# SPEC CPU®2017 Integer Rate Result

## Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL20 Gen10
(3.80 GHz, Intel Xeon E-2244G)

<table>
<thead>
<tr>
<th>Software</th>
<th>Hardware</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS: SUSE Linux Enterprise Server 15 (x86_64) SP1</td>
<td>CPU Name: Intel Xeon E-2244G</td>
</tr>
<tr>
<td>Kernel 4.12.14-195-default</td>
<td>Max MHz: 4800</td>
</tr>
<tr>
<td>Compiler: C/C++: Version 19.0.1.144 of Intel C/C++</td>
<td>Nominal: 3800</td>
</tr>
<tr>
<td>Compiler Build 20181018 for Linux; Fortran: Version 19.0.1.144 of Intel Fortran</td>
<td>Enabled: 4 cores, 1 chip, 2 threads/core</td>
</tr>
<tr>
<td>Compiler Build 20181018 for Linux</td>
<td>Orderable: 1 chip</td>
</tr>
<tr>
<td>Firmware: HPE BIOS Version U43 09/05/2019 released Sep-2019</td>
<td>Cache L1: 32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td>File System: xfs</td>
<td>L2: 256 KB I+D on chip per core</td>
</tr>
<tr>
<td>System State: Run level 3 (multi-user)</td>
<td>L3: 8 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Base Pointers: 64-bit</td>
<td>Other: None</td>
</tr>
<tr>
<td>Peak Pointers: Not Applicable</td>
<td>Other: None</td>
</tr>
<tr>
<td>Other: None</td>
<td>Power Management: --</td>
</tr>
</tbody>
</table>

| SPECrate®2017_int_base = 33.7 | SPECrate®2017_int_peak = Not Run |

<table>
<thead>
<tr>
<th>Copies</th>
<th>500.perlbench_r</th>
<th>502.gcc_r</th>
<th>505.mcf_r</th>
<th>520.omnetpp_r</th>
<th>523.xalancbmk_r</th>
<th>525.x264_r</th>
<th>531.deepsjeng_r</th>
<th>541.leela_r</th>
<th>548.exchange2_r</th>
<th>557.xz_r</th>
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<tr>
<td>8</td>
<td>27.6</td>
<td>30.1</td>
<td>44.8</td>
<td>18.9</td>
<td>38.1</td>
<td>75.1</td>
<td>28.9</td>
<td>26.5</td>
<td>60.6</td>
<td>20.4</td>
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**Test Sponsor:** HPE  
**Test Date:** Oct-2019  
**Hardware Availability:** Nov-2019  
**Software Availability:** Oct-2019
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SPECrate®2017_int_base = 33.7
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tr>
<td>502.gcc_r</td>
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<td>30.6</td>
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<tr>
<td>505.mcf_r</td>
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<td>44.6</td>
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<tr>
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<td>18.9</td>
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<td>18.9</td>
<td>556</td>
<td>18.9</td>
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<tr>
<td>523.xalanbmk_r</td>
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<td>38.1</td>
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<td>38.2</td>
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<tr>
<td>525.x264_r</td>
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<td>75.1</td>
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<td>75.0</td>
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<tr>
<td>531.deepsjeng_r</td>
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<td>319</td>
<td>28.8</td>
<td>317</td>
<td>28.9</td>
<td>317</td>
<td>28.9</td>
</tr>
<tr>
<td>541.leela_r</td>
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<td>26.6</td>
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<td>26.1</td>
<td>500</td>
<td>26.5</td>
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<tr>
<td>548.exchange2_r</td>
<td>8</td>
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<td>60.8</td>
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<td>60.5</td>
<td>346</td>
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<td>8</td>
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<td>20.4</td>
<td>423</td>
<td>20.4</td>
<td>422</td>
<td>20.5</td>
</tr>
</tbody>
</table>

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

Submit Notes
The taskset mechanism was used to bind copies to processors. The config file option 'submit' was used to generate taskset 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

General Notes
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/lib/ia32:/home/cpu2017/lib/intel64"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM memory using Redhat Enterprise Linux 7.5
Yes: 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.
Platform Notes

