



# SPEC CPU®2017 Integer Rate Result

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## Hewlett Packard Enterprise

(Test Sponsor: HPE)

### ProLiant DL20 Gen11

(3.30 GHz, Intel Xeon E-2456)

SPECrate®2017\_int\_base = 78.0

SPECrate®2017\_int\_peak = 81.2

CPU2017 License: 3

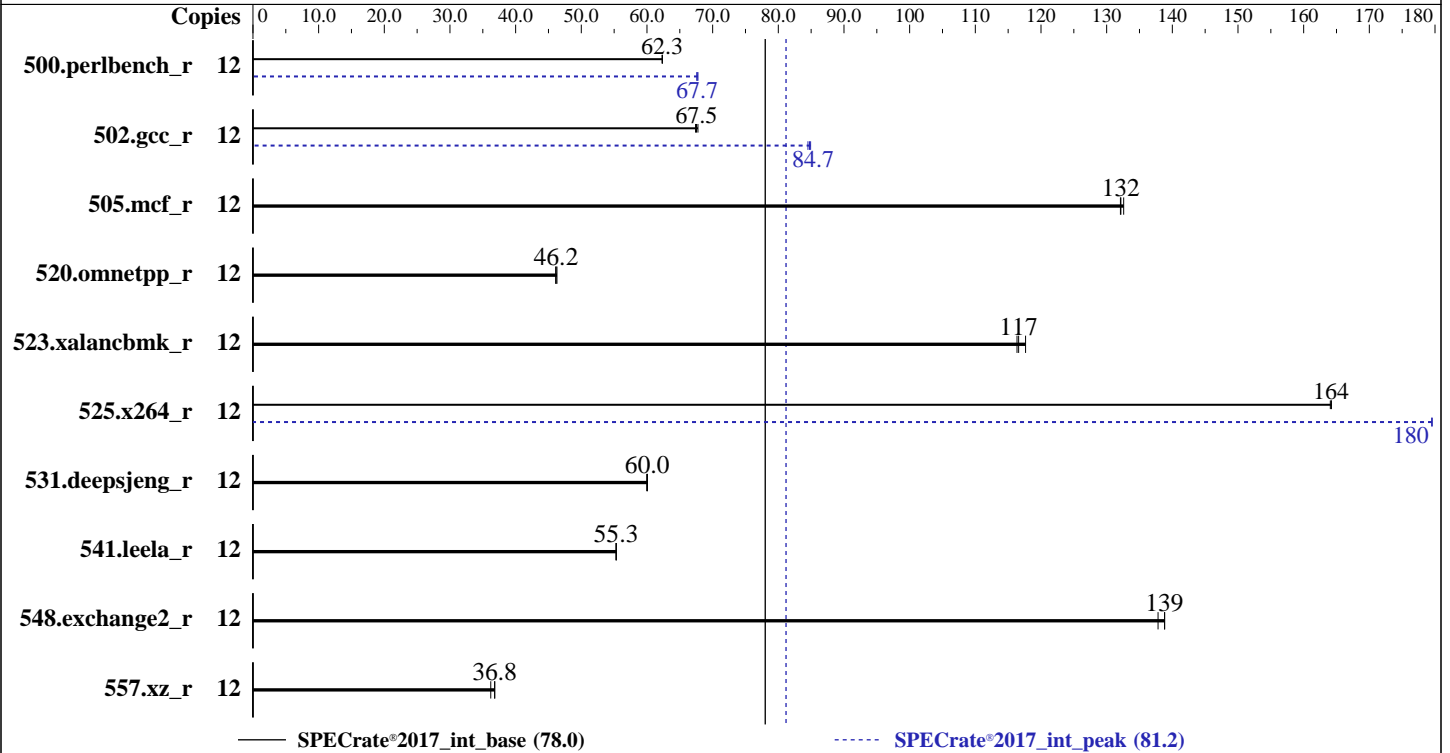
Test Sponsor: HPE

Tested by: HPE

Test Date: Jan-2024

Hardware Availability: Dec-2023

Software Availability: Dec-2023



### Hardware

CPU Name: Intel Xeon E-2456  
 Max MHz: 5100  
 Nominal: 3300  
 Enabled: 6 cores, 1 chip, 2 threads/core  
 Orderable: 1 Chip  
 Cache L1: 32 KB I + 48 KB D on chip per core  
 L2: 2 MB I+D on chip per core  
 L3: 18 MB I+D on chip per chip  
 Other: None  
 Memory: 64 GB (2 x 32 GB 2Rx8 PC5-5600B-E, running at 4400), orderable using HPE part# P64339-B21  
 Storage: 1 x 480 GB SATA SSD  
 Other: None

### Software

OS: SUSE Linux Enterprise Server 15 SP4  
 Kernel 5.14.21-150400.22-default  
 Compiler: C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++ Compiler for Linux;  
 Fortran: Version 2023.2.3 of Intel Fortran Compiler for Linux;  
 Parallel: No  
 Firmware: HPE BIOS Version v1.44 01/04/2024 released Jan-2024  
 File System: xfs  
 System State: Run level 3 (multi-user)  
 Base Pointers: 64-bit  
 Peak Pointers: 32/64-bit  
 Other: jemalloc memory allocator V5.0.1  
 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						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	12	306	62.3	306	62.3	<b>306</b>	<b>62.3</b>	12	283	67.6	<b>282</b>	<b>67.7</b>	282	67.8
502.gcc_r	12	<b>252</b>	<b>67.5</b>	251	67.8	252	67.4	12	200	84.9	201	84.5	<b>201</b>	<b>84.7</b>
505.mcf_r	12	147	132	<b>147</b>	<b>132</b>	146	133	12	147	132	<b>147</b>	<b>132</b>	146	133
520.omnetpp_r	12	<b>341</b>	<b>46.2</b>	342	46.1	340	46.3	12	<b>341</b>	<b>46.2</b>	342	46.1	340	46.3
523.xalancbmk_r	12	<b>109</b>	<b>117</b>	109	116	108	118	12	<b>109</b>	<b>117</b>	109	116	108	118
525.x264_r	12	128	164	128	164	<b>128</b>	<b>164</b>	12	117	180	<b>117</b>	<b>180</b>	117	180
