SPEC CPU®2017 Integer Rate Result

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Hewlett Packard Enterprise

(Test Sponsor: HPE)

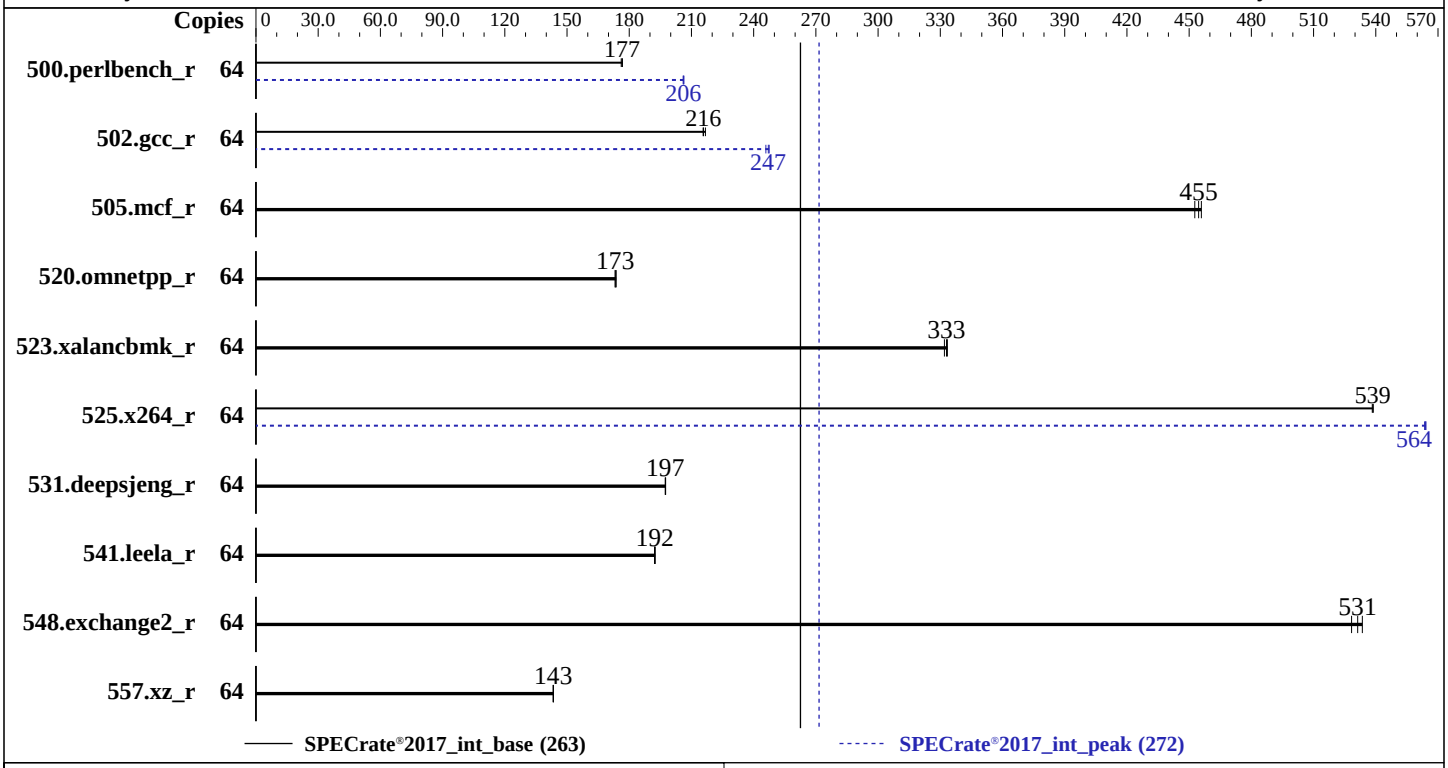
ProLiant DL360 Gen10 Plus
(2.90 GHz, Intel Xeon Gold 6326)

SPECrate®2017_int_base = 263

SPECrate®2017_int_peak = 272

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

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021



Hardware

CPU Name:	Intel Xeon Gold 6326
Max MHz:	3500
Nominal:	2900
Enabled:	32 cores, 2 chips, 2 threads/core
Orderable:	1, 2 chip(s)
Cache L1:	32 KB I + 48 KB D on chip per core
L2:	1.25 MB I+D on chip per core
L3:	24 MB I+D on chip per chip
Other:	None
Memory:	2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R)
Storage:	1 x 400 GB SAS SSD, RAID 0
Other:	None

