



# SPEC CPU®2017 Integer Rate Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

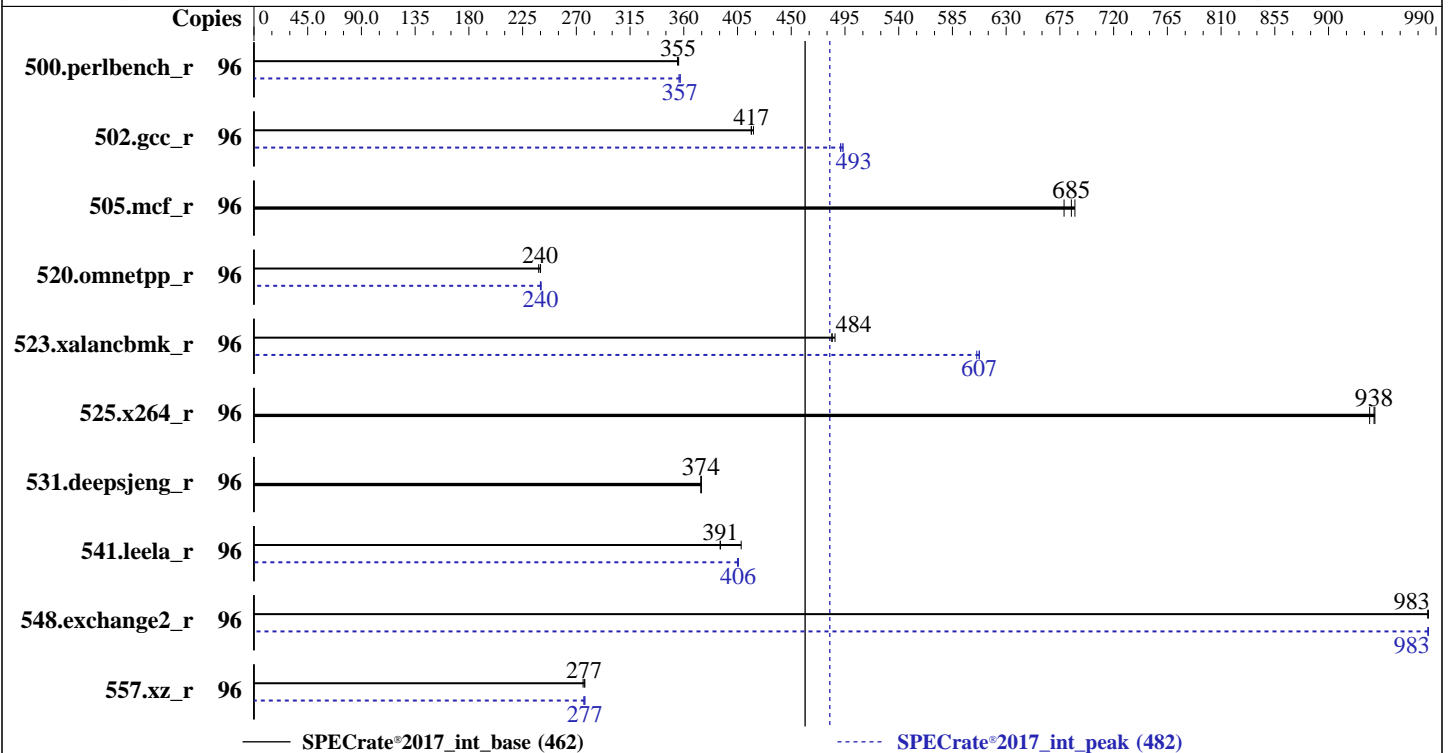
ProLiant DL385 Gen10 Plus v2  
(2.80 GHz, AMD EPYC 7473X)

SPECrate®2017\_int\_base = 462

SPECrate®2017\_int\_peak = 482

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 7473X  
 Max MHz: 3700  
 Nominal: 2800  
 Enabled: 48 cores, 2 chips, 2 threads/core  
 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: 768 MB I+D on chip per chip,  
 96 MB shared / 3 cores  
 Other: None  
 Memory: 2 TB (16 x 128 GB 4Rx4 PC4-3200AA-L)  
 Storage: 1 x 400 GB SAS SSD  
 Other: None

