



# SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

ProLiant DL325 Gen11

(3.85 GHz, AMD EPYC 9374F)

SPECspeed®2017\_base =

SPECspeed®2017\_fp\_peak =

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jan-2023

Hardware Availability: Dec-2022

Software Availability: Nov-2022

**SPEC has determined that this result does not comply with the SPEC CPU 2017 run and reporting rules. Specifically, the test sponsor notified SPEC that the results were measured on an unsupported configuration.**

### Threads

603.bwaves\_s

607.cactuBSSN\_s

619.lbm\_s

621.wrf\_s

627.cam4\_s

628.pop2\_s

638.imagick\_s

644.nab\_s

649.fotonik3d\_s

654.roms\_s

### Hardware

CPU Name: AMD EPYC 9374F

Nominal: 3850

Enabled: 32 cores, 1 chip

Orderable: 1 chip

Cache L1: 32 KB I + 32 KB D on chip per core

L2: 1 MB I+D on chip per core

L3: 256 MB I+D on chip per chip,  
32 MB shared / 4 cores

Other: None

Memory: 768 GB (12 x 64 GB 2Rx4 PC5-4800B-R)

Storage: 1 x 960 GB SATA SSD

Other: None

### Software

OS:

Red Hat Enterprise Linux 9.0 (Plow)

Kernel 5.14.0-70.13.1.el9\_0.x86\_64

Compiler:

C/C++/Fortran: Version 4.0.0 of AOCC

Parallel:

Yes

Firmware:

HPE BIOS Version v1.12 11/24/2022 released

Nov-2022

File System:

xfs

System State:

Run level 3 (multi-user)

Base Pointers:

64-bit

Peak Pointers:

64-bit

Other:

None

Power Management: BIOS and OS 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    | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 607.cactuBSSN_s | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 619.lbm_s       | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 621.wrf_s       | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 627.cam4_s      | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 628.pop2_s      | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 638.imagick_s   | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 644.nab_s       | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 649.fotonik3d_s | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |
| 654.roms_s      | NC      | NC      | NC    | NC      | NC    | NC      | NC    | NC      | NC      | NC    | NC      | NC    | NC      | NC    |  |  |

SPECspeed®2017\_fp\_base =

SPECspeed®2017\_fp\_peak =

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.  
The option 'bind' 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 limit  
'ulimit -l 2097152' was used to set environment locked pages in memory limit

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

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.

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## Operating System Notes (Continued)

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, and 'echo always > /sys/kernel/mm/transparent\_hugepage/enabled' and 'echo always > /sys/kernel/mm/transparent\_hugepage/defrag' run as root.

To always enable THP for peak runs of:

603.bwaves\_s, 607.cactuBSSN\_s, 619.lbm\_s, 627.cam4\_s, 638.pop2\_s, 638.imagick\_s, 644.nab\_s, 649.fotonik3d\_s:

'echo madvise > /sys/kernel/mm/transparent\_hugepage/enabled; echo always > /sys/kernel/mm/transparent\_hugepage/defrag' run as root.

To disable THP for peak runs of 641.wrf\_s:

'echo never > /sys/kernel/mm/transparent\_hugepage/enabled; echo always > /sys/kernel/mm/transparent\_hugepage/defrag' run as root.

To enable THP only on request for peak runs of 654.roms\_s:

'echo madvise > /sys/kernel/mm/transparent\_hugepage/enabled; echo madvise > /sys/kernel/mm/transparent\_hugepage/defrag' 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 = "/hpe/cpu2017/float_speed_aocc400_genoa_B_lib/lib:"
LIBOMP_NUM_HIDDEN_HELPERS_THREADS = "0"
MALLOC_CONF = "oversize_threshold:0,retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "32"
```

Environment variables set by runcpu during the 603.bwaves\_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

Environment variables set by runcpu during the 621.wrf\_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

Environment variables set by runcpu during the 627.cam4\_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

Environment variables set by runcpu during the 628.pop2\_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

Environment variables set by runcpu during the 649.fotonik3d\_s peak run:

```
GOMP_CPU_AFFINITY = "0-31"
```

```
PGHPF_ZMEM = "yes"
```

Environment variables set by runcpu during the 654.roms\_s peak run:

