Dell Inc.

PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)

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

Test Date: Jan-2020
Hardware Availability: Dec-2019

Software

OS: SUSE Linux Enterprise Server 15 SP1
kernel 4.12.14-195-default
Compiler: C/C++: Version 19.0.4.227 of Intel C/C++
Compiler Build 20190416 for Linux;
Fortran: Version 19.0.4.227 of Intel Fortran
Compiler Build 20190416 for Linux
Parallel: Yes
Firmware: Version 2.1.6 released Sep-2018
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Power Management: BIOS set to prefer performance at the cost of additional power usage

Threads

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>8</td>
<td>77.5</td>
<td>77.5</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>8</td>
<td>41.2</td>
<td>42.9</td>
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<tr>
<td>619.lbm_s</td>
<td>8</td>
<td>15.4</td>
<td>15.4</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>8</td>
<td>40.8</td>
<td>42.9</td>
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<tr>
<td>627.cam4_s</td>
<td>8</td>
<td>24.6</td>
<td>24.7</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>8</td>
<td>32.4</td>
<td>34.9</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>8</td>
<td>21.5</td>
<td>24.9</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>8</td>
<td>50.3</td>
<td>50.1</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>8</td>
<td>17.0</td>
<td>17.1</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>8</td>
<td>17.4</td>
<td>17.3</td>
</tr>
</tbody>
</table>
Dell Inc. PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)

SPECspeed®2017_fp_base = 29.6
SPECspeed®2017_fp_peak = 29.9

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
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<tr>
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<tr>
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<tr>
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<td>654.roms_s</td>
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<td>17.4</td>
<td>8</td>
<td>904</td>
<td>17.4</td>
<td>908</td>
</tr>
</tbody>
</table>

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

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:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64"
OMP_STACKSIZE = "192M"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Files system page cache synced and cleared with:
    sync; echo 3>/proc/sys/vm/drop_caches
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.
SPEC CPU®2017 Floating Point Speed Result

Dell Inc.

PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)

SPECspeed®2017_fp_base = 29.6
SPECspeed®2017_fp_peak = 29.9

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.
Test Date: Jan-2020
Hardware Availability: Dec-2019
Software Availability: Jun-2019

Platform Notes

Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on linux-g3ob Fri Jan 31 15:14:32 2020

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) E-2288G CPU @ 3.70GHz
  1 "physical id"s (chips)
  16 "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

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 39 bits physical, 48 bits virtual
CPU(s): 16
On-line CPU(s) list: 0-15
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 1
NUMA node(s): 1
Vendor ID: GenuineIntel
CPU family: 6
Model: 158
Model name: Intel(R) Xeon(R) E-2288G CPU @ 3.70GHz
Stepping: 13
CPU MHz: 3700.000
BogoMIPS: 7392.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 256K
L3 cache: 16384K
NUMA node0 CPU(s): 0-15
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 pbesyscall nx pdpe1gb rdtsscp
lm constant_tsc 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

(Continued on next page)
Dell Inc.
PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)

SPECspeed®2017_fp_base = 29.6
SPECspeed®2017_fp_peak = 29.9

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

Platform Notes (Continued)

sdbg fma cx16 xtpr pdcid pdcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer
aes xsave avx fl6c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb invpcid_single
ssbd ibrs ibpb stibp ibrs_enhanced tpr_shadow vmmi flexpriority ept vpid fsqsbse
atec_adjust bm1 hle avx2 smep bmi2 erms invpcid_rtm mpx rdseed adx smap ciflushopt
intel_pt xsaveopt xsavex xgetbv1 xsaves dtherm ida arat pln pts md_clear flush_lld
arch_capabilities

/proc/cpuinfo cache data
   cache size : 16384 KB

From numactl --hardware WARNING: a numactl 'node' might or might not correspond to a
physical chip.
   available: 1 nodes (0)
   node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
   node 0 size: 64131 MB
   node 0 free: 56295 MB
   node distances:
      node 0
      0: 10

