SPEC CPU®2017 Integer Rate Result

Copyright 2017-2024 Standard Performance Evaluation Corporation

Dell Inc.

$SPECrate^®2017\_int\_base = 413$

PowerEdge R660 (Intel Xeon Platinum 8471N)
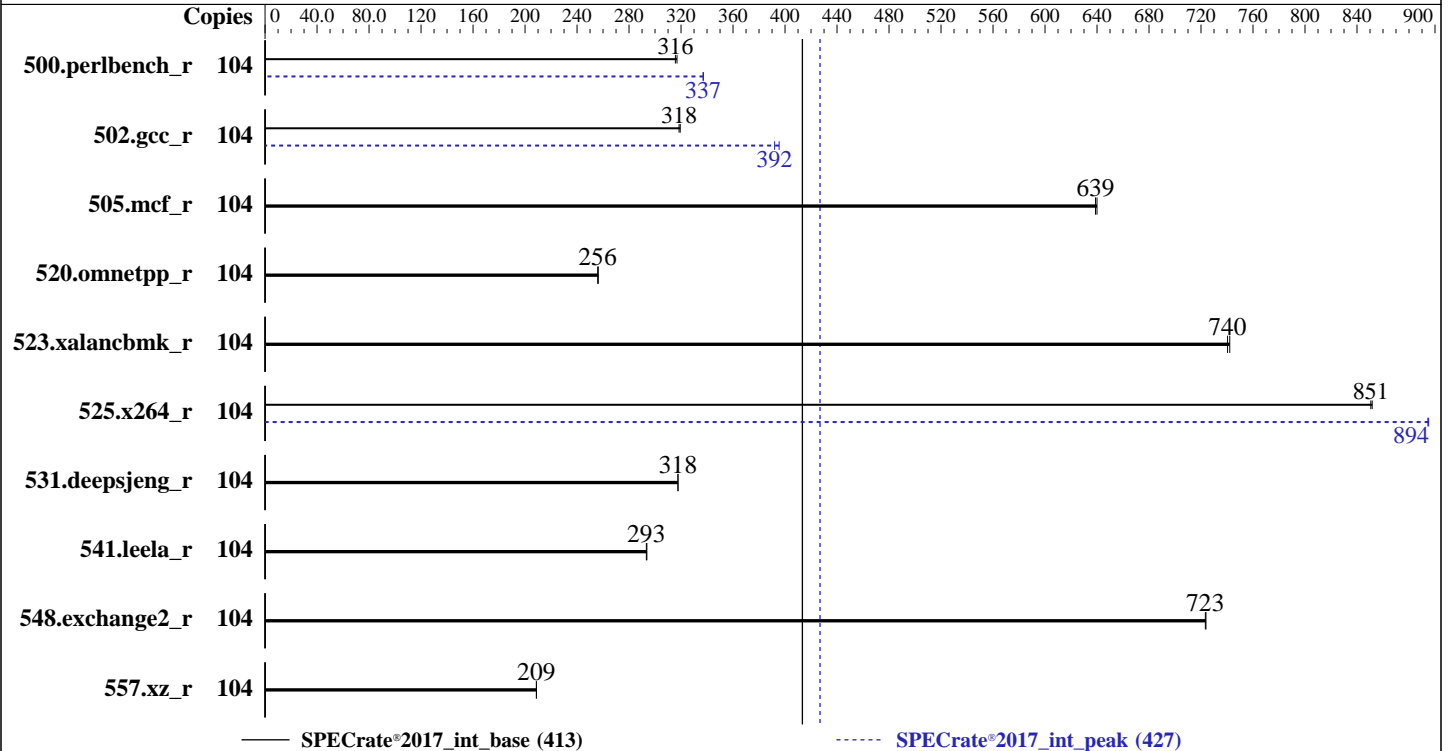
$SPECrate^®2017\_int\_peak = 427$

Copies

Benchmark	Copies	base	peak
500.perlbench_r	104	316	337
502.gcc_r	104	318	392
505.mcf_r	104	639	
520.omnetpp_r	104	256	
523.xalancbmk_r	104	740	
525.x264_r	104	851	894
531.deepsjeng_r	104	318	
541.leela_r	104	293	
548.exchange2_r	104	723	
557.xz_r	104	209	

