## SPEC® CPU2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant BL460c Gen10  
(2.10 GHz, Intel Xeon Silver 4110)  

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
<th>72.4</th>
<th>SPECrate2017_int_peak</th>
<th>76.6</th>
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</thead>
</table>

**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Test Date:** Jun-2018  
**Hardware Availability:** Jun-2018  
**Software Availability:** May-2018

### Hardware

| CPU Name | Intel Xeon Silver 4110  
| Max MHz | 3000  
| Nominal | 2100  
| Enabled | 16 cores, 2 chips, 2 threads/core  
| Orderable | 1, 2 chip(s)  
| Cache L1 | 32 KB I + 32 KB D on chip per core  
| Cache L2 | 1 MB I+D on chip per core  
| Cache L3 | 11 MB I+D on chip per chip  
| Other | None  
| Memory | 192 GB (12 x 16 GB 2Rx4 PC4-2666V-R, running at 2400)  
| Storage | 2 x 600 GB 10 K SAS, RAID 1  
| Other | None  

### Software

| OS | SUSE Linux Enterprise Server 12 SP2 (x86_64)  
| Kernel | 4.4.121-92.76-default  
| Compiler | C/C++: Version 18.0.2.199 of Intel C/C++  
| Compiler for Linux |  
| Furtran | Version 18.0.2.199 of Intel Furtran  
| File System | xfs  
| System State | Run level 3 (multi-user)  
| Base Pointers | 64-bit  
| Peak Pointers | 32/64-bit  
| Other | jemalloc memory allocator library V5.0.1  

---

Copy  
500.perlbench_r  
502.gcc_r  
505.mcf_r  
520.omnetpp_r  
523.xalancbmk_r  
525.x264_r  
531.deepsjeng_r  
541.leela_r  
548.exchange2_r  
557.xz_r  

---

Hardware Availability: Jun-2018  
Software Availability: May-2018

---

### Performance Graph

<table>
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<th>SPECrate2017_int_base (72.4)</th>
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**(Test Sponsor: HPE)**
**ProLiant BL460c Gen10**
**(2.10 GHz, Intel Xeon Silver 4110)**

### Results Table

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<tr>
<th>Benchmark</th>
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<th>Seconds</th>
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<td>505.mcf_r</td>
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<td>520.omnetpp_r</td>
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</tbody>
</table>

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### 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 = "/cpu2017/lib/ia32:/cpu2017/lib/intel64"`
- Binaries compiled on a system with 1x Intel Core i7-6700K 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)
General Notes (Continued)

is mitigated in the system as tested and documented.
jemalloc: configured and built at default for 32bit (i686) and 64bit (x86_64) targets;
built with RedHat Enterprise 7.4, and the system compiler gcc 4.8.5;

Platform Notes

BIOS Configuration:
Memory Patrol Scrubbing set to Disabled
LLC Dead Line Allocation set to Disabled
LLC Prefetch set to Enabled
Thermal Configuration set to Maximum Cooling
Workload Profile set to General Throughput Compute
Minimum Processor Idle Power Core C-State set to C1E State
Workload Profile set to Custom
Sub-NUMA Clustering (SNC) set to Disabled

Sysinfo program /cpu2017/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bccc091c0f
running on pl12 Thu Jun 14 11:49:34 2018

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) Silver 4110 CPU @ 2.10GHz
  2 "physical id"s (chips)
  32 "processors"
core, siblings (Caution: counting these is hw and system dependent. The following
excerpts from /proc/cpuinfo might not be reliable. Use with caution.)
cpu cores : 8
siblings : 16
physical 0: cores 0 1 2 3 4 5 6 7
physical 1: cores 0 1 2 3 4 5 6 7

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 2
NUMA node(s): 2

(Continued on next page)
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| SPECrate2017_int_base | 72.4 |
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<tr>
<td>3</td>
<td>Jun-2018</td>
<td>HPE</td>
<td>Jun-2018</td>
<td>HPE</td>
<td>May-2018</td>
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Platform Notes (Continued)

Vendor ID:             GenuineIntel
CPU family:            6
Model:                 85
Model name:            Intel(R) Xeon(R) Silver 410 CPU @ 2.10GHz
Stepping:              4
CPU MHz:               2095.086
BogoMIPS:              4190.17
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              1024K
L3 cache:              11264K
NUMA node0 CPU(s):     0-7,16-23
NUMA node1 CPU(s):     8-15,24-31
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
aperfmperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg
fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
xsave avx f16c rdrand lahf_lm abm 3dnowprefetch ida arat epb invpcid_single pln pts
dtherm intel_pt rsb_ctxsw spec_ctrl stibp rds retpoline kaiser tpr_shadow vnmi
flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 ersedms invpcid rtm
cqm mpx avx512f avx512dq avx512cd avx512bw avx512vl xsaveopt xsaveprec xgetbv1
cqm_llc cqm_occup_llc

