Hewlett Packard Enterprise
(Test Sponsor: HPE)
ProLiant DL20 Gen11
(2.80 GHz, Intel Xeon E-2478)

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HPE

SPECrate®2017_int_base = 97.6
SPECrate®2017_int_peak = 102

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

Test Date: Jan-2024
Hardware Availability: Dec-2023

Software
OS: SUSE Linux Enterprise Server 15 SP4
Kernel 5.14.21-150400.22-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 v1.44 01/04/2024 released Jan-2024
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

Hardware
CPU Name: Intel Xeon E-2478
Max MHz: 5200
Nominal: 2800
Enabled: 8 cores, 1 chip, 2 threads/core
Orderable: 1 Chip
Cache L1: 32 KB I + 48 KB D on chip per core
L2: 2 MB I+D on chip per core
L3: 24 MB I+D on chip per chip
Other: None
Memory: 64 GB (2 x 32 GB 2Rx8 PC5-5600B-E, running at 4400), orderable using HPE part# P64339-B21
Storage: 1 x 480 GB SATA SSD
Other: None

SPECrate®2017_int_base (97.6)
SPECrate®2017_int_peak (102)

500.perlbench_r
502.gcc_r
505.mcf_r
520.omnetpp_r
523.xalancbmk_r
525.x264_r
531.deepsjeng_r
541.leela_r
548.exchange2_r
557.xz_r
**SPEC CPU®2017 Integer Rate Result**

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**Results Table**

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<td>365</td>
<td>47.3</td>
<td>370</td>
<td>46.7</td>
</tr>
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</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`
- Tuned service was stopped using "systemctl stop tuned"

**Environment Variables Notes**

- Environment variables set by runcpu before the start of the run:
  - `LD_LIBRARY_PATH = "/home/cpu2017_new/lib/intel64:/home/cpu2017_new/lib/ia32:/home/cpu2017_new/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
- 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

(Continued on next page)
General Notes (Continued)


Platform Notes

The system ROM used for this result contains Intel microcode version 0x121 for
the Intel Xeon E-2478 processor.

BIOS Configuration:

Sysinfo program /home/cpu2017_new/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c6ae2c92c097bec197
running on localhost Wed Jan 17 00:01:30 2024

SUT (System Under Test) info as seen by some common utilities.

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23. BIOS

1. uname -a
Linux localhost 5.14.21-150400.22-default #1 SMP PREEMPT_DYNAMIC Wed May 11 06:57:18 UTC 2022 (49db222/lp)
x86_64 x86_64 x86_64 GNU/Linux

2. w
00:01:30 up 2 min, 2 users, load average: 0.02, 0.02, 0.00
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT
root tty1 -- 00:00 1:22 0.00s 0.00s -bash
root pts/0 172.16.0.100 00:00 9.00s 0.64s 0.00s -bash

3. Username
From environment variable $USER: root
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Platform Notes (Continued)

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   (-i) 256720
   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) 256720
   virtual memory   (kbytes, -v) unlimited
   file locks   (-x) unlimited

4. ulimit -a
   core file size   (blocks, -c) unlimited
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   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@pts/0
-rbash
bash
runpcpu --nobuild --action validate --define default-platform-flags --define numcopies=16 -c
ic2023.2.3-lin-core-avx2-rate-20231121.cfg --define smt-on --define cores=8 --define physicalfirst
--define no-numa --tune base,peak -o all --define drop_caches intrate
runpcpu --nobuild --action validate --define default-platform-flags --define numcopies=16 --configfile
ic2023.2.3-lin-core-avx2-rate-20231121.cfg --define smt-on --define cores=8 --define physicalfirst
--define no-numa --tune base,peak --output_format all --define drop_caches --nopower --runmode rate --tune
base:peak --size refrain intrate --nopreenv --note-preenv --logfile
$SPEC/tmp/CPU2017.001/templogs/preenv.intrate.001.0.log --lognum 001.0 --from_runcpu 2
specperl $SPEC/bin/sysinfo
$SPEC = /home/cpu2017_new

6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) E E-2478
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 183
   stepping        : 1
   microcode       : 0x121
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swapgs
   cpu cores       : 8
   siblings        : 16
   1 physical ids (chips)
   16 processors (hardware threads)
   physical id 0: core ids 0-7
   physical id 0: apicids 0-15
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
   virtualized systems. Use the above data carefully.

7. Iscpu
From lscpu from util-linux 2.37.2:
   Architecture: x86_64
   CPU op-mode(s): 32-bit, 64-bit

(Continued on next page)
Platform Notes (Continued)

Address sizes: 46 bits physical, 48 bits virtual
Byte Order: Little Endian
CPU(s): 16
On-line CPU(s) list: 0-15
Vendor ID: GenuineIntel
Model name: Intel(R) Xeon(R) E E-2478
CPU family: 6
Model: 183
Thread(s) per core: 2
Core(s) per socket: 8
Socket(s): 1
Stepping: 1
BogoMIPS: 5606.40
Flags: fpu vme de pse tsc msr pae 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 tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid ssmi efer ssse clflushopt path registering mmx+dir mmx+abs mfmsr mmx+tst arch_capabilities
Virtualization: VT-x
L1d cache: 384 KiB (8 instances)
L1i cache: 256 KiB (8 instances)
L2 cache: 16 MiB (8 instances)
L3 cache: 24 MiB (1 instance)
NUMA node(s): 1
NUMA node0 CPU(s): 0-15
Vulnerability Itlb multihit: Not affected
Vulnerability L1tf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swappgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Txsa async abort: Not affected

