i cache: 32K
- L2 cache: 1024K
- L3 cache: 25344K
- NUMA node0 CPU(s): 0-8, 36-44
- NUMA node1 CPU(s): 9-17, 45-53
- NUMA node2 CPU(s): 18-26, 54-62
- NUMA node3 CPU(s): 27-35, 63-71
- Flags: `fpu vme de pse tsc msr pae mca 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 arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid  
  `- aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3  
  `- sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 Evaluating of x2apic movbe popcnt  
  `- tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault  
  `- epb cat_l3 cdp_l3 invpcid_single intel.ppint mba tpr_shadow vnni flexpriority ept  
  `- vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a  
  `- avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl  
  `- xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occu_p LLC cqm_mbb total cqm_mbb_local  
  `- ibpb ibrs stibp dtcement ida atar pln pts pkup ospe avx512_vnni arch_capabilities ssbd`

/proc/cpuinfo cache data
- cache size: 25344 KB

---

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 8 36 37 38 39 40 41 42 43 44  
  - node 0 size: 96321 MB  
  - node 0 free: 95863 MB  
  - node 1 cpus: 9 10 11 12 13 14 15 16 17 45 46 47 48 49 50 51 52 53  
  - node 1 size: 96764 MB  
  - node 1 free: 96551 MB  
  - node 2 cpus: 18 19 20 21 22 23 24 25 26 54 55 56 57 58 59 60 61 62  
  - node 2 size: 96764 MB  
  - node 2 free: 96626 MB  
  - node 3 cpus: 27 28 29 30 31 32 33 34 35 63 64 65 66 67 68 69 70 71  
  - node 3 size: 96763 MB  
  - node 3 free: 96632 MB  
  - node distances:  
    - node 0 1 2 3  
      - 0: 10 21 31 31  
      - 1: 21 10 31 31  
      - 2: 31 31 10 21

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Platform Notes (Continued)

3: 31 31 21 10

From /proc/meminfo
MemTotal: 395892604 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*

os-release:
NAME="SLES"
VERSION="15"
VERSION_ID="15"
PRETTY_NAME="SUSE Linux Enterprise Server 15"
ID="sles"
ID_LIKE="suse"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:15"

uname -a:
Linux linux-pe3i 4.12.14-23-default #1 SMP Tue May 29 21:04:44 UTC 2018 (cd0437b)
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:
CVE-2017-5754 (Meltdown): Not affected
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Indirect Branch Restricted Speculation, IBPB, IBRS_PW

run-level 3 Jul 2 02:18

SPEC is set to: /home/cpu2017_u2
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 476G 53G 424G 11% /home

Additional information from dmidecode 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.

BIOS HPE U32 05/21/2019
Memory:
24x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2666

(End of data from sysinfo program)
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### Compiler Version Notes

```plaintext
<table>
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<tr>
<th>Compiler</th>
<th>Base Invocations</th>
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<tbody>
<tr>
<td>C</td>
<td>500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)</td>
</tr>
</tbody>
</table>
|          | Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.2.187 Build 20190117  
|          | Copyright (C) 1985-2019 Intel Corporation. All rights reserved. |
| C++      | 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base) 541.leela_r(base) |
|          | Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.2.187 Build 20190117  
|          | Copyright (C) 1985-2019 Intel Corporation. All rights reserved. |
| Fortran  | 548.exchange2_r(base) |
|          | Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.2.187 Build 20190117  
|          | Copyright (C) 1985-2019 Intel Corporation. All rights reserved. |
```

### Base Compiler Invocation

- **C benchmarks:**
  - icc -m64 -std=c11

- **C++ benchmarks:**
  - icpc -m64

- **Fortran benchmarks:**
  - ifort -m64

### 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

*(Continued on next page)*
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Base Portability Flags (Continued)

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

Base Optimization Flags

C benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

C++ benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

Fortran benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-CLX-revB.xml
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2019-04-03.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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