SPECrate®2017_int_base (413) — SPECrate®2017_int_peak (427)

Hardware

CPU Name: Intel Xeon Platinum 8471N
 Max MHz: 3600
 Nominal: 1800
Enabled: 52 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: 97.5 MB I+D on chip per chip
 Other: None
Memory: 512 GB (8 x 64 GB 2Rx4 PC5-4800B-R)
Storage: 125 GB on tmpfs
Other: None

Software

OS: SUSE Linux Enterprise Server 15 SP4
 5.14.21-150400.22-default
Compiler: C/C++: Version 2022.1 of Intel oneAPI DPC++/C++ Compiler for Linux;
 Fortran: Version 2022.1 of Intel Fortran Compiler for Linux;
Parallel: No
Firmware: Version 0.3.2 released Nov-2022
File System: tmpfs
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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PowerEdge R660 (Intel Xeon Platinum 8471N)

$SPECrate®2017\_int\_base = 413$

$SPECrate®2017\_int\_peak = 427$

CPU2017 License: 6573
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: Dec-2022
Hardware Availability: Feb-2023
Software Availability: Jun-2022

Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	104	522	317	**525**	**316**			104	491	337	**491**	**337**		
502.gcc_r	104	**462**	**318**	461	319			104	**376**	**392**	372	395		
505.mcf_r	104	263	640	**263**	**639**			104	263	640	**263**	**639**		
520.omnetpp_r	104	532	256	**533**	**256**			104	532	256	**533**	**256**		
523.xalancbmk_r	104	148	742	**148**	**740**			104	148	742	**148**	**740**		
525.x264_r	104	214	852	**214**	**851**			104	203	895	**204**	**894**		
531.deepsjeng_r	104	**375**	**318**	375	318			104	**375**	**318**	375	318		
541.leela_r	104	586	294	**587**	**293**			104	586	294	**587**	**293**		
548.exchange2_r	104	**377**	**723**	376	724			104	**377**	**723**	376	724		
557.xz_r	104	**538**	**209**	538	209			104	**538**	**209**	538	209		
SPECrate®2017_int_base =	413													
SPECrate®2017_int_peak =	427													

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

Compiler Notes

```
SPEC has ruled that the compiler used for this result was performing a compilation
that specifically improves the performance of the 523.xalancbmk_r / 623.xalancbmk_s
benchmarks using a priori knowledge of the SPEC code and dataset to perform a
transformation that has narrow applicability.

In order to encourage optimizations that have wide applicability (see rule 1.4
https://www.spec.org/cpu2017/Docs/runrules.html#rule_1.4), SPEC will no longer
publish results using this optimization.

This result is left in the SPEC results database for historical reference.
```

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"
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/lib/ia32:/mnt/ram
     disk/cpu2017-1.1.8-ic2022.1/je5.0.1-32"
MALLOC_CONF = "retain:true"
```

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Software Availability: Jun-2022

General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM
memory using Red Hat Enterprise Linux 8.4
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
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
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

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.

Benchmark run from a 125 GB ramdisk created with the cmd: "mount -t tmpfs -o size=125G tmpfs /mnt/ramdisk"

Platform Notes

BIOS settings:
                    ADDDC Setting : Disabled
          DIMM Self Healing on
    Uncorrectable Memory Error : Disabled
      Virtualization Technology : Disabled
              Sub NUMA Cluster : 4-way Clustering
        DCU Streamer Prefetcher : Disabled
                  LLC Prefetch : Disabled
          Dead Line LLC Alloc : Disabled
                Optimizer Mode : Enabled

                System Profile : Custom
        CPU Power Management : Maximum Performance
                          C1E : Disabled
                      C States : Autonomous
          Memory Patrol Scrub : Disabled
      Energy Efficiency Policy : Performance
            PCI ASPM L1 Link
              Power Management : Disabled

Sysinfo program /mnt/ramdisk/cpu2017-1.1.8-ic2022.1/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
running on localhost Wed Dec 14 12:28:15 2022

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see
   https://www.spec.org/cpu2017/Docs/config.html#sysinfo

From /proc/cpuinfo
   model name : Intel(R) Xeon(R) Platinum 8471N
      1 "physical id"s (chips)
      104 "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 : 52

(Continued on next page)

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Platform Notes (Continued)