### Software

OS: Ubuntu 20.04.2 LTS (x86\_64)  
 Kernel 5.11.0-41-generic  
 Compiler: C/C++/Fortran: Version 3.2.0 of AOCC  
 Parallel: No  
 Firmware: HPE BIOS Version A42 v2.56 02/10/2022 released Feb-2022  
 File System: ext4  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-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						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	96	430	356	<b>430</b>	<b>355</b>	431	355	96	428	357	<b>428</b>	<b>357</b>	429	356
502.gcc_r	96	<b>326</b>	<b>417</b>	326	417	325	418	96	<b>276</b>	<b>493</b>	275	493	277	491
505.mcf_r	96	226	688	229	678	<b>227</b>	<b>685</b>	96	226	688	229	678	<b>227</b>	<b>685</b>
520.omnetpp_r	96	<b>525</b>	<b>240</b>	525	240	528	238	96	<b>525</b>	<b>240</b>	524	241	525	240
523.xalancbmk_r	96	208	487	<b>209</b>	<b>484</b>	209	484	96	167	608	<b>167</b>	<b>607</b>	167	605
525.x264_r	96	179	939	180	934	<b>179</b>	<b>938</b>	96	179	939	180	934	<b>179</b>	<b>938</b>
531.deepsjeng_r	96	294	374	<b>294</b>	<b>374</b>	294	375	96	294	374	<b>294</b>	<b>374</b>	294	375
541.leela_r	96	390	408	407	390	<b>407</b>	<b>391</b>	96	393	405	392	406	<b>392</b>	<b>406</b>
548.exchange2_r	96	256	983	256	984	<b>256</b>	<b>983</b>	96	<b>256</b>	<b>983</b>	256	984	256	983
557.xz_r	96	374	277	<b>375</b>	<b>277</b>	376	276	96	374	277	<b>374</b>	<b>277</b>	375	276

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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.  
'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 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.  
To disable address space layout randomization (ASLR) to reduce run-to-run  
variability, 'sysctl -w kernel.randomize\_va\_space=0' run as root.

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## Operating System Notes (Continued)

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

## Environment Variables Notes

Environment variables set by runcpu before the start of the run:  
LD\_LIBRARY\_PATH =  
"/home/cpu2017/amd\_rate\_aocc320\_milanx\_A\_lib/lib;/home/cpu2017/amd\_rate\_aocc320\_milanx\_A\_lib/lib32:"  
MALLOC\_CONF = "retain:true"

Environment variables set by runcpu during the 523.xalancbmk\_r peak run:  
MALLOC\_CONF = "thp:never"

## 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.  
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 Throughput 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 Four memory domains per socket  
Memory Interleaving Mode set to Disabled

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## Platform Notes (Continued)

Thermal Configuration set to Maximum Cooling  
Infinity Fabric Power Management set to Disabled  
Infinity Fabric Performance State set to P0  
Workload Profile set to Custom  
L2 HW Prefetcher set to Disabled

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/cpu2017/bin/sysinfo  
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d  
running on oem-ProLiant-DL385-Gen10-Plus Thu Jul 22 00:32:45 2021

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 7473X 24-Core Processor  
2 "physical id"s (chips)  
96 "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 : 48  
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 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): 96  
On-line CPU(s) list: 0-95  
Thread(s) per core: 2  
Core(s) per socket: 24  
Socket(s): 2  
NUMA node(s): 16  
Vendor ID: AuthenticAMD  
CPU family: 25  
Model: 1  
Model name: AMD EPYC 7473X 24-Core Processor

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## Platform Notes (Continued)

```

Stepping:                2
CPU MHz:                  2794.721
BogoMIPS:                 5589.44
Virtualization:          AMD-V
L1d cache:                1.5 MiB
L1i cache:                1.5 MiB
L2 cache:                 24 MiB
L3 cache:                 1.5 GiB
NUMA node0 CPU(s):       0-2,48-50
NUMA node1 CPU(s):       3-5,51-53
NUMA node2 CPU(s):       6-8,54-56
NUMA node3 CPU(s):       9-11,57-59
NUMA node4 CPU(s):       12-14,60-62
NUMA node5 CPU(s):       15-17,63-65
NUMA node6 CPU(s):       18-20,66-68
NUMA node7 CPU(s):       21-23,69-71
NUMA node8 CPU(s):       24-26,72-74
NUMA node9 CPU(s):       27-29,75-77
NUMA node10 CPU(s):      30-32,78-80
NUMA node11 CPU(s):      33-35,81-83
NUMA node12 CPU(s):      36-38,84-86
NUMA node13 CPU(s):      39-41,87-89
NUMA node14 CPU(s):      42-44,90-92
NUMA node15 CPU(s):      45-47,93-95
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 aperfmperf pni pclmulqdq monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c 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

