



# SPEC CPU®2017 Floating Point Speed Result

Copyright 2017-2023 Standard Performance Evaluation Corporation

Dell Inc.

SPECspeed®2017\_fp\_base = 270

PowerEdge R660 (Intel Xeon Gold 6454S)

SPECspeed®2017\_fp\_peak = 270

CPU2017 License: 6573

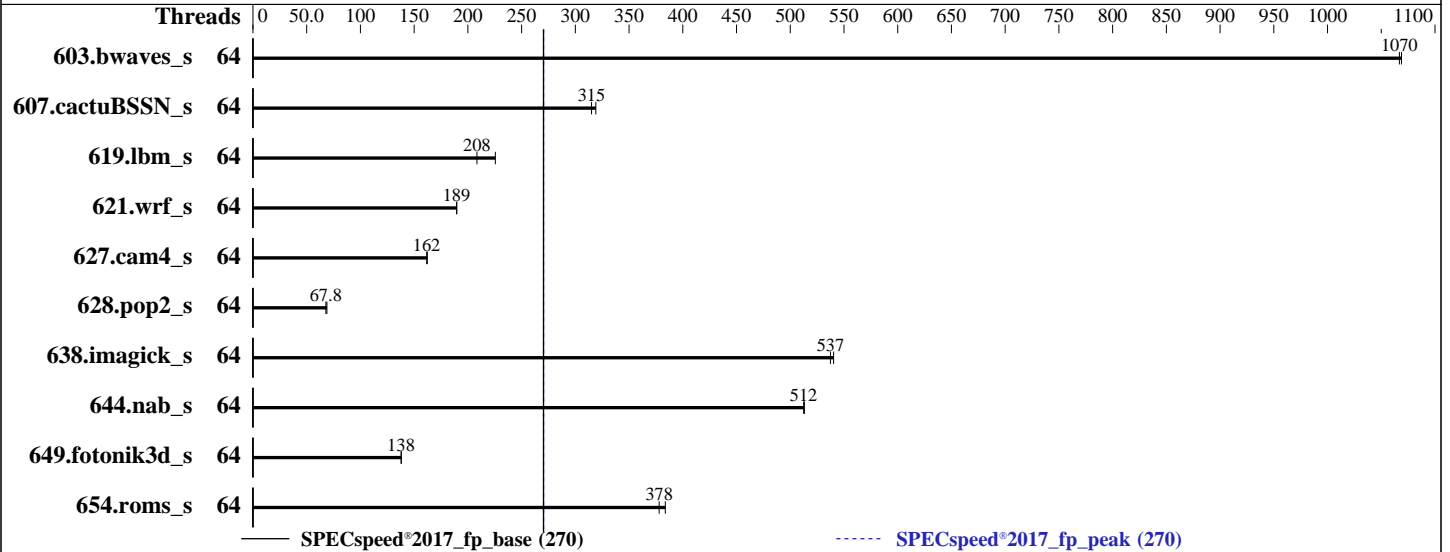
Test Date: Dec-2022

Test Sponsor: Dell Inc.

Hardware Availability: Feb-2023

Tested by: Dell Inc.

Software Availability: Jun-2022



## Hardware

CPU Name: Intel Xeon Gold 6454S  
 Max MHz: 3400  
 Nominal: 2200  
 Enabled: 64 cores, 2 chips  
 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: 60 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: Yes  
 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.



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## Results Table

Benchmark	Base						Peak							
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
603.bwaves_s	64	55.2	1070	<b><u>55.3</u></b>	<b><u>1070</u></b>			64	55.2	1070	<b><u>55.3</u></b>	<b><u>1070</u></b>		
607.cactuBSSN_s	64	52.2	319	<b><u>52.9</u></b>	<b><u>315</u></b>			64	52.2	319	<b><u>52.9</u></b>	<b><u>315</u></b>		
619.lbm_s	64	23.2	226	<b><u>25.1</u></b>	<b><u>208</u></b>			64	23.2	226	<b><u>25.1</u></b>	<b><u>208</u></b>		
621.wrf_s	64	69.7	190	<b><u>69.8</u></b>	<b><u>189</u></b>			64	69.7	190	<b><u>69.8</u></b>	<b><u>189</u></b>		
627.cam4_s	64	<b><u>54.8</u></b>	<b><u>162</u></b>	54.6	162			64	<b><u>54.8</u></b>	<b><u>162</u></b>	54.6	162		
628.pop2_s	64	172	68.8	<b><u>175</u></b>	<b><u>67.8</u></b>			64	172	68.8	<b><u>175</u></b>	<b><u>67.8</u></b>		
638.imagick_s	64	26.7	540	<b><u>26.8</u></b>	<b><u>537</u></b>			64	26.7	540	<b><u>26.8</u></b>	<b><u>537</u></b>		
644.nab_s	64	<b><u>34.1</u></b>	<b><u>512</u></b>	34.0	513			64	<b><u>34.1</u></b>	<b><u>512</u></b>	34.0	513		
649.fotonik3d_s	64	<b><u>66.1</u></b>	<b><u>138</u></b>	66.0	138			64	<b><u>66.1</u></b>	<b><u>138</u></b>	66.0	138		
654.roms_s	64	<b><u>41.7</u></b>	<b><u>378</u></b>	41.0	384			64	<b><u>41.7</u></b>	<b><u>378</u></b>	41.0	384		

