



# SPEC CPU®2017 Floating Point Speed Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

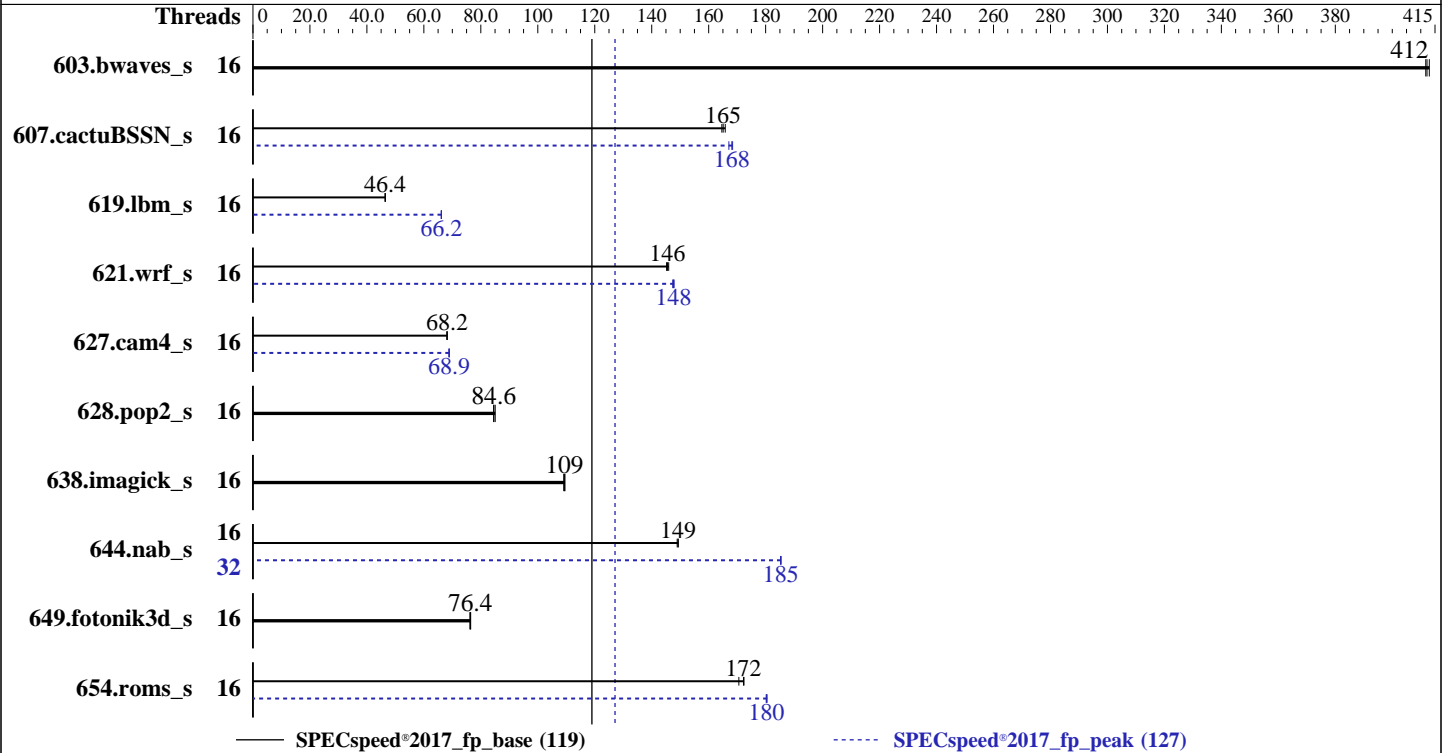
ProLiant DL325 Gen10 Plus v2  
(3.05 GHz, AMD EPYC 7373X)

SPECspeed®2017\_fp\_base = 119

SPECspeed®2017\_fp\_peak = 127

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

Test Date: Feb-2022  
Hardware Availability: Mar-2022  
Software Availability: Jan-2022