531.deepsjeng_r	12	229	60.0	<b>229</b>	<b>60.0</b>	229	60.1	12	229	60.0	<b>229</b>	<b>60.0</b>	229	60.1
541.leela_r	12	359	55.3	359	55.3	<b>359</b>	<b>55.3</b>	12	359	55.3	359	55.3	<b>359</b>	<b>55.3</b>
548.exchange2_r	12	228	138	<b>226</b>	<b>139</b>	226	139	12	228	138	<b>226</b>	<b>139</b>	226	139
557.xz_r	12	352	36.8	358	36.2	<b>352</b>	<b>36.8</b>	12	352	36.8	358	36.2	<b>352</b>	<b>36.8</b>

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

## Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

## Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"  
Transparent Huge Pages enabled by default  
Prior to runcpu invocation  
Filesystem page cache synced and cleared with:  
sync; echo 3> /proc/sys/vm/drop\_caches  
tuned service was stopped using "systemctl stop tuned"

## Environment Variables Notes

Environment variables set by runcpu before the start of the run:  
LD\_LIBRARY\_PATH = "/home/cpu2017\_new/lib/intel64:/home/cpu2017\_new/lib/ia32:/home/cpu2017\_new/je5.0.1-32"  
MALLOC\_CONF = "retain:true"

## General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Red Hat Enterprise Linux 8.4  
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, a general purpose malloc implementation  
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

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## General Notes (Continued)

sources available from jemalloc.net or <https://github.com/jemalloc/jemalloc/releases>

## Platform Notes

The system ROM used for this result contains Intel microcode version 0x121 for the Intel Xeon E-2456 processor.

BIOS Configuration:

Workload Profile set to General Throughput Compute  
Thermal Configuration set to Maximum Cooling  
Enhanced Processor Performance Profile set to Enabled

Sysinfo program /home/cpu2017\_new/bin/sysinfo  
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197  
running on localhost Wed Jan 31 22:39:19 2024

SUT (System Under Test) info as seen by some common utilities.