Software

OS:	Red Hat Enterprise Linux 8.3 (Ootpa) Kernel 4.18.0-240.el8.x86_64
Compiler:	C/C++: Version 2021.1 of Intel oneAPI DPC++/C++ Compiler Build 20201113 for Linux; Fortran: Version 2021.1 of Intel Fortran Compiler Classic Build 20201112 for Linux; C/C++: Version 2021.1 of Intel C/C++ Compiler Classic Build 20201112 for Linux
Parallel:	No
Firmware:	HPE BIOS Version U46 v1.42 05/16/2021 released May-2021
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 set to prefer performance at the cost of additional power usage

Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	64	578	176	577	177	**577**	**177**	64	495	206	494	206	**494**	**206**
502.gcc_r	64	**420**	**216**	420	216	418	217	64	366	247	**367**	**247**	369	246
505.mcf_r	64	227	456	228	453	**228**	**455**	64	227	456	228	453	**228**	**455**
520.omnetpp_r	64	483	174	485	173	**485**	**173**	64	483	174	485	173	**485**	**173**
523.xalancbmk_r	64	203	333	204	332	**203**	**333**	64	203	333	204	332	**203**	**333**
525.x264_r	64	208	539	208	538	**208**	**539**	64	**199**	**564**	199	564	199	564
531.deepsjeng_r	64	**372**	**197**	372	197	371	198	64	**372**	**197**	372	197	371	198
541.leela_r	64	551	192	**551**	**192**	551	192	64	551	192	**551**	**192**	551	192
548.exchange2_r	64	**316**	**531**	314	534	317	528	64	**316**	**531**	314	534	317	528
557.xz_r	64	**482**	**143**	482	143	482	143	64	**482**	**143**	482	143	482	143

SPECrate®2017_int_base = 263

SPECrate®2017_int_peak = 272

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
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/cpu2017_1.1.8/lib/intel64:/home/cpu2017_1.1.8/lib/ia32:/home/cpu2
     017_1.1.8/je5.0.1-32"
MALLOC_CONF = "retain:true"
```

General Notes

```
Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Red Hat Enterprise Linux 8.1
```

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General Notes (Continued)

```
 runcpu command invoked through numactl i.e.:
 numactl --interleave=all runcpu <etc>
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
 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases

Submitted_by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon Jun 21 10:21:12 EDT 2021
Submission: cpu2017-20210621-27540.sub
```

Platform Notes

```
The system ROM used for this result contains Intel microcode version 0xd0002a0 for
the Intel Xeon Gold 6326 processor.
  BIOS Configuration:
  Workload Profile set to General Throughput Compute
  Memory Patrol Scrubbing set to Disabled
  Advanced Memory Protection set to Advanced ECC
  XPT Remote Prefetcher set to Enabled
  Last Level Cache (LLC) Dead Line Allocation set to Disabled
  Enhanced Processor Performance set to Enabled
  Enhanced Processor Performance Profile set to Aggressive
  Thermal Configuration set to Maximum Cooling
  Intel UPI Link Frequency set to Minimum
  Intel UPI Link Enablement set to Single Link
  D2K set to Disabled
  Workload Profile set to Custom
    DCU Stream Prefetcher set to Disabled
    Energy Efficient Turbo set to Enabled
    Adjacent Sector Prefetcher set to Disabled
    Intel UPI Link Power Management set to Enabled

 Sysinfo program /home/cpu2017_1.1.8/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on localhost.localdomain Tue Jun  8 16:22:36 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
```

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Platform Notes (Continued)

```
From /proc/cpuinfo
   model name : Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
      2  "physical id"s (chips)
      64 "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
      physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

From lscpu from util-linux 2.32.1:
     Architecture:        x86_64
     CPU op-mode(s):      32-bit, 64-bit
     Byte Order:          Little Endian
     CPU(s):              64
     On-line CPU(s) list: 0-63
     Thread(s) per core:  2
     Core(s) per socket:  16
     Socket(s):           2
     NUMA node(s):        4
     Vendor ID:           GenuineIntel
     CPU family:          6
     Model:               106
     Model name:          Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
     Stepping:            6
     CPU MHz:             2847.794
     BogoMIPS:            5800.00
     Virtualization:      VT-x
     L1d cache:           48K
     L1i cache:           32K
     L2 cache:            1280K
     L3 cache:            24576K
     NUMA node0 CPU(s):   0-7,32-39
     NUMA node1 CPU(s):   8-15,40-47
     NUMA node2 CPU(s):   16-23,48-55
     NUMA node3 CPU(s):   24-31,56-63
     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 pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
     xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
     avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 invpcid_single ssbd
     mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid ept_ad
     fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq
     rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha_ni avx512bw
     avx512vl xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total
```

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Platform Notes (Continued)

