## SPEC CPU®2017 Integer Rate Result

**ASUSTeK Computer Inc.**  
ASUS ESC8000 G4(Z11PG-D24) Server System  
(2.20 GHz, Intel Xeon Gold 5220R)

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU Name:</strong> Intel Xeon Gold 5220R</td>
<td><strong>OS:</strong> SUSE Linux Enterprise Server 15 SP1</td>
</tr>
<tr>
<td><strong>Max MHz:</strong> 4000</td>
<td><strong>Kernel 4.12.14-195-default</strong></td>
</tr>
<tr>
<td><strong>Nominal:</strong> 2200</td>
<td><strong>Compiler:</strong> C/C++: Version 19.1.1.217 of Intel C/C++ Compiler Build 20200306 for Linux:</td>
</tr>
<tr>
<td><strong>Enabled:</strong> 48 cores, 2 chips, 2 threads/core</td>
<td><strong>Fortran: Version 19.1.1.217 of Intel Fortran Compiler Build 20200306 for Linux</strong></td>
</tr>
<tr>
<td><strong>Orderable:</strong> 1, 2 chip(s)</td>
<td><strong>Parallel:</strong> No</td>
</tr>
<tr>
<td><strong>Cache L1:</strong> 32 KB I + 32 KB D on chip per core</td>
<td><strong>Firmware:</strong> Version 6102 released Dec-2019</td>
</tr>
<tr>
<td><strong>L2:</strong> 1 MB I+D on chip per core</td>
<td><strong>File System:</strong> xfs</td>
</tr>
<tr>
<td><strong>L3:</strong> 35.75 MB I+D on chip per chip</td>
<td><strong>System State:</strong> Run level 3 (multi-user)</td>
</tr>
<tr>
<td><strong>Other:</strong> None</td>
<td><strong>Base Pointers:</strong> 64-bit</td>
</tr>
<tr>
<td><strong>Memory:</strong> 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R, running at 2666)</td>
<td><strong>Peak Pointers:</strong> 32/64-bit</td>
</tr>
<tr>
<td><strong>Storage:</strong> 1 x 1 TB SATA SSD</td>
<td><strong>Other:</strong> jemalloc: jemalloc memory allocator library V5.0.1</td>
</tr>
<tr>
<td><strong>Other:</strong> None</td>
<td><strong>Power Management:</strong> BIOS and OS set to prefer performance at the cost of additional power usage</td>
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</tbody>
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**SPECrate®2017_int_base = 319**  
**SPECrate®2017_int_peak = 330**

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<td>523.xalancbmk_r 96</td>
<td>418</td>
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<tr>
<td>525.x264_r 96</td>
<td>686</td>
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<tr>
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<td>585</td>
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SPECrate®2017_int_base = 319
SPECrate®2017_int_peak = 330

Results Table

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Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Compiler Notes
The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler.
The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux
The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux

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 = "/191u1/lib/intel64:/191u1/lib/ia32:/191u1/je5.0.1-32"
MALLOC_CONF = "retain:true"
ASUSTeK Computer Inc.
ASUS ESC8000 G4(Z11PG-D24) Server System
(2.20 GHz, Intel Xeon Gold 5220R)

SPEC CPU®2017 Integer Rate Result
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SPECrate®2017_int_base = 319
SPECrate®2017_int_peak = 330

CPU2017 License: 9016
Test Sponsor: ASUSTeK Computer Inc.
Tested by: ASUSTeK Computer Inc.

Test Date: May-2020
Hardware Availability: Feb-2020
Software Availability: Apr-2020

General Notes

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB RAM memory using Redhat Enterprise Linux 8.0
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.
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.

