SPEC CPU®2017 Integer Speed Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen10 Plus
(2.90 GHz, Intel Xeon Gold 6326)

SPECspeed®2017_int_base = 11.5
SPECspeed®2017_int_peak = 11.8

CPU2017 License: 3
Test Sponsor: HPE
Tested by: HPE

<table>
<thead>
<tr>
<th>Test</th>
<th>Base</th>
<th>Peak</th>
<th>threads</th>
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</thead>
<tbody>
<tr>
<td>perlbench_s</td>
<td>6.48</td>
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<td>32</td>
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<tr>
<td>gcc_s</td>
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<td>11.0</td>
<td>32</td>
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<tr>
<td>mcf_s</td>
<td>13.3</td>
<td>17.4</td>
<td>32</td>
</tr>
<tr>
<td>omnetpp_s</td>
<td>10.1</td>
<td>16.7</td>
<td>32</td>
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<tr>
<td>xalancbmk_s</td>
<td>5.93</td>
<td>19.3</td>
<td>32</td>
</tr>
<tr>
<td>x264_s</td>
<td>13.3</td>
<td>22.1</td>
<td>32</td>
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<tr>
<td>xalancbmk_s</td>
<td>4.85</td>
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<tr>
<td>deepsjeng_s</td>
<td></td>
<td>17.4</td>
<td>32</td>
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<tr>
<td>leela_s</td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>exchange2_s</td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>xz_s</td>
<td></td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

Hardware
CPU Name: Intel Xeon Gold 6326
Max MHz: 3500
Nominal: 2900
Enabled: 32 cores, 2 chips
Orderable: 1, 2 chip(s)
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 1.25 MB I+D on chip per core
L3: 24 MB I+D on chip per chip
Other: None
Memory: 2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R)
Storage: 1 x 400 GB SAS SSD, RAID 0
Other: None

Software
OS: Red Hat Enterprise Linux 8.3 (Ootpa)
Kernel 4.18.0-240.el8.x86_64
Compiler: C/C++: Version 2021.1 of Intel oneAPI DPC++/C++
Fortran: Version 2021.1 of Intel Fortran Compiler
C/C++: Version 2021.1 of Intel C/C++ Compiler
Classic Build 20201112 for Linux
Parallel: Yes
Firmware: HPE BIOS Version U46 v1.42 05/16/2021 released May-2021
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
Power Management: BIOS set to prefer performance at the cost of additional power usage
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**SPECspeed®2017_int_base = 11.5**  
**SPECspeed®2017_int_peak = 11.8**

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<thead>
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<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<th>Ratio</th>
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</thead>
<tbody>
<tr>
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<td>620.omnetpp_s</td>
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<td>10.1</td>
<td>162</td>
<td>10.0</td>
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<td>10.1</td>
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<td>10.1</td>
<td>162</td>
<td>10.0</td>
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<td>13.3</td>
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<td>648.exchange2_s</td>
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<td>22.1</td>
<td>281</td>
<td>22.0</td>
<td>280</td>
<td>22.1</td>
</tr>
</tbody>
</table>

Operating System Notes

Stack size set to unlimited using "ulimit -s unlimited"
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
```

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
```
KMP_AFFINITY = "granularity=fine,scatter"
LD_LIBRARY_PATH = "/home/cpu2017_1.1.8/lib/intel64:/home/cpu2017_1.1.8/je5.0.1-64"
MALLOCONF = "retain:true"
OMP_STACKSIZE = "192M"
```

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE 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) 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

(Continued on next page)
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CPU2017 License: 3
Test Sponsor: HPE
Test Date: Jun-2021
Hardware Availability: Jun-2021
Tested by: HPE
Software Availability: Jun-2021

General Notes (Continued)

built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5

Submitted by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon Jun 21 10:21:12 EDT 2021
Submission: cpu2017-20210621-27546.sub

Platform Notes

The system ROM used for this result contains Intel microcode version 0xd0002a0 for
the Intel Xeon Gold 6326 processor.
BIOS Configuration:
Workload Profile set to General Peak Frequency Compute
Intel Hyper-Threading set to Disabled
Thermal Configuration set to Maximum Cooling
Memory Patrol Scrubbing set to Disabled
Advanced Memory Protection set to Advanced ECC
Last Level Cache (LLC) Prefetch set to Enabled
Last Level Cache (LLC) Dead Line Allocation set to Disabled
Enhanced Processor Performance set to Enabled
Workload Profile set to Custom
Energy/Performance Bias set to Balanced Power
DCU Stream Prefetcher set to Disabled
Adjacent Sector Prefetch set to Disabled
Minimum Processor Idle Power Package C-State set to No Package State
Numa Group Size Optimization set to Flat

Sysinfo program /home/cpu2017_1.1.8/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acac46d
running on localhost.localdomain Tue Jun  8 10:33:25 2021

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 6326 CPU @ 2.90GHz
  2 "physical id"'s (chips)
  32 "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 : 16
siblings : 16
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

(Continued on next page)
Platform Notes (Continued)

From lscpu from util-linux 2.32.1:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 1
Core(s) per socket: 16
Socket(s): 2
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Gold 6326 CPU @ 2.90GHz
Stepping: 6
CPU MHz: 800.357
BogoMIPS: 5800.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 24576K
NUMA node0 CPU(s): 0-15
NUMA node1 CPU(s): 16-31
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 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
xtrn pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsane
avx f16c rdrand lahf_lm abm 3dnowprefetch cpuid_fault epb cat_13 invpcid_single ssbd
mba ibrs intel ibrd i bres enhanced tpr_shadow vni flexpriority ept vpid ept_ad
fsbbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid cqm rdt_a avx512f avx512dq
rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw
avx512vl xsaveopt xsaveprec xsaveopt xsaveopt mmcp xge tpm2 xsave cqm llc cqm_occov llc cqm_mbb_total
cqm_mbb_local split_lock_detect wbinvd dtherm ida arat pin pts avx512vmbi umip pku
ospe avx512_vbmi2 gfnl vaes vpc1mulqdq avx512_vnni avx512_bitalg tme
avx512_vpopcntdq la57 rdpid md_clear pconfug flush_lld arch_capabilities

/proc/cpuinfo cache data
cache size: 24576 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 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
node 0 size: 1002033 MB
node 0 free: 1031375 MB

(Continued on next page)
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Platform Notes (Continued)

node 1 cpus: 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
node 1 size: 1004107 MB
node 1 free: 1031380 MB
node distances:
node 0 1
 0:  10  20
 1:  20  10

From /proc/meminfo
 MemTotal:        2113495792 kB
 HugePages_Total:       0
 Hugepagesize:       2048 kB

/sbin/tuned-adm active
 Current active profile: throughput-performance

From /etc/*release* /etc/*version*
 os-release:
  NAME="Red Hat Enterprise Linux"
  VERSION="8.3 (Ootpa)"
  ID="rheil"
  ID_LIKE="fedora"
  VERSION_ID="8.3"
  PLATFORM_ID="platform:el8"
  PRETTY_NAME="Red Hat Enterprise Linux 8.3 (Ootpa)"
  ANSI_COLOR="0;31"
redhat-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release: Red Hat Enterprise Linux release 8.3 (Ootpa)
system-release-cpe: cpe:/o:redhat:enterprise_linux:8.3:ga
uname -a:
 Linux localhost.localdomain 4.18.0-240.el8.x86_64 #1 SMP Wed Sep 23 05:13:10 EDT 2020
 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): Mitigation: Speculative Store Bypass disabled via prctl and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swapsgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Enhanced IBRS, IBPB:
CVE-2017-5715 (Spectre variant 2):
**Platform Notes (Continued)**

conditional, RSB filling

CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Jun 8 10:32

SPEC is set to: /home/cpu2017_1.1.8

<table>
<thead>
<tr>
<th>Filesystem</th>
<th>Type</th>
<th>Size</th>
<th>Used</th>
<th>Avail</th>
<th>Use%</th>
<th>Mounted on</th>
</tr>
</thead>
<tbody>
<tr>
<td>/dev/mapper/rhel00-home</td>
<td>xfs</td>
<td>372G</td>
<td>216G</td>
<td>157G</td>
<td>58%</td>