From /proc/meminfo
   MemTotal: 65670280 kB
   HugePages_Total: 0
   Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
   os-release:
      NAME="SLES"
      VERSION="15-SP1"
      VERSION_ID="15.1"
      PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
      ID="sles"
      ID_LIKE="suse"
      ANSI_COLOR="0;32"
      CPE_NAME="cpe:/o:suse:sles:15:sp1"

uname -a:
   Linux linux-g3ob 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
   x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

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

(Continued on next page)
Dell Inc.  
PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)  

SPECspeed®2017 fp_peak = 29.9  
SPECspeed®2017 fp_base = 29.6

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

Test Date: Jan-2020  
Hardware Availability: Dec-2019  
Software Availability: Jun-2019

Platform Notes (Continued)

CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization  
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 Jan 31 12:25 last=5

SPEC is set to: /home/cpu2017  
Filesystem Type Size Used Avail Use% Mounted on  
/dev/sda2 xfs 440G 40G 401G 9% /

From /sys/devices/virtual/dmi/id  
BIOS: Dell Inc. 2.1.6 09/27/2018  
Vendor: Dell Inc.  
Product: PowerEdge R240  
Product Family: PowerEdge

Additional information from dmidecode 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 00AD00000A02 HMA82GU7CJR8N-VK 16 GB 2 rank 2666  
2x 00AD00000A07 HMA82GU7CJR8N-VK 16 GB 2 rank 2666

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================  
C               | 619.lbm_s(base, peak) 638.imagick_s(base, peak)  
| 644.nab_s(base, peak)  
==============================================================================  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

==============================================================================  
C++, C, Fortran | 607.cactuBSSN_s(base, peak)  
==============================================================================  
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.  
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,  
Version 19.0.4.227 Build 20190416  
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

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Dell Inc.
PowerEdge R240 (Intel Xeon E-2288G, 3.70 GHz)

SPECsm®2017_fp_base = 29.6
SPECsm®2017_fp_peak = 29.9

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

Compiler Version Notes (Continued)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Base Portability Flags

603.bwaves_s: -DSPEC_LP64

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

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SPECspeed®2017_fp_peak = 29.9
SPECspeed®2017_fp_base = 29.6

CPU2017 License: 55
Test Sponsor: Dell Inc.
Tested by: Dell Inc.
Test Date: Jan-2020
Hardware Availability: Dec-2019
Software Availability: Jun-2019

Base Portability Flags (Continued)

607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
   -assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP

Fortran benchmarks:
-DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
   -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
   -nostandard-realloc-lhs

Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
   -nostandard-realloc-lhs

Benchmarks using Fortran, C, and C++:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
   -nostandard-realloc-lhs

Peak Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

(Continued on next page)
## Peak Compiler Invocation (Continued)

Benchmarks using Fortran, C, and C++:
```bash
icpc -m64 icc -m64 -std=c11 ifort -m64
```

## Peak Portability Flags

Same as Base Portability Flags

## Peak Optimization Flags

C benchmarks:
```bash
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
```

Fortran benchmarks:
```bash
603.bwaves_s: -prof-gen(pass 1) -prof-use(pass 2) -DSPEC_SUPPRESS_OPENMP
-DSPEC_OPENMP -O2 -xCORE-AVX2 -qopt-prefetch -ipo -O3
-ffinite-math-only -no-prec-div -qopt-mem-layout-trans=4
-qopenmp -nostandard-realloc-lhs

649.fotonik3d_s: Same as 603.bwaves_s

654.roms_s: -DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4
-qopenmp -nostandard-realloc-lhs
```

Benchmarks using both Fortran and C:
```bash
621.wrf_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2
-qopt-prefetch -ipo -O3 -ffinite-math-only -no-prec-div
-qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs

627.cam4_s: -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs

628.pop2_s: Same as 621.wrf_s
```

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

Benchmarks using Fortran, C, and C++:
- `xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only`
- `qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP`
- `nostandard-realloc-lhs`

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:
