Dell Inc.

PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

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

<table>
<thead>
<tr>
<th>Performance Test</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>183</td>
<td>512</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>99.9</td>
<td>307</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>130</td>
<td>293</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>114</td>
<td>88.4</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>67.8</td>
<td>88.2</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>159</td>
<td>164</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 55  
**Test Date:** May-2020  
**Test Sponsor:** Dell Inc.  
**Hardware Availability:** Feb-2020

**Tested by:** Dell Inc.  
**Software Availability:** Apr-2020

### Hardware
- **CPU Name:** Intel Xeon Gold 6248R  
- **Max MHz:** 4000  
- **Nominal:** 3000  
- **Enabled:** 48 cores, 2 chips  
- **Orderable:** 1.2 chips  
- **Cache L1:** 32 KB I + 32 KB D on chip per core  
- **L2:** 1 MB I+D on chip per core  
- **L3:** 35.75 MB I+D on chip per chip  
- **Memory:** 384 GB (10 x 32 GB 2Rx4 PC4-2933Y-R; 2 x 32 GB 2Rx4 PC4-3200AA-R, running at 2933)  
- **Storage:** 1 x 960GB SATA SSD  
- **Other:** None

### Software
- **OS:** Red Hat Enterprise Linux 8.1  
  kernel 4.18.0-147.el8.x86_64  
- **Compiler:** C/C++: Version 19.1.1.217 of Intel C/C++ Compiler for Linux; Fortran: Version 19.1.1.217 of Intel Fortran Compiler for Linux
- **Parallel:** Yes  
- **Firmware:** Version 2.7.3 released Mar-2020  
- **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 set to prefer performance at the cost of additional power usage
Dell Inc.  
PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)  

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Peak</th>
<th></th>
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<td>48</td>
<td>114</td>
<td>517</td>
<td>117</td>
<td>503</td>
<td>115</td>
<td>512</td>
<td>48</td>
<td>113</td>
<td>522</td>
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<tr>
<td>607.cactuBSSN_s</td>
<td>48</td>
<td>90.3</td>
<td>185</td>
<td>91.0</td>
<td>183</td>
<td>92.5</td>
<td>180</td>
<td>48</td>
<td>90.3</td>
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<td>52.7</td>
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<td>99.9</td>
<td>48</td>
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<tr>
<td>621.wrf_s</td>
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<td>102</td>
<td>130</td>
<td>102</td>
<td>129</td>
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<td>130</td>
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<td>159</td>
<td>90.5</td>
<td>159</td>
<td>90.6</td>
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<td>48</td>
<td>90.7</td>
<td>159</td>
</tr>
<tr>
<td>644.nab_s</td>
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<td>59.6</td>
<td>293</td>
<td>59.5</td>
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<td>48</td>
<td>57.0</td>
<td>307</td>
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<td>649.fotonik3d_s</td>
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<td>103</td>
<td>88.4</td>
<td>103</td>
<td>88.6</td>
<td>103</td>
<td>88.3</td>
<td>48</td>
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<td>87.5</td>
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<tr>
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<td>96.1</td>
<td>164</td>
<td>96.6</td>
<td>163</td>
<td>96.1</td>
<td>164</td>
<td>48</td>
<td>96.1</td>
<td>164</td>
</tr>
</tbody>
</table>

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"

Environment Variables Notes
Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/dev/shm/cpu2017-ic19.1u1/lib/intel64:/dev/shm/cpu2017-ic19.1u1/je5.0.1-64"
MALLOC_CONF = "retain:true"
OMP_STACKSIZE = "192M"

General Notes
Binaries compiled on a system with 1x Intel Core i9–9900K CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0
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)
Dell Inc.
PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

General Notes (Continued)