The jemalloc library was configured and built at default for 32bit (i686) and 64bit (x86_64) targets;
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
ENERGY_PERF_BIAS_CFG mode = performance
SNC = Enabled
IMC interleaving = 1-way
Engine Boost = Level3(Max)
CSM Support = Disabled
SR-IOV Support = Disabled
LLC dead line allc = Disabled

Sysinfo program /191u1/bin/sysinfo
Rev: r6365 of 2019-08-21 295195f888a3d7edbbe6e46a485a0011
running on linux-628j Sat May 23 02:27:50 2020

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

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Platform Notes (Continued)

model name : Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
2 "physical id"s (chips)
96 "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 : 24
siblings : 48
physical 0: cores 0 1 2 3 4 5 6 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29
physical 1: cores 0 1 2 3 4 5 6 9 10 11 12 13 16 17 18 19 20 21 24 25 26 27 28 29

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
Address sizes: 46 bits physical, 48 bits virtual
CPU(s): 96
On-line CPU(s) list: 0-95
Thread(s) per core: 2
Core(s) per socket: 24
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5220R CPU @ 2.20GHz
Stepping: 7
CPU MHz: 2200.000
CPU max MHz: 4000.0000
CPU min MHz: 1000.0000
BogoMIPS: 4400.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 36608K
NUMA node0 CPU(s): 0-3,7,8,12-14,18-20,48-51,55,56,60-62,66-68
NUMA node1 CPU(s): 4-6,9-11,15-17,21-23,32-34,52-53,57-59,63-65,69-71
NUMA node2 CPU(s): 24-27,31,32,36-38,42-44,72-75,79,80,84-86,90-92
NUMA node3 CPU(s): 28-30,33-35,39-41,45-47,76-78,81-83,87-89,93-95
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 rdtrunc
lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc cpuid
aperfperf npi pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16
xtpr 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_l3 cdp cce
invlpg intel_pcin ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi
flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm

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Platform Notes (Continued)

cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
avx512bw avx512vl xsaveopt xsaves xgetbv1 xsavees cqm_llc cqm_occult_llc cqm_mbm_total
cqm_mbm_local dtherm ida arat pln pts hwp hwp_act_window hwp_epp hwp_pkg_req pku
ospke avx512_vnni md_clear flush_l1d arch_capabilities

/proc/cpuinfo cache data
  cache size : 36608 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 7 8 12 13 14 18 19 20 48 49 50 51 55 56 60 61 62 66 67 68
    node 0 size: 192077 MB
    node 0 free: 191247 MB
    node 1 cpus: 4 5 6 9 10 11 15 16 17 21 22 23 52 53 54 57 58 59 63 64 65 69 70 71
    node 1 size: 193501 MB
    node 1 free: 192802 MB
    node 2 cpus: 24 25 26 27 31 32 36 37 38 42 43 44 72 73 74 75 79 80 84 85 86 90 91 92
    node 2 size: 193531 MB
    node 2 free: 192809 MB
    node 3 cpus: 28 29 30 33 34 35 39 40 41 45 46 47 76 77 78 81 82 83 87 88 89 93 94 95
    node 3 size: 193529 MB
    node 3 free: 192641 MB
    node distances:
      node 0 1 2 3
      0:  10 11 21 21
      1:  11 10 21 21
      2:  21 21 10 11
      3:  21 21 11 10

From /proc/meminfo
  MemTotal:       791184264 kB
  HugePages_Total:       0
  Hugepagesize:       2048 kB

From /etc/*release* /etc/*version*
  os-release:
    NAME="SLES"
    VERSION="15-SP1"
    VERSION_ID="15.1"
    PRETTY_NAME="SUSE Linux Enterprise Server 15 SP1"
    ID="sles"
    ID_LIKE="suse"
    ANSI_COLOR="0;32"
    CPE_NAME="cpe:/o:suse:sles:15:sp1"

  uname -a:

(Continued on next page)
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Platform Notes (Continued)

Linux linux-628j 4.12.14-195-default #1 SMP Tue May 7 10:55:11 UTC 2019 (8fba516)
x86_64 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-3620 (L1 Terminal Fault): Not affected
Microarchitectural Data Sampling: Not affected
CVE-2017-5754 (Meltdown): Not affected
CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
via prctl and seccomp
CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run-level 3 May 22 00:42
SPEC is set to: /191u1
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda4      xfs   932G   23G  910G   3% /

From /sys/devices/virtual/dmi/id
BIOS: American Megatrends Inc. 6102 12/19/2019
Vendor: ASUSTeK COMPUTER INC.
Product: Z11PG-D24 Series
Product Family: Server
Serial: System Serial Number

Additional information from dmidecode 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:
24x Samsung M393A4K40CB2-CVF 32 GB 2 rank 2933

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
| C       | 502.gcc_r(peak) |
Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen
Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.
==============================================================================

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**Test Sponsor:** ASUSTeK Computer Inc.

