**Huawei**

(32A3: China Academy of Information and Communications Technology)

**Huawei 2288H V5 (Intel Xeon Gold 6240R)**

<table>
<thead>
<tr>
<th>SPECrate®2017_fp_base</th>
<th>274</th>
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<tr>
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**CPU2017 License:** 6177  
**Test Date:** Jul-2020  
**Hardware Availability:** Feb-2020

**Test Sponsor:** China Academy of Information and Communications Technology  
**Software Availability:** Apr-2020  
**Tested by:** China Academy of Information and Communications Technology

### Hardware

- **CPU Name:** Intel Xeon Gold 6240R  
- **Max MHz:** 4000  
- **Nominal:** 2400  
- **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 core  
- **Other:** None  
- **Memory:** 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R)  
- **Storage:** 1 x 800 GB SAS SSD  
- **Other:** None

### Software

- **OS:** SUSE Linux Enterprise Server 12 SP4 (x86_64)  
- **Kernel:** 4.12.14-94.41-default  
- **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  
- **Firmware:** Version 6.83 released Jun-2019  
- **Parallel:** No  
- **File System:** xfs  
- **System State:** Run level 3 (multi-user)  
- **Base Pointers:** 64-bit  
- **Peak Pointers:** 64-bit  
- **Other:** jemalloc memory allocator V5.0.1

---

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

Huawei

Huawei 2288H V5 (Intel Xeon Gold 6240R)

SPECrate®2017_fp_base = 274
SPECrate®2017_fp_peak = 275

CPU2017 License: 6177
Test Sponsor: China Academy of Information and Communications Technology
Test Date: Jul-2020
Hardware Availability: Feb-2020
Tested by: China Academy of Information and Communications Technology
Software Availability: Apr-2020

Technology

Software (Continued)

Power Management: BIOS set to prefer performance at the cost of additional power usage.

Results Table

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</table>

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
SPEC has learned that this result, which used an evaluation compiler, was submitted contrary to the compiler license terms.
Intel has granted a one-time waiver for this result.

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.
Huawei 2288H V5 (Intel Xeon Gold 6240R)

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<tr>
<td>Hardware Availability: Feb-2020</td>
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<td>Software Availability: Apr-2020</td>
</tr>
</tbody>
</table>

### 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 = "/opt/intel/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64:/usr/local/jemalloc64-5.0.1"
MALLOC_CONF = "retain:true"
```

### General Notes

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>
```
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:
Power Policy Set to Performance
SNC Set to Enabled
IMC Interleaving Set to 1-way Interleave
XPT Prefetch Set to Enabled

```
Sysinfo program /spec2017/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edble6e46a485a0011
running on linux-r48i Fri Jul 24 03:44:21 2020
```

SUT (System Under Test) info as seen by some common utilities.
For more information on this section, see

(Continued on next page)
Huawei 2288H V5 (Intel Xeon Gold 6240R)

SPECrates®2017_fp_base = 274
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CPU2017 License: 6177
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Technology
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Technology
Software Availability: Apr-2020

Platform Notes (Continued)

From /proc/cpuinfo

```
model name : Intel(R) Xeon(R) Gold 6240R CPU @ 2.40GHz
  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
physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 17 18 19 20 21 24 25 26 27 28 29
physical 1: 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
```

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 6240R CPU @ 2.40GHz
Stepping:              7
CPU MHz:               2400.000
CPU max MHz:           4000.0000
CPU min MHz:           1000.0000
BogoMIPS:              4800.00
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              1024K
L3 cache:              36608K
NUMA node0 CPU(s):     0-3,7-9,13,14-18,20,48-51,55-57,61,62,66-68
NUMA node1 CPU(s):     4-6,10-12,15-17,21-23,52-54,58-60,63-65,69-71
NUMA node2 CPU(s):     24-27,31-33,37-39,43,44,72-75,79-81,85-87,91,92
NUMA node3 CPU(s):     28-30,34-36,40-42,45-47,76-78,82-84,88-90,93-95
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 pdpe1gb rdtscp
                       lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
                       aperfmperf pni pclmulqdq dtes64 mmmx vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm
```
Huawei 2288H V5 (Intel Xeon Gold 6240R)

**CPU2017 License:** 6177  
**Test Sponsor:** China Academy of Information and Communications Technology  
**Tested by:** China Academy of Information and Communications Technology

**Platform Notes (Continued)**

```
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_13 cpd_13 invpcid_single ssbd
mba ibpb stibp tpr_shadow vnni flexpriority ept vpid fsqsbse tsc_adjust bmi1
hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq rdseed adx smap
c1flushopt clwb intel_pt avx512cd avx512bw avx512vl xsaveopt xsaves xsavec xgetbv1 xsave
cqmm _llc cqmm _occup _llc cqmm _mbm _total cqmm _mbm _local dtherm ida arat pln pts pk u ospke
avx512_vnni flush_lid arch_capabilities

/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: 4 nodes (0-3)
   node 0 cpus: 0 1 2 3 7 8 9 13 14 18 19 20 3 4 5 6 10 11 12 15 16 17 18 19 20 21 22 23 24 25 26 27
   node 0 size: 191973 MB
   node 0 free: 191080 MB
   node 1 cpus: 4 5 6 10 11 12 15 16 17 18 19 20 21 22 23 24 25 26 27 31 32 33 37 38 39 43 44 47 73 74
   node 1 size: 193531 MB
   node 1 free: 192447 MB
   node 2 cpus: 24 25 26 27 31 32 33 37 38 39 43 44 47 73 74 75 79 80 81 85 86 87 91 92
   node 2 size: 193502 MB
   node 2 free: 192706 MB
   node 3 cpus: 28 29 30 34 35 36 40 41 42 45 46 47 76 77 78 82 83 84 88 89 90 93 94 95
   node 3 size: 193321 MB
   node 3 free: 192481 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:       790864820 kB
   HugePages_Total:       0
   Hugepagesize:       2048 kB