### Hardware

CPU Name: AMD EPYC 7373X  
 Max MHz: 3800  
 Nominal: 3050  
 Enabled: 16 cores, 1 chip, 2 threads/core  
 Orderable: 1 chip  
 Cache L1: 32 KB I + 32 KB D on chip per core  
 L2: 512 KB I+D on chip per core  
 L3: 768 MB I+D on chip per chip,  
 96 MB shared / 2 cores  
 Other: None  
 Memory: 1 TB (8 x 128 GB 4Rx4 PC4-3200AA-L)  
 Storage: 1 x 480 GB SATA SSD, RAID 0  
 Other: None

### Software

OS: Ubuntu 20.04.3 LTS  
 Kernel 5.13.0-28-generic  
 Compiler: C/C++/Fortran: Version 3.2.0 of AOCC  
 Parallel: Yes  
 Firmware: HPE BIOS Version A43 v2.56 02/10/2022 released Feb-2022  
 File System: ext4  
 System State: Run level 5 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 64-bit  
 Other: jemalloc: jemalloc memory allocator library v5.1.0  
 Power Management: BIOS set to prefer performance at the cost of additional power usage



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## Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	16	143	413	<b><u>143</u></b>	<b><u>412</u></b>	143	412	16	143	413	<b><u>143</u></b>	<b><u>412</u></b>	143	412
607.cactuBSSN_s	16	101	165	<b><u>101</u></b>	<b><u>165</u></b>	101	166	16	99.0	168	99.8	167	<b><u>99.2</u></b>	<b><u>168</u></b>
619.lbm_s	16	113	46.5	<b><u>113</u></b>	<b><u>46.4</u></b>	113	46.4	16	<b><u>79.2</u></b>	<b><u>66.2</u></b>	79.1	66.2	79.3	66.1
621.wrf_s	16	<b><u>90.9</u></b>	<b><u>146</u></b>	90.6	146	91.1	145	16	<b><u>89.6</u></b>	<b><u>148</u></b>	89.4	148	89.7	147
627.cam4_s	16	<b><u>130</u></b>	<b><u>68.2</u></b>	130	68.2	130	68.1	16	129	68.8	129	68.9	<b><u>129</u></b>	<b><u>68.9</u></b>
628.pop2_s	16	<b><u>140</u></b>	<b><u>84.6</u></b>	141	84.5	140	85.0	16	<b><u>140</u></b>	<b><u>84.6</u></b>	141	84.5	140	85.0
638.imagick_s	16	132	109	<b><u>132</u></b>	<b><u>109</u></b>	132	110	16	132	109	<b><u>132</u></b>	<b><u>109</u></b>	132	110
644.nab_s	16	<b><u>117</u></b>	<b><u>149</u></b>	117	149	117	149	32	<b><u>94.3</u></b>	<b><u>185</u></b>	94.2	185	94.3	185
649.fotonik3d_s	16	120	76.2	119	76.4	<b><u>119</u></b>	<b><u>76.4</u></b>	16	120	76.2	119	76.4	<b><u>119</u></b>	<b><u>76.4</u></b>
654.roms_s	16	<b><u>91.4</u></b>	<b><u>172</u></b>	91.3	172	92.3	171	16	87.2	181	87.4	180	<b><u>87.3</u></b>	<b><u>180</u></b>

SPECspeed®2017\_fp\_base = **119**

SPECspeed®2017\_fp\_peak = **127**

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

## Compiler Notes

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

## Submit Notes

The config file option 'submit' was used.

## Operating System Notes

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

To limit dirty cache to 8% of memory, 'sysctl -w vm.dirty\_ratio=8' run as root.  
To limit swap usage to minimum necessary, 'sysctl -w vm.swappiness=1' run as root.  
To free node-local memory and avoid remote memory usage,  
'sysctl -w vm.zone\_reclaim\_mode=1' run as root.  
To clear filesystem caches, 'sync; sysctl -w vm.drop\_caches=3' run as root.  
To disable address space layout randomization (ASLR) to reduce run-to-run  
variability, 'sysctl -w kernel.randomize\_va\_space=0' run as root.

