SPEC CPU®2017 Integer Rate Result

Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL380 Gen11
(2.00 Ghz, Intel Xeon Silver 4514Y)

SPECrater®2017_int_base = 267
SPECrater®2017_int_peak = 274

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

Hardware
CPU Name: Intel Xeon Silver 4514Y
Max MHz: 3400
Nominal: 2000
Enabled: 32 cores, 2 chips, 2 threads/core
Orderable: 1, 2 chip(s)
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 2 MB I+D on chip per core
L3: 30 MB I+D on chip per chip
Other: None
Memory: 512 GB (16 x 32 GB 2Rx8 PC5-5600B-R, running at 4400)
Storage: 1 x 3.2 TB NVMe SSD
Other: CPU Cooling: Air

Software
OS: SUSE Linux Enterprise Server 15 SP5
Kernel: 5.14.21-150500.53-default
Compiler: C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++ Compiler for Linux;
Fortran: Version 2023.2.3 of Intel Fortran Compiler for Linux;
Parallel: No
Firmware: HPE BIOS Version v2.12 12/13/2023 released Dec-2023
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 and OS set to prefer performance at the cost of additional power usage
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Tested by: HPE

Test Date: Mar-2024
Hardware Availability: Feb-2024
Software Availability: Dec-2023

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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:
exec > /proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.: runcpu --interleave=all runcpu <etc>
tuned-adm profile was set to throughput-performance using "tuned-adm profile throughput-performance"

Environment Variables Notes

Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH = */home/cpu2017/lib/intel64:/home/cpu2017/lib/ia32:/home/cpu2017/je5.0.1-32"
MALLOC_CONF = "retain:true"

General Notes

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM
memory using Red Hat Enterprise Linux 8.4
runcpu command invoked through numactl i.e.: runcpu --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)
General Notes (Continued)

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:
Workload Profile set to General Throughput Compute
Thermal Configuration set to Maximum Cooling
Memory Patrol Scrubbing set to Disabled
Enhanced Processor Performance Profile set to Aggressive
Last Level Cache (LLC) Dead Line Allocation set to Disabled
Workload Profile set to Custom
Adjacent Sector Prefetch set to Disabled
DCU Stream Prefetcher set to Disabled
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Tue Mar 19 01:37:21 2024
SUT (System Under Test) info as seen by some common utilities.

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---------------------------------------------
1. uname –a
Linux localhost 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043)
x86_64 x86_64 x86_64 GNU/Linux

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Platform Notes (Continued)

2. w
01:37:21 up 0 min, 0 users, load average: 0.14, 0.05, 0.02
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT

--------------------------------------------
3. Username
From environment variable $USER: root

--------------------------------------------
4. ulimit -a
  core file size (blocks, -c) unlimited
  data seg size (kbytes, -d) unlimited
  scheduling priority (--e) 0
  file size (blocks, -f) unlimited
  pending signals (--l) 2062776
  max locked memory (kbytes, -l) 64
  max memory size (kbytes, -m) unlimited
  open files (--n) 1024
  pipe size (512 bytes, -p) 8
  POSIX message queues (Bytes, -q) 819200
  real-time priority (--r) 0
  stack size (kbytes, -s) unlimited
  cpu time (seconds, -t) unlimited
  max user processes (--u) 2062776
  virtual memory (kbytes, -v) unlimited
  file locks (--x) unlimited

--------------------------------------------
5. sysinfo process ancestry
/usr/lib/systemd/systemd --switched-root --system --deserialize 29
sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups
sshd: root@notty
bash -c cd $SPEC/ && $SPEC/intrateTP.sh
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=64 -c
ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=32 --define physicalfirst
--define invoke_with_interleave --define drop_caches --tune base,peak --o all intrate
runcpu --nobuild --action validate --define default-platform-flags --define numcopies=64 --configfile
ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=32 --define physicalfirst
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--define invoke_with_interleave --define drop_caches --tune base,peak --o all intrate
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017

--------------------------------------------
6. /proc/cpuinfo
  model name: INTEL(R) XEON(R) SILVER 4514Y
  vendor_id: GenuineIntel
  cpu family: 6
  model: 207
  stepping: 2
  microcode: 0x21000200
  bugs: spectre_v1 spectre_v2 spec_store_bypass swappgs eiibrsb_pbrsb
  cpu cores: 16
  siblings: 32
  2 physical ids (chips)
  64 processors (hardware threads)
  physical id 0: core ids 0-15
  physical id 1: core ids 0-15
  physical id 0: apicids 0-31

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Platform Notes (Continued)

physical id 1: apicid 128-159
Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for virtualized systems. Use the above data carefully.