```
     siblings  : 104
   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 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51

 From lscpu from util-linux 2.37.2:
     Architecture:              x86_64
     CPU op-mode(s):            32-bit, 64-bit
     Address sizes:             46 bits physical, 57 bits virtual
     Byte Order:                Little Endian
     CPU(s):                    104
     On-line CPU(s) list:       0-103
     Vendor ID:                 GenuineIntel
     Model name:                Intel(R) Xeon(R) Platinum 8471N
     CPU family:                6
     Model:                     143
     Thread(s) per core:        2
     Core(s) per socket:        52
     Socket(s):                 1
     Stepping:                  8
     BogoMIPS:                  3600.00
     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 ds_cpl 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 cat_l2 cdp_l3 invpcid_single cdp_l2 ssbd mba ibrs ibpb stibp
   ibrs_enhanced fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm 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
   cqm_mbm_local split_lock_detect avx_vnni avx512_bf16 wbnoinvd dtherm ida arat pln
   pts avx512vbmi umip pku ospke waitpkg avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni
   avx512_bitalg tme avx512_vpopcntdq la57 rdpid bus_lock_detect cldemote movdiri
   movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfig arch_lbr avx512_fp16
   flush_l1d arch_capabilities
     L1d cache:                 2.4 MiB (52 instances)
     L1i cache:                 1.6 MiB (52 instances)
     L2 cache:                  104 MiB (52 instances)
     L3 cache:                  97.5 MiB (1 instance)
     NUMA node(s):              4
     NUMA node0 CPU(s):         0-12,52-64
     NUMA node1 CPU(s):         13-25,65-77
     NUMA node2 CPU(s):         26-38,78-90
     NUMA node3 CPU(s):         39-51,91-103
     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     2.4M   12 Data             1   64      1              64
```

(Continued on next page)

Dell Inc.

PowerEdge R660 (Intel Xeon Platinum 8471N)

SPECrate®2017_int_base = 413

SPECrate®2017_int_peak = 427

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Test Date: Dec-2022
Hardware Availability: Feb-2023
Software Availability: Jun-2022

Platform Notes (Continued)

```
      L1i          32K     1.6M    8 Instruction     1     64        1            64
      L2            2M     104M   16 Unified          2   2048        1            64
      L3         97.5M    97.5M   15 Unified          3 106496        1            64

  /proc/cpuinfo cache data
     cache size : 99840 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 8 9 10 11 12 52 53 54 55 56 57 58 59 60 61 62 63 64
    node 0 size: 128469 MB
    node 0 free: 119507 MB
    node 1 cpus: 13 14 15 16 17 18 19 20 21 22 23 24 25 65 66 67 68 69 70 71 72 73 74 75 76
    77
    node 1 size: 128982 MB
    node 1 free: 128706 MB
    node 2 cpus: 26 27 28 29 30 31 32 33 34 35 36 37 38 78 79 80 81 82 83 84 85 86 87 88 89
    90
    node 2 size: 129017 MB
    node 2 free: 128745 MB
    node 3 cpus: 39 40 41 42 43 44 45 46 47 48 49 50 51 91 92 93 94 95 96 97 98 99 100 101
    102 103
    node 3 size: 128988 MB
    node 3 free: 128733 MB
    node distances:
    node   0   1   2   3
      0:  10  12  12  12
      1:  12  10  12  12
      2:  12  12  10  12
      3:  12  12  12  10

  From /proc/meminfo
     MemTotal:       527829692 kB
     HugePages_Total:        0
     Hugepagesize:        2048 kB

  From /etc/*release* /etc/*version*
     os-release:
        NAME="SLES"
        VERSION="15-SP4"
        VERSION_ID="15.4"
        PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
        ID="sles"
        ID_LIKE="suse"
        ANSI_COLOR="0;32"
        CPE_NAME="cpe:/o:suse:sles:15:sp4"

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

(Continued on next page)

