## SPEC CPU®2017 Integer Rate Result

**ASUSTeK Computer Inc.**  
ASUS ESC4000-E11  
(2.20 GHz, Intel Xeon Gold 6454S)

**SPECrate®2017_int_base = 567**  
**SPECrate®2017_int_peak = 585**

### CPU2017 License:
9016

**Test Date:**  
Feb-2024

**Test Sponsor:**  
ASUSTeK Computer Inc.

**Hardware Availability:**  
Jul-2023

**Tested by:**  
ASUSTeK Computer Inc.

**Software Availability:**  
Dec-2023

### Hardware

- **CPU Name:** Intel Xeon Gold 6454S  
  - **Max MHz:** 3400  
  - **Nominal:** 2200  
  - **Enabled:** 64 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:** 60 MB I+D on chip per chip  
  - **Other:** None  
  - **Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-4800B-R)  
  - **Storage:** 1 x 1.6 TB PCIe NVMe SSD  
  - **Other:** Cooling: DLC

### Software

- **OS:** SUSE Linux Enterprise Server 15 SP4 (x86_64)  
  - **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:** Version 2101 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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Results Table

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<td>1130</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"  
OS set to performance mode via cpupower frequency-set -g performance

Environment Variables Notes

Environment variables set by runcpu before the start of the run:  
LD_LIBRARY_PATH = "/ic23u2/lib/intel64:/ic23u2/lib/ia32:/ic23u2/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  
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>

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.

(Continued on next page)
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Tested by: ASUSTeK Computer Inc.

General Notes (Continued)

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:
VT-d = Disabled
Patrol Scrub = Disabled
SNC = Enable SNC4 (4-clusters)
LLC dead line alic = Disabled
Engine Boost = Aggressive
SR-IOV Support = Disabled
BMC Configuration:
Fan mode = Full speed mode

Sysinfo program /lc23u2/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Sun Feb 25 05:40:15 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)
x86_64 x86_64 x86_64 GNU/Linux

2. w

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Platform Notes (Continued)

05:40:15 up 1 day, 19:11, 2 users, load average: 28.56, 72.76, 98.79
USER    TTY       FROM    LOGIN@    IDLE    JCPU    PCPU    WHAT
root    tty1      -        Fri10    43:08m   1.01s   0.00s /bin/bash ./rate.sh
root    tty2      -        Fri10    36:48m   0.03s   0.03s -bash

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          (-i) 4126764
   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) 4126764
   virtual memory          (kbytes, -v) unlimited
   file locks                (-x) unlimited

5. sysinfo process ancestry
   /usr/lib/systemd/systemd --switched-root --system --deserialize 30
   login -- root
   -bash
   /bin/bash ./rate.sh
   /bin/bash ./rate.sh
   runcpu --nobuild --action validate --define default-platform-flags --define numcopies=128 --c
   ic2023.2.3-lin-sapphirerapids-rate-20231121.cfg --define smt-on --define cores=64 --define physicalfirst
   --define invoke_with_interleave --define drop_caches --tune base,peak --output_format all --nopower
   --runmode rate --tune base:peak --size refrate intrate --nopreenv --note-preenv --logfile
   $SPEC/tmp/CPU2017.415/templogs/preenv.intrate.415.0.log --lognum 415.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /ic23u2

6. /proc/cpuinfo
   model name      : Intel(R) Xeon(R) Gold 6454S
   vendor_id       : GenuineIntel
   cpu family      : 6
   model           : 143
   stepping        : 8
   microcode       : 0x2b000461
   bugs            : spectre_v1 spectre_v2 spec_store_bypass swaps
   cpu cores       : 32
   siblings        : 64
   2 physical ids (chips)
   128 processors (hardware threads)
   physical id 0: core ids 0-31

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

physical id 1: core ids 0-31  
physical id 0: apicids 0-63  
physical id 1: apicids 128-191  
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 2.37.2:

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): 128  
On-line CPU(s) list: 0-127  
Vendor ID: GenuineIntel  
Model name: Intel(R) Xeon(R) Gold 6454S  
CPU family: 6  
Model: 143  
Thread(s) per core: 2  
Core(s) per socket: 32  
Socket(s): 2  
Stepping: 8  
CPU max MHz: 3400.00  
CPU min MHz: 800.00  
BogoMIPS: 4400.00  
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 rdtps  
lm constant-tsc arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid aperfeserf tsc_known_freq pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tdc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3nowprefetch cpuid_fault epb cat_l3 cat_l2 cdq cpuid  
invpcid_single intel_ppin cdq_l2 srad mbd ibs ibs_enhanced tpr_shadow vnmi fesibility ept vpd ept_ad fsgsbase tsc_adjust bmi1 hle avx2 amf bmi2 erms invvpid rtm cqm rdt_a avx512f avx512dq rdseed adx smap avx512ifma clflushopt clwb intel_pt avx512fd sha ni avx512bw avx512vl xsaveopt xsaves xsavec xstopv xstate cxm caches cmqm_cache cmqm_mm_cache cmqm_m坐标 split_lock detect avx_vnni avx512_bf16 wbtino nd dtherm ida arat pln pts hwp hwp_act_window hwp_epp hwp_pkg_req avx512vbmi ump kpu ospke waiitpkb avx512 vbmi qfi vaes vpcmldq qavx512_vnni avx512_bits0 tms avx512_vvpontd wgq57 rdpid bus_lock_detect cidevent modvdir moddirav64b enqcmd ffrd m_fi clear serialize t5xldtrk pconfi arch_lbr avx512_fp16  
amx_mic flush_l1d arch_capabilities

```
Virtualization: VT-x  
L1d cache: 3 MiB (64 instances)  
L1l cache: 2 MiB (64 instances)  
L2 cache: 128 MiB (64 instances)  
L3 cache: 120 MiB (2 instances)  
NUMA node(s): 8  
NUMA node0 CPU(s): 0-7,64-71  
NUMA node1 CPU(s): 8-15,72-79  
NUMA node2 CPU(s): 16-23,80-87  
NUMA node3 CPU(s): 24-31,88-95  
NUMA node4 CPU(s): 32-39,96-103  
NUMA node5 CPU(s): 40-47,104-111  
NUMA node6 CPU(s): 48-55,112-119  
NUMA node7 CPU(s): 56-63,120-127  
Vulnerability Itlb multihit: Not affected
```

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Software Availability: Dec-2023

Platform Notes (Continued)

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/swapgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBPB conditional, RSB filling
Vulnerability Srbds: Not affected
Vulnerability Tsx async abort: Not affected

From lscpu --cache:

NAME ONE-SIZE ALL-SIZE WAYS TYPE LEVEL SETS PHY-LINE COHERENCY-SIZE
L1d 48K 3M 12 Data 1 64 1 64
L1i 32K 2M 8 Instruction 1 64 1 64
L2 2M 128M 16 Unified 2 2048 1 64
L3 60M 120M 15 Unified 3 65536 1 64

-----------------------------
8. numactl --hardware
NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 8 nodes (0-7)
node 0 cpus: 0-7,64-71
node 0 size: 128623 MB
node 0 free: 127208 MB
node 1 cpus: 8-15,72-79
node 1 size: 129019 MB
node 1 free: 128208 MB
node 2 cpus: 16-23,80-87
node 2 size: 129019 MB
node 2 free: 128220 MB
node 3 cpus: 24-31,88-95
node 3 size: 129019 MB
node 3 free: 128212 MB
node 4 cpus: 32-39,96-103
node 4 size: 129019 MB
node 4 free: 128117 MB
node 5 cpus: 40-47,104-111
node 5 size: 129019 MB
node 5 free: 128195 MB
node 6 cpus: 48-55,112-119
node 6 size: 129019 MB
node 6 free: 128229 MB
node 7 cpus: 56-63,120-127
node 7 size: 128972 MB
node 7 free: 128095 MB
node distances:
node 0 1 2 3 4 5 6 7
0: 10 12 12 12 21 21 21 21
1: 12 10 12 12 21 21 21 21
2: 12 12 10 12 21 21 21 21
3: 12 12 12 10 21 21 21 21
4: 21 21 21 21 10 12 12 12
5: 21 21 21 21 12 10 12 12
6: 21 21 21 21 12 12 10 12
7: 21 21 21 21 12 12 12 10

------------------------------------------------------------
9. /proc/meminfo
MemTotal: 1056477044 kB

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Platform Notes (Continued)

10. who -r
  run-level 3 Feb 23 10:29

------------------------------------------------------------
11. Systemd service manager version: systemd 249 (249.11+suse.124.q2bc0b2c447)
  Default Target Status
  multi-user running

------------------------------------------------------------
12. Services, from systemctl list-unit-files
    STATE UNIT FILES
    enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron display-manager getty@ haveged
              irqbalance issue-generator kbdsettings klog 1vm2-monitor nscd nvme-fc-boot-connections
              postfix purge-kernels rollback rsyslog smartd sshd wicked wickedd-auto4 wickedd-dhcp4
              wickedd-dhcp6 wickedd-nanny
    enabled-runtime systemd-remount-fs
    disabled autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-console-getty cups-cups-browsed
cron-debug-shell etables exchange-bmc-os-info
              firewall gpm grub2-_once haveged-switch-root hwloc-dump-hdata ipmi ipmi_event
              issue-add-ssh-keys kexec-load luumask man-db-create multipathd nfs nfs-blkmap
              nvmf-autoconnect rdisc rmdir rpmconfigcheck rsyncd serial-getty@ smartd_generate_opts
              snmpd snmptrapd svnservice systemd-boot-check-no-failures systemd-network-generator
              systemd-sysext systemd-time-sync systemd-timesyncd tuned udisks2
    indirect wicked

------------------------------------------------------------
13. Linux kernel boot-time arguments, from /proc/cmdline
    BOOT_IMAGE=/boot/vmlinuz-5.14.21-150400.22-default
    root=UUID=9bcf0374-b29f-4a4c-932e-9c0e90fe0803
    splash=silent
    mitigations=auto
    quiet

------------------------------------------------------------
14. cpupower frequency-info
    analyzing CPU 0:
    current policy: frequency should be within 800 MHz and 3.40 GHz.

    The governor "performance" may decide which speed to use
    within this range.

    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 1
    kernel.randomize_va_space 2
    vm.compartment_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
    vm.dirty_writeback_centisecs 500
    vm.dirtytime_expire_seconds 43200

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Platform Notes (Continued)

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+madvice [madvice] never
enabled [always] madvice never
hpaged_pmd_size 2097152
shmem_enabled always within_size advise [never] deny force

------------------------------------------------------------
18. /sys/kernel/mm/transparent_hugepage/transparent
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: /ic23u2
Filesystem Type Size Used Avail Use% Mounted on
/dev/nvme0n1p8 xfs 500G 296G 205G 60% /

------------------------------------------------------------
21. /sys/devices/virtual/dmi/id
Vendor: ASUSTeK COMPUTER INC.
Product: ESC4000-E11
Product Family: Server
Serial: /psn/

------------------------------------------------------------
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:
16x Samsung M321R8GA0BB0-CQKVG 64 GB 2 rank 4800

------------------------------------------------------------
23. BIOS
(Continued on next page)
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Platform Notes (Continued)

| BIOS Date: | 12/12/2023 |
| BIOS Revision: | 21.1 |

Compiler Version Notes

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<th>Compiler</th>
<th>Base Compiler Invocation</th>
<th>Note</th>
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<td>502.gcc_r(peak)</td>
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<tr>
<td></td>
<td>Intel(R) oneAPI DPC++/C++ Compiler for applications running on IA-32, Version 2023.2.3 Build x</td>
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<tr>
<td></td>
<td>Copyright (C) 1985-2023 Intel Corporation. All rights reserved.</td>
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<tr>
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<td>548.exchange2_r(base, peak)</td>
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Base Compiler Invocation

C benchmarks:
icx

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

ASUSTeK Computer Inc.
ASUS ESC4000-E11
(2.20 GHz, Intel Xeon Gold 6454S)

SPECrate®2017_int_base = 567
SPECrate®2017_int_peak = 585

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<th>CPU2017 License</th>
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<td>Feb-2024</td>
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### Base Compiler Invocation (Continued)

**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 -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**:

## SPEC CPU®2017 Integer Rate Result

**ASUSTeK Computer Inc.**  
ASUS ESC4000-E11  
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- **CPU2017 License:** 9016  
- **Test Sponsor:** ASUSTeK Computer Inc.  
- **Tested by:** ASUSTeK Computer Inc.

### Test Details
- **Test Date:** Feb-2024  
- **Hardware Availability:** Jul-2023  
- **Software Availability:** Dec-2023

### 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.proftdata(pass 2) -xCORE-AVX2(pass 1) -flto -Ofast -xCORE-AVX512 -ffast-math -mfpmath=sse -funroll-loops -gopt-mem-layout-trans=4 -fno-strict-overflow -L/home/specdev/new_compilers/ic2023.2.3/compiler/lib/intel64_lin -lqkmalloc`

(Continued on next page)
ASUSTeK Computer Inc.
ASUS ESC4000-E11
(2.20 GHz, Intel Xeon Gold 6454S)

SPEC CPU®2017 Integer Rate Result
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ASUSTeK Computer Inc.

SPECrate®2017_int_base = 567
SPECrate®2017_int_peak = 585

CPU2017 License: 9016
Test Sponsor: ASUSTeK Computer Inc.
Tested by: ASUSTeK Computer Inc.
Test Date: Feb-2024
Hardware Availability: Jul-2023
Software Availability: Dec-2023

Peak Optimization Flags (Continued)

505.mcf_r: basepeak = yes

525.x264_r: -w -std=c11 -m64 -Wl,-z,muldefs -xsapphirerapids -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fno-alias
-L/home/specdev/new_compilers/ic2023.2.3/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/Intel-ic2023p2-official-linux64.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/ASUSTekPlatform-Settings-z13-V1.3.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-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 CPU®2017 v1.1.9 on 2024-02-24 16:40:15-0500.
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