From /etc/*release*/etc/*version*
   SuSE-release:
      SUSE Linux Enterprise Server 12 (x86_64)
      VERSION = 12
      PATCHLEVEL = 4
      # This file is deprecated and will be removed in a future service pack or release.
      # Please check /etc/os-release for details about this release.
```

(Continued on next page)
Huawei 2288H V5 (Intel Xeon Gold 6240R)

CPU2017 License: 6177
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SPECrate®2017_fp_base = 274
SPECrate®2017_fp_peak = 275

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

Platform Notes (Continued)

os-release:
NAME="SLES"
VERSION="12-SP4"
VERSION_ID="12.4"
PRETTY_NAME="SUSE Linux Enterprise Server 12 SP4"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12:sp4"

uname -a:
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:
CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: No status reported
CVE-2017-5754 (Meltdown): Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2017-5734 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Indirect Branch Restricted Speculation, IBPB, IBRS_FW

run-level 3 Jul 23 17:56
SPEC is set to: /spec2017

From /sys/devices/virtual/dmi/id
BIOS: INSYDE Corp. 6.83 06/29/2019
Vendor: Huawei
Product: 2288H V5
Product Family: Purley
Serial: Huawei

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)
Huawei

CPU: Huawei 2288H V5 (Intel Xeon Gold 6240R)

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Compiler Version Notes

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<tr>
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<tr>
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| 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. ifort: NOTE: The evaluation period for this product ends on 30-jul-2020 UTC. |

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| 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. ifort: NOTE: The evaluation period for this product ends on 30-jul-2020 UTC. |

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## Compiler Version Notes (Continued)

Fortran, C | 521.wrf_r (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.
ifort: NOTE: The evaluation period for this product ends on 30-jul-2020 UTC.
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.
icc: NOTE: The evaluation period for this product ends on 30-jul-2020 UTC.

---

## 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

(Continued on next page)


Huawei 2288H V5 (Intel Xeon Gold 6240R)

<table>
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<tr>
<th>SPECrate®2017_fp_base = 274</th>
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<td>SPECrate®2017_fp_peak = 275</td>
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CPU2017 License: 6177
Test Sponsor: China Academy of Information and Communications Technology
Test Date: Jul-2020
Hardware Availability: Feb-2020
Tested by: China Academy of Information and Communications Technology
Software Availability: Apr-2020

Base Portability Flags (Continued)

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 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
-funroll-loops -qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/ -ljemalloc

C++ benchmarks:
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefs -fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto
-mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-L/usr/local/jemalloc64-5.0.1/ -ljemalloc

Fortran benchmarks:
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
-fuse-ld=gold -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 -L/usr/local/jemalloc64-5.0.1/ -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-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
-align array32byte -auto -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/ -ljemalloc

(Continued on next page)
Huawei

SPEC CPU® 2017 Floating Point Rate Result
Copyright 2017-2020 Standard Performance Evaluation Corporation

Huawei 2288H V5 (Intel Xeon Gold 6240R)

SPECrate® 2017_fp_base = 274
SPECrate® 2017_fp_peak = 275

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<td>Tested by: China Academy of Information and Communications Technology</td>
<td>Software Availability: Apr-2020</td>
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</table>

Base Optimization Flags (Continued)

Benchmarks using both C and C++:
- m64 -qnextgen -std=c11
- W1, -plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -xCORE-AVX512 -Ofast -ffast-math -flto -mfpmath=sse
- funroll-loops -qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/
  -ljemalloc

Benchmarks using Fortran, C, and C++:
- m64 -qnextgen -std=c11
- W1, -plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs
- fuse-ld=gold -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
- align array32byte -auto -mbranches-within-32B-boundaries
- L/usr/local/jemalloc64-5.0.1/ -ljemalloc

Peak 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
Huawei 2288H V5 (Intel Xeon Gold 6240R)

SPEC CPU®2017 Floating Point Rate Result

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Huawei

Test Sponsor: China Academy of Information and Communications Technology

Tested by: China Academy of Information and Communications Technology

Test Date: Jul-2020

Hardware Availability: Feb-2020

Software Availability: Apr-2020

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: basepeak = yes

C++ benchmarks:

508.namd_r: basepeak = yes

510.parest_r: -m64 -qnextgen
- W1,-plugin-opt=-x86-branches-within-32B-boundaries
- W1,-z,muldefs -fuse-ld=gold -xCORE-AVX512 -Ofast
- ffast-math -flto -mfpmath=sse -funroll-loops
- qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/
- ljemalloc

Fortran benchmarks:

503.bwaves_r: -m64 -W1,-plugin-opt=-x86-branches-within-32B-boundaries
- W1,-z,muldefs -fuse-ld=gold -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
- L/usr/local/jemalloc64-5.0.1/ -ljemalloc

549.fotonik3d_r: basepeak = yes

554.roms_r: Same as 503.bwaves_r

Benchmarks using both Fortran and C:

521.wrf_r: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX512 -O3
-ipo -no-prec-div -qopt-prefetch -ffinite-math-only
- qopt-multiple-gather-scatter-by-shuffles

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

521.wrf_r (continued):
- qopt-mem-layout-trans=4  
- mbranches-within-32B-boundaries  
- nostandard-realloc-lhs  
- align array32byte -auto  
- L/usr/local/jemalloc64-5.0.1/ -ljemalloc

527.cam4_r: basepeak = yes

Benchmarks using both C and C++:

511.povray_r: -m64 -qnextgen -std=c11  
- Wl,-plugin-opt=-x86-branches-within-32B-boundaries  
- Wl,-z,muldefs -fuse-ld=gold -flto -xCORE-AVX512 -Ofast  
- qopt-mem-layout-trans=4 -L/usr/local/jemalloc64-5.0.1/ -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:
http://www.spec.org/cpu2017/flags/Intel-ic19.1u1-official-linux64_revB.xml  
http://www.spec.org/cpu2017/flags/CAICT-Platform-Settings-V1.0.2020-08-21.xml

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