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Platform Notes (Continued)

```
                                               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 Dec 14 12:21

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-ic2022.1
   Filesystem      Type   Size  Used Avail Use% Mounted on
   tmpfs           tmpfs  125G  3.6G  122G   3% /mnt/ramdisk

From /sys/devices/virtual/dmi/id
    Vendor:         Dell Inc.
    Product:        PowerEdge R660
    Product Family: PowerEdge
    Serial:         SLR6603

Additional information from dmidecode 3.2 follows.  WARNING: Use caution when you
interpret this section. The 'dmidecode' program reads system data which is "intended to
allow hardware to be accurately determined", but the intent may not be met, as there are
frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.
  Memory:
    8x 002C00B3002C MTC40F2046S1RC48BA1 64 GB 2 rank 4800

BIOS:
   BIOS Vendor:      Dell Inc.
   BIOS Version:     0.3.2
   BIOS Date:        11/30/2022
   BIOS Revision:    0.3

(End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================================
C      | 502.gcc_r(peak)
----------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
----------------------------------------------------------------------------------------------


==============================================================================================
C      | 502.gcc_r(peak)
----------------------------------------------------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
----------------------------------------------------------------------------------------------
```

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CPU2017 License: 6573	**Test Date:** Dec-2022
Test Sponsor: Dell Inc.	**Hardware Availability:** Feb-2023
Tested by: Dell Inc.	**Software Availability:** Jun-2022

Compiler Version Notes (Continued)

```
==================================================================================
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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 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 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
----------------------------------------------------------------------------------


==================================================================================
Fortran | 548.exchange2_r(base, peak)
----------------------------------------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2022.1.0 Build 20220316
Copyright (C) 1985-2022 Intel Corporation. All rights reserved.
----------------------------------------------------------------------------------
```

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

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Test Sponsor: Dell Inc.		**Hardware Availability:**	Feb-2023
Tested by: Dell Inc.		**Software Availability:**	Jun-2022

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
-L/usr/local/intel/compiler/2022.1.0/linux/compiler/lib/intel64_lin
-lqkmalloc
```

C++ benchmarks:
```
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/intel/compiler/2022.1.0/linux/compiler/lib/intel64_lin
-lqkmalloc
```

Fortran benchmarks:
```
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/intel/compiler/2022.1.0/linux/compiler/lib/intel64_lin
-lqkmalloc
```

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`

(Continued on next page)

Dell Inc.

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CPU2017 License: 6573		**Test Date:**	Dec-2022
Test Sponsor: Dell Inc.		**Hardware Availability:**	Feb-2023
Tested by: Dell Inc.		**Software Availability:**	Jun-2022

Peak Portability Flags (Continued)

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.profdata`(pass 2) `-xCORE-AVX512`
`-Ofast -ffast-math -flto -mfpmath=sse -funroll-loops`
`-qopt-mem-layout-trans=4 -fno-strict-overflow`
`-L/usr/local/intel/compiler/2022.1.0/linux/compiler/lib/intel64_lin`
`-lqkmalloc`

502.gcc_r: `-m32`
`-L/usr/local/intel/compiler/2022.1.0/linux/compiler/lib/ia32_lin`
`-std=gnu89 -Wl,-z,muldefs -fprofile-generate`(pass 1)
`-fprofile-use=default.profdata`(pass 2) `-xCORE-AVX512`
`-Ofast -ffast-math -flto -mfpmath=sse -funroll-loops`
`-qopt-mem-layout-trans=4 -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 -Ofast`
`-ffast-math -flto -mfpmath=sse -funroll-loops`
`-qopt-mem-layout-trans=4 -fno-alias`
`-L/usr/local/intel/compiler/2022.1.0/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:

(Continued on next page)

Dell Inc.

PowerEdge R660 (Intel Xeon Platinum 8471N)

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$SPECrate®2017\_int\_peak = 427$

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Test Sponsor:	Dell Inc.	**Hardware Availability:**	Feb-2023
Tested by:	Dell Inc.	**Software Availability:**	Jun-2022

Peak Optimization Flags (Continued)

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/Intel-ic2022-official-linux64-revB.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.2.html

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

http://www.spec.org/cpu2017/flags/Intel-ic2022-official-linux64-revB.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge-Intel-Xeon-v1.2.xml

Tested with SPEC CPU®2017 v1.1.8 on 2022-12-14 13:28:14-0500.
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