```
GOMP_CPU_AFFINITY = "0 16 1 17 2 18 3 19 4 20 5 21 6 22 7 23 8 24 9 25 10 26 11 27 12 28 13 29 14 30 15 31"
```



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## General Notes

Binaries were compiled on a system with 2x AMD EPYC 9174 (2.9 GHz) + 1.5TB Memory using RHEL 8.6

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.

## Platform Notes

### BIOS Configuration

Workload Profile set to General Work Frequency Compute

Determinism Control set to Manual

Performance Determinism set to Power Deterministic

AMD SMT Option set to Disabled

Last-Level Cache (LLC) as NUMA Node set to Enabled

ACPI CST C2 Latency set to 18 microseconds

Memory PStates set to Limited

Thermal Configuration set to Maximum Cooling

Workload Profile set to Custom

Power Regulator set to OS Control Mode

The system ROM used for this result contains microcode version 0xa10110e for the AMD EPYC 9nn4X family processors. The reference code/AGESA version used in this ROM is version GenoaPI\_0.0.1-L6

Sysinfo program: /home/cpu2017/bin/sysinfo  
Rev: r6622 of 2022-07-07 982a61ec0915b55891ef0e16acafc64d  
running on localhost.localdomain Thu Apr 7 05:37:13 2022

SUI (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

modelname : AMD EPYC 9374F 32-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 : 32

siblings : 32

physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

25 26 27 28 29 30 31

From lscpu from util-linux 2.37.4:

Architecture: x86\_64

CPU op-mode(s): 32-bit, 64-bit

(Continued on next page)



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## Platform Notes (Continued)

```

Address sizes:          52 bits physical, 52 bits virtual
Byte Order:            Little Endian
CPU(s):                32
On-line CPU(s) list:   0-31
Vendor ID:             AuthenticAMD
BIOS Vendor ID:       Advanced Micro Devices, Inc.
Model name:            AMD EPYC 9374F 8-Core Processor
BIOS Model name:      AMD EPYC 9374F 8-Core Processor
CPU family:            23
Model:                 17
Thread(s) per core:   1
Core(s) per socket:   32
Socket(s):             1
Stepping:              1
Frequency boost:       enabled
CPU max MHz:           4304.912
CPU min MHz:           1000000
BogoMIPS:              7688.47
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 rdtscp lm constant_tsc rep_good noopl nonstop_tsc cpuid extd_apicid
aperfperf rapl ppi pku qlqdg monitor ssse3 fma cx16 pcid sse4_1 sse4_2 x2apic movbe
popcnt aes xsave avx flt rdand 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 npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid decodeassists pausefilter
pftfthreshold tlbv_vmsave_vmload vgif v_spec_ctrl avx512vbmi umip pku ospke
avx512vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg avx512_vpopcntdq la57
rdseed overflow_recov succor smca fsrm flush_l1d
Cache Allocation:      AMD-V
L1d cache:            1 MiB (32 instances)
L1i cache:            1 MiB (32 instances)
L2 cache:             32 MiB (32 instances)
L3 cache:             256 MiB (8 instances)
NUMA node(s):         8
NUMA node0 CPU(s):    0-3
NUMA node1 CPU(s):    16-19
NUMA node2 CPU(s):    8-11
NUMA node3 CPU(s):    24-27
NUMA node4 CPU(s):    12-15
NUMA node5 CPU(s):    28-31
NUMA node6 CPU(s):    4-7
NUMA node7 CPU(s):    20-23
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf:   Not affected
Vulnerability Mds:     Not affected
Vulnerability Meltdown: Not affected

```

(Continued on next page)



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## Platform Notes (Continued)

Vulnerability Spec store bypass: Mitigation: Speculative Store Bypass disabled via prctl  
 Vulnerability Spectre v1: Mitigation: usercopy/swapgs barriers and \_\_user pointer sanitization  
 Vulnerability Spectre v2: Mitigation: Retpolines, IBPB conditional, IBRS\_FW, STIBP disabled, RSB filling  
 Vulnerability Srbds: Not affected  
 Vulnerability Tsx async abort: Not affected

From lscpu --cache:

| NAME | ONE-SIZE | ALL-SIZE | WAYS | TYPE        | LEVEL | SETS  | PHY-LINE | COHERENCY-SIZE |
|------|----------|----------|------|-------------|-------|-------|----------|----------------|
| L1d  | 32K      | 1M       |      | Data        | 1     | 64    | 1        | 64             |
| L1i  | 32K      | 1M       |      | Instruction | 1     | 64    | 1        | 64             |
| L2   | 1M       | 32M      |      | Unified     | 2     | 2048  | 1        | 64             |
| L3   | 32M      | 256M     | 16   | Unified     | 3     | 32768 | 1        | 64             |

/proc/cpuinfo cache data  
cache size : 1024 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 2 3
node 0 size: 96520 MB
node 0 free: 96374 MB
node 1 cpus: 4 5 6 7
node 1 size: 96766 MB
node 1 free: 96634 MB
node 2 cpus: 8 9 10 11
node 2 size: 96730 MB
node 2 free: 96537 MB
node 3 cpus: 12 13 14 15
node 3 size: 96766 MB
node 3 free: 96570 MB
node 4 cpus: 16 17 18 19
node 4 size: 96766 MB
node 4 free: 96624 MB
node 5 cpus: 20 21 22 23
node 5 size: 96718 MB
node 5 free: 96326 MB
node 6 cpus: 24 25 26 27
node 6 size: 96766 MB
node 6 free: 96537 MB
node 7 cpus: 28 29 30 31
node 7 size: 96766 MB
node 7 free: 96542 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

