Dell Inc. PowerEdge R660 (Intel Xeon Platinum 8470)

**SPECrates**:  
SPECrater®2017_fp_base = 910  
SPECrater®2017_fp_peak = 973

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<tr>
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<td>549.fotonik3d_r</td>
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<tr>
<td>554.roms_r</td>
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<td>339</td>
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</tbody>
</table>

**Hardware**

- **CPU Name**: Intel Xeon Platinum 8470  
- **Max MHz**: 3800  
- **Nominal**: 2000  
- **Enabled**: 104 cores, 2 chips, 2 threads/core  
- **Orderable**: 1.2 chips  
- **Cache L1**: 32 KB I + 48 KB D on chip per core  
- **L2**: 2 MB I+D on chip per core  
- **L3**: 105 MB I+D on chip per chip  
- **Other**: None  
- **Memory**: 1 TB (16 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**: 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.
## Results Table

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</tbody>
</table>

### 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/je5.0.1-64"
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
Transparent Huge Pages enabled by default

(Continued on next page)
**SPEC CPU®2017 Floating Point Rate Result**

Dell Inc.  
PowerEdge R660 (Intel Xeon Platinum 8470)  

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base = 910</th>
<th>SPECrate®2017_fp_peak = 973</th>
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</thead>
</table>

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

---

**General Notes (Continued)**

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  

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:  
```
ADDCC 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 982a61ec0915b5555891ef0e16acaf64d  
running on localhost Sat Dec 3 13:44:37 2022

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

(Continued on next page)
### Dell Inc. PowerEdge R660 (Intel Xeon Platinum 8470)

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

---

**Platform Notes (Continued)**

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 8470
- **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
  - `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
  - `physical 1`: 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)**: 208
- **On-line CPU(s) list**: 0-207
- **Vendor ID**: GenuineIntel
- **Model name**: Intel(R) Xeon(R) Platinum 8470
- **CPU family**: 6
- **Model**: 143
- **Thread(s) per core**: 2
- **Core(s) per socket**: 52
- **Socket(s)**: 2
- **Stepping**: 8
- **BogoMIPS**: 4000.00

**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 ept 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 ebp cat13 cat12 cdp13 invpcid_single cdp12 ssbd mba ibrs ibpb stibp ibrs_enabled 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 xsaves xgetbv1 xsavec xsaveopt xsavec cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local split_lock_detect avx_vnni avx512_fp16 rdpid bus_lock_detect clidemote movdiri movdir64b enqcmd fsrm md_clear serialize tsxldtrk pconfi carch lbr avx512_fp16 amx_tile flush_l1d arch_capabilities

(Continued on next page)
Dell Inc. PowerEdge R660 (Intel Xeon Platinum 8470)

**SPECrate®2017_fp_base = 910**

**SPECrate®2017_fp_peak = 973**

**CPU2017 License:** 6573

**Test Sponsor:** Dell Inc.

**Test Date:** Dec-2022

**Hardware Availability:** Feb-2023

**Tested by:** Dell Inc.

**Software Availability:** Jun-2022

---

**Platform Notes (Continued)**

- L1d cache: 4.9 MiB (104 instances)
- L1i cache: 3.3 MiB (104 instances)
- L2 cache: 208 MiB (104 instances)
- L3 cache: 210 MiB (2 instances)
- NUMA node(s): 8
- NUMA node0 CPU(s): 0-12,104-116
- NUMA node1 CPU(s): 13-25,117-129
- NUMA node2 CPU(s): 26-38,130-142
- NUMA node3 CPU(s): 39-51,143-155
- NUMA node4 CPU(s): 52-64,156-168
- NUMA node5 CPU(s): 65-77,169-181
- NUMA node6 CPU(s): 78-90,182-194
- NUMA node7 CPU(s): 91-103,195-207
- 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:

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<th>ALL-SIZE</th>
<th>WAYS</th>
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<td>L2</td>
<td>2M</td>
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<td>114688</td>
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</table>

/proc/cpuinfo cache data

cache size: 107520 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 4 5 6 7 8 9 10 11 12 104 105 106 107 108 109 110 111 112 113 114 115 116
node 0 size: 128435 MB
node 0 free: 113363 MB
node 1 cpus: 13 14 15 16 17 18 19 20 21 22 23 24 25 117 118 119 120 121 122 123 124 125 126 127 128 129
node 1 size: 129017 MB
node 1 free: 111329 MB

(Continued on next page)
# SPEC CPU®2017 Floating Point Rate Result

## Dell Inc.

### PowerEdge R660 (Intel Xeon Platinum 8470)

<table>
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<td>Feb-2023</td>
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<tr>
<td>Dell Inc.</td>
<td>Jun-2022</td>
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<table>
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<tbody>
<tr>
<td>Dell Inc.</td>
</tr>
</tbody>
</table>

### SPECrate®2017 fp_base = 910
### SPECrate®2017 fp_peak = 973

**Platform Notes (Continued)**

Based on /proc/meminfo:
- MemTotal: 1056266320 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*:
- NAME="SLES"
- VERSION="15-SP4"
- VERSION_ID="15.4"
- PRETTY_NAME="SUSE Linux Enterprise Server 15 SP4"
- ID="sles"

(Continued on next page)
**SPEC CPU®2017 Floating Point Rate Result**

Dell Inc.

PowerEdge R660 (Intel Xeon Platinum 8470)

<table>
<thead>
<tr>
<th>CPU2017 License: 6573</th>
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**SPECrate®2017_fp_base = 910**

**SPECrate®2017_fp_peak = 973**

---

**Platform Notes (Continued)**

```
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 seccomp
- **CVE-2018-5753 (Spectre variant 1):** Mitigation: usecopy/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

```
runtime 3 Dec 3 09:11
```

```
SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-ic2022.1
Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 125G 82G 44G 66% /mnt/ramdisk
```

From /sys/devices/virtual/dmi/id
```
Vendor: Dell Inc.
Product: PowerEdge R660
Product Family: PowerEdge
Serial: SLR6602
```

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:
16x 00CE00B300CE M321R8GA0BB0-CQKEG 64 GB 2 rank 4800
```

**BIOS:**
```
BIOS Vendor: Dell Inc.
BIOS Version: 0.3.2
```

(Continued on next page)
Dell Inc.  
PowerEdge R660 (Intel Xeon Platinum 8470)  

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**SPEC CPU®2017 Floating Point Rate Result**

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---

**Platform Notes (Continued)**

BIOS Date: 11/30/2022  
BIOS Revision: 0.3  
(End of data from sysinfo program)

---

**Compiler Version Notes**

```
C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak) 544.nab_r(base, peak)
```

Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
Version 2022.1.0 Build 20220316  
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```
C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)
```

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```
C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)
```

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---

```
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
```

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(Continued on next page)
Dell Inc. | PowerEdge R660 (Intel Xeon Platinum 8470)

SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Dell Inc. | SPECrate®2017_fp_base = 910
SPECrate®2017_fp_peak = 973

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

Compiler Version Notes (Continued)

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Fortran

503.bwaves_r(base, peak)
549.fotonik3d_r(base, peak)
554.roms_r(base, peak)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version
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Fortran, C

521.wrf_r(base, peak)
527.cam4_r(base, peak)

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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

Benchmarks using both Fortran and C:
ifx icx

Benchmarks using both C and C++:
icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifx
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Base Portability Flags

503.bwaves_r: -DSPEC_LP64  
507.cactuBSSN_r: -DSPEC_LP64  
508.namd_r: -DSPEC_LP64  
510.parest_r: -DSPEC_LP64  
511.povray_r: -DSPEC_LP64  
519.lbm_r: -DSPEC_LP64  
521.wrf_r: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian  
526.blender_r: -DSPEC_LP64 -DSPEC_LINUX -funsigned-char  
527.cam4_r: -DSPEC_LP64 -DSPEC_CASE_FLAG  
538.imagick_r: -DSPEC_LP64  
544.nab_r: -DSPEC_LP64  
549.fotonik3d_r: -DSPEC_LP64  
554.roms_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto  
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto  
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4  
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4  
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both C and C++:
-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -ljemalloc  
-L/usr/local/jemalloc64-5.0.1/lib

(Continued on next page)
## Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
- `-w` `-m64` `-std=c11` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast` `-ffast-math`
- `-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4`
- `-nostandard-realloc-lhs` `-align array32byte` `-auto` `-ljemalloc`
- `-L/usr/local/jemalloc64-5.0.1/lib`

## Peak Compiler Invocation

- **C benchmarks:**
  - `icx`

- **C++ benchmarks:**
  - `icpx`

- **Fortran benchmarks:**
  - `ifx`

- Benchmarks using both Fortran and C:
  - `ifx icx`

- Benchmarks using both C and C++:
  - `icpx icx`

- Benchmarks using Fortran, C, and C++:
  - `icpx icx ifx`

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

- **C benchmarks:**
  - `519.lbm_r`: `basepeak = yes`
  - `538.imagick_r`: `basepeak = yes`
  - `544.nab_r`: `-w` `-std=c11` `-m64` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast` `-ffast-math` `-flto` `-mfpmath=sse` `-funroll-loops`
Peak Optimization Flags (Continued)

544.nab_r (continued):
-qopt-mem-layout-trans=4 -qopt-zmm-usage=high -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

C++ benchmarks:

508.namd_r: basepeak = yes

510.parest_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:

503.bwaves_r: basepeak = yes

549.fotonik3d_r: basepeak = yes

554.roms_r: -w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Benchmarks using both Fortran and C:

521.wrf_r: -w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs
-align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: basepeak = yes

526.blender_r: basepeak = yes

Benchmarks using Fortran, C, and C++:

-w -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib
## SPEC CPU®2017 Floating Point Rate Result

**Dell Inc.**

**PowerEdge R660 (Intel Xeon Platinum 8470)**

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

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

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Tested with SPEC CPU®2017 v1.1.8 on 2022-12-03 14:44:37-0500.
Report generated on 2023-01-17 18:42:19 by CPU2017 PDF formatter v6442.
Originally published on 2023-01-17.