To enable Transparent Hugepages (THP) for all allocations,  
'echo always > /sys/kernel/mm/transparent\_hugepage/enabled' and  
'echo always > /sys/kernel/mm/transparent\_hugepage/defrag' run as root.  
To enable THP only on request for peak runs of 628.pop2\_s:

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## Operating System Notes (Continued)

```
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root.  
To disable THP for peak runs of 627.cam4_s, 649.fotonik3d_s, and 654.roms_s,  
'echo never > /sys/kernel/mm/transparent_hugepage/enabled' run as root.
```

## Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:  
GOMP_CPU_AFFINITY = "0-31"  
LD_LIBRARY_PATH =  
    "/home/oem/cpu2017/amd_speed_aocc320_milanx_A_lib/lib;/home/oem/cpu2017/  
    amd_speed_aocc320_milanx_A_lib/lib32:"  
LIBOMP_NUM_HIDDEN_HELPER_THREADS = "0"  
MALLOC_CONF = "retain:true"  
OMP_DYNAMIC = "false"  
OMP_SCHEDULE = "static"  
OMP_STACKSIZE = "128M"  
OMP_THREAD_LIMIT = "32"  
  
Environment variables set by runcpu during the 607.cactuBSSN_s peak run:  
GOMP_CPU_AFFINITY = "0-15"  
  
Environment variables set by runcpu during the 619.lbm_s peak run:  
GOMP_CPU_AFFINITY = "0-15"  
  
Environment variables set by runcpu during the 621.wrf_s peak run:  
GOMP_CPU_AFFINITY = "0-15"  
  
Environment variables set by runcpu during the 627.cam4_s peak run:  
GOMP_CPU_AFFINITY = "0-15"  
  
Environment variables set by runcpu during the 644.nab_s peak run:  
GOMP_CPU_AFFINITY = "0-31"  
  
Environment variables set by runcpu during the 654.roms_s peak run:  
GOMP_CPU_AFFINITY = "0-15"
```

## General Notes

Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using openSUSE 15.2

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.

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## General Notes (Continued)

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 v4.8.2 in RHEL 7.4 (No options specified)  
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

Workload Profile set to General Peak Frequency Compute  
Determinism Control set to Manual  
Performance Determinism set to Power Deterministic  
Last-Level Cache (LLC) as NUMA Node set to Enabled  
NUMA memory domains per socket set to One memory domain per socket  
Thermal Configuration set to Maximum Cooling  
Memory Patrol Scrubbing set to Disabled  
Infinity Fabric Power Management set to Disabled  
Infinity Fabric Performance State set to P0

The system date and time as discovered by sysinfo is incorrect as the time was not updated prior to the run. The test\_date field shows an accurate date for the result.

The system ROM used for this result contains microcode version 0x 0A001227h for the AMD EPYC 7nn3X family of processors. The reference code/AGESA version used in this ROM is version MilanPI 1.0.0.8.

```
Sysinfo program /home/oem/cpu2017/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on oem-dl325Gen10Plus Mon Jan 10 15:15:15 2022
```

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 7373X 16-Core Processor
 1 "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 : 32
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

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## Platform Notes (Continued)

From lscpu from util-linux 2.34:

```

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):                 32
On-line CPU(s) list:   0-31
Thread(s) per core:    2
Core(s) per socket:    16
Socket(s):              1
NUMA node(s):          8
Vendor ID:              AuthenticAMD
CPU family:             25
Model:                  1
Model name:             AMD EPYC 7373X 16-Core Processor
Stepping:               2
CPU MHz:                3044.145
BogoMIPS:               6088.29
Virtualization:        AMD-V
L1d cache:              512 KiB
L1i cache:              512 KiB
L2 cache:               8 MiB
L3 cache:               768 MiB
NUMA node0 CPU(s):     0,1,16,17
NUMA node1 CPU(s):     2,3,18,19
NUMA node2 CPU(s):     4,5,20,21
NUMA node3 CPU(s):     6,7,22,23
NUMA node4 CPU(s):     8,9,24,25
NUMA node5 CPU(s):     10,11,26,27
NUMA node6 CPU(s):     12,13,28,29
NUMA node7 CPU(s):     14,15,30,31
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:     Not affected
Vulnerability Mds:      Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Full AMD retpoline, IBPB conditional, IBRS_FW, STIBP always-on, RSB filling
Vulnerability Srbds:    Not affected
Vulnerability Tsx async abort: Not affected
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 rdtscp lm constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid

```

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## Platform Notes (Continued)

aperfmpperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4\_1 sse4\_2 movbe popcnt aes  
xsave avx fl6c rdrand lahf\_lm cmp\_legacy svm extapic cr8\_legacy abm sse4a  
misalignsse 3dnowprefetch osvw ibs skinit wdt tce topoext perfctr\_core perfctr\_nb  
bpext perfctr\_llc mwaitx cpb cat\_l3 cdp\_l3 invpcid\_single hw\_pstate ssbd mba ibrs  
ibpb stibp vmmcall fsgsbase bmi1 avx2 smep bmi2 invpcid cqm rdt\_a rdseed adx smap  
clflushopt clwb sha\_ni xsaveopt xsavec xgetbv1 xsaves cqm\_llc cqm\_occup\_llc  
cqm\_mbm\_total cqm\_mbm\_local clzero irperf xsaveerptr rdpru wbnoinvd amd\_ppin arat  
npt lbrv svm\_lock nrip\_save tsc\_scale vmcb\_clean flushbyasid decodeassists  
pausefilter pfthreshold v\_vmsave\_vmload vgif v\_spec\_ctrl umip pku ospke vaes  
vpclmulqdq rdpid overflow\_recov succor smca

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL
L1d	32K	512K	8	Data	1
L1i	32K	512K	8	Instruction	1
L2	512K	8M	8	Unified	2
L3	96M	768M	16	Unified	3

/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: 8 nodes (0-7)  
node 0 cpus: 0 1 16 17  
node 0 size: 128712 MB  
node 0 free: 128015 MB  
node 1 cpus: 2 3 18 19  
node 1 size: 128989 MB  
node 1 free: 128753 MB  
node 2 cpus: 4 5 20 21  
node 2 size: 129022 MB  
node 2 free: 128965 MB  
node 3 cpus: 6 7 22 23  
node 3 size: 129022 MB  
node 3 free: 128861 MB  
node 4 cpus: 8 9 24 25  
node 4 size: 129022 MB  
node 4 free: 128805 MB  
node 5 cpus: 10 11 26 27  
node 5 size: 129022 MB  
node 5 free: 128906 MB  
node 6 cpus: 12 13 28 29  
node 6 size: 129022 MB  
node 6 free: 128788 MB  
node 7 cpus: 14 15 30 31  
node 7 size: 116908 MB

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## Platform Notes (Continued)

```
node 7 free: 116777 MB
node distances:
node   0   1   2   3   4   5   6   7
  0:  10  11  11  11  11  11  11  11
  1:  11  10  11  11  11  11  11  11
  2:  11  11  10  11  11  11  11  11
  3:  11  11  11  10  11  11  11  11
  4:  11  11  11  11  10  11  11  11
  5:  11  11  11  11  11  10  11  11
  6:  11  11  11  11  11  11  10  11
  7:  11  11  11  11  11  11  11  10
```

```
From /proc/meminfo
MemTotal:      1044197932 kB
HugePages_Total:      0
Hugepagesize:    2048 kB
```

```
/sbin/tuned-adm active
Current active profile: balanced
```

```
/usr/bin/lsb_release -d
Ubuntu 20.04.3 LTS
```

```
From /etc/*release* /etc/*version*
debian_version: bullseye/sid
os-release:
NAME="Ubuntu"
VERSION="20.04.3 LTS (Focal Fossa)"
ID=ubuntu
ID_LIKE=debian
PRETTY_NAME="Ubuntu 20.04.3 LTS"
VERSION_ID="20.04"
HOME_URL="https://www.ubuntu.com/"
SUPPORT_URL="https://help.ubuntu.com/"
```

```
uname -a:
Linux oem-dl325Gen10Plus 5.13.0-28-generic #31~20.04.1-Ubuntu SMP Wed Jan 19 14:08:10
UTC 2022 x86_64 x86_64 x86_64 GNU/Linux
```

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):	Not affected
CVE-2018-3620 (L1 Terminal Fault):	Not affected
Microarchitectural Data Sampling:	Not affected
CVE-2017-5754 (Meltdown):	Not affected
CVE-2018-3639 (Speculative Store Bypass):	Mitigation: Speculative Store Bypass disabled via prctl and

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```

CVE-2017-5753 (Spectre variant 1):          seccomp
                                              Mitigation: usercopy/swaps
                                              barriers and __user pointer
                                              sanitization
CVE-2017-5715 (Spectre variant 2):          Mitigation: Full AMD retpoline,
                                              IBPB: conditional, IBRS_FW, STIBP:
                                              always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort):    Not affected

```

run-level 5 Jan 10 10:27

```

SPEC is set to: /home/oem/cpu2017
Filesystem      Type  Size  Used Avail Use% Mounted on
/dev/sda2       ext4  439G   16G  401G   4% /

```

```

From /sys/devices/virtual/dmi/id
Vendor:          HPE
Product:         ProLiant DL325 Gen10 Plus v2
Product Family: ProLiant
Serial:          CN70381LLR

```

Additional information from dmidecode 3.2 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.

```

Memory:
  8x Hynix HMABAGL7ABR4N-XN 128 GB 4 rank 3200
  8x UNKNOWN NOT AVAILABLE

```

```

BIOS:
  BIOS Vendor:      HPE
  BIOS Version:     A43
  BIOS Date:        02/10/2022
  BIOS Revision:    2.56
  Firmware Revision: 2.60

```

(End of data from sysinfo program)

## Compiler Version Notes

```

=====
C          | 619.lbm_s(base, peak) 638.imagick_s(base, peak)
          | 644.nab_s(base, peak)
-----

```

AMD clang version 13.0.0 (CLANG: AOCC\_3.2.0-Build#128 2021\_11\_12) (based on

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## Compiler Version Notes (Continued)

LLVM Mirror.Version.13.0.0)  
Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

=====  
C++, C, Fortran | 607.cactuBSSN\_s(base, peak)

AMD clang version 13.0.0 (CLANG: AOCC\_3.2.0-Build#128 2021\_11\_12) (based on LLVM Mirror.Version.13.0.0)

Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

AMD clang version 13.0.0 (CLANG: AOCC\_3.2.0-Build#128 2021\_11\_12) (based on LLVM Mirror.Version.13.0.0)

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=====  
Fortran | 603.bwaves\_s(base, peak) 649.fotonik3d\_s(base, peak)  
| 654.roms\_s(base, peak)

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Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

=====  
Fortran, C | 621.wrf\_s(base, peak) 627.cam4\_s(base, peak)  
| 628.pop2\_s(base, peak)

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Target: x86\_64-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin  
-----

## Base Compiler Invocation

C benchmarks:

clang

Fortran benchmarks:

flang

Benchmarks using both Fortran and C:

flang clang

Benchmarks using Fortran, C, and C++:

clang++ clang flang

## Base Portability Flags

603.bwaves\_s: -DSPEC\_LP64  
607.cactuBSSN\_s: -DSPEC\_LP64  
619.lbm\_s: -DSPEC\_LP64  
621.wrf\_s: -DSPEC\_CASE\_FLAG -Mbyteswapio -DSPEC\_LP64  
627.cam4\_s: -DSPEC\_CASE\_FLAG -DSPEC\_LP64  
628.pop2\_s: -DSPEC\_CASE\_FLAG -Mbyteswapio -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:

-m64 -Wl,-mllvm -Wl,-region-vectorize  
-Wl,-mllvm -Wl,-function-specialize  
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6  
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3  
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=5

(Continued on next page)



# SPEC CPU®2017 Floating Point Speed Result

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**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

