## Hardware

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Name</td>
<td>Intel Xeon Platinum 8160</td>
</tr>
<tr>
<td>Max MHz.</td>
<td>3700</td>
</tr>
<tr>
<td>Nominal</td>
<td>2100</td>
</tr>
<tr>
<td>Enabled</td>
<td>48 cores, 2 chips, 2 threads/core</td>
</tr>
<tr>
<td>Orderable</td>
<td>1.2 chips</td>
</tr>
<tr>
<td>Cache L1</td>
<td>32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td>L2</td>
<td>1 MB I+D on chip per core</td>
</tr>
<tr>
<td>L3</td>
<td>33 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Other</td>
<td>None</td>
</tr>
<tr>
<td>Memory</td>
<td>384 GB (12 x 32 GB 2Rx4 PC4-2666V-R)</td>
</tr>
<tr>
<td>Storage</td>
<td>1 x 1200 GB SAS, 10000 RPM</td>
</tr>
<tr>
<td>Other</td>
<td>None</td>
</tr>
</tbody>
</table>

## Software

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS</td>
<td>Red Hat Enterprise Linux Server release 7.3 (Maipo) 3.10.0-693.11.6.el7.x86_64</td>
</tr>
<tr>
<td>Compiler</td>
<td>C/C++: Version 18.0.0.128 of Intel C/C++ Compiler for Linux; Fortran: Version 18.0.0.128 of Intel Fortran Compiler for Linux</td>
</tr>
<tr>
<td>Parallel</td>
<td>No</td>
</tr>
<tr>
<td>Firmware</td>
<td>Version 0.59 Released Feb-2018</td>
</tr>
<tr>
<td>File System</td>
<td>xfs</td>
</tr>
<tr>
<td>System State</td>
<td>Run level 3 (multi-user)</td>
</tr>
<tr>
<td>Base Pointers</td>
<td>64-bit</td>
</tr>
<tr>
<td>Peak Pointers</td>
<td>32/64-bit</td>
</tr>
<tr>
<td>Other</td>
<td>jemalloc: jemalloc memory allocator library V5.0.1;</td>
</tr>
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</table>
Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>96</td>
<td>886</td>
<td>173</td>
<td>889</td>
<td>172</td>
<td>895</td>
<td>171</td>
<td>96</td>
<td>720</td>
<td>212</td>
<td>724</td>
<td>211</td>
<td>723</td>
<td>211</td>
</tr>
<tr>
<td>502.gcc_r</td>
<td>96</td>
<td>715</td>
<td>190</td>
<td>719</td>
<td>189</td>
<td>723</td>
<td>188</td>
<td>96</td>
<td>592</td>
<td>230</td>
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<td>230</td>
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<td>230</td>
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<tr>
<td>505.mcf_r</td>
<td>96</td>
<td>581</td>
<td>267</td>
<td>596</td>
<td>260</td>
<td>603</td>
<td>257</td>
<td>96</td>
<td>581</td>
<td>267</td>
<td>596</td>
<td>260</td>
<td>603</td>
<td>257</td>
</tr>
<tr>
<td>520.omnetpp_r</td>
<td>96</td>
<td>885</td>
<td>142</td>
<td>886</td>
<td>142</td>
<td>926</td>
<td>136</td>
<td>96</td>
<td>885</td>
<td>142</td>
<td>886</td>
<td>142</td>
<td>926</td>
<td>136</td>
</tr>
<tr>
<td>523.xalancbmk_r</td>
<td>96</td>
<td>495</td>
<td>205</td>
<td>498</td>
<td>203</td>
<td>499</td>
<td>203</td>
<td>96</td>
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<td>250</td>
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<td>250</td>
<td>404</td>
<td>251</td>
</tr>
<tr>
<td>525.x264_r</td>
<td>96</td>
<td>368</td>
<td>456</td>
<td>372</td>
<td>452</td>
<td>370</td>
<td>454</td>
<td>96</td>
<td>350</td>
<td>481</td>
<td>355</td>
<td>474</td>
<td>356</td>
<td>472</td>
</tr>
<tr>
<td>531.deepsjeng_r</td>
<td>96</td>
<td>561</td>
<td>196</td>
<td>573</td>
<td>192</td>
<td>574</td>
<td>192</td>
<td>96</td>
<td>561</td>
<td>196</td>
<td>573</td>
<td>192</td>
<td>574</td>
<td>192</td>
</tr>
<tr>
<td>541.leela_r</td>
<td>96</td>
<td>832</td>
<td>191</td>
<td>848</td>
<td>187</td>
<td>855</td>
<td>186</td>
<td>96</td>
<td>837</td>
<td>190</td>
<td>842</td>
<td>189</td>
<td>839</td>
<td>189</td>
</tr>
<tr>
<td>548.exchange2_r</td>
<td>96</td>
<td>573</td>
<td>439</td>
<td>571</td>
<td>440</td>
<td>574</td>
<td>438</td>
<td>96</td>
<td>572</td>
<td>439</td>
<td>573</td>
<td>439</td>
<td>573</td>
<td>439</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>96</td>
<td>654</td>
<td>159</td>
<td>661</td>
<td>157</td>
<td>661</td>
<td>157</td>
<td>96</td>
<td>661</td>
<td>157</td>
<td>662</td>
<td>157</td>
<td>661</td>
<td>157</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"

General Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = "/spec/lib/ia32/:/spec/lib/intel64:/spec/je5.0.1-32:/spec/je5.0.1-64"

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM memory using Redhat Enterprise Linux 7.4
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>
jemalloc: configured and built at default for 32bit (i686) and 64bit (x86_64) targets;
jemalloc: built with the RedHat Enterprise 7.4, and the system compiler gcc 4.8.5;
jemalloc: sources available from jemalloc.net or

(Continued on next page)
Huawei
Huawei XH321 V5 (Intel Xeon Platinum 8160)

SPECrate2017_int_base = 221
SPECrate2017_int_peak = 236

CPU2017 License: 3175
Test Sponsor: Huawei
 Tested by: Huawei

Test Date: May-2018
Hardware Availability: Jul-2017
Software Availability: Jan-2018

General Notes (Continued)

Yes: 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.

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
ADDDC Sparing Set to Disabled
Sysinfo program /spec/bin/sysinfo
Rev: r5797 of 2017-06-14 96c45e4568ad54c135fd618bcc091c0f
running on localhost.localdomain Fri May 25 11:03:42 2018

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) Platinum 8160 CPU @ 2.10GHz
  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 8 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 8 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

(Continued on next page)
<table>
<thead>
<tr>
<th>SPEC CPU2017 Integer Rate Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huawei</td>
</tr>
<tr>
<td>Huawei XH321 V5 (Intel Xeon Platinum 8160)</td>
</tr>
<tr>
<td>SPECrate2017_int_base = 221</td>
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<tr>
<td>SPECrate2017_int_peak = 236</td>
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</table>

CPU2017 License: 3175
Test Sponsor: Huawei
Tested by: Huawei

<table>
<thead>
<tr>
<th>Platform Notes (Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU family: 6</td>
</tr>
<tr>
<td>Model: 85</td>
</tr>
<tr>
<td>Model name: Intel(R) Xeon(R) Platinum 8160 CPU @ 2.10GHz</td>
</tr>
<tr>
<td>Stepping: 4</td>
</tr>
<tr>
<td>CPU MHz: 2100.000</td>
</tr>
<tr>
<td>BogoMIPS: 4204.54</td>
</tr>
<tr>
<td>Virtualization: VT-x</td>
</tr>
<tr>
<td>L1d cache: 32K</td>
</tr>
<tr>
<td>L1i cache: 32K</td>
</tr>
<tr>
<td>L2 cache: 1024K</td>
</tr>
<tr>
<td>L3 cache: 33792K</td>
</tr>
<tr>
<td>NUMA node0 CPU(s): 0-2, 6-8, 12-14, 18-20, 48-50, 54-56, 60-62, 66-68</td>
</tr>
<tr>
<td>NUMA node1 CPU(s): 3-5, 9-11, 15-17, 21-23, 51-53, 57-59, 63-65, 69-71</td>
</tr>
<tr>
<td>NUMA node2 CPU(s): 24-26, 30-32, 36-38, 42-44, 72-74, 78-80, 84-86, 90-92</td>
</tr>
<tr>
<td>NUMA node3 CPU(s): 27-29, 33-35, 39-41, 45-47, 75-77, 81-83, 87-89, 93-95</td>
</tr>
</tbody>
</table>

/proc/cpuinfo cache data
  cache size: 33792 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 6 7 8 12 13 14 18 19 20 48 49 50 54 55 56 60 61 62 66 67 68
  node 0 size: 96437 MB
  node 0 free: 93108 MB
  node 1 cpus: 3 4 5 9 10 11 15 16 17 21 22 23 51 52 53 57 58 59 63 64 65 69 70 71
  node 1 size: 98304 MB
  node 1 free: 95881 MB
  node 2 cpus: 24 25 26 30 31 32 36 37 38 42 43 44 72 73 74 78 79 80 84 85 86 90 91 92
  node 2 size: 98304 MB
  node 2 free: 96024 MB
  node 3 cpus: 27 28 29 33 34 35 39 40 41 45 46 47 75 76 77 81 82 83 87 88 89 93 94 95
  node 3 size: 98304 MB
  node 3 free: 95944 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: 394174484 kB
  HugePages_Total: 0
  Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*

(Continued on next page)
Huawei
Huawei XH321 V5 (Intel Xeon Platinum 8160)

SPECrate2017_int_base = 221
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Platform Notes (Continued)

```
os-release:
    NAME="Red Hat Enterprise Linux Server"
    VERSION="7.3 (Maipo)"
    ID="rhel"
    ID_LIKE="fedora"
    VERSION_ID="7.3"
    PRETTY_NAME="Red Hat Enterprise Linux Server 7.3 (Maipo)"
    ANSI_COLOR="0;31"
    CPE_NAME="cpe:/o:redhat:enterprise_linux:7.3:GA:server"
redhat-release: Red Hat Enterprise Linux Server release 7.3 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.3 (Maipo)
```

```
uname -a:
Linux localhost.localdomain 3.10.0-693.11.6.el7.x86_64 #1 SMP Thu Dec 28 14:23:39 EST 2017 x86_64 x86_64 x86_64 GNU/Linux
run-level 3 May 25 10:24

SPEC is set to: /spec
```

```
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda8      xfs   325G   29G  297G   9% /
```

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.

BIOS INSYDE Corp. 0.59 02/24/2018
Memory:
4x NO DIMM NO DIMM
12x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666

(End of data from sysinfo program)

Compiler Version Notes

```
==============================================================================
CC  500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
    525.x264_r(base, peak) 557.xz_r(base, peak)
==============================================================================
icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.
==============================================================================
CC  500.perlbench_r(peak) 502.gcc_r(peak)
```
(Continued on next page)
Huawei
Huawei XH321 V5 (Intel Xeon Platinum 8160)

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CPU2017 License: 3175
Test Date: May-2018
Test Sponsor: Huawei
Hardware Availability: Jul-2017
Tested by: Huawei
Software Availability: Jan-2018

Compiler Version Notes (Continued)

icc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

CXXC 520.omnetpp_r(base) 523.xalancbmk_r(base) 531.deepsjeng_r(base)
541.leela_r(base)

icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

CXXC 520.omnetpp_r(peak) 523.xalancbmk_r(peak) 531.deepsjeng_r(peak)
541.leela_r(peak)

icpc (ICC) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

FC 548.exchange2_r(base, peak)

ifort (IFORT) 18.0.0 20170811
Copyright (C) 1985-2017 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icc
C++ benchmarks:
icpc
Fortran benchmarks:
ifort

Base Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64

(Continued on next page)
### SPEC CPU2017 Integer Rate Result

**Huawei**

Huawei XH321 V5 (Intel Xeon Platinum 8160)

<table>
<thead>
<tr>
<th>SPECrate2017_int_base</th>
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<tbody>
<tr>
<td>221</td>
<td>236</td>
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</table>

**CPU2017 License:** 3175  
**Test Sponsor:** Huawei  
**Tested by:** Huawei  
**Test Date:** May-2018  
**Hardware Availability:** Jul-2017  
**Software Availability:** Jan-2018

#### Base Portability Flags (Continued)

- 505.mcf_r: -DSPEC_LP64
- 520.omnetpp_r: -DSPEC_LP64
- 523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
- 525.x264_r: -DSPEC_LP64
- 531.deepsjeng_r: -DSPEC_LP64
- 541.leela_r: -DSPEC_LP64
- 548.exchange2_r: -DSPEC_LP64
- 557.xz_r: -DSPEC_LP64

#### Base Optimization Flags

**C benchmarks:**

- -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
- -qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

**C++ benchmarks:**

- -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
- -qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib -ljemalloc

**Fortran benchmarks:**

- -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
- -qopt-mem-layout-trans=3 -nostandard-realloc-lhs -align array32byte
- -L/usr/local/je5.0.1-64/lib -ljemalloc

#### Base Other Flags

**C benchmarks:**

- -m64 -std=c11

**C++ benchmarks:**

- -m64

**Fortran benchmarks:**

- -m64

#### Peak Compiler Invocation

**C benchmarks:**

- icc

(Continued on next page)
Huawei
Huawei XH321 V5 (Intel Xeon Platinum 8160)

**SPEC CPU2017 Integer Rate Result**

- **SPECrate2017_int_base** = 221
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**CPU2017 License:** 3175
**Test Sponsor:** Huawei
**Test Date:** May-2018
**Tested by:** Huawei
**Hardware Availability:** Jul-2017
**Software Availability:** Jan-2018

**Peak Compiler Invocation (Continued)**

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

**Peak Portability Flags**

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -D_FILE_OFFSET_BITS=64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

**Peak Optimization Flags**

C benchmarks:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
-fno-strict-overflow -L/usr/local/je5.0.1-64/lib
-ljemalloc

502.gcc_r: -L/opt/intel/compilers_and_libraries_2018/linux/lib/ia32
-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=3
-L/usr/local/je5.0.1-32/lib -ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -fno-alias
-L/usr/local/je5.0.1-64/lib -ljemalloc

557.xz_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=3 -L/usr/local/je5.0.1-64/lib
-ljemalloc

(Continued on next page)
Huawei

Huawei XH321 V5 (Intel Xeon Platinum 8160)

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CPU2017 License: 3175
Test Sponsor: Huawei
Test Date: May-2018
Tested by: Huawei
Hardware Availability: Jul-2017
Software Availability: Jan-2018

Peak Optimization Flags (Continued)

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbnk_r: -L/opt/intel Compilers_and_Libraries_2018/linux/lib/ia32
- W, - z, muldefs - prof-gen(pass 1) - prof-use(pass 2) - ipo
- xCORE-AVX512 - O3 - no-prec-div - qopt-mem-layout-trans=3
- L/usr/local/jc5.0.1-32/lib -ljemalloc

531.deepsjeng_r: basepeak = yes

541.leela_r: -Wl, -z, muldefs - prof-gen(pass 1) - prof-use(pass 2) - ipo
- xCORE-AVX512 - O3 - no-prec-div - qopt-mem-layout-trans=3
- L/usr/local/jc5.0.1-64/lib -ljemalloc

Fortran benchmarks:
- W, - z, muldefs - xCORE-AVX512 - ipo - O3 - no-prec-div
- qopt-mem-layout-trans=3 - nostandard-realloc-lhs - align array32byte
- L/usr/local/jc5.0.1-64/lib -ljemalloc

Peak Other Flags

C benchmarks (except as noted below):
- m64 - std=c11

502.gcc_r: -m32 - std=c11

C++ benchmarks (except as noted below):
- m64

523.xalancbnk_r: -m32

Fortran benchmarks:
- m64

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Intel IC18.0-official-linux64.html
<table>
<thead>
<tr>
<th>Huawei XH321 V5 (Intel Xeon Platinum 8160)</th>
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| CPU2017 License: 3175                  | Test Date: May-2018       |
| Test Sponsor: Huawei                   | Hardware Availability: Jul-2017 |
| Tested by: Huawei                      | Software Availability: Jan-2018 |

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

- http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

Tested with SPEC CPU2017 v1.0.2 on 2018-05-25 11:03:41-0400.
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