7. lscpu

From lscpu from util-linux 2.37.4:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Address sizes: 46 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 64
On-line CPU(s) list: 0-63
Vendor ID: GenuineIntel
Model name: INTEL(R) XEON(R) SILVER 4514Y
CPU family: 6
Model: 207
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 2
Stepping: 2
BogoMIPS: 4000.00
Flags:

Virtualization:
L1d cache: 1.5 MiB (32 instances)
L1i cache: 1 MiB (32 instances)
L2 cache: 64 MiB (32 instances)
L3 cache: 60 MiB (2 instances)
NUMA node(s): 4
NUMA node0 CPU(s): 0-7,32-39
NUMA node1 CPU(s): 8-15,40-47
NUMA node2 CPU(s): 16-23,48-55
NUMA node3 CPU(s): 24-31,56-63
Vulnerability Itlb multihit: Not affected
Vulnerability l1tlf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spectre store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usecopy/swappgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling, PBRSB-eIBRS SW sequence

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Platform Notes (Continued)
Vulnerability Srbds: Not affected
Vulnerability Tax async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 48K 1.5M 12 Data 1 64 1 64
L1i 32K 1M 8 Instruction 1 64 1 64
L2  2M 64M 16 Unified  2 2048 1 64
L3  30M 60M 15 Unified  3 32768 1 64

--------------------------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
   available: 4 nodes (0-3)
   node 0 cpus: 0-7,32-39
   node 0 size: 128712 MB
   node 0 free: 127873 MB
   node 1 cpus: 8-15,40-47
   node 1 size: 128985 MB
   node 1 free: 128607 MB
   node 2 cpus: 16-23,48-55
   node 2 size: 129019 MB
   node 2 free: 128211 MB
   node 3 cpus: 24-31,56-63
   node 3 size: 128999 MB
   node 3 free: 128501 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

--------------------------------------------
9. /proc/meminfo
   MemTotal:       528094352 kB

--------------------------------------------
10. who -r
    run-level 3 Mar 19 01:36

--------------------------------------------
11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
   Default Target Status
   multi-user running

--------------------------------------------
12. Services, from systemctl list-unit-files
   STATE UNIT FILES
   enabled apparmor auditd cron getty@ irqbalance issue-generator kbdsettings nvmefc-boot-connections
           postfix purge-kernels rollback sshd systemd-pstore wicked wickedd-auto4 wickedd-dhcp4
           wickedd-dhcp6 wickedd-nanny
   enabled-runtime systemd-remount-fs
   disabled boot-sysctl ca-certificates chrony-wait chronyd console-getty debug-shell grub2-once
           haveged haveged-switch-root issue-add-ssh-keys kexec-load nvmf-autoconnect rpmconfigcheck
           serial-getty@ systemd-boot-boot-check-no-failures systemd-network-generator systemd-sysext
           systemd-time-wait-sync systemd-timesyncd tuned
           wickedd

(Continued on next page)
Platform Notes (Continued)

13. Linux kernel boot-time arguments, from /proc/cmdline
   BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default
   root=UUID=a806a23c-58ee-4027-a60d-04b4da1323d6
   resume=/dev/disk/by-uuid/ebbabfc7-d0cb-4aac-aeed-3d2c035d5d16
   mitigations=auto
   quiet
   security=apparmor

------------------------------------------------------------
14. cpupower frequency-info
    analyzing CPU 0:
    Unable to determine current policy
    boost state support:
    Supported: yes
    Active: yes

------------------------------------------------------------
15. tuned-adm active
    Current active profile: throughput-performance

------------------------------------------------------------
16. sysctl
   kernel numa_balancing               1
   kernel randomize va space            2
   vm compaction proactiveness           20
   vm dirty_background bytes            0
   vm dirty background ratio             10
   vm dirty bytes                        0
   vm dirty_expire_centisecs             3000
   vm dirty ratio                        20
   vm dirty writeback_centisecs          500
   vm dirtytime expire seconds           43200
   vm extrfrag_threshold                 500
   vm min unmapped_ratio                 1
   vm nrhugepages                        0
   vm nr hugepages mempolicy             0
   vm nr overcommit hugepages            0
   vm swappiness                         10
   vm watermark boost_factor             15000
   vm watermark scale_factor             10
   vm zone reclaim mode                  0