/proc/cpuinfo cache data
  cache size : 11264 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.
  available: 2 nodes (0-1)
  node 0 cpus: 0 1 2 3 4 5 6 7 16 17 18 19 20 21 22 23
  node 0 size: 96338 MB
  node 0 free: 95936 MB
  node 1 cpus: 8 9 10 11 12 13 14 15 24 25 26 27 28 29 30 31
  node 1 size: 96764 MB
  node 1 free: 96375 MB
  node distances:
    node 0 1
    0: 10 21
    1: 21 10

From /proc/meminfo
  MemTotal: 197737428 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

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**SPECRate2017_int_base = 72.4**  
**SPECRate2017_int_peak = 76.6**

**Platform Notes (Continued)**

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

SuSE-release:
- SUSE Linux Enterprise Server 12 (x86_64)
- VERSION = 12
- PATCHLEVEL = 2
- # This file is deprecated and will be removed in a future service pack or release.  
- # Please check /etc/os-release for details about this release.

os-release:
- NAME="SLES"
- VERSION="12-SP2"
- VERSION_ID="12.2"
- PRETTY_NAME="SUSE Linux Enterprise Server 12 SP2"
- ID="sles"
- ANSI_COLOR="0;32"
- CPE_NAME="cpe:/o:suse:sles:12:sp2"

uname -a:
- Linux pl12 4.4.121-92.76-default #1 SMP Tue May 8 19:06:40 UTC 2018 (95b450b) x86_64
- x86_64 x86_64 GNU/Linux

run-level 3 Jun 14 11:47

SPEC is set to: /cpu2017
- /dev/sda2 Type Size Used Avail Use% Mounted on
- xfs 559G 49G 511G 9% /

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 I41 05/14/2018
Memory:
- 12x HPE 840756-091 16 GB 2 rank 2666, configured at 2400
- 4x UNKNOWN NOT AVAILABLE

(End of data from sysinfo program)

Regarding the sysinfo display about the memory installed, the correct amount of memory is 192 GB and the dmidecode description should have one line reading as:
- 12x HPE 840756-091 16 GB 2 rank 2666, configured at 2400

**Compiler Version Notes**

```
                    CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base) 525.x264_r(base) 557.xz_r(base)
```

(Continued on next page)
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**Hardware Availability:** Jun-2018  
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**CPU2017 License:** 3

**Hewlett Packard Enterprise**  
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<th>Compiler Version Notes (Continued)</th>
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```
icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

```
CC  500.perlbench_r(peak) 502.gcc_r(peak) 505.mcf_r(peak) 525.x264_r(peak)  
557.xz_r(peak)
```

```
icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

```
CXXC 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)  
541.leela_r(base)
```

```
icc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

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CXXC 520.omnetpp_r(peak) 523.xalancbmk_r(peak) 531.deepsjeng_r(peak)  
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icpc (ICC) 18.0.2 20180210  
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CXXC 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)  
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icpc (ICC) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

```
FC  548.exchange2_r(base)
```

```
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

```
FC  548.exchange2_r(peak)
```

```
ifort (IFORT) 18.0.2 20180210  
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
```

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

(Continued on next page)
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Base Compiler Invocation (Continued)

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
523.xalanne_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:
-W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

C++ benchmarks:
-W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

Fortran benchmarks:
-W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -nostandard-realloc-lhs
-L/usr/local/je5.0.1-64/lib -ljemalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icc -m64 -std=c11

(Continued on next page)
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Peak Compiler Invocation (Continued)

502.gcc_r: icc -m32 -std=c11 -L/home/prasadj/specdev/IC18u2_Internal/lin_18_0_20180210/compiler/lib/ia32_lin

C++ benchmarks (except as noted below):
  icpc -m64

523.xalancbmk_r: icpc -m32 -L/home/prasadj/specdev/IC18u2_Internal/lin_18_0_20180210/compiler/lib/ia32_lin

Fortran benchmarks:
  ifort -m64

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: -D_FILE_OFFSET_BITS=64 -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

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
  -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
  -fno-strict-overflow -L/usr/local/je5.0.1-64/lib
  -ljemalloc

502.gcc_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
  -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
  -L/usr/local/je5.0.1-32/lib -ljemalloc

505.mcf_r: basepeak = yes
525.x264_r: basepeak = yes

(Continued on next page)
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Peak Optimization Flags (Continued)

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: -wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
-L/usr/local/je5.0.1-32/lib -ljemalloc

531.deepsjeng_r: basepeak = yes

541.leela_r: -wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
-L/usr/local/je5.0.1-64/lib -ljemalloc

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-V1.2-SKX-revH.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-12-21.xml
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.2-SKX-revH.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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