**ProLiant DL325 Gen10 Plus v2**  
(3.05 GHz, AMD EPYC 7373X)

**SPECspeed®2017\_fp\_base = 119**

**SPECspeed®2017\_fp\_peak = 127**

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

**Test Date:** Feb-2022  
**Hardware Availability:** Mar-2022  
**Software Availability:** Jan-2022

## Base Optimization Flags (Continued)

C benchmarks (continued):

```
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:

```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Hz,1,0x1 -O3
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -z muldefs -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

Benchmarks using both Fortran and C:

```
-m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -Hz,1,0x1
-Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange -mllvm -compute-interchange-order
-z muldefs -DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang
```

Benchmarks using Fortran, C, and C++:

```
-m64 -Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-freemap-arrays -mllvm -function-specialize -flv-function-specialization
```

(Continued on next page)



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## Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):

```
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -enable-partial-unswitch -mllvm -unroll-threshold=100
-finline-aggressive -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -convert-pow-exp-to-int=false
-Hz,1,0x1 -Mrecursive -mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -lsr-in-nested-loop -mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -z muldefs -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

## Base Other Flags

C benchmarks:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Fortran benchmarks:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Benchmarks using both Fortran and C:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Benchmarks using Fortran, C, and C++:

```
-Wno-unused-command-line-argument -Wno-return-type
```

## Peak Compiler Invocation

C benchmarks:

```
clang
```

Fortran benchmarks:

```
flang
```

Benchmarks using both Fortran and C:

```
flang clang
```

Benchmarks using Fortran, C, and C++:

```
clang++ clang flang
```



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## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:

```
619.lbm_s: -m64 -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=5 -mllvm -unroll-threshold=50
-freemap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

638.imagick\_s: basepeak = yes

```
644.nab_s: -m64 -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -freemap-arrays
-mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-mllvm -do-block-reorder=aggressive -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:

603.bwaves\_s: basepeak = yes

649.fotonik3d\_s: basepeak = yes

```
654.roms_s: -m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp
```

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## Peak Optimization Flags (Continued)

654.roms\_s (continued):

```
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp
-Mrecursive -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -enable-licm-vrp
-DSPEC_OPENMP -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang
```

Benchmarks using both Fortran and C:

```
621.wrf_s: -m64 -Wl,-mllvm -Wl,-enable-X86-prefetching
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=5 -mllvm -unroll-threshold=50
-freemap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -Hz,1,0x1 -Mrecursive
-mllvm -fuse-tile-inner-loop -funroll-loops
-mllvm -extra-vectorizer-passes -mllvm -lsr-in-nested-loop
-mllvm -enable-loopinterchange
-mllvm -compute-interchange-order -DSPEC_OPENMP
-fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
```

627.cam4\_s: Same as 621.wrf\_s

628.pop2\_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

```
-m64 -Wl,-mllvm -Wl,-x86-use-vzeroupper=false
-Wl,-mllvm -Wl,-enable-licm-vrp
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -freemap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true -mllvm -function-specialize
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
```

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**Software Availability:** Jan-2022

## Peak Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):

```
-finline-aggressive -mllvm -unroll-threshold=100 -mllvm -reroll-loops  
-mllvm -aggressive-loop-unswitch -Mrecursive  
-mllvm -do-block-reorder=aggressive -DSPEC_OPENMP -fopenmp=libomp  
-lomp -lamdlibm -ljemalloc -lflang
```

## Peak Other Flags

C benchmarks:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Fortran benchmarks:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Benchmarks using both Fortran and C:

```
-Wno-unused-command-line-argument -Wno-return-type
```

Benchmarks using Fortran, C, and C++:

```
-Wno-unused-command-line-argument -Wno-return-type
```

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

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

<http://www.spec.org/cpu2017/flags/aocc320-flags-A1.html>

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revR.xml>

<http://www.spec.org/cpu2017/flags/aocc320-flags-A1.xml>

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Tested with SPEC CPU®2017 v1.1.8 on 2022-01-10 04:45:15-0500.

Report generated on 2022-03-22 10:11:52 by CPU2017 PDF formatter v6442.

Originally published on 2022-03-21.