**SPEC CPU®2017 Floating Point Speed Result**

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
ProLiant DL385 Gen10  
(2.80 GHz, AMD EPYC 7402)

**CPU2017 License:** 3  
**Test Sponsor:** HPE  
**Tested by:** HPE  
**Test Date:** Jul-2019  
**Hardware Availability:** Oct-2019  
**Software Availability:** Jun-2019

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>139</td>
<td>Not Run</td>
</tr>
</tbody>
</table>

**Threads**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Value</th>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>48</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>48</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>48</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>48</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>48</td>
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<tr>
<td>628.pop2_s</td>
<td>48</td>
</tr>
<tr>
<td>638.imagick_s</td>
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<tr>
<td>644.nab_s</td>
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<tr>
<td>649.fotonik3d_s</td>
<td>48</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>48</td>
</tr>
</tbody>
</table>

**Hardware**

- **CPU Name:** AMD EPYC 7402  
- **Max MHz:** 3350  
- **Nominal:** 2800  
- **Enabled:** 48 cores, 2 chips  
- **Orderable:** 1, 2 chip(s)  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 512 KB I+D on chip per core  
- **L3:** 128 MB I+D on chip per chip, 16 MB shared / 3 cores  
- **Other:** None  
- **Memory:** 1 TB (16 x 64 GB 4Rx4 PC4-2933Y-L)  
- **Storage:** 1 x 400 GB SAS SSD, RAID 0  
- **Other:** None

**Software**

- **OS:** SUSE Linux Enterprise Server 15 (x86_64) SP1  
- **Kernel:** 4.12.14-195-default  
- **Compiler:** C/C++: Version 1.3.0 of AOCC  
- **Fortran:** Version 4.8.2 of GCC  
- **Parallel:** Yes  
- **Firmware:** HPE BIOS Version A40 07/20/2019 released Oct-2019  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** jemalloc: jemalloc memory allocator library v5.1.0;  
- **Power Management:** --
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SPECspeed®2017_fp_base =  139
SPECspeed®2017_fp_peak = Not Run

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
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<th>Ratio</th>
<th>Peak</th>
<th>Seconds</th>
<th>Ratio</th>
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<td>603.bwaves_s</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Compiler Notes

The AMD64 AOCC Compiler Suite is available at
http://developer.amd.com/amd-aocc/

The AOCC Fortran Plugin version 1.3.0 was used to leverage AOCC optimizers with gfortran. It is available here:
http://developer.amd.com/amd-aocc/

Submit Notes

The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.
See the configuration file for details.

Operating System Notes

'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit

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

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

(Continued on next page)
## Operating System Notes (Continued)

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)

## General Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/home/cpu2017/amd_speed_aocc130_naples_A_lib/64; /home/cpu2017/amd_speed_aocc130_naples_A_lib/32:"
OMP_DYNAMIC = "false"
OMP_PLACES = "cores"
OMP_PROC_BIND = "close"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "192M"
OMP_WAIT_POLICY = "active"

Binaries were compiled on a system with 2p AMD EPYC 7601 CPU + 512GB Memory using RHEL 7.6

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.
jemalloc: configured and built with GCC v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.1.0 is available here: https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2

## Platform Notes

BIOS Configuration
Thermal Configuration set to Maximum Cooling
SMT Mode set to Disabled
Determinism Control set to Manual
Performance Determinism set to Power Deterministic
Minimum Processor Idle Power core C-State set to C6 State
Memory Patrol Scrubbing set to Disabled
Workload Profile set to General Peak Frequency Compute
NUMA memory domains per socket set to One memory domains per socket
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcd6f2999c33d61f64985e45859ee9
running on dl385-gen10-rome-64c Thu Feb 14 11:30:50 2019

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

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`: AMD EPYC 7402 24-Core Processor
- `2 "physical id"s (chips)`
- `48 "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`: 24
  - `siblings`: 24
  - `physical 0: cores 0 1 2 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30`
  - `physical 1: cores 0 1 2 4 5 6 8 9 10 12 13 14 16 17 18 20 21 22 24 25 26 28 29 30`