### Table of contents

1. uname -a
2. w
3. Username
4. ulimit -a
5. sysinfo process ancestry
6. /proc/cpuinfo
7. lscpu
8. numactl --hardware
9. /proc/meminfo
10. who -r
11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. tuned-adm active
16. sysctl
17. /sys/kernel/mm/transparent\_hugepage
18. /sys/kernel/mm/transparent\_hugepage/khugepaged
19. OS release
20. Disk information
21. /sys/devices/virtual/dmi/id
22. dmidecode
23. BIOS

```

1. uname -a
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222/lp)
x86_64 x86_64 x86_64 GNU/Linux

```

```

2. w
22:39:19 up 13:27, 1 user, load average: 0.00, 0.00, 0.00
USER  TTY      FROM             LOGIN@   IDLE   JCPU   PCPU   WHAT
root  pts/0    172.16.0.100     09:12   7.00s  0.65s  0.00s  -bash

```

```

3. Username
From environment variable $USER:  root

```

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## Platform Notes (Continued)

```

-----
4. ulimit -a
   core file size          (blocks, -c) unlimited
   data seg size           (kbytes, -d) unlimited
   scheduling priority     (-e) 0
   file size               (blocks, -f) unlimited
   pending signals        (-i) 256724
   max locked memory      (kbytes, -l) 64
   max memory size        (kbytes, -m) unlimited
   open files             (-n) 1024
   pipe size              (512 bytes, -p) 8
   POSIX message queues   (bytes, -q) 819200
   real-time priority     (-r) 0
   stack size            (kbytes, -s) unlimited
   cpu time               (seconds, -t) unlimited
   max user processes     (-u) 256724
   virtual memory         (kbytes, -v) unlimited
   file locks             (-x) unlimited

```

```

-----
5. sysinfo process ancestry
   /usr/lib/systemd/systemd --switched-root --system --deserialize 29
   sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
   sshd: root@pts/0
   -bash
   -bash
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=12 -c
     ic2023.2.3-lin-core-avx2-rate-20231121.cfg --define smt-on --define cores=6 --define physicalfirst
     --define no-numa --tune base,peak -o all --define drop_caches intrate
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=12 --configfile
     ic2023.2.3-lin-core-avx2-rate-20231121.cfg --define smt-on --define cores=6 --define physicalfirst
     --define no-numa --tune base,peak --output_format all --define drop_caches --nopower --runmode rate --tune
     base:peak --size refrate intrate --nopreenv --note-preenv --logfile
     $$SPEC/tmp/CPU2017.002/templogs/preenv.intrate.002.0.log --lognum 002.0 --from_runcpu 2
   specperl $$SPEC/bin/sysinfo
   $$SPEC = /home/cpu2017_new

```

```

-----
6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) E E-2456
   vendor_id      : GenuineIntel
   cpu family     : 6
   model          : 183
   stepping      : 1
   microcode     : 0x121
   bugs          : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores     : 6
   siblings      : 12
   1 physical ids (chips)
   12 processors (hardware threads)
   physical id 0: core ids 0-5
   physical id 0: apicids 0-11
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
   virtualized systems. Use the above data carefully.

```

```

-----
7. lscpu

From lscpu from util-linux 2.37.2:

```

(Continued on next page)



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## Platform Notes (Continued)

```

Architecture:          x86_64
CPU op-mode(s):       32-bit, 64-bit
Address sizes:         46 bits physical, 48 bits virtual
Byte Order:           Little Endian
CPU(s):                12
On-line CPU(s) list:  0-11
Vendor ID:             GenuineIntel
Model name:           Intel(R) Xeon(R) E E-2456
CPU family:           6
Model:                183
Thread(s) per core:   2
Core(s) per socket:   6
Socket(s):            1
Stepping:             1
BogoMIPS:             6604.80
Flags:                fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36
                    clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
                    lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology
                    nonstop_tsc cpuid aperfmperf tsc_known_freq pni pclmulqdq dtes64 monitor
                    ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid sse4_1 sse4_2
                    x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm
                    abm 3dnowprefetch cpuid_fault epb invpcid_single ssbd ibrs ibpb stibp
                    ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid ept_ad fsgsbase
                    tsc_adjust bmi1 avx2 smep bmi2 erms invpcid rdseed adx smap clflushopt
                    clwb intel_pt sha_ni xsaveopt xsavec xgetbv1 xsaves avx_vnni dtherm ida
                    arat pln pts umip pku ospke waitpkg gfni vaes vpclmulqdq tme rdpid movdiri
                    movdir64b fsrm md_clear serialize pconfig arch_lbr flush_l1d
                    arch_capabilities

Virtualization:       VT-x
L1d cache:            288 KiB (6 instances)
L1i cache:            192 KiB (6 instances)
L2 cache:             12 MiB (6 instances)
L3 cache:             18 MiB (1 instance)
NUMA node(s):        1
NUMA node0 CPU(s):   0-11
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; Enhanced IBRS, IBPB conditional, 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	48K	288K	12	Data	1	64	1	64
L1i	32K	192K	8	Instruction	1	64	1	64
L2	2M	12M	16	Unified	2	2048	1	64
L3	18M	18M	9	Unified	3	32768	1	64

8. numactl --hardware

NOTE: a numactl 'node' might or might not correspond to a physical chip.

```

available: 1 nodes (0)
node 0 cpus: 0-11
node 0 size: 64203 MB
node 0 free: 58266 MB
node distances:

```

(Continued on next page)



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## Platform Notes (Continued)

node 0  
0: 10

9. /proc/meminfo  
MemTotal: 65744620 kB

10. who -r  
run-level 3 Jan 31 09:12

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)  
Default Target Status  
multi-user running

12. Services, from systemctl list-unit-files

STATE	UNIT FILES
enabled	apparmor auditd cron getty@ haveged irqbalance issue-generator kbdsettings lvm2-monitor postfix purge-kernels rollback sshd wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcp6 wickedd-nanny
enabled-runtime	systemd-remount-fs
disabled	blk-availability boot-sysctl ca-certificates chrony-wait chronyd console-getty debug-shell grub2-once haveged-switch-root hwloc-dump-hwdata issue-add-ssh-keys kexec-load lunmask rpmconfigcheck serial-getty@ systemd-boot-check-no-failures systemd-network-generator systemd-sysexit systemd-time-wait-sync systemd-timesyncd tuned
indirect	pcscd wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline  
BOOT\_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default  
root=UUID=0568eef9-b0ff-4cd5-adb9-1f8e14da628c  
splash=silent  
resume=/dev/disk/by-uuid/ffb9593d-577b-484e-83b9-b995375d44ca  
mitigations=auto  
quiet  
security=apparmor

14. cpupower frequency-info  
analyzing CPU 0:  
Unable to determine current policy  
boost state support:  
Supported: yes  
Active: yes

15. tuned-adm active  
It seems that tuned daemon is not running, preset profile is not activated.  
Preset profile: throughput-performance

16. sysctl

kernel.numa_balancing	0
kernel.randomize_va_space	2
vm.compaction_proactiveness	20
vm.dirty_background_bytes	0
vm.dirty_background_ratio	10
vm.dirty_bytes	0

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## Platform Notes (Continued)

```

vm.dirty_expire_centisecs    3000
vm.dirty_ratio               20
vm.dirty_writeback_centisecs 500
vm.dirtytime_expire_seconds 43200
vm.extfrag_threshold         500
vm.min_unmapped_ratio        1
vm.nr_hugepages              0
vm.nr_hugepages_mempolicy    0
vm.nr_overcommit_hugepages   0
vm.swappiness                60
vm.watermark_boost_factor    15000
vm.watermark_scale_factor    10
vm.zone_reclaim_mode         0

```

```

-----
17. /sys/kernel/mm/transparent_hugepage
defrag          always defer defer+madvise [madvise] never
enabled         [always] madvise never
hpage_pmd_size 2097152
shmem_enabled   always within_size advise [never] deny force

```

