## Dell Inc.

**PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)**

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
<th>SPECrate®2017_fp_peak</th>
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<td>149</td>
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**CPU2017 License:** 55

**Test Sponsor:** Dell Inc.

**Tested by:** Dell Inc.

**Test Date:** Dec-2021

**Hardware Availability:** Oct-2021

**Software Availability:** May-2021

### Hardware

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<td>554.roms_r</td>
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### Software

- **OS:** Red Hat Enterprise Linux 8.4 (Ootpa) 4.18.0-305.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:** Version 1.3.8 released Aug-2021
- **File System:** tmpfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 64-bit
- **Peak Pointers:** 64-bit
- **Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage.
## Dell Inc.

PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

### Results Table

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</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-ic2021.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.8-ic2021.1/je5.0.1-64"

MALLOCP_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. Transparent Huge Pages enabled by default.

(Continued on next page)

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https://www.spec.org/
SPEC CPU®2017 Floating Point Rate Result

Dell Inc. PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz) SPECrate®2017_fp_base = 145
SPECrate®2017_fp_peak = 149

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.

Test Date: Dec-2021
Hardware Availability: Oct-2021
Software Availability: May-2021

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:
Virtualization Technology : Disabled

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

Sysinfo program /mnt/ramdisk/cpu2017-1.1.8-ic2021.1/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on localhost.localdomain Fri Dec 3 19:23:31 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 : Intel(R) Xeon(R) Silver 4309Y CPU @ 2.80GHz
2 "physical id"s (chips)

(Continued on next page)
Dell Inc. PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

SPECrate®2017_fp_base = 145
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CPU2017 License: 55
Test Sponsor: Dell Inc.
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Test Date: Dec-2021
Hardware Availability: Oct-2021
Software Availability: May-2021

Platform Notes (Continued)

32 "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 : 8
siblings : 16
physical 0: cores 0 1 2 3 4 5 6 7
physical 1: cores 0 1 2 3 4 5 6 7

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): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
BIOS Vendor ID: Intel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Silver 4309Y CPU @ 2.80GHz
Stepping: 6
CPU MHz: 1752.100
BogoMIPS: 5600.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 12288K
NUMA node0 CPU(s): 0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30
NUMA node1 CPU(s): 1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31
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 pdelgb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpubi
aperfmprefn pni pclmulqdq dtex64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtrr pdcm pcd dca sse4_1 sse4_2 x2apic movbe popcnt popcnt_tsc_deadline_timer aes xsave
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 invpcid_single
intel_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced fsgsbase tsc_adjust bmi1 hle avx2
smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq rdseed adx smap avx512sfma
cflushopt clwb intel_pt avx512cd sha ni avx512bw avx512vl xsaveopt xsavec xgetbv1
xsaveas cqm_ll1 cqm_occap_ll1 cqm_mbb_total cqm_mbb_local split_lock_detect wbinvd
dtherm ida arat pln pts avx512v bmi umip pkf ospke avx512_vbmi2 gfn vaes vpclmulqdq
avx512_vbni avx512_bitalg tme avx512_vpopcntdq la57 rdrpid fshr md_clear pconfi
flush_lld arch_capabilities

(Continued on next page)
Dell Inc.

PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

SPEC CPU®2017 Floating Point Rate Result

Copyright 2017-2021 Standard Performance Evaluation Corporation

SPECrate®2017_fp_base = 145
SPECrate®2017_fp_peak = 149

CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Dec-2021
Tested by: Dell Inc.
Hardware Availability: Oct-2021
Software Availability: May-2021

Platform Notes (Continued)

/proc/cpuinfo cache data
  cache size : 12288 KB

From numactl --hardware
WARNING: a numactl 'node' might or might not correspond to a physical chip.
available: 2 nodes (0-1)
  node 0 cpus: 0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
  node 0 size: 257182 MB
  node 0 free: 245706 MB
  node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
  node 1 size: 258004 MB
  node 1 free: 242432 MB
node distances:
  node 0 1
  0:  10  20
  1:  20  10

From /proc/meminfo
  MemTotal:       527552060 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="8.4 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.4"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.4 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.4 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.4 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.4:ga

uname -a:
  Linux localhost.localdomain 4.18.0-305.el8.x86_64 #1 SMP Thu Apr 29 08:54:30 EDT 2021
  x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit): Not affected

(Continued on next page)
Dell Inc.  
PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)  

<table>
<thead>
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<td>Hardware Availability: Oct-2021</td>
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<tr>
<td>Tested by: Dell Inc.</td>
<td>Software Availability: May-2021</td>
</tr>
</tbody>
</table>

## Platform Notes (Continued)

- **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 Dec 3 14:44

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-ic2021.1

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<td>21G</td>
<td>105G</td>
<td>17%</td>
<td>/mnt/ramdisk</td>
</tr>
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</table>

From /sys/devices/virtual/dmi/id

Vendor: Dell Inc.
Product: PowerEdge R450
Product Family: PowerEdge
Serial: 1S31501

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 002C00B3002C 18ASF4G72PDZ-3G2E1 32 GB 2 rank 3200, configured at 2666

BIOS:

- BIOS Vendor: Dell Inc.
- BIOS Version: 1.3.8
- BIOS Date: 08/31/2021
- BIOS Revision: 1.3

(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)
```

(Continued on next page)
Dell Inc.

PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

SPECrates:
- SPECrate®2017_fp_base = 145
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Compiler Version Notes (Continued)

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++             | 508.namd_r(base, peak) 510.parest_r(base, peak)
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Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C++, C          | 511.povray_r(peak)
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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++, C          | 511.povray_r(base) 526.blender_r(base, peak)
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C++, C          | 511.povray_r(peak)
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Intel(R) C++ Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
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==============================================================================
C++, C          | 511.povray_r(base) 526.blender_r(base, peak)
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==============================================================================
C++, C          | 511.povray_r(base) 526.blender_r(base, peak)
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(Continued on next page)
## SPEC CPU®2017 Floating Point Rate Result

**Dell Inc.**

**PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)**

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### Compiler Version Notes (Continued)

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| 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. |
| 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. |
-----------------------------------------------------------------------------------------------
```

```plaintext
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| Copyright (C) 1985-2020 Intel Corporation. All rights reserved. |
-----------------------------------------------------------------------------------------------
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```plaintext
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| Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak) 554.roms_r(base, peak) |
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| 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. |
-----------------------------------------------------------------------------------------------
```

```plaintext
-----------------------------------------------------------------------------------------------
| Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak) |
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| Intel(R) Fortran Intel(R) 64 Compiler Classic for applications running on |
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PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)  

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**SPECrater®2017_fp_base = 145**

**SPECrater®2017_fp_peak = 149**

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**Base Compiler Invocation**

- **C benchmarks**: icx
- **C++ benchmarks**: icpx
- **Fortran benchmarks**: ifort
- **Benchmarks using both Fortran and C**: ifort icx
- **Benchmarks using both C and C++**: icpx icx
- **Benchmarks using Fortran, C, and C++**: icpx icx ifort

---

**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
  -fproto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
  -mbranches-within-32B-boundaries -ljemalloc
  -L/usr/local/jemalloc64-5.0.1/lib

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Dell Inc.

PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

SPEC CPU®2017 Floating Point Rate Result

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SPECrate®2017_fp_base = 145
SPECrate®2017_fp_peak = 149

CPU2017 License: 55
Test Sponsor: Dell Inc.
Test Date: Dec-2021
Tested by: Dell Inc.
Hardware Availability: Oct-2021
Software Availability: May-2021

C++ benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

Fortran benchmarks:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries -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 -O3 -ipo
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-nostandard-realloc-lhs
-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
-mbranches-within-32B-boundaries -ljemalloc
-L/usr/local/jemalloc64-5.0.1/lib

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 -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-multiple-gather-scatter-by-shuffles
-nostandard-realloc-lhs
-L/usr/local/jemalloc64-5.0.1/lib

Peak Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx
Dell Inc.

PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

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

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**SPECrate®2017_fp_base = 145**

**SPECrate®2017_fp_peak = 149**

Peak Compiler Invocation (Continued)

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icx

Benchmarks using both C and C++:
511.povray_r: icpc icc
526.blender_r: icpx icx

Benchmarks using Fortran, C, and C++:
icpx icx ifort

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 -flto
-Ofast -qopt-mem-layout-trans=4
-fimf-accuracy-bits=14:sqrt
-mbranches-within-32B-boundaries -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 -mbranches-within-32B-boundaries
-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib

(Continued on next page)
**Peak Optimization Flags (Continued)**

Fortran benchmarks:

- `503.bwaves_r`: `basepeak = yes`
- `549.fotonik3d_r`: `basepeak = yes`
- `554.roms_r` with the following flags:
  - `-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo`
  - `-no-prec-div -gopt-prefetch -ffinite-math-only`
  - `-gopt-multiple-gather-scatter-by-shuffles`
  - `-gopt-mem-layout-trans=4 -nostandard-realloc-lhs`
  - `-align array32byte -auto -mbranches-within-32B-boundaries`
  - `-ljemalloc -L/usr/local/jemalloc64-5.0.1/lib`

Benchmarks using both Fortran and C:

- `521.wrf_r`: `basepeak = yes`
- `527.cam4_r`: `basepeak = yes`

Benchmarks using both C and C++:

- `511.povray_r` with the following flags:
  - `-prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3`
  - `-ipo -no-prec-div -gopt-prefetch -ffinite-math-only`
  - `-gopt-multiple-gather-scatter-by-shuffles`
  - `-gopt-mem-layout-trans=4 -mbranches-within-32B-boundaries`
  - `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

- `526.blender_r`: `basepeak = yes`

Benchmarks using Fortran, C, and C++:

- `507.cactuBSSN_r`: `basepeak = yes`

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:

### Dell Inc. PowerEdge R450 (Intel Xeon Silver 4309Y, 2.80 GHz)

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Tested with SPEC CPU®2017 v1.1.8 on 2021-12-03 19:23:30-0500.
Report generated on 2021-12-22 12:32:24 by CPU2017 PDF formatter v6442.
Originally published on 2021-12-21.