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.
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>
Benchmark run from a 225 GB ramdisk created with the cmd; "mount -t tmpfs -o size=225G tmpfs /mnt/ramdisk"
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS settings:
Sub NUMA Cluster enabled
Virtualization Technology disabled
System Profile set to Custom
CPU Performance set to Maximum Performance
C States set to Autonomous
C1E disabled
Uncore Frequency set to Dynamic
Energy Efficiency Policy set to Performance
Memory Patrol Scrub set to standard
Logical Processor disabled
CPU Interconnect Bus Link Power Management disabled
PCI ASPM L1 Link Power Management disabled
UPI Prefetch enabled
LLC Prefetch disabled
Dead Line LLC Alloc enabled
Directory AtoS disabled

Sysinfo program /dev/shm/cpu2017-ic19.1u1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edbe6e46a485a0011
running on localhost.localdomain Fri Jul  3 23:00:19 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) Gold 6248R CPU @ 3.00GHz
    2  "physical id"s (chips)
    48 "processors"
(Continued on next page)
SPEC CPU®2017 Floating Point Speed Result

Dell Inc.
PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

SPECspeed®2017_fp_base = 151
SPECspeed®2017_fp_peak = 153

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

Test Date: May-2020
Hardware Availability: Feb-2020
Software Availability: Apr-2020

Platform Notes (Continued)
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 : 24
siblings : 24
physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 16 17 18 19 20 21 25 26 27 28 29
physical 1: cores 0 1 2 3 4 5 6 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 48
On-line CPU(s) list: 0-47
Thread(s) per core: 1
Core(s) per socket: 24
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 6248R CPU @ 3.00GHz
Stepping: 7
CPU MHz: 2592.513
CPU max MHz: 4000.0000
CPU min MHz: 1200.0000
BogoMIPS: 6000.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 36608K
NUMA node0 CPU(s):
0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46
NUMA node1 CPU(s):
1,3,5,7,9,11,13,15,17,19,21,23,25,27,29,31,33,35,37,39,41,43,45,47
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 rdtsscp
  lm constant_tsc arch_perfmon pebs bts rep_good nopl xaplayer nondisruptive tsc npc
  pcid msr_write ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
  xtpr pdcm dcm dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
  avx f16c rdrand lahf_lm abtm 80mmexecmask nonstop_tsc cpuid
  aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
  xtopr pdcm pdcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave
  avx f16c rdrand lahf_lm abtm 3nowprefetch cpuid_fault ebst cat_l3 cdp_l3
invpcid_single intel_pinn ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmi
flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
  cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
  avx512bw avx512vl xsavesopt xsavec xgetbv1 xsaveopt cqm_llc cqm_occp_llc cqm_mbb_total
  cqm_mbb_local dtherm ida arat pfn pts pku ospke avx512_vnni md_clear flush_l1d
arch_capabilities

(Continued on next page)
Platform Notes (Continued)

```
/proc/cpuinfo cache data
  cache size : 36608 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 32 34 36 38 40 42 44 46
  node 0 size: 192072 MB
  node 0 free: 182958 MB
  node 1 cpus: 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47
  node 1 size: 193505 MB
  node 1 free: 192543 MB
  node distances:
    node   0   1
    0:  10  21
    1:  21  10

From /proc/meminfo
  MemTotal:       394831408 kB
  HugePages_Total:       0
  Hugepagesize:       2048 kB

From /etc/*release* /etc/*version*
  os-release:
    NAME="Red Hat Enterprise Linux"
    VERSION="8.1 (Ootpa)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="8.1"
    PLATFORM_ID="platform:el8"
    PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
    ANSI_COLOR="0;31"
  redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
  system-release: Red Hat Enterprise Linux release 8.1 (Ootpa)
  system-release-cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

uname -a:
  Linux localhost.localdomain 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019
  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
```
SPEC CPU®2017 Floating Point Speed Result

Dell Inc.

PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

SPECspeed®2017_fp_base = 151
SPECspeed®2017_fp_peak = 153

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

Platform Notes (Continued)

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

run-level 3 Jul 3 22:49

SPEC is set to: /dev/shm/cpu2017-ic19.1ual
Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 189G 4.2G 185G 3% /dev/shm

From /sys/devices/virtual/dmi/id
BIOS: Dell Inc. 2.7.3 03/25/2020
Vendor: Dell Inc.
Product: PowerEdge C6420
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:
6x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
1x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
2x 00AD063200AD HMA84GR7CJR4N-XN 32 GB 2 rank 3200
3x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
4x Not Specified Not Specified

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
<table>
<thead>
<tr>
<th>C</th>
<th>619.lbm_s(base, peak) 638.imagick_s(base, peak)</th>
</tr>
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<tr>
<td></td>
<td>644.nab_s(base, peak)</td>
</tr>
</tbody>
</table>
==============================================================================

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 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,

(Continued on next page)
Dell Inc. PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

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

Compiler Version Notes (Continued)

Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
Fortran         | 603.bwaves_s(base, peak) 649.fotonik3d_s(base, peak)
| 654.roms_s(base, peak)
==============================================================================

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
Fortran, C      | 621.wrf_s(base, peak) 627.cam4_s(base, peak)
| 628.pop2_s(base, peak)
==============================================================================

Base Compiler Invocation

C benchmarks:
icc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using Fortran, C, and C++:
icpc icc ifort
## Dell Inc. PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)

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**CPU2017 License:** 55  
**Test Sponsor:** Dell Inc.  
**Test Date:** May-2020  
**Tested by:** Dell Inc.  
**Hardware Availability:** Feb-2020  
**Software Availability:** Apr-2020

### Base Portability Flags

- 603.bwaves_s: -DSPEC_LP64  
- 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:**

- m64 -std=c11 -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch  
-ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP  
-mbranches-within-32B-boundaries

**Fortran benchmarks:**

- m64 -Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -nostandard-realloc-lhs -mbranches-within-32B-boundaries  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Benchmarks using both Fortran and C:**

- m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

**Benchmarks using Fortran, C, and C++:**

- m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs  
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

### Peak Compiler Invocation

**C benchmarks:**

- icc

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</table>

**Peak Compiler Invocation (Continued)**

Fortran benchmarks:
```fortran
ifort
```

Benchmarks using both Fortran and C:
```fortran
ifort icc
```

Benchmarks using Fortran, C, and C++:
```fortran
icpc icc ifort
```

**Peak Portability Flags**

Same as Base Portability Flags

**Peak Optimization Flags**

C benchmarks:
```
619.lbm_s: basepeak = yes
638.imagick_s: basepeak = yes
```

```
644.nab_s: -m64 -std=c11 -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3
-no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -gopenmp -DSPEC_OPENMP
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

Fortran benchmarks:
```
603.bwaves_s: -m64 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-DSPEC_SUPPRESS_OPENMP -DSPEC_OPENMP -ipo -xCORE-AVX2
-O3 -no-prec-div -qopt-prefetch -ffinite-math-only
-qopt-mem-layout-trans=4 -gopenmp -nostandard-realloc-lhs
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc
```

```
649.fotonik3d_s: Same as 603.bwaves_s
654.roms_s: basepeak = yes
```

Benchmarks using both Fortran and C:
```
(Continued on next page)
# SPEC CPU®2017 Floating Point Speed Result

**Dell Inc.**  
**PowerEdge C6420 (Intel Xeon Gold 6248R, 3.00 GHz)**

| SPECspeed®2017_fp_base | 151  
|-------------------------|-----  
| SPECspeed®2017_fp_peak  | 153  

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

| Test Date    | May-2020  
|--------------|-----------  
| Hardware Availability | Feb-2020  
| Software Availability | Apr-2020  

## Peak Optimization Flags (Continued)

621.wrf_s: -m64 -std=c11 -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX2 -O3 -no-prec-div -qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=4 -DSPEC_SUPPRESS_OPENMP -qopenmp -DSPEC_OPENMP -mbranches-within-32B-boundaries -nostandard-realloc-lhs -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

627.cam4_s: basepeak = yes

628.pop2_s: basepeak = yes

**Benchmarks using Fortran, C, and C++:**

607.cactuBSSN_s: basepeak = yes

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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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