SPEC CPU®2017 Integer Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL360 Gen10 Plus
(2.10 GHz, Intel Xeon Silver 4310)

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

SPECrate®2017_int_base = 168
SPECrate®2017_int_peak = 174

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(2.10 GHz, Intel Xeon Silver 4310)

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

500.perlbench_r 48
502.gcc_r 48
505.mcf_r 48
520.omnetpp_r 48
523.xalancbmk_r 48
525.x264_r 48
531.deepsjeng_r 48
541.leela_r 48
548.exchange2_r 48
557.xz_r 48

Hardware

CPU Name: Intel Xeon Silver 4310
Max MHz: 3300
Nominal: 2100
Enabled: 24 cores, 2 chips, 2 threads/core
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: 18 MB I+D on chip per chip
Other: None
Memory: 2 TB (32 x 64 GB 2Rx4 PC4-3200AA-R, running at 2666)
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++
              Compiler Build 20201113 for Linux;
              Fortran: Version 2021.1 of Intel Fortran Compiler
              Classic Build 20201112 for Linux;
              C/C++: Version 2021.1 of Intel C/C++ Compiler
              Classic Build 20201112 for Linux
Parallel: No
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: 32/64-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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(2.10 GHz, Intel Xeon Silver 4310)

---

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

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### Results Table

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<td>93.6</td>
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</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"  
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:  
`LD_LIBRARY_PATH = 
"/home/cpu2017_1.1.8/lib/intel64:/home/cpu2017_1.1.8/lib/ia32:/home/cpu2017_1.1.8/jd5.0.1-32"
MALLOCP_CONF = "retain:true"

## General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Red Hat Enterprise Linux 8.1
runcpu command invoked through numactl i.e.:

---

(Continued on next page)
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GENERAL NOTES

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.

Submitted by: "Bhatnagar, Prateek" <prateek.bhatnagar@hpe.com>
Submitted: Mon Jun 21 10:35:38 EDT 2021
Submission: cpu2017-20210621-27596.sub

PLATFORM NOTES

The system ROM used for this result contains Intel microcode version 0xd0002a0 for the Intel Xeon Silver 4310 processor.

BIOS Configuration:
- Workload Profile set to General Throughput Compute
- Memory Patrol Scrubbing set to Disabled
- Advanced Memory Protection set to Advanced ECC
- XPT Remote Prefetcher set to Enabled
- Last Level Cache (LLC) Dead Line Allocation set to Disabled
- Enhanced Processor Performance set to Enabled
- Enhanced Processor Performance Profile set to Aggressive
- Thermal Configuration set to Maximum Cooling
- Intel UPI Link Frequency set to Minimum
- Intel UPI Link Enablement set to Single Link
- D2K set to Disabled
- Workload Profile set to Custom
  - DCU Stream Prefetcher set to Disabled
  - Energy Efficient Turbo set to Enabled
  - Adjacent Sector Prefetcher set to Disabled
  - Intel UPI Link Power Management set to Enabled

Sysinfo program /home/cpu2017_1.1.8/bin/sysinfo
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d
running on localhost.localdomain Sat Jun 19 17:01:33 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

(Continued on next page)
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Test Date: Jun-2021
Hardware Availability: Jun-2021
Software Availability: Jun-2021

Platform Notes (Continued)

model name : Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz
2 "physical id"s (chips)
48 "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 : 12
siblings : 24
physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11
physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11

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): 48
On-line CPU(s) list: 0-47
Thread(s) per core: 2
Core(s) per socket: 12
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 106
Model name: Intel(R) Xeon(R) Silver 4310 CPU @ 2.10GHz
Stepping: 6
CPU MHz: 1051.114
BogoMIPS: 4200.00
Virtualization: VT-x
L1d cache: 48K
L1i cache: 32K
L2 cache: 1280K
L3 cache: 18432K
NUMA node0 CPU(s): 0-5,24-29
NUMA node1 CPU(s): 6-11,30-35
NUMA node2 CPU(s): 12-17,36-41
NUMA node3 CPU(s): 18-23,42-47
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 pdpte1gb rdtscp
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperffmapref pni pclmulqdq dtst64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtrm 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_13 invpcid_single ssbd
mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vmni flexpriority ept vpid ept_ad
fssecure tsc_adjust bmi1 hle avx2 smep bmi2 ets invpcid cmc rdt_a avx512f avx512dq
rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512cd sha ni avx512bw
avx512vl xsaveopt xsavec xgetbv1 xsaveas cmc_llc cmc_occcllcm cmc_mbm_total
cmc_mbm_local split_lock detect wbnoinv dtherm ida arat pin pts avx512vbmi umip pk