From `lscpu`:
- `Architecture`: x86_64
- `CPU op-mode(s)`: 32-bit, 64-bit
- `Byte Order`: Little Endian
- `Address sizes`: 48 bits physical, 48 bits virtual
- `CPU(s)`: 48
- `On-line CPU(s) list`: 0-47
- `Thread(s) per core`: 1
- `Core(s) per socket`: 24
- `Socket(s)`: 2
- `NUMA node(s)`: 2
- `Vendor ID`: AuthenticAMD
- `CPU family`: 23
- `Model`: 49
- `Model name`: AMD EPYC 7402 24-Core Processor
- `Stepping`: 0
- `CPU MHz`: 2800.000
- `CPU max MHz`: 2800.0000
- `CPU min MHz`: 1500.0000
- `BogoMIPS`: 5589.40
- `Virtualization`: AMD-V
- `L1d cache`: 32K
- `L1i cache`: 32K
- `L2 cache`: 512K
- `L3 cache`: 16384K
- `NUMA node0 CPU(s)`: 0-23
- `NUMA node1 CPU(s)`: 24-47
- `Flags`: fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtsscp lm constant_tsc rep_good nopl xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch

(Continued on next page)
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SPECspeed®2017_fp_base = 139
SPECspeed®2017_fp_peak = Not Run

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

Test Date: Jul-2019
Hardware Availability: Oct-2019
Software Availability: Jun-2019

Platform Notes (Continued)

osvw ibs skinit wdt tce topoext perfctr_core perfctr_nb mwaitx cpb
cat_l3 cdp_l3 hw_pstate ssbsd ibrs ibbp stibp vmmcall fsqsbase bmi1 avx2 smep bmi2
cqm rdt_a rdseed adx smap clflushopt clwb sha ni xsaveopt xsavec xgetbv1 xsave

cqm_llc cqm_occup_llc cqm_mbml_total cqm_mbml_local clzero irperf xsaveerptr arat npt
lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pfthreshold avic v_vmsave_vmload vgif umip rdpid overflow_recov succor smca

/proc/cpuinfo cache data
  cache size: 512 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 16 17 18 19 20 21 22 23
  node 0 size: 515786 MB
  node 0 free: 515460 MB
  node 1 cpus: 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
  node 1 size: 515848 MB
  node 1 free: 515318 MB
  node distances:

From /proc/meminfo
  MemTotal: 1056394428 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 dl385-gen10-rome-64c 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): Not affected

(Continued on next page)
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Platform Notes (Continued)

CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Full AMD retpoline, IBPB: conditional, IBRS_Fw, STIBP: disabled, RSB filling

run-level 3 Feb 14 08:21
SPEC is set to: /home/cpu2017
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda2 btrfs 371G 96G 275G 26% /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 A40 07/20/2019
Memory:
16x HPE P03054-091 64 GB 4 rank 2933
16x UNKNOWN NOT AVAILABLE

Compiler Version Notes

==============================================================================
C               | 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)
------------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
------------------------------------------------------------------------------

==============================================================================
C++, C, Fortran | 607.cactuBSSN_s(base)
------------------------------------------------------------------------------
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin
AOCC.LLVM.1.3.0.B34.2018_10_22 clang version 7.0.0 (CLANG: Jenkins
AOCC_1_3_0_Release-Build#34) (based on LLVM AOCC.LLVM.1.3.0.B34.2018_10_22)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /root/work/compilers/aocc1.3.0/AOCC-1.3.0-Compiler/bin

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Compiler Version Notes (Continued)

GNU Fortran (GCC) 4.8.2
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GNU Fortran comes with NO WARRANTY, to the extent permitted by law.
You may redistribute copies of GNU Fortran
under the terms of the GNU General Public License.
For more information about these matters, see the file named COPYING

Fortran | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)
------------------------------------------------------------------------------
Fortran, C | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)
------------------------------------------------------------------------------

