SPEC CPU®2017 Integer Rate Result

Dell Inc.
(Test Sponsor: Dell Inc)

PowerEdge R740 (Intel Xeon Gold 5222, 3.80 GHz)

SPECrate®2017_int_base = 69.9
SPECrate®2017_int_peak = 72.5

CPU2017 License: 55
Test Date: Jul-2020
Test Sponsor: Dell Inc
Hardware Availability: Apr-2019
Tested by: Dell Inc.
Software Availability: Apr-2020

Cores

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<th>SPECrate®2017_int_peak</th>
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<td>53.9</td>
<td>72.5</td>
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<tr>
<td>gcc_r</td>
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<tr>
<td>mcf_r</td>
<td>16</td>
<td>65.0</td>
<td></td>
</tr>
<tr>
<td>omnetpp_r</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>xalancbmk_r</td>
<td>16</td>
<td>99.2</td>
<td></td>
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<tr>
<td>x264_r</td>
<td>16</td>
<td></td>
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<tr>
<td>deepsjeng_r</td>
<td>16</td>
<td>53.4</td>
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<tr>
<td>leela_r</td>
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<tr>
<td>exchange2_r</td>
<td>16</td>
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</tr>
<tr>
<td>xz_r</td>
<td>16</td>
<td>40.2</td>
<td></td>
</tr>
</tbody>
</table>

**Hardware**

CPU Name: Intel Xeon Gold 5222
Max MHz: 3900
Nominal: 3800
Enabled: 8 cores, 2 chips, 2 threads/core
Orderable: 1.2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 16.5 MB I+D on chip per chip
Other: None
Memory: 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R)
Storage: 1 x 1.92 TB SATA SSD
Other: None

**Software**

OS: Red Hat Enterprise Linux 8.1
Kernel: 4.18.0-147.el8.x86_64
Compiler: C/C++: Version 19.1.1.217 of Intel C/C++ Compiler for Linux;
Fortran: Version 19.1.1.217 of Intel Fortran Compiler for Linux
Parallel: No
Firmware: Version 2.7.7 released May-2020
File System: tmpfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other: None

**Power Management:**

BIOS set to prefer performance at the cost of additional power usage.

jemalloc memory allocator V5.0.1
## Results Table

<table>
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<tr>
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<th>Ratio</th>
<th>Seconds</th>
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<td>41.0</td>
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<td><strong>40.9</strong></td>
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**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

**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"

**Environment Variables Notes**

Environment variables set by runcpu before the start of the run:

```
LD_LIBRARY_PATH = 
  "/mnt/ramdisk/cpu2017-ic19.1u1/lib/intel64:/mnt/ramdisk/cpu2017-ic19.1u1/lib/ia32:/mnt/ramdisk/cpu2017-ic19.1u1/je5.0.1-32"

MALLOC_CONF = "retain:true"
```
## General Notes

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

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.

Transparent Huge Pages enabled by default

Prior to runcpu invocation

Filesystem page cache synced and cleared with:

```bash
sync; echo 3> /proc/sys/vm/drop_caches
```

runcpu command invoked through numactl i.e.:

```bash
numactl --interleave=all runcpu <etc>
```

Benchmark run from a 225 GB ramdisk created with the cmd; "mount -t tmpfs -o size=225G tmpfs /mnt/ramdisk"


## Platform Notes

BIOS settings:

- Sub NUMA Cluster enabled
- Virtualization Technology disabled
- System Profile set to Custom
- CPU Performance set to Maximum Performance
- C States set to Autonomous
- C1E disabled
- Uncore Frequency set to Dynamic
- Energy Efficiency Policy set to Performance
- Logical Processor enabled
- CPU Interconnect Bus Link Power Management disabled
- PCI ASPM L1 Link Power Management disabled
- UPI Prefetch enabled
- LLC Prefetch disabled
- Dead Line LLC Alloc enabled
- Directory AtoS disabled

Sysinfo program /mnt/ramdisk/cpu2017-ic19.1u1/bin/sysinfo

Rev: r6365 of 2019-08-21 295195f888a3d7ed8e6e46a485a0011
running on user-pc.spa.lab Fri Jul 25 16:15:37 2031

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

(Continued on next page)
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CPU2017 License: 55
Test Sponsor: Dell Inc
Tested by: Dell Inc.

Test Date: Jul-2020
Hardware Availability: Apr-2019
Software Availability: Apr-2020

Platform Notes (Continued)

From /proc/cpuinfo
model name : Intel(R) Xeon(R) Gold 5222 CPU @ 3.80GHz
  2 "physical id"s (chips)
  16 "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 : 4
siblings : 8
physical 0: cores 2 5 8 13
physical 1: cores 5 8 9 13

From lscpu:
Architecture: x86_64
CPU op-mode(s): 32-bit, 64-bit
Byte Order: Little Endian
CPU(s): 16
On-line CPU(s) list: 0-15
Thread(s) per core: 2
Core(s) per socket: 4
Socket(s): 2
NUMA node(s): 4
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Gold 5222 CPU @ 3.80GHz
Stepping: 6
CPU MHz: 2864.333
CPU max MHz: 3900.0000
CPU min MHz: 1200.0000
BogoMIPS: 7600.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 16896K
NUMA node0 CPU(s): 0,4,8,12
NUMA node1 CPU(s): 1,3,9,11
NUMA node2 CPU(s): 2,6,10,14
NUMA node3 CPU(s): 5,7,13,15
Flags: fpu vme de pse tsc msr pae mce 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 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 tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch cpld Fault epb cat L3 cdp L3 invpcid_single intel_pstate ssbd mba ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi

(Continued on next page)
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Platform Notes (Continued)

flexpriority ept vpid fsgsbase tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm
   cqm mpx rdt_a avx512f avx512dq rdseed adx smap clflushopt clwb intel_pt avx512cd
   avx512bw avx512vl xsaveopt xsaves cqm_llc cqm_occup_llc cqm_mbm_total
   cqm_mbm_local dtherm ida arat pln pts pku ospke avx512_vnni md_clear flush_l1d
   arch_capabilities

/proc/cpuinfo cache data
   cache size : 16896 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 4 8 12
   node 0 size: 192076 MB
   node 0 free: 182722 MB
   node 1 cpus: 1 3 9 11
   node 1 size: 193534 MB
   node 1 free: 193168 MB
   node 2 cpus: 2 6 10 14
   node 2 size: 193509 MB
   node 2 free: 193198 MB
   node 3 cpus: 5 7 13 15
   node 3 size: 193534 MB
   node 3 free: 193106 MB
   node distances:
      node   0   1   2   3
      0:  10  21  11  21
      1:  21  10  21  11
      2:  11  21  10  21
      3:  21  11  21  10

From /proc/meminfo
   MemTotal:       791198628 kB
   HugePages_Total:       0
   Hugepagesize:       2048 kB

From /etc/*release* /etc/*version*
   os-release:
      NAME="Red Hat Enterprise Linux"
      VERSION="8.1 (Ootpa)"
      ID="rhel"
      ID_LIKE="fedora"
      VERSION_ID="8.1"
      PLATFORM_ID="platform:el8"
      PRETTY_NAME="Red Hat Enterprise Linux 8.1 (Ootpa)"
      ANSI_COLOR="0;31"
      redhat-release: Red Hat Enterprise Linux release 8.1 (Ootpa)

(Continued on next page)
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CPU2017 License: 55  
Test Sponsor: Dell Inc  
Tested by: Dell Inc

Platform Notes (Continued)

system−release: Red Hat Enterprise Linux release 8.1 (Ootpa)
system−release−cpe: cpe:/o:redhat:enterprise_linux:8.1:ga

uname −a:
Linux user-pc.spa.lab 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019 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: usercopy/swapgs barriers and __user pointer sanitization
CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling

run−level 3 Jul 25 11:12 last=5

SPEC is set to: /mnt/ramdisk/cpu2017-ic19.1u1

Filesystem Type Size Used Avail Use% Mounted on
tmpfs tmpfs 225G 4.3G 221G 2% /mnt/ramdisk

From /sys/devices/virtual/dmi/id
BIOS: Dell Inc. 2.7.7 05/04/2020
Vendor: Dell Inc.
Product: PowerEdge R740xd
Product Family: PowerEdge
Serial: F5BMCS2

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:
19x 00AD00B300AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
1x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
4x 00AD069D00AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933

(End of data from sysinfo program)
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
### Compiler Version Notes

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(Test Sponsor: Dell Inc)

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**Test Date:** Jul-2020

**Hardware Availability:** Apr-2019

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### Compiler Version Notes (Continued)

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#### C

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

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304

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---

#### C

| 500.perlbench_r(peak) 557.xz_r(peak) |

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304

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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) C++ Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304

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---

#### Fortran

| 548.exchange2_r(base, peak) |

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

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:
-m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z, muldefs
-xCORE-AVX512 -O3 -ffast-math -ftlo -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-boundaries
-Wl,-z, muldefs -xCORE-AVX512 -O3 -ffast-math -ftlo -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

Fortran benchmarks:
-m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z, muldefs
-xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4

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

Dell Inc.
(Test Sponsor: Dell Inc)

PowerEdge R740 (Intel Xeon Gold 5222, 3.80 GHz)

SPECrater®2017_int_base = 69.9
SPECrater®2017_int_peak = 72.5

CPU2017 License: 55
Test Sponsor: Dell Inc
Tested by: Dell Inc.

Test Date: Jul-2020
Hardware Availability: Apr-2019
Software Availability: Apr-2020

Base Optimization Flags (Continued)

Fortran benchmarks (continued):
- nostandard-realloc-lhs -align array32byte -auto
- mbranches-within-32B-boundaries
- L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
  -lqkmalloc

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

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

(Continued on next page)
Dell Inc.  
(Test Sponsor: Dell Inc)  
PowerEdge R740 (Intel Xeon Gold 5222, 3.80 GHz)  

**SPEC CPU®2017 Integer Rate Result**  
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**SPECrate®2017_int_base = 69.9**  
**SPECrate®2017_int_peak = 72.5**  

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### Peak Optimization Flags (Continued)

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

505.mcf_r: basepeak = yes

525.x264_r: 
- -m64 -qnextgen -std=c11  
- -Wl,-plugin-opt=-x86-branches-within-32B-boundaries  
- -Wl,-z,muldefs -xCORE-AVX512 -flto -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: 
- -Wl,-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


### SPEC CPU®2017 Integer Rate Result

**Dell Inc.**  
(Test Sponsor: Dell Inc)

**PowerEdge R740 (Intel Xeon Gold 5222, 3.80 GHz)**

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


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