------------------------------------------------------------
17. /sys/kernel/mm/transparent_hugepage
    defrag always defer defer madvise [madvise] never
    enabled [always] madvise never
    hpage pmd size 2097152
    shmem enabled always within size advise [never] deny force

------------------------------------------------------------
18. /sys/kernel/mm/transparent_hugepage/khugepaged
    alloc sleep milliseconds 60000
    defrag 1
    max ptes none 511
    max ptes shared 256
    max ptes swap 64
    pages to scan 4096
    scan sleep milliseconds 10000

(Continued on next page)
Platform Notes (Continued)

19. OS release
   From /etc/*-release /etc/*-version
   os-release SUSE Linux Enterprise Server 15 SP5

20. Disk information
   SPEC is set to: /home/cpu2017
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/nvme0n1p3  xfs   2.5T  130G  2.3T   6% /home

21. /sys/devices/virtual/dmi/id
   Vendor:         HPE
   Product:        ProLiant DL380 Gen11
   Product Family: ProLiant
   Serial:         CNX210000G3

22. dmidecode
   Additional information from dmidecode 3.4 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:
   16x Hynix HMCG88AGBRA193N 32 GB 2 rank 5600, configured at 4400

23. BIOS
   (This section combines info from /sys/devices and dmidecode.)
   BIOS Vendor:       HPE
   BIOS Version:      2.12
   BIOS Date:         12/13/2023
   BIOS Revision:     2.12
   Firmware Revision: 1.52

Compiler Version Notes

C | 502.gcc_r(peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

C | 500.perlbench_r(base, peak) 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 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

C | 502.gcc_r(peak)

Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x
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Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

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Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
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Base Compiler Invocation

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

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
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**Base Optimization Flags**

C benchmarks:
- `w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math`  
- `flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`  
- `L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin`  
- `lqkmalloc`

C++ benchmarks:
- `w -std=c++14 -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math`  
- `flto -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`  
- `L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin`  
- `lqkmalloc`

Fortran benchmarks:
- `w -m64 -Wl,-z,muldefs -xsapphirerapids -O3 -ffast-math -flto`  
- `mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4`  
- `nostandard-realloc-lhs -align array32byte -auto`  
- `L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin`  
- `lqkmalloc`

**Peak Compiler Invocation**

C benchmarks:  
`icx`

C++ benchmarks:  
`icpx`

Fortran benchmarks:  
`ifx`

**Peak Portability Flags**

500.perlibench_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

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</tr>
</tbody>
</table>

**SPECrate®2017_int_base = 267**

**SPECrate®2017_int_peak = 274**

Peak Portability Flags (Continued)

557.xz_r: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -w -std=c11 -m64 -Wl,-z,muldefs
-ffp-profile-generate(pass 1)
-ffp-profile-use=default.profdata(pass 2) -xcORE-AVX2(pass 1)
-flto -Ofast -xcORE-AVX512 -ffast-math -mfpmath=sse
-ffunroll-loops -qopt-mem-layout-trans=4
-ffno-strict-overflow
-ff-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-fflqkmalloc

502.gcc_r: -m32
-ff-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/ia32_lin
-ff-std-gnu89 -Wl,-z,muldefs -ffp-profile-generate(pass 1)
-ffp-profile-use=default.profdata(pass 2) -xcORE-AVX2(pass 1)
-flto -Ofast -xcORE-AVX512 -ffast-math -mfpmath=sse
-ffrunroll-loops -qopt-mem-layout-trans=4
-ff-L/usr/local/jemalloc32-5.0.1/lib -fljemalloc

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -ffunroll-loops
-ffqopt-mem-layout-trans=4 -ffno-alias
-ff-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-fflqkmalloc

557.xz_r: basepeak = yes

C++ benchmarks:

520.omnetpp_r: basepeak = yes

523.xalancbnk_r: basepeak = yes

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

(Continued on next page)
Hewlett Packard Enterprise  
(Test Sponsor: HPE)  
ProLiant DL380 Gen11  
(2.00 Ghz, Intel Xeon Silver 4514Y)  

| SPECrate\textsuperscript{\textregistered}2017\textunderscore int\_base = 267 |
| SPECrate\textsuperscript{\textregistered}2017\textunderscore int\_peak = 274 |

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

Test Date: Mar-2024  
Hardware Availability: Feb-2024  
Software Availability: Dec-2023

Peak Optimization Flags (Continued)

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/Intel-ic2023p2-official-linux64.html  
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.html

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

http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml  
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-EMR-rev1.0.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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