```

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## Platform Notes (Continued)

pausefilter pfthreshold v\_vmsave\_vmload vgif umip pku ospke vaes vpclmulqdq rdpid  
overflow\_recov succor smca

From lscpu --cache:

NAME	ONE-SIZE	ALL-SIZE	WAYS	TYPE	LEVEL
L1d	32K	1.5M	8	Data	1
L1i	32K	1.5M	8	Instruction	1
L2	512K	24M	8	Unified	2
L3	96M	1.5G	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: 16 nodes (0-15)
node 0 cpus: 0 1 2 48 49 50
node 0 size: 128711 MB
node 0 free: 128551 MB
node 1 cpus: 3 4 5 51 52 53
node 1 size: 129020 MB
node 1 free: 128864 MB
node 2 cpus: 6 7 8 54 55 56
node 2 size: 129022 MB
node 2 free: 128907 MB
node 3 cpus: 9 10 11 57 58 59
node 3 size: 128989 MB
node 3 free: 128867 MB
node 4 cpus: 12 13 14 60 61 62
node 4 size: 129022 MB
node 4 free: 128815 MB
node 5 cpus: 15 16 17 63 64 65
node 5 size: 129021 MB
node 5 free: 128360 MB
node 6 cpus: 18 19 20 66 67 68
node 6 size: 129022 MB
node 6 free: 128916 MB
node 7 cpus: 21 22 23 69 70 71
node 7 size: 129009 MB
node 7 free: 128906 MB
node 8 cpus: 24 25 26 72 73 74
node 8 size: 129022 MB
node 8 free: 128917 MB
node 9 cpus: 27 28 29 75 76 77
node 9 size: 129021 MB
node 9 free: 128909 MB
node 10 cpus: 30 31 32 78 79 80

```

(Continued on next page)



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## Platform Notes (Continued)

```

node 10 size: 129022 MB
node 10 free: 128914 MB
node 11 cpus: 33 34 35 81 82 83
node 11 size: 129021 MB
node 11 free: 128914 MB
node 12 cpus: 36 37 38 84 85 86
node 12 size: 129022 MB
node 12 free: 128913 MB
node 13 cpus: 39 40 41 87 88 89
node 13 size: 129021 MB
node 13 free: 128917 MB
node 14 cpus: 42 43 44 90 91 92
node 14 size: 129022 MB
node 14 free: 128919 MB
node 15 cpus: 45 46 47 93 94 95
node 15 size: 129016 MB
node 15 free: 128914 MB
node distances:
node  0  1  2  3  4  5  6  7  8  9 10 11 12 13 14 15
 0:  10 11 12 12 12 12 12 12 32 32 32 32 32 32 32 32
 1:  11 10 12 12 12 12 12 12 32 32 32 32 32 32 32 32
 2:  12 12 10 11 12 12 12 12 32 32 32 32 32 32 32 32
 3:  12 12 11 10 12 12 12 12 32 32 32 32 32 32 32 32
 4:  12 12 12 12 10 11 12 12 32 32 32 32 32 32 32 32
 5:  12 12 12 12 11 10 12 12 32 32 32 32 32 32 32 32
 6:  12 12 12 12 12 12 10 11 32 32 32 32 32 32 32 32
 7:  12 12 12 12 12 12 11 10 32 32 32 32 32 32 32 32
 8:  32 32 32 32 32 32 32 32 10 11 12 12 12 12 12 12
 9:  32 32 32 32 32 32 32 32 11 10 12 12 12 12 12 12
10:  32 32 32 32 32 32 32 32 12 12 10 11 12 12 12 12
11:  32 32 32 32 32 32 32 32 12 12 11 10 12 12 12 12
12:  32 32 32 32 32 32 32 32 12 12 12 12 10 11 12 12
13:  32 32 32 32 32 32 32 32 12 12 12 12 11 10 12 12
14:  32 32 32 32 32 32 32 32 12 12 12 12 12 12 10 11
15:  32 32 32 32 32 32 32 32 12 12 12 12 12 12 11 10

```

```

From /proc/meminfo
MemTotal:      2113526152 kB
HugePages_Total:      0
Hugepagesize:    2048 kB

```