<td>/home</td>
</tr>
</tbody>
</table>

From /sys/devices/virtual/dmi/id
Vendor:         HPE
Product:        ProLiant DL360 Gen10 Plus
Product Family: ProLiant
Serial:         CN701108CQ

Additional information from dmidecode 3.2 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:
32x Micron 36ASF8G72PZ-3G2B2 64 GB 2 rank 3200

BIOS:
BIOS Vendor:       HPE
BIOS Version:      U46
BIOS Date:         05/16/2021
BIOS Revision:     1.42
Firmware Revision: 2.42

(End of data from sysinfo program)

**Compiler Version Notes**

==============================================================================
C       | 600.perlbench_s(peak)
==============================================================================
Intel(R) C Intel(R) 64 Compiler Classic for applications running on Intel(R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
                        625.x264_s(base, peak) 657.xz_s(base, peak)
==============================================================================

(Continued on next page)
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Compiler Version Notes (Continued)

Intel (R) oneAPI DPC++/C++ Compiler for applications running on Intel (R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
C       | 600.perlbench_s(peak)
------------------------------------------------------------------------------

Intel (R) C Intel (R) 64 Compiler Classic for applications running on Intel (R) 64,
Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
C       | 600.perlbench_s(base) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
        | 625.x264_s(base, peak) 657.xz_s(base, peak)
------------------------------------------------------------------------------

Intel (R) oneAPI DPC++/C++ Compiler for applications running on Intel (R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
C++      | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak)
        | 631.deepsjeng_s(base, peak) 641.leela_s(base, peak)
------------------------------------------------------------------------------

Intel (R) oneAPI DPC++/C++ Compiler for applications running on Intel (R) 64,
Version 2021.1 Build 20201113
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

------------------------------------------------------------------------------
Fortran  | 648.exchange2_s(base, peak)
------------------------------------------------------------------------------

Intel (R) Fortran Intel (R) 64 Compiler Classic for applications running on
Intel (R) 64, Version 2021.1 Build 20201112_000000
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

(Continued on next page)
Base Compiler Invocation (Continued)

Fortran benchmarks:
ifort

Base Portability Flags

600.perlbench_s: -DSPEC_LP64 -DSPEC_LINUX_X64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LP64 -DSPEC_LINUX
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-DSPEC_OPENMP -std=c11 -m64 -fioopenmp -Wl,-z,muldefs -xCORE-AVX512
-O3 -ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

C++ benchmarks:
-DSPEC_OPENMP -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin/
-lqkmalloc

Fortran benchmarks:
-m64 -xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-boundaries
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Tested by: HPE

Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021

Peak Compiler Invocation

C benchmarks (except as noted below):
  icx

600.perlbench_s: icc

C++ benchmarks:
  icpx

Fortran benchmarks:
  ifort

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

600.perlbench_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
  -xCORE-AVX512 -ipo -O3 -no-prec-div
  -qopt-mem-layout-trans=4 -fno-strict-overflow
  -mbranches-within-32B-boundaries
  -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

602.gcc_s: -m64 -std=c11 -Wl,-z,muldefs -fprofile-generate(pass 1)
  -fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto
  -Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4
  -mbranches-within-32B-boundaries
  -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

605.mcf_s: basepeak = yes

625.x264_s: -DSPEC_OPENMP -fiopenmp -std=c11 -m64 -Wl,-z,muldefs
  -xCORE-AVX512 -flto -O3 -ffast-math
  -qopt-mem-layout-trans=4 -fno-alias
  -mbranches-within-32B-boundaries
  -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

657.xz_s: basepeak = yes

(Continued on next page)
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### CPU2017 License: 3

**Test Sponsor:** HPE

**Test Date:** Jun-2021

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**Hardware Availability:** Jun-2021

**Software Availability:** Jun-2021

### SPECspeed®2017_int_base = 11.5

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---

### Peak Optimization Flags (Continued)

**C++ benchmarks:**

- 620.omnetpp_s: basepeak = yes
- 623.xalancbmk_s: basepeak = yes
- 631.deepsjeng_s: basepeak = yes
- 641.leela_s: basepeak = yes

**Fortran benchmarks:**

- 648.exchange2_s: basepeak = yes

---

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

- http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.html

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

- http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-V1.0-ICX-revC.xml

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