SPEC® CPU2017 Integer Rate Result

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Dell Inc.

PowerEdge R940 (Intel Xeon Gold 6238, 2.10GHz)

$SPECrate2017\_int\_base = 485$

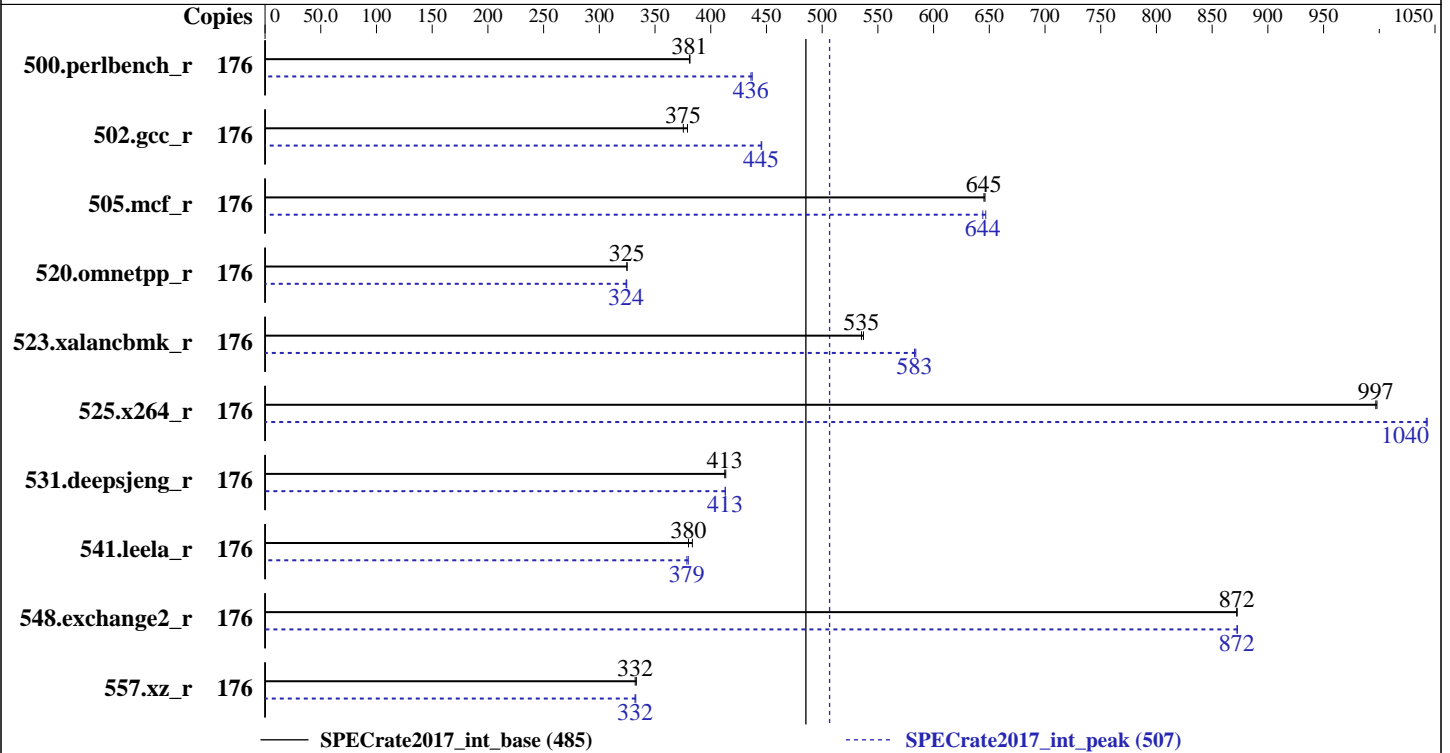$SPECrate2017\_int\_peak = 507$

CPU2017 License: 55

Test Sponsor: Dell Inc.

Tested by: Dell Inc.

Test Date: Jun-2019

Hardware Availability: Apr-2019

Software Availability: Feb-2019

Benchmark	Copies	Base	Peak
500.perlbench_r	176	381	436
502.gcc_r	176	375	445
505.mcf_r	176	645	644
520.omnetpp_r	176	325	324
523.xalancbmk_r	176	535	583
525.x264_r	176	997	1040
531.deepsjeng_r	176	413	413
541.leela_r	176	380	379
548.exchange2_r	176	872	872
557.xz_r	176	332	332

SPECrate2017_int_base (485)   SPECrate2017_int_peak (507)

Hardware

CPU Name: Intel Xeon Gold 6238
 Max MHz.: 3700
 Nominal: 2100
Enabled: 88 cores, 4 chips, 2 threads/core
Orderable: 2,4 chips
Cache L1: 32 KB I + 32 KB D on chip per core
 L2: 1 MB I+D on chip per core
 L3: 30.25 MB I+D on chip per chip
 Other: None
Memory: 768 GB (24 x 32 GB 2Rx4 PC4-2933Y-R)
Storage: 1 x 960 GB SATA SSD
Other: None

Software

OS: Ubuntu 18.04.2 LTS
 kernel 4.15.0-45-generic
Compiler: C/C++: Version 19.0.1.144 of Intel C/C++
 Compiler Build 20181018 for Linux;
 Fortran: Version 19.0.1.144 of Intel Fortran
 Compiler Build 20181018 for Linux
Parallel: No
Firmware: Version 2.1.8 released Apr-2019
File System: ext4
System State: Run level 5 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other: jemalloc memory allocator V5.0.1