```
      cqm_mbm_local split_lock_detect wbnoinvd dtherm ida arat pln pts avx512vbmi umip pku
      ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme
      avx512_vpopcntdq la57 rdpid md_clear pconfig flush_l1d arch_capabilities

 /proc/cpuinfo cache data
    cache size : 24576 KB

 From numactl --hardware
 WARNING: a numactl 'node' might or might not correspond to a physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0 1 2 3 4 5 6 7 32 33 34 35 36 37 38 39
   node 0 size: 507046 MB
   node 0 free: 515383 MB
   node 1 cpus: 8 9 10 11 12 13 14 15 40 41 42 43 44 45 46 47
   node 1 size: 507773 MB
   node 1 free: 515556 MB
   node 2 cpus: 16 17 18 19 20 21 22 23 48 49 50 51 52 53 54 55
   node 2 size: 507811 MB
   node 2 free: 515845 MB
   node 3 cpus: 24 25 26 27 28 29 30 31 56 57 58 59 60 61 62 63
   node 3 size: 507365 MB
   node 3 free: 515797 MB
   node distances:
   node   0   1   2   3
     0:  10  20  30  30
     1:  20  10  30  30
     2:  30  30  10  20
     3:  30  30  20  10

 From /proc/meminfo
    MemTotal:       2113488200 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

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

 From /etc/*release* /etc/*version*
    os-release:
       NAME="Red Hat Enterprise Linux"
       VERSION="8.3 (Ootpa)"
       ID="rhel"
       ID_LIKE="fedora"
       VERSION_ID="8.3"
       PLATFORM_ID="platform:el8"
       PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
       ANSI_COLOR="0;31"
```

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Platform Notes (Continued)

```
    redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
    system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
    system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga

  uname -a:
    Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
    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: Enhanced IBRS, IBPB:
                                                           conditional, RSB filling
  CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
  CVE-2019-11135 (TSX Asynchronous Abort):                 Not affected

  run-level 3 Jun 8 16:21

  SPEC is set to: /home/cpu2017_1.1.8
     Filesystem              Type  Size  Used Avail Use% Mounted on
     /dev/mapper/rhel00-home xfs   372G  216G  157G  58% /home

  From /sys/devices/virtual/dmi/id
      Vendor:         HPE
      Product:        ProLiant DL360 Gen10 Plus
      Product Family: ProLiant
      Serial:         CN701108CQ

  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:
      32x Micron 36ASF8G72PZ-3G2B2 64 GB 2 rank 3200

  BIOS:
     BIOS Vendor:       HPE
     BIOS Version:      U46
```

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Platform Notes (Continued)

```
    BIOS Date:          05/16/2021
    BIOS Revision:      1.42
    Firmware Revision: 2.42

  (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 500.perlbench_r(peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 502.gcc_r(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version
  2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base) 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 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 502.gcc_r(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version
  2021.1 Build 20201113
```

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Compiler Version Notes (Continued)

```
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base) 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 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R)
  64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 502.gcc_r(peak)
------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version
  2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base) 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 2021.1 Build 20201113
Copyright (C) 1985-2020 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 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
------------------------------------------------------------------------------

==============================================================================
```

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Compiler Version Notes (Continued)

```
Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on
  Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

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-AVX512 -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

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Base Optimization Flags (Continued)

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-auto -mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
icx

500.perlbench_r: icc

C++ benchmarks:
icpx

Fortran benchmarks:
ifort

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: `-Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2)
`-xCORE-AVX512 -ipo -O3 -no-prec-div`
`-qopt-mem-layout-trans=4 -fno-strict-overflow`
`-mbranches-within-32B-boundaries`
`-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin`
`-lqkmalloc`

502.gcc_r: `-m32`
`-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/ia32_lin`
`-std=gnu89 -Wl,-z,muldefs -fprofile-generate`(pass 1)
`-fprofile-use=default.profdata`(pass 2) `-xCORE-AVX512 -flto`
`-Ofast`(pass 1) `-O3 -ffast-math -qopt-mem-layout-trans=4`
`-mbranches-within-32B-boundaries`
`-L/usr/local/jemalloc32-5.0.1/lib -ljemalloc`

505.mcf_r: `basepeak = yes`

525.x264_r: `-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -flto`
`-O3 -ffast-math -qopt-mem-layout-trans=4 -fno-alias`
`-mbranches-within-32B-boundaries`
`-L/opt/intel/oneapi/compiler/2021.1.1/linux/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-V1.0-ICX-revC.html`
`http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.html`

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.xml
http://www.spec.org/cpu2017/flags/Intel-ic2021-official-linux64_revA.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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