BIOS Configuration:
Thermal Configuration set to Maximum Cooling
LLC prefetch set to Enabled
Workload Profile set to General Throughput Compute
Minimum Processor Idle Power Core C-State set to C1E
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on linux-vb4y Sat Oct  5 16:06:55 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) E-2244G CPU @ 3.80GHz
  1 "physical id"s (chips)
  8 "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 : 4
siblings : 8
physical 0: cores 0 1 2 3

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 39 bits physical, 48 bits virtual
CPU(s): 8
On-line CPU(s) list: 0-7
Thread(s) per core: 2
Core(s) per socket: 4
Socket(s): 1
NUMA node(s): 1
Vendor ID: GenuineIntel
CPU family: 6
Model: 158
Model name: Intel(R) Xeon(R) E-2244G CPU @ 3.80GHz
Stepping: 10
CPU MHz: 3800.000
BogoMIPS: 7584.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 256K
L3 cache: 8192K
NUMA node0 CPU(s): 0-7

(Continued on next page)
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

Flags:
fpu  vme  de  pse  tsx  mcr  msr  pae  mce  cmov
pat  pse36  cflush  dtc  acpi  mmx  fxsr  sse2  ss  ht  tm  pbe  syscall  nx  pdpe1gb  rdtsscp
lm  constant_tsc  art  arch_perfmon  pebs  bts  rep_good  nopl  xtopology  nonstop_tsc  cpuid
aperfmerf  tsc_known_freq  pni  pclmulqdq  dtc64  monitor  ds_cpl  vmx  smx  est  tm2  ssse3
sdbg  fma  cx16  xtrm  pdcm  pconf  sse4_1  sse4_2  x2apic  movbe  popcnt  tsc_deadline_timer
aes  xsave  avx  f16c  rdrand  lahf_lm  abm  3dnowprefetch  cpuid_fault  epb  invpcid_single
pti  ssbd  ibrs  ibpb  stibp  tpr_shadow  vnumi  flexpriority  ept  vpid  fsqbse  tsc_adjust
bm1  hle  avx2  smep  bmi2  erms  invpcid  rtm  mpx  rdseed  adx  smap  clflushopt  intel_pt
xsaveopt  xsavec  xgetbv1  xsave  dthrm  ida  arat  pln  pts  md_clear  flush_l1d

From /proc/cpuinfo cache data
  cache size : 8192 KB

From numactl --hardware
WARN: a numactl 'node' might or might not correspond to a physical chip.
  available: 1 nodes (0)
  node 0 cpus: 0 1 2 3 4 5 6 7
  node 0 size: 64022 MB
  node 0 free: 63488 MB
  node distances:
    node   0
    0: 10

From /proc/meminfo
  MemTotal: 65559328 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

From /etc/*release*/etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP1"
    VERSION_ID="15.1"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp1"

uname -a:
  Linux linux-vb4y 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
  x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2017-5754 (Meltdown):
  Mitigation: PTI

CVE-2017-5753 (Spectre variant 1):
  Mitigation: __user pointer sanitization

(Continued on next page)
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CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)
CVE-2017-5715 (Spectre variant 2): Mitigation: Indirect Branch Restricted Speculation, IBPB: conditional, IBRS_FW, STIBP: conditional, RSB filling
run-level 3 Oct 5 16:05

SPEC is set to: /home/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 270G 63G 207G 24% /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 U43 09/05/2019
Memory:
4x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2666

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C       | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)
==============================================================================

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 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 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 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 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
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**Test Date:** Oct-2019  
**Hardware Availability:** Nov-2019  
**Software Availability:** Oct-2019

### Base Compiler Invocation

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

C++ benchmarks:  
`icpc -m64`

Fortran benchmarks:  
`ifort -m64`

### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
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<tbody>
<tr>
<td>perlbench_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX_X64</td>
</tr>
<tr>
<td>gcc_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>mcf_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>omnetpp_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>xalanchbk_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX</td>
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</tr>
<tr>
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</tr>
<tr>
<td>xz_r</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

### Base Optimization Flags

C benchmarks:  
```bash  
-WL,-z,muldefs -xCORE-AVX2 -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:  
```bash  
-WL,-z,muldefs -xCORE-AVX2 -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:  
```bash  
-WL,-z,muldefs -xCORE-AVX2 -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  
```
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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](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/HPE-Platform-Flags-Intel-V1.2-CLX-revB.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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