```

(Continued on next page)



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## Platform Notes (Continued)

```

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: 792375840 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

```

```

/sbin/tuned-adm active
Current active profile: throughput-performance

```

```

/sys/devices/system/cpu/cpu*/cpu*/scaling_governor has
performance

```

```

From /etc/*release* /etc/*version*
os-release:
NAME="Red Hat Enterprise Linux"
VERSION="9.0 (Plow)"
ID="rhel"
ID_LIKE="fedora"
VERSION_ID="9.0"
PLATFORM_ID="platform:el9"
PRETTY_NAME="Red Hat Enterprise Linux 9.0 (Plow)"
ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release: Red Hat Enterprise Linux release 9.0 (Plow)
system-release-cpe: cpe:/o:redhat:enterprise_linux:9::baseos

```

```

uname -a:
Linux localhost.localdomain 5.14.0-70.13.1.el9_0.x86_64 #1 SMP PREEMPT Thu Apr 14 2022 x86_64 x86_64 x86_64 GNU/Linux

```

Kernel self-reported vulnerability status:

```

CVE-2017-12207 (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
CVE-2017-5753 (Spectre variant 1): Mitigation: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Retpolines, IBPB: conditional, IBRS_FW, STIBP: disabled, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

```

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## Platform Notes (Continued)

run-level 3 Apr 7 05:30

SPEC is set to: /home/cpu2017

| Filesystem                | Type | Size | Used | Avail | Use% | Mounted on |
|---------------------------|------|------|------|-------|------|------------|
| /dev/mapper/rhel-home xfs |      | 819G | 82G  | 737G  |      | /home      |

From /sys/devices/virtual/dmi/id

Vendor: HPE  
 Product: ProLiant DL325 Gen11  
 Product Family: ProLiant  
 Serial: DL325G11-01

Additional information from dmi code 3.3 follows. WARNING: Use caution when you interpret this section. The 'dmi code' 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:

10x Hynix HMC94AEBRA103N 64GB 2 rank 4800  
 2x Hynix HMC94MEBRA121N 64GB 2 rank 4800

BIOS:

BIOS Vendor: HPE  
 BIOS Version: 1.12  
 BIOS Date: 11/24/2022  
 BIOS Revision: 1.12  
 Firmware Revision: 1.10

(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 14.0.6 (CLANG: AOCC\_4.0.0-Build#389 2022\_10\_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

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

AMD clang version 14.0.6 (CLANG: AOCC\_4.0.0-Build#389 2022\_10\_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86\_64-unknown-linux-gnu

Thread model: posix

InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin

AMD clang version 14.0.6 (CLANG: AOCC\_4.0.0-Build#389 2022\_10\_07) (based on LLVM Mirror.Version.14.0.6)

Target: x86\_64-unknown-linux-gnu

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## Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
```

```
-----
Fortran          | 603.bwaves_s(base, peak) 649.tonik3d_s(base, peak) 654.roms_s(base, peak)
-----
```

```
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
```

```
-----
Fortran, C       | 621.wrf_s(base, peak) 627.cam4_s(base, peak) 628.pop2_s(base, peak)
-----
```

```
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/bin
AMD clang version 14.0.6 (CLANG: AOCC_4.0.0-Build#389 2022_10_07) (based on LLVM Mirror.Version.14.0.6)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc/aocc-compiler-rel-4.0-3206-389/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