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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 =
  "/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/lib/intel64:/mnt/ramdisk/cpu2017-1.1.8-ic2022.1/je5.0.1-64"
MALLOCONF = "retain:true"
OMP_STACKSIZE = "192M"
```

## General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Redhat Enterprise Linux 8.0  
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  
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.

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## General Notes (Continued)

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
      Logical Processor : Disabled
      Sub NUMA Cluster : 2-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 Mon Dec 5 20:17:37 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) Gold 6454S
 2 "physical id"s (chips)
 64 "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 : 32

```

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## Platform Notes (Continued)

siblings : 32  
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  
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

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): 64  
On-line CPU(s) list: 0-63  
Vendor ID: GenuineIntel  
Model name: Intel(R) Xeon(R) Gold 6454S  
CPU family: 6  
Model: 143  
Thread(s) per core: 1  
Core(s) per socket: 32  
Socket(s): 2  
Stepping: 8  
BogoMIPS: 4400.00  
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  
pdpelgb rdtscp lm constant\_tsc art arch\_perfmon pebs bts rep\_good nopl xtopology  
nonstop\_tsc cpuid aperfperf 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  
amx\_tile flush\_lli arch\_capabilities  
L1d cache: 3 MiB (64 instances)  
L1i cache: 2 MiB (64 instances)  
L2 cache: 128 MiB (64 instances)  
L3 cache: 120 MiB (2 instances)  
NUMA node(s): 4  
NUMA node0 CPU(s): 0-15  
NUMA node1 CPU(s): 16-31  
NUMA node2 CPU(s): 32-47  
NUMA node3 CPU(s): 48-63  
Vulnerability Itlb multihit: Not affected

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## Platform Notes (Continued)

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	3M	12	Data	1	64	1	64
L1i	32K	2M	8	Instruction	1	64	1	64
L2	2M	128M	16	Unified	2	2048	1	64
L3	60M	120M	15	Unified	3	65536	1	64

/proc/cpuinfo cache data  
cache size : 61440 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 13 14 15  
 node 0 size: 257496 MB  
 node 0 free: 255903 MB  
 node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31  
 node 1 size: 258009 MB  
 node 1 free: 243727 MB  
 node 2 cpus: 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47  
 node 2 size: 258043 MB  
 node 2 free: 257922 MB  
 node 3 cpus: 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63  
 node 3 size: 258014 MB  
 node 3 free: 257741 MB  
 node distances:  
 node 0 1 2 3  
 0: 10 12 21 21  
 1: 12 10 21 21  
 2: 21 21 10 12  
 3: 21 21 12 10

From /proc/meminfo

MemTotal: 1056321796 kB  
HugePages\_Total: 0

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## Platform Notes (Continued)

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 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 5 10:42

SPEC is set to: /mnt/ramdisk/cpu2017-1.1.8-ic2022.1

Filesystem	Type	Size	Used	Avail	Use%	Mounted on
tmpfs	tmpfs	125G	9.6G	116G	8%	/mnt/ramdisk

From /sys/devices/virtual/dmi/id

Vendor: Dell Inc.  
Product: PowerEdge R660  
Product Family: PowerEdge  
Serial: SLR6604

Additional information from dmidecode 3.2 follows. WARNING: Use caution when you

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## Platform Notes (Continued)

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 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 | 619.lbm\_s(base, peak) 638.imagick\_s(base, peak)  
644.nab\_s(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++, C, Fortran | 607.cactuBSSN\_s(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.  
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
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Copyright (C) 1985-2022 Intel Corporation. All rights reserved.  
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.  
-----

=====  
Fortran | 603.bwaves\_s(base, peak) 649.fotonik3d\_s(base, peak)  
654.roms\_s(base, peak)

Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version  
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## Compiler Version Notes (Continued)

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

## Base Compiler Invocation

C benchmarks:  
icx

Fortran benchmarks:  
ifx

Benchmarks using both Fortran and C:  
ifx icx

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

## 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
```





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## Base Optimization Flags

C benchmarks:

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

Fortran benchmarks:

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

Benchmarks using both Fortran and C:

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

Benchmarks using Fortran, C, and C++:

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

## Peak Compiler Invocation

C benchmarks:

icx

Fortran benchmarks:

ifx

Benchmarks using both Fortran and C:

ifx icx

Benchmarks using Fortran, C, and C++:

icpx icx ifx

## Peak Portability Flags

Same as Base Portability Flags



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## Peak Optimization Flags

C benchmarks:

619.lbm\_s: basepeak = yes

638.imagick\_s: basepeak = yes

644.nab\_s: basepeak = yes

Fortran benchmarks:

603.bwaves\_s: basepeak = yes

649.fotonik3d\_s: basepeak = yes

654.roms\_s: basepeak = yes

Benchmarks using both Fortran and C:

621.wrf\_s: basepeak = yes

627.cam4\_s: basepeak = yes

628.pop2\_s: basepeak = yes

Benchmarks using Fortran, C, and C++:

607.cactuBSSN\_s: 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>

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