Base Compiler Invocation

C benchmarks:
clang

Fortran benchmarks:
clang gfortran

Benchmarks using both Fortran and C:
clang gfortran

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

Benchmarks using Fortran, C, and C++:
clang++ clang gfortran

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
627.cam4_s: -DSPEC_CASE_FLAG -DSPEC_LP64
628.pop2_s: -DSPEC_CASE_FLAG -fconvert=big-endian -DSPEC_LP64
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:
-fflto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-1sr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compare=false -O3 -ffast-math
-march=znver1 -mno-avx2 -fstruct-layout=3 -ml1vm -unroll-threshold=50
-fremap-arrays -ml1vm -inline-threshold=1000
-fly-function-specialization -ml1vm -enable-gvn-hoist
-ml1vm -function-specialize -z muldefs -DSPEC_OPENMP -fopenmp
-DUSE_OPENMP -fopenmp=libomp -lomp -lpthread -ldl -ljemalloc
-llamdlibm

Fortran benchmarks:
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-1sr-in-nested-loop
-Wl,-plugin-opt=-enable-vectorize-compare=false -O3 -mavx -madx
-funroll-loops -ffast-math -z muldefs -fplugin=dragonegg.so
-fplugin-arg=dragonegg-llvm-option=-merge-constant
-fplugin-arg=dragonegg-llvm-option=-enable-vectorize-compare=false
-DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
-ldl -ljemalloc -llamdlibm -lgfortran

Benchmarks using both Fortran and C:
-flto -Wl,-plugin-opt=-merge-constant
-Wl,-plugin-opt=-1sr-in-nested-loop

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**Base Optimization Flags (Continued)**

Benchmarks using both Fortran and C (continued):
- -Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
- -march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
- -fremap-arrays -mllvm -inline-threshold=1000
- -flv-function-specialization -mllvm -enable-gvn-hoist
- -mllvm -function-specialize -mavx -madx -funroll-loops -z muldefs
- -fplugin=dragonegg.so -fplugin-arg-dragonegg-llvm-option=merge-constant
- -fplugin-arg-dragonegg-llvm-option=enable-vectorize-compares:false
- -DSPEC_OPENMP -DUSE_OPENMP -fopenmp -fopenmp=libomp -lomp -lpthread
- -ldl -ljemalloc -lamdlibm -lgfortran

Benchmarks using Fortran, C, and C++:
- -std=c++98 -flto -Wl,-plugin-opt=-merge-constant
- -Wl,-plugin-opt=-lsl-in-nested-loop
- -Wl,-plugin-opt=-enable-vectorize-compares=false -O3 -ffast-math
- -march=znver1 -mno-avx2 -fstruct-layout=3 -mllvm -unroll-threshold=50
- -fremap-arrays -mllvm -inline-threshold=1000
- -flv-function-specialization -mllvm -enable-gvn-hoist
- -mllvm -function-specialize -mllvm -unroll-threshold=100
- -finline-aggressive -mllvm -enable-vectorize-compares=false -mavx
- -madx -funroll-loops -z muldefs -fplugin=dragonegg.so
- -fplugin-arg-dragonegg-llvm-option=merge-constant
- -fplugin-arg-dragonegg-llvm-option=enable-vectorize-compares:false
- -DSPEC_OPENMP -fopenmp -DUSE_OPENMP -fopenmp=libomp -lomp -lpthread
- -ldl -ljemalloc -lamdlibm

**Base Other Flags**

C benchmarks:
- -Wno-return-type

Fortran benchmarks:
- -Wno-return-type

Benchmarks using both Fortran and C:
- -Wno-return-type

Benchmarks using Fortran, C, and C++:
- -Wno-return-type

The flags files that were used to format this result can be browsed at

(Continued on next page)
**SPEC CPU®2017 Floating Point Speed Result**

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<th>Test Sponsor: HPE</th>
<th>SPECspeed®2017_fp_base = 139</th>
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<td>ProLiant DL385 Gen10</td>
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</table>

The flags files that were used to format this result can be browsed at (Continued)

http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revE.html

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

http://www.spec.org/cpu2017/flags/aocc130-flags-revA2-HPE.xml
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revE.xml

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