```

-----
18. /sys/kernel/mm/transparent_hugepage/khugepaged
alloc_sleep_millisecs 60000
defrag                 1
max_ptes_none         511
max_ptes_shared       256
max_ptes_swap         64
pages_to_scan         4096
scan_sleep_millisecs 10000

```

```

-----
19. OS release
From /etc/*-release /etc/*-version
os-release SUSE Linux Enterprise Server 15 SP4

```

```

-----
20. Disk information
SPEC is set to: /home/cpu2017_new
Filesystem  Type  Size  Used Avail Use% Mounted on
/dev/sda3   xfs   344G  93G  252G  27% /home

```

```

-----
21. /sys/devices/virtual/dmi/id
Vendor:      HPE
Product:     ProLiant DL20 Gen11
Product Family: ProLiant
Serial:      DA2G93DK88

```

```

-----
22. dmidecode
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:
  2x Hynix HMC88AGBEA084N 32 GB 2 rank 5600, configured at 4400

```

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## Platform Notes (Continued)

23. BIOS  
(This section combines info from /sys/devices and dmidecode.)  
BIOS Vendor: HPE  
BIOS Version: 1.44  
BIOS Date: 01/04/2024  
BIOS Revision: 1.44  
Firmware Revision: 1.45

## Compiler Version Notes

=====  
C | 502.gcc\_r(peak)  
-----

Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.  
-----

=====  
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)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.  
-----

=====  
C | 502.gcc\_r(peak)  
-----

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557.xz\_r(base, peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.  
-----

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

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.  
-----

=====  
Fortran | 548.exchange2\_r(base, peak)  
-----

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x  
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.  
-----





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## Base Compiler Invocation

C benchmarks:

icx

C++ benchmarks:

icpx

Fortran benchmarks:

ifx

## Base Portability Flags

```
500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
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
```

## Base Optimization Flags

C benchmarks:

```
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX2 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc
```

C++ benchmarks:

```
-w -std=c++14 -m64 -Wl,-z,muldefs -xCORE-AVX2 -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc
```

Fortran benchmarks:

```
-w -m64 -Wl,-z,muldefs -xCORE-AVX2 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc
```



# SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

**Hewlett Packard Enterprise**

(Test Sponsor: HPE)

ProLiant DL20 Gen11

(3.30 GHz, Intel Xeon E-2456)

SPECrate®2017\_int\_base = 78.0

SPECrate®2017\_int\_peak = 81.2

**CPU2017 License:** 3

**Test Sponsor:** HPE

**Tested by:** HPE

**Test Date:** Jan-2024

**Hardware Availability:** Dec-2023

**Software Availability:** Dec-2023

## Peak Compiler Invocation

C benchmarks:

icx

C++ benchmarks:

icpx

Fortran benchmarks:

ifx

## Peak Portability Flags

```

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
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: -w -std=c11 -m64 -Wl,-z,muldefs
-fprofile-generate(pass 1)
-fprofile-use=default.profddata(pass 2) -xCORE-AVX2 -flto
-Ofast -ffast-math -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fno-strict-overflow
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc

502.gcc_r: -m32
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/ia32_lin
-std=gnu89 -Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profddata(pass 2) -xCORE-AVX2 -flto
-Ofast -ffast-math -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib
-ljemalloc

```

(Continued on next page)



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Test Date: Jan-2024

Hardware Availability: Dec-2023

Software Availability: Dec-2023

## Peak Optimization Flags (Continued)

505.mcf\_r: basepeak = yes

```
525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX2 -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fno-alias
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-lqkmalloc
```

557.xz\_r: basepeak = yes

C++ benchmarks:

520.omnetpp\_r: basepeak = yes

523.xalancbmk\_r: basepeak = yes

531.deepsjeng\_r: basepeak = yes

541.leela\_r: basepeak = yes

Fortran benchmarks:

548.exchange2\_r: basepeak = yes

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-RPL-rev2.0.html>

<http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.html>

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

<http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-RPL-rev2.0.xml>

<http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml>

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