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**Hardware Availability:** Feb-2020

**Software Availability:** Apr-2020

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<th>C</th>
<th>502.gcc_r(peak)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304</td>
</tr>
</tbody>
</table>

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Standard Performance Evaluation Corporation (info@spec.org)  
https://www.spec.org/
## Compiler Version Notes (Continued)

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<table>
<thead>
<tr>
<th>C</th>
<th>500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base)</th>
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Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

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<table>
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<tr>
<th>C</th>
<th>500.perlbench_r(peak) 557.xz_r(peak)</th>
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Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306
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<table>
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<tr>
<th>C++</th>
<th>520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)</th>
</tr>
</thead>
</table>

Intel(R) C++ Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
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<table>
<thead>
<tr>
<th>Fortran</th>
<th>548.exchange2_r(base, peak)</th>
</tr>
</thead>
</table>

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306
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## Base Compiler Invocation

### C benchmarks:
- icc

### C++ benchmarks:
- icpc
### Base Compiler Invocation (Continued)

Fortran benchmarks:

```fortran
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:

```
-m64 -qnextgen -std=c11
-W1,-plugin-opt=-x86-branches-within-32B-bounds=-Wl,-z,muldefs
-xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse -funroll-loops
-fuse-ld=gold -qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

**C++** benchmarks:

```
-m64 -qnextgen -Wl,-plugin-opt=-x86-branches-within-32B-bounds=-Wl,-z,muldefs
-xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse
-funroll-loops -fused-ld=gold -qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

**Fortran** benchmarks:

```
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-bounds=-Wl,-z,muldefs
-xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4
-nostandard-realloc-lhs -align array32byte -auto
-mbranches-within-32B-bounds
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```
ASUSTeK Computer Inc.  
ASUS ESC8000 G4(Z11PG-D24) Server System  
(2.20 GHz, Intel Xeon Gold 5220R)  

**SPEC CPU®2017 Integer Rate Result**  
Copyright 2017-2020 Standard Performance Evaluation Corporation  

**SPECrate®2017_int_base = 319**  
**SPECrate®2017_int_peak = 330**  

**CPU2017 License:** 9016  
**Test Date:** May-2020  
**Test Sponsor:** ASUSTeK Computer Inc.  
**Hardware Availability:** Feb-2020  
**Tested by:** ASUSTeK Computer Inc.  
**Software Availability:** Apr-2020  

**Peak Compiler Invocation**  
C benchmarks:  
icc  
C++ benchmarks:  
icpc  
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  
(Continued on next page)  

**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/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin  
-lqkmalloc  
502.gcc_r: -m32  
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/ia32_lin  
-std=gnu89  
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries  
-Wl,-z,muldefs -fprofile-generate(pass 1)  
-fprofile-use=default.profdata(pass 2) -xCORE-AVX512 -flto  
-Ofast(pass 1) -O3 -ffast-math -qnextgen -fuse-ld=gold  
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib  
-ljemalloc  
(Continued on next page)
ASUSTeK Computer Inc.
ASUS ESC8000 G4(Z11PG-D24) Server System
(2.20 GHz, Intel Xeon Gold 5220R)

| SPECrate®2017_int_base = 319 |
| SPECrate®2017_int_peak = 330 |

**CPU2017 License:** 9016
**Test Sponsor:** ASUSTeK Computer Inc.
**Tested by:** ASUSTeK Computer Inc.

| Test Date: | May-2020 |
| Hardware Availability: | Feb-2020 |
| Software Availability: | Apr-2020 |

### Peak Optimization Flags (Continued)

505.mcf_r: basepeak = yes

525.x264_r: -m64 -qnextgen -std=c11
- W1, -plugin-opt=-x86-branches-within-32B-boundaries
- W1, -z, muldefs -xCORE-AVX512 -f1to -O3 -ffast-math
- fuse-ld=gold -qopt-mem-layout-trans=4 -fno-alias
- L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
- lqkmalloc

557.xz_r: -W1, -z, muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
- qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
- L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
- lqkmalloc

### 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


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


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Tested with SPEC CPU®2017 v1.1.0 on 2020-05-22 14:27:50-0400.
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