```

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

```

```

/usr/bin/lsb_release -d
Ubuntu 20.04.2 LTS

```

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## Platform Notes (Continued)

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

debian\_version: bullseye/sid

os-release:

NAME="Ubuntu"

VERSION="20.04.2 LTS (Focal Fossa)"

ID=ubuntu

ID\_LIKE=debian

PRETTY\_NAME="Ubuntu 20.04.2 LTS"

VERSION\_ID="20.04"

HOME\_URL="https://www.ubuntu.com/"

SUPPORT\_URL="https://help.ubuntu.com/"

uname -a:

Linux oem-ProLiant-DL385-Gen10-Plus 5.11.0-41-generic #45~20.04.1-Ubuntu SMP Wed Nov 10 10:20:10 UTC 2021 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 seccomp
CVE-2017-5753 (Spectre variant 1):	Mitigation: usercopy/swapgs 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 3 Jul 22 00:30

SPEC is set to: /home/cpu2017

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
/dev/sdb2	ext4	366G	74G	274G	22%	/

From /sys/devices/virtual/dmi/id

Vendor: HPE  
Product: ProLiant DL385 Gen10 Plus  
Product Family: ProLiant  
Serial: CN7931051F

Additional information from dmidecode 3.2 follows. WARNING: Use caution when you

(Continued on next page)





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## Platform Notes (Continued)

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:

16x Samsung M386AAG40AM3-CWE 128 GB 4 rank 3200  
16x UNKNOWN NOT AVAILABLE

BIOS:

BIOS Vendor: HPE  
BIOS Version: A42  
BIOS Date: 02/10/2022  
BIOS Revision: 2.56  
Firmware Revision: 2.55

(End of data from sysinfo program)

## Compiler Version Notes

=====  
C | 502.gcc\_r(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: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin  
-----

=====  
C | 500.perlbench\_r(base, peak) 502.gcc\_r(base) 505.mcf\_r(base, peak)  
525.x264\_r(base, peak) 557.xz\_r(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  
-----

=====  
C | 502.gcc\_r(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: i386-unknown-linux-gnu  
Thread model: posix

(Continued on next page)



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## Compiler Version Notes (Continued)

InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

=====  
C | 500.perlbench\_r(base, peak) 502.gcc\_r(base) 505.mcf\_r(base, peak)  
| 525.x264\_r(base, peak) 557.xz\_r(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

=====  
C++ | 523.xalanbmk\_r(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: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

=====  
C++ | 520.omnetpp\_r(base, peak) 523.xalanbmk\_r(base)  
| 531.deepsjeng\_r(base, peak) 541.leela\_r(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

=====  
C++ | 523.xalanbmk\_r(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: i386-unknown-linux-gnu  
Thread model: posix  
InstalledDir: /opt/AMD/aocc-compiler-3.2.0/bin

=====  
C++ | 520.omnetpp\_r(base, peak) 523.xalanbmk\_r(base)  
=====

(Continued on next page)



# SPEC CPU®2017 Integer Rate Result

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**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

**ProLiant DL385 Gen10 Plus v2**  
(2.80 GHz, AMD EPYC 7473X)

**SPECrate®2017\_int\_base = 462**

**SPECrate®2017\_int\_peak = 482**

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

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

## Compiler Version Notes (Continued)

| 531.deepsjeng\_r(base, peak) 541.leela\_r(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  
-----

=====  
Fortran | 548.exchange2\_r(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  
-----

## Base Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

flang

## Base Portability Flags

500.perlbench\_r: -DSPEC\_LINUX\_X64 -DSPEC\_LP64  
502.gcc\_r: -DSPEC\_LP64  
505.mcf\_r: -DSPEC\_LP64  
520.omnetpp\_r: -DSPEC\_LP64  
523.xalancbmk\_r: -DSPEC\_LINUX -DSPEC\_LP64  
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



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## Base Optimization Flags

C benchmarks:

```
-m64 -Wl,-allow-multiple-definition -Wl,-mllvm -Wl,-enable-licm-vrp
-flto -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
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -fstruct-layout=5 -mllvm -unroll-threshold=50
-mllvm -inline-threshold=1000 -fremap-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 -enable-loop-fusion -z muldefs -lamdlibm -ljemalloc -lflang
```

C++ benchmarks:

```
-m64 -std=c++98 -flto -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
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
-mllvm -enable-loop-fusion -z muldefs -fvirtual-function-elimination
-fvisibility=hidden -lamdlibm -ljemalloc -lflang
```

Fortran benchmarks:

```
-m64 -Wl,-mllvm -Wl,-inline-recursion=4
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split
-flto -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
-Wl,-mllvm -Wl,-enable-loop-fusion -O3 -march=znver3 -fveclib=AMDLIBM
-ffast-math -z muldefs -mllvm -unroll-aggressive
-mllvm -unroll-threshold=500 -lamdlibm -ljemalloc -lflang
```

## Base Other Flags

C benchmarks:

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

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## Base Other Flags (Continued)

C++ benchmarks:

-Wno-unused-command-line-argument

## Peak Compiler Invocation

C benchmarks:

clang

C++ benchmarks:

clang++

Fortran benchmarks:

flang

## Peak Portability Flags

500.perlbench\_r: -DSPEC\_LINUX\_X64 -DSPEC\_LP64

502.gcc\_r: -D\_FILE\_OFFSET\_BITS=64

505.mcf\_r: -DSPEC\_LP64

520.omnetpp\_r: -DSPEC\_LP64

523.xalancbmk\_r: -DSPEC\_LINUX -DSPEC\_LP64

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: -m64 -Wl,-allow-multiple-definition

-Wl,-mllvm -Wl,-enable-licm-vrp -flto

-Wl,-mllvm -Wl,-function-specialize

-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6

-Wl,-mllvm -Wl,-reduce-array-computations=3

-fprofile-instr-generate(pass 1)

-fprofile-instr-use(pass 2) -Ofast -march=znver3

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## Peak Optimization Flags (Continued)

500.perlbench\_r (continued):

```
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7  
-mllvm -unroll-threshold=50 -fremap-arrays  
-flv-function-specialization -mllvm -inline-threshold=1000  
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=false  
-mllvm -function-specialize -mllvm -enable-licm-vrp  
-mllvm -reduce-array-computations=3 -lamdlibm -ljemalloc
```

502.gcc\_r: -m32 -Wl,-allow-multiple-definition

```
-Wl,-mllvm -Wl,-enable-licm-vrp -flto  
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3  
-fveclib=AMDLIBM -ffast-math -fstruct-layout=7  
-mllvm -unroll-threshold=50 -fremap-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 -fgnu89-inline  
-ljemalloc
```

505.mcf\_r: basepeak = yes

525.x264\_r: basepeak = yes

557.xz\_r: -m64 -Wl,-allow-multiple-definition

```
-Wl,-mllvm -Wl,-enable-licm-vrp -flto  
-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  
-fstruct-layout=7 -mllvm -unroll-threshold=50  
-fremap-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 -lamdlibm -ljemalloc
```

C++ benchmarks:

520.omnetpp\_r: -m64 -std=c++98 -flto -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  
-finline-aggressive -mllvm -unroll-threshold=100  
-flv-function-specialization -mllvm -enable-licm-vrp  
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch  
-mllvm -reduce-array-computations=3
```

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## Peak Optimization Flags (Continued)

520.omnetpp\_r (continued):

```
-mllvm -global-vectorize-slp=true  
-fvirtual-function-elimination -fvisibility=hidden  
-lamdlibm -ljemalloc
```

```
523.xalancbmk_r: -m32 -Wl,-mllvm -Wl,-do-block-reorder=aggressive -flto  
-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  
-finline-aggressive -mllvm -unroll-threshold=100  
-flv-function-specialization -mllvm -enable-licm-vrp  
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch  
-mllvm -reduce-array-computations=3  
-mllvm -global-vectorize-slp=true  
-mllvm -do-block-reorder=aggressive  
-fvirtual-function-elimination -fvisibility=hidden  
-ljemalloc
```

531.deepsjeng\_r: basepeak = yes

541.leela\_r: Same as 520.omnetpp\_r

Fortran benchmarks:

```
-m64 -Wl,-mllvm -Wl,-inline-recursion=4  
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split  
-flto -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 -mllvm -unroll-aggressive  
-mllvm -unroll-threshold=500 -lamdlibm -ljemalloc -lflang
```

## Peak Other Flags

C benchmarks (except as noted below):

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

502.gcc\_r: -L/usr/lib -Wno-unused-command-line-argument

```
-L/sppo/bin/cpu2017v118-aocc3-milanX/amd_rate_aocc320_milanx_A_lib/lib32
```

C++ benchmarks (except as noted below):

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

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## Peak Other Flags (Continued)

```
523.xalancbmk_r: -L/usr/lib -Wno-unused-command-line-argument  
-L/sppo/bin/cpu2017v118-aocc3-milanX/amd_rate_aocc320_milanx_A_lib/lib32
```

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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