From lscpu --cache:
NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 48K 384K 12 Data 1 64 1 64
L1i 32K 256K 8 Instruction 1 64 1 64
L2 2M 16M 16 Unified 2 2048 1 64
L3 24M 24M 12 Unified 3 32768 1 64

8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 1 nodes (0)
node 0 cpus: 0-15
node 0 size: 64202 MB
node 0 free: 63603 MB
node distances:
node 0
0: 10

(Continued on next page)
### Platform Notes (Continued)

9. `/proc/meminfo`
   ```
   MemTotal:       65743624 kB
   ```

10. `who -r`
    ```
    run-level 3 Jan 16 23:59
    ```

11. Systemd service manager version: systemd 249 (249.11+suse.124.g2bc0b2c447)
    ```
    Default Target  Status
    multi-user      running
    ```

12. Services, from systemctl list-unit-files
    ```
    STATE   UNIT FILES
    enabled  apparmor auditd cron getty@ haveged irqbalance issue-generator lvm2-monitor postfix purge-kernels rollback sshd wicked wickedd-auto4 wickeddd-dhcp wickeddd-dhcp6 wickeddd-nanny
    enabled-runtime  systemd-remount-fs
    indirect  pcsd wicked
    ```

13. Linux kernel boot-time arguments, from `/proc/cmdline`
    ```
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=0568eef9-b0ff-4cd5-9f97-1f8e14da628c
    splash=silent
    resume=/dev/disk/by-uuid/ffb9593d-577b-484e-83b9-b995375d44ca
    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`
    It seems that tuned daemon is not running, preset profile is not activated.
    Preset profile: throughput-performance

16. `sysctl`
    ```
    kernel.numa_balancing 0
    kernel.randomize_va_space 2
    vm.compaction_proactive 20
    vm.dirty_background_bytes 0
    vm.dirty_background_ratio 10
    vm.dirty_bytes 0
    vm.dirty_expire_centisecs 3000
    vm.dirty_ratio 20
    ```

(Continued on next page)
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Test Date: Jan-2024
Hardware Availability: Dec-2023
Software Availability: Dec-2023

Platform Notes (Continued)

---

vm.dirty_writeback_centisecs 500
vm.dirtytime_expire_seconds 43200
vm.extfrag_threshold 500
vm.min_unmapped_ratio 1
vm.nr_hugepages 0
vm.nr_hugepages_mempolicy 0
vm.nr_overcommit_hugepages 0
vm.swappiness 60
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
hpag_pmd_size 2097152
shmem_enabled always within_size advise [never] deny force

---

18. /sys/kernel/mm/transparent_hugepage/khugepaged
alloc_sleep_millisecs 60000
defrag 1
max_ptes_none 511
max_ptes_shared 256
max_ptes_swap 64
pages_to_scan 4096
scan_sleep_millisecs 10000

---

19. OS release
From /etc/*-release /etc/*-version
os-release SUSE Linux Enterprise Server 15 SP4

---

20. Disk information
SPEC is set to: /home/cpu2017_new

Filesystem  Type  Size  Used Avail Use% Mounted on
/dev/sda3  xfs  344G 75G 270G 22% /home

---

21. /sys/devices/virtual/dmi/id
Vendor: HPE
Product: ProLiant DL20 Gen11
Product Family: ProLiant
Serial: DA2G93DK88

---

22. dmidecode
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:
2x Hynix HMCG88AGBEA084N 32 GB 2 rank 5600, configured at 4400

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23. BIOS
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**Platform Notes (Continued)**

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**Compiler Version Notes**

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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

Base Optimization Flags

C benchmarks:
-w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX2 -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 -xCORE-AVX2 -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 -xCORE-AVX2 -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
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---

**Peak Compiler Invocation**

C benchmarks:
icx

C++ benchmarks:
icpx

Fortran benchmarks:
ifx

---

**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

---

**Peak Optimization Flags**

C benchmarks:

500.perlbench_r: -w -std=c11 -m64 -Wl,-z,muldefs -fprofile-generate(pass 1)  
-fprofile-use=default.profdata(pass 2) -xCORE-AVX2 -flto  
-Ofast -ffast-math -mfpmath=sse -funroll-loops -qopt-mem-layout-trans=4 -fno-strict-overflow  
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin -lqkmalloc

502.gcc_r: -m32  
-L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/ia32_lin  
-std=gnu89 -Wl,-z,muldefs -fprofile-generate(pass 1)  
-fprofile-use=default.profdata(pass 2) -xCORE-AVX2 -flto  
-ljemalloc

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Peak Optimization Flags (Continued)

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xCORE-AVX2 -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fno-alias
-LL/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin
-1qkmalloc

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-RPL-rev2.0.html
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-Intel-RPL-rev2.0.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml