## Lenovo Global Technology

**ThinkSystem SR650**  
(3.00 GHz, Intel Xeon Gold 6248R)

### SPEC CPU®2017 Floating Point Rate Result

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<td>511.povray_r</td>
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<td>519.lbm_r</td>
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<td>521.wrf_r</td>
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<td>549.fotonik3d_r</td>
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<td>96</td>
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<tr>
<td>554.roms_r</td>
<td>105</td>
<td>96</td>
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</table>

### Hardware

- **CPU Name:** Intel Xeon Gold 6248R  
- **Max MHz:** 4000  
- **Nominal:** 3000  
- **Enabled:** 48 cores, 2 chips, 2 threads/core  
- **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  
- **Other:** None  
- **Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R)  
- **Storage:** 1 x 800 GB SATA SSD  
- **Other:** None

### Software

- **OS:** Red Hat Enterprise Linux 8.1 (Ootpa)  
- **Compiler:** C/C++: Version 19.1.1.217 of Intel  
- **Compiler for Linux:**  
- **Compiler for Fortran:**  
- **Compiler for Linux:**  
- **Parallel:** No  
- **Firmware:** Lenovo BIOS Version IVE155L 2.61 released May-2020  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** Not Applicable  
- **Other:** jemalloc memory allocator V5.0.1  
- **Power Management:** BIOS set to prefer performance at the cost of additional power usage

---

**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Hardware Availability:** Mar-2020  
**Software Availability:** Apr-2020

**Test Date:** Jun-2020
Lenovo Global Technology
ThinkSystem SR650
(3.00 GHz, Intel Xeon Gold 6248R)

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Benchmark | Copies | Seconds | Ratio | Base | Seconds | Ratio | Peak | Seconds | Ratio |
-----------|--------|---------|-------|------|---------|-------|------|---------|-------|
503.bwaves_r | 96 | 1798 | 535 | 1799 | 535 | 1803 | 534 |
507.cactuBSSN_r | 96 | 346 | 351 | 347 | 350 | 345 | 352 |
508.namd_r | 96 | 376 | 242 | 373 | 244 | 373 | 245 |
510.parest_r | 96 | 1815 | 138 | 1811 | 139 | 1824 | 138 |
511.povray_r | 96 | 623 | 360 | 625 | 359 | 623 | 360 |
519.lbm_r | 96 | 796 | 127 | 796 | 127 | 795 | 127 |
521.wrf_r | 96 | 917 | 234 | 918 | 234 | 914 | 235 |
526.blender_r | 96 | 475 | 308 | 475 | 308 | 476 | 307 |
527.cam4_r | 96 | 532 | 316 | 528 | 318 | 529 | 317 |
538.imagick_r | 96 | 291 | 820 | 291 | 821 | 291 | 820 |
544.nab_r | 96 | 358 | 451 | 358 | 452 | 358 | 452 |
549.fotonik3d_r | 96 | 2151 | 174 | 2154 | 174 | 2156 | 173 |
554.roms_r | 96 | 1448 | 105 | 1453 | 105 | 1450 | 105 |

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

Compiler Notes
The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler.
The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux
The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

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 = "/home/cpu2017-1.1.0-ic19.1.1/lib/intel64:/home/cpu2017-1.1.0-ic19.1.1/jede5.0.1-64"
MALLOC_CONF = "retain:true"
Lenovo Global Technology
ThinkSystem SR650
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<thead>
<tr>
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<tr>
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General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM
memory using Redhat Enterprise Linux 8.0
Transparent Huge Pages enabled by default
Prior to runcpu invocation
Filesysten 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>
```
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.
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
C-States set to Legacy
SNC set to Enable
DCU Streamer Prefetcher set to Disable
Trusted Execution Technology set to Enable
Stale AtoS set to Enable
LLC dead line alloc set to Disable
Patrol Scrub set to Disable

Sysinfo program /home/cpu2017-1.1.0-ic19.1.1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f808a3d7edbe6e46a485a0011
running on localhost.localdomain Sat Jun  6 01:36:47 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)
  96 "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 : 24
siblings : 48
```

(Continued on next page)
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**Platform Notes (Continued)**

- physical 0: 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
- 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): 96
- On-line CPU(s) list: 0-95
- Thread(s) per core: 2
- Core(s) per socket: 24
- Socket(s): 2
- NUMA node(s): 4
- Vendor ID: GenuineIntel
- CPU family: 6
- Model: 85
- Model name: Intel(R) Xeon(R) Gold 6248R CPU @ 3.00GHz
- Stepping: 7
- CPU MHz: 2394.471
- 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): 0-3, 7, 8, 12-14, 18-20, 48-51, 55, 56, 60-62, 66-68
- NUMA node1 CPU(s): 4-6, 9-11, 15-17, 21-23, 52-54, 57-59, 63-65, 69-71
- NUMA node2 CPU(s): 24-27, 31, 32, 36-38, 42-44, 72-75, 79, 80, 84-86, 90-92
- NUMA node3 CPU(s): 28-30, 33-35, 39-41, 45-47, 76-78, 81-83, 87-89, 93-95
- 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 pdperral rdtscp lm constant_tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
- aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtrunc pdcm pclid 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 cdp_l3
- invpcid_single intel_pinn ssbd mba ibrs ibpb ibrs_enhanced tpr_shadow vnmi
- flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invvpidd rtm
- cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
- avx512bw avx512vl xsaves xgetbv1 xsaves cqm_llc cqm_occu llc cqm_mbb_total
- cqm_mbb_local dtherm ida arat pln pts kpu ospke avx512_vnni md_clear flush_lld
- arch_capabilities

/(Continued on next page)
Platform Notes (Continued)

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 7 8 12 13 14 18 19 20 48 49 50 51 55 56 60 61 62 66 67 68
node 0 size: 193124 MB
node 0 free: 192622 MB
node 1 cpus: 4 5 6 9 10 11 15 16 17 21 22 23 52 53 54 57 58 59 63 64 65 69 70 71
node 1 size: 193531 MB
node 1 free: 193169 MB
node 2 cpus: 24 25 26 27 31 32 36 37 38 42 43 44 72 73 74 75 79 80 84 85 86 90 91 92
node 2 size: 193531 MB
node 2 free: 192931 MB
node 3 cpus: 28 29 30 33 34 35 39 40 41 45 46 47 76 77 78 81 82 83 87 88 89 93 94 95
node 3 size: 193530 MB
node 3 free: 193204 MB
node distances:
node   0   1   2   3
 0:  10  11  21  21
 1:  11  10  21  21
 2:  21  21  10  11
 3:  21  21  11  10

From /proc/meminfo
MemTotal:  792286948 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:

(Continued on next page)
Lenovo Global Technology
ThinkSystem SR650
(3.00 GHz, Intel Xeon Gold 6248R)

SPECrate®2017_fp_base = 272
SPECrate®2017_fp_peak = Not Run

Platform Notes (Continued)

CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: userncopy/swapgs barriers and __user pointer sanitation
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 Jun 6 01:34

SPEC is set to: /home/cpu2017-1.1.0-ic19.1.1
Filesystem Type Size Used Avail Use% Mounted on
/dev/sdb2 xfs 689G 44G 645G 7% /home

From /sys/devices/virtual/dmi/id
BIOS: Lenovo -[IVE155L-2.61]- 05/20/2020
Vendor: Lenovo
Product: ThinkSystem SR650 -[7X05RCZ000]-
Product Family: ThinkSystem
Serial: 1234567890

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:
24x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933

(End of data from sysinfo program)

Compiler Version Notes
==============================================================================
C | 519.lbm_r(base) 538.imagick_r(base) 544.nab_r(base)
-----------------------------------------------------------------------------
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
-----------------------------------------------------------------------------

C++ | 508.namd_r(base) 510.parest_r(base)
-----------------------------------------------------------------------------
Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1

(Continued on next page)
## Lenovo Global Technology

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</table>

### Compiler Version Notes (Continued)

Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

---

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

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

---

C++, C, Fortran | 507.cactuBSSN_r(base)
---

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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         | 503.bwaves_r(base) 549.fotonik3d_r(base) 554.roms_r(base)
---

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      | 521.wrf_r(base) 527.cam4_r(base)
---

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.
Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
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Lenovo Global Technology
ThinkSystem SR650
(3.00 GHz, Intel Xeon Gold 6248R)

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

SPECratenumber = 272
SPECratenumber = Not Run

Test Date: Jun-2020
Hardware Availability: Mar-2020
Software Availability: Apr-2020

Base Compiler Invocation

C benchmarks:
icc

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Benchmarks using both Fortran and C:
ifort icc

Benchmarks using both C and C++:
icpc icc

Benchmarks using Fortran, C, and C++:
icpc icc 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:
-m64 -mnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -gopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

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**CPU2017 License:** 9017

**Test Sponsor:** Lenovo Global Technology

**Tested by:** Lenovo Global Technology

---

**Base Optimization Flags (Continued)**

C++ benchmarks:
- `m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries`  
- `Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto`  
- `mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`  
- `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

Fortran benchmarks:
- `m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`  
- `fuse-ld=gold -xCORE-AVX2 -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`  
- `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

Benchmarks using both Fortran and C:
- `m64 -qnextgen -std=c11`  
- `Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`  
- `fuse-ld=gold -xCORE-AVX2 -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`  
- `align array32byte -auto -mbranches-within-32B-boundaries`  
- `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

Benchmarks using both C and C++:
- `m64 -qnextgen -std=c11`  
- `Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`  
- `fuse-ld=gold -xCORE-AVX2 -Ofast -ffast-math -flto -mfpmath=sse`  
- `funroll-loops -qopt-mem-layout-trans=4`  
- `-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc`

Benchmarks using Fortran, C, and C++:
- `m64 -qnextgen -std=c11`  
- `Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`  
- `fuse-ld=gold -xCORE-AVX2 -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`  
- `align array32byte -auto -mbranches-within-32B-boundaries`  
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**Test Sponsor:** Lenovo Global Technology  
**Tested by:** Lenovo Global Technology  
**Test Date:** Jun-2020  
**Hardware Availability:** Mar-2020  
**Software Availability:** Apr-2020

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

- [http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-I.html](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-I.html)

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

- [http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-I.xml](http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-CLX-I.xml)

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