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**Platform Notes (Continued)**

ospke avx512_vbmi2 gfni vaes vpclmulqdq avx512_vnni avx512_bitalg tme  
avx512_vpopcntdq la57 rdpid md_clear pconfig flush_l1d arch_capabilities

```
/proc/cpuinfo cache data
  cache size: 18432 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 24 25 26 27 28 29
  node 0 size: 510347 MB
  node 0 free: 515390 MB
  node 1 cpus: 6 7 8 9 10 11 30 31 32 33 34 35
  node 1 size: 510698 MB
  node 1 free: 515810 MB
  node 2 cpus: 12 13 14 15 16 17 36 37 38 39 40 41
  node 2 size: 510852 MB
  node 2 free: 515761 MB
  node 3 cpus: 18 19 20 21 22 23 42 43 44 45 46 47
  node 3 size: 510888 MB
  node 3 free: 515687 MB
  node distances:
    node 0 1 2 3
    0: 10  20  30  30
    1: 20  10  30  30
    2: 30  30  10  20
    3: 30  30  20  10

From /proc/meminfo
  MemTotal: 2113491664 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="rhel"
    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)

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Test Sponsor: HPE
Tested by: HPE

Platform Notes (Continued)

```
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 prct1 and seccomp
CVE-2018-3639 (Speculative Store Bypass): Mitigation: usercopy/swappgs barriers and __user pointer sanitization
CVE-2017-5753 (Spectre variant 1): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2017-5715 (Spectre variant 2): Not affected
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
CVE-2019-11135 (TSX Asynchronous Abort): Not affected

run-level 3 Jun 19 17:00

SPEC is set to: /home/cpu2017_1.1.8
Filesystem Type Size Used Avail Use% Mounted on
/dev/mapper/rhel00-home xfs 372G 219G 153G 59% /home

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, configured at 2666

BIOS:
    BIOS Vendor: HPE
    BIOS Version: U46
    BIOS Date: 05/16/2021
```
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**Software Availability:** Jun-2021

### Platform Notes (Continued)

- BIOS Revision: 1.42  
- Firmware Revision: 2.42

(End of data from sysinfo program)

### Compiler Version Notes

```
 Celtics | 500.perlbench_r(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.
```

```
 Celtics | 502.gcc_r(peak)

 Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version  
 2021.1 Build 20201113  
 Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
```

```
 Celtics | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)  
 | 525.x264_r(base, peak) 557.xz_r(base, peak)

 Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64,  
 Version 2021.1 Build 20201113  
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2021.1 Build 20201113
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| C++ | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) | 531.deepsjeng_r(base, peak) 541.leela_r(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 | 548.exchange2_r(base, peak) |
---

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**Compiler Version Notes (Continued)**

```
------------------------------------------------------------------------------
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  
Fortran benchmarks:  
ifort

**Base Portability Flags**

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64  
502.gcc_r: -DSPEC_LP64  
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:  
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math  
-flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4  
-mbraches-within-32B-boundaries  
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin  
-lqkmalloc

C++ benchmarks:  
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto

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

Hewlett Packard Enterprise

ProLiant DL360 Gen10 Plus

(2.10 GHz, Intel Xeon Silver 4310)

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SPECrate®2017_int_base = 168

SPECrate®2017_int_peak = 174

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

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

Base Optimization Flags (Continued)

C++ benchmarks (continued):
-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:
-w -m64 -Wl,-z,muldefs -xCORE-AVX512 -O3 -ipo -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-auto -mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

Peak Compiler Invocation

C benchmarks (except as noted below):

icx

500.perlbench_r: icc

C++ benchmarks:

icpx

Fortran benchmarks:

ifort

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
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
SPEC CPU®2017 Integer Rate Result

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Peak Optimization Flags

C benchmarks:

500.perlbench_r: -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/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

502.gcc_r: -m32
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/ia32_lin
-std=gnu89 -Wl,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -f1to
-Ofast(pass 1) -O3 -ffast-math -qopt-mem-layout-trans=4
-mbranches-within-32B-boundaries
-L/usr/local/jemalloc32-5.0.1/lib -ljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX512 -f1to
-O3 -ffast-math -qopt-mem-layout-trans=4 -fno-alias
-mbranches-within-32B-boundaries
-L/opt/intel/oneapi/compiler/2021.1.1/linux/compiler/lib/intel64_lin
-lqkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: basepeak = yes

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: 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
### SPEC CPU®2017 Integer Rate Result

**Hewlett Packard Enterprise**  
(Test Sponsor: HPE)  
**ProLiant DL360 Gen10 Plus**  
(2.10 GHz, Intel Xeon Silver 4310)

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

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