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Copyright 2017-2023 Standard Performance Evaluation Corporation

Hewlett Packard Enterprise

(Test Sponsor: HPE)

ProLiant DL325 Gen11

(3.85 GHz, AMD EPYC 9374F)

SPECspeed®2017\_base =

SPECspeed®2017\_fp\_peak =

CPU2017 License: 3

Test Sponsor: HPE

Tested by: HPE

Test Date: Jan-2023

Hardware Availability: Dec-2022

Software Availability: Nov-2022

**SPEC has determined that this result does not comply with the SPEC CPU 2017 run and reporting rules. Specifically, the test sponsor notified SPEC that the results were measured on an unsupported configuration.**

## 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,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-fremap-arrays -fskip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang

```

Fortran benchmarks:

```

-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -Mrecursive
-funroll-loops -mllvm -lsr-in-nested-loop
-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp -lomp
-lamdlibm -lamdalloc -lflang

```

Benchmarks using both Fortran and C:

```

-m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp -flto -fstruct-layout=7
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000

```

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## Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):

```
-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -Mrecursive -funroll-loops
-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang
```

Benchmarks using Fortran, C, and C++:

```
-m64 -Wl,-mllvm -Wl,-align-all-nofallthrough -blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-x86-use-vector-grouper=false -O3 -march=znver4
-fveclib=AMDLIBM -ffast-math -fopenmp=flto -fstruct-layout=7
-mllvm -unroll-threshold=500000 -mllvm -inline-threshold=1000
-fremap-arrays -fstrip-mining -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -zopt -mllvm -unroll-threshold=100 -finline-aggressive
-mllvm -loop-unswitch-threshold=200000 -Mrecursive -funroll-loops
-mllvm -lsr-in-nested-loop -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang
```

## Base Other Flags

C benchmarks:

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

Benchmarks using both Fortran and C:

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

Benchmarks using Fortran, C, and C++:

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



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## 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

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:

619.lbm\_s: basepeak = yes

638.imagick\_s: basepeak = yes

644.nab\_s: basepeak = yes

Fortran benchmarks:

```
603.bwaves_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -Mrecursive -mllvm -reduce-array-computations=3
-fvector-transform -fscalar-transform -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang
```

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## Peak Optimization Flags (Continued)

```
649.fotonik3d_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -DSPEC_OPENMP
-Ofast -march=znver4 -fveclib=AMDLIBM -ffast-math
-fopenmp -flto -Mrecursive
-mllvm -reduce-array-computations=3 -zopt -fopenmp=libomp
-lomp -lamdlibm -lamdalloc -lflang
```

654.roms\_s: Same as 603.bwaves\_s

Benchmarks using both Fortran and C:

```
621.wrf_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-freemap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-O3 -Mrecursive -funroll-loops -mllvm -lsr-in-nested-loop
-fopenmp=libomp -lomp -lamdlibm -lamdalloc -lflang
```

```
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-freemap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-Mrecursive -fopenmp=libomp -lomp -lamdlibm -lamdalloc
-lflang
```

```
628.pop2_s: -m64 -Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -Ofast
```

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## Peak Optimization Flags (Continued)

628.pop2\_s (continued):

```
-march=znver4 -fveclib=AMDLIBM -ffast-math -fopenmp
-flto -fstruct-layout=9 -mllvm -unroll-threshold=50
-fremap-arrays -fstrip-mining
-mllvm -inline-threshold=1000
-mllvm -reduce-array-computations=3 -DSPEC_OPENMP -zopt
-Mrecursive -fvector-transform -fscalar-transform
-fopenmp=libomp -lomp -lamdlibm -lamdlibm -lflang
```

Benchmarks using Fortran, C, and C++:

607.cactuBSSN\_s: basepeak = yes

## Peak Other Flags

C benchmarks:

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

Fortran benchmarks:

```
-Wno-unused-command-line-argument
```

Benchmarks using both Fortran and C:

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

Benchmarks using Fortran, C, and C++:

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

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-Genoa-rev2.1.html>

<http://www.spec.org/cpu2017/flags/aocc400-flags.html>

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-Genoa-rev2.1.xml>

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For questions about this result, please contact the tester. For other inquiries, please contact [info@spec.org](mailto:info@spec.org).

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