Hewlett Packard Enterprise
ProLiant BL460c Gen10
(2.10 GHz, Intel Xeon Silver 4216)

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

Test Date: Apr-2019
Hardware Availability: Apr-2019
Software Availability: Feb-2019

| SPECspeed2017_fp_base = 113 |
| SPECspeed2017_fp_peak = Not Run |

| Threads | 0  | 20  | 40  | 60  | 80  | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 | 400 | 420 |
|---------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 603.bwaves_s | 32 |     |     |     |     |     |     |     | 125 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 607.cactuBSSN_s | 32 |     |     |     |     |     |     |     | 83.5 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 619.lbm_s | 32 |     |     |     |     |     | 109 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 621.wrf_s | 32 |     |     |     |     |     |     |     |     | 80.7 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 627.cam4_s | 32 |     |     |     |     |     |     |     |     |     | 90.3 |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 628.pop2_s | 32 |     |     |     |     |     |     |     |     |     |     |     | 61.0 |     |     |     |     |     |     |     |     |     |     |     |
| 638.imagick_s | 32 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 644.nab_s | 32 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 649.fotonik3d_s | 32 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 654.roms_s | 32 |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

Hardware

CPU Name: Intel Xeon Silver 4216
Max MHz.: 3200
Nominal: 2100
Enabled: 32 cores, 2 chips
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: 22 MB I+D on chip per chip
Other: None
Memory: 192 GB (12 x 16 GB 2Rx8 PC4-2933Y-R, running at 2400)
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: Yes
Firmware: HPE BIOS Version I41 02/02/2019 released Apr-2019
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: Not Applicable
Other: None
SPEC CPU2017 Floating Point Speed Result

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SPECspeed2017_fp_base = 113
SPECspeed2017_fp_peak = Not Run

Results Table

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<tr>
<th>Benchmark</th>
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<th>Ratio</th>
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</tr>
</tbody>
</table>

SPECspeed2017_fp_base = 113
SPECspeed2017_fp_peak = Not Run

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

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:
KMP_AFFINITY = "granularity=core,compact"
LD_LIBRARY_PATH = "/home/cpu2017_u2/lib/ia32:/home/cpu2017_u2/lib/intel64"
OMP_STACKSIZE = "192M"

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) is mitigated in the system as tested and documented.

Platform Notes

BIOS Configuration:
Hyper-Threading set to Disabled
Thermal Configuration set to Maximum Cooling

(Continued on next page)
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Memory Patrol Scrubbing set to Disabled
LLC Prefetch set to Enabled
LLC Dead Line Allocation set to Disabled
Workload Profile set to General Peak Frequency Compute
   Energy/Performance Bias set to Balanced Power
Workload Profile set to Custom
   Numa Group Size Optimization set to Flat
Sysinfo program /home/cpu2017_u2/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on bl460-sles15-6244 Mon Apr 29 21:28:03 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) Silver 4216 CPU @ 2.10GHz
      2 "physical id"s (chips)
      32 "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 : 16
          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:
   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: 1
   Core(s) per socket: 16
   Socket(s):         2
   NUMA node(s):      2
   Vendor ID:         GenuineIntel
   CPU family:        6
   Model:             85
   Model name:        Intel(R) Xeon(R) Silver 4216 CPU @ 2.10GHz
   Stepping:          6
   CPU MHz:           2100.000
   BogoMIPS:          4200.00
   Virtualization:    VT-x
   L1d cache:         32K
   L1i cache:         32K
   L2 cache:          1024K

(Continued on next page)
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Platform Notes (Continued)

L3 cache: 22528K
NUMA node0 CPU(s): 0-15
NUMA node1 CPU(s): 16-31
Flags: fpu vme de pse tsc msr pae 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 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 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cd p13 invpcid_single intel_pinn mba tpr_shadow vmi flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 ersed revn invpcid rtm cqm mpx rdtsa_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1 xsaveas cqm_llc cqm_occup_llc cqm_mm_total cqm_mm_local ibpb ibrs stibp dtherm ida arat pln pts pkup ospke avx512_vnni arch_capabilities ssbd

/cache /proc/cpuinfo cache data

cache size: 22528 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 8 9 10 11 12 13 14 15
node 0 size: 96322 MB
node 0 free: 95722 MB
node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
node 1 size: 96764 MB
node 1 free: 96599 MB
node distances:
node 0 1
0: 10 21
1: 21 10

From /proc/meminfo

MemTotal: 197720484 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"

(Continued on next page)
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Platform Notes (Continued)

uname -a:
   Linux bl460-sles15-6244 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_FW

run-level 3 Apr 29 21:27
SPEC is set to: /home/cpu2017_u2
   Filesystem Type Size Used Avail Use% Mounted on
   /dev/sda3 xfs 144G 101G 44G 70% /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 I41 02/02/2019
   Memory:
      4x UNKNOWN NOT AVAILABLE
      12x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2933, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

CC  619.lbm_s(base) 638.imagick_s(base) 644.nab_s(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.

FC  607.cactuBSSN_s(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.
   Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Compiler Version Notes (Continued)

Version 19.0.2.187 Build 20190117
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.
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.

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FC  603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(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.

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CC  621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)

--

Intel (R) Fortran Intel (R) 64 Compiler for applications running on Intel (R)
64, Version 19.0.2.187 Build 20190117
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C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Base Portability Flags

603.bwaves_s: -DSPEC_LP64

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

607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-qopt-prefetch-issue-excl-hint -ansi-alias -complex-limited-range

Fortran benchmarks:
-DSPEC_OPENMP -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-qopt-prefetch-issue-excl-hint -ansi-alias -complex-limited-range
-nostandard-realloc-lhs

Benchmarks using both Fortran and C:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-qopt-prefetch-issue-excl-hint -ansi-alias -complex-limited-range
-nostandard-realloc-lhs

Benchmarks using Fortran, C, and C++:
-xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
-qopt-prefetch-issue-excl-hint -ansi-alias -complex-limited-range
-nostandard-realloc-lhs

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-revA.html
http://www.spec.org/cpu2017/flags/HPE-ic19.0u1-flags-linux64.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-revA.xml
http://www.spec.org/cpu2017/flags/HPE-ic19.0u1-flags-linux64.xml
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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU2017 v1.0.5 on 2019-04-29 11:58:03-0400.