Standard Performance Evaluation Corporation (info@spec.org)

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	176	735	381	**736**	**381**			176	**643**	**436**	641	437		
502.gcc_r	176	**664**	**375**	657	379			176	**560**	**445**	559	446		
505.mcf_r	176	440	646	**441**	**645**			176	440	647	**442**	**644**		
520.omnetpp_r	176	711	325	**711**	**325**			176	711	325	**713**	**324**		
523.xalancbmk_r	176	**347**	**535**	346	537			176	318	584	**319**	**583**		
525.x264_r	176	309	998	**309**	**997**			176	**296**	**1040**	295	1040		
531.deepsjeng_r	176	488	413	**489**	**413**			176	**488**	**413**	488	413		
541.leela_r	176	**767**	**380**	760	384			176	**770**	**379**	767	380		
548.exchange2_r	176	529	872	**529**	**872**			176	528	873	**529**	**872**		
557.xz_r	176	570	333	**572**	**332**			176	571	333	**573**	**332**		
SPECrate2017_int_base =		**485**												
SPECrate2017_int_peak =		**507**												

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"

General Notes

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

LD_LIBRARY_PATH = "/home/cpu2017/lib/ia32:/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-32:/home/cpu2017/je5.0.1-64"

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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:
sync; echo 3>   /proc/sys/vm/drop_caches
runcpu command invoked through numactl i.e.:

(Continued on next page)

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General Notes (Continued)

```
numactl --interleave=all runcpu <etc>
jemalloc, a general purpose malloc implementation
built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases
```

Platform Notes

```
BIOS settings
ADDDC setting disabled
Sub NUMA Cluster enabled
Virtualization Technology disabled
DCU Streamer Prefetcher 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
Memory Patrol Scrub disabled
Logical Processor enabled
CPU Interconnect Bus Link Power Management disabled
PCI ASPM L1 Link Power Management disabled
Sysinfo program /home/cpu2017/bin/sysinfo
Rev: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on intel-sut Thu Jun 27 15:31:45 2019

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
   model name : Intel(R) Xeon(R) Gold 6238 CPU @ 2.10GHz
      4  "physical id"s (chips)
      176 "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 : 22
      siblings  : 44
      physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27 28
      physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27 28
      physical 2: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27 28
      physical 3: cores 0 1 2 3 4 5 8 9 10 11 12 16 17 18 19 20 21 24 25 26 27 28

From lscpu:
      Architecture:          x86_64
      CPU op-mode(s):        32-bit, 64-bit
```

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Platform Notes (Continued)

```
       Byte Order:          Little Endian
       CPU(s):              176
       On-line CPU(s) list: 0-175
       Thread(s) per core:  2
       Core(s) per socket:  22
       Socket(s):           4
       NUMA node(s):        8
       Vendor ID:           GenuineIntel
       CPU family:          6
       Model:               85
       Model name:          Intel(R) Xeon(R) Gold 6238 CPU @ 2.10GHz
       Stepping:            7
       CPU MHz:             1247.775
       BogoMIPS:            4200.00
       Virtualization:      VT-x
       L1d cache:           32K
       L1i cache:           32K
       L2 cache:            1024K
       L3 cache:            30976K
       NUMA node0 CPU(s):
       0,8,16,24,32,40,48,56,64,72,80,88,96,104,112,120,128,136,144,152,160,168
       NUMA node1 CPU(s):
       1,9,17,25,33,41,49,57,65,73,81,89,97,105,113,121,129,137,145,153,161,169
       NUMA node2 CPU(s):
       2,10,18,26,34,42,50,58,66,74,82,90,98,106,114,122,130,138,146,154,162,170
       NUMA node3 CPU(s):
       3,11,19,27,35,43,51,59,67,75,83,91,99,107,115,123,131,139,147,155,163,171
       NUMA node4 CPU(s):
       4,12,20,28,36,44,52,60,68,76,84,92,100,108,116,124,132,140,148,156,164,172
       NUMA node5 CPU(s):
       5,13,21,29,37,45,53,61,69,77,85,93,101,109,117,125,133,141,149,157,165,173
       NUMA node6 CPU(s):
       6,14,22,30,38,46,54,62,70,78,86,94,102,110,118,126,134,142,150,158,166,174
       NUMA node7 CPU(s):
       7,15,23,31,39,47,55,63,71,79,87,95,103,111,119,127,135,143,151,159,167,175
       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 rdtscp
       lm constant_tsc art 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 aes xsave avx f16c rdrand
       lahf_lm abm 3dnowprefetch cpuid_fault epb cat_l3 cdp_l3 invpcid_single ssbd mba ibrs
       ibpb stibp ibrs_enhanced tpr_shadow vnmi 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 xsavec xgetbv1
       xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku
       ospke avx512_vnni flush_l1d arch_capabilities
```

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Platform Notes (Continued)

```
/proc/cpuinfo cache data
   cache size : 30976 KB

From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
physical chip.
  available: 8 nodes (0-7)
  node 0 cpus: 0 8 16 24 32 40 48 56 64 72 80 88 96 104 112 120 128 136 144 152 160 168
  node 0 size: 95167 MB
  node 0 free: 94921 MB
  node 1 cpus: 1 9 17 25 33 41 49 57 65 73 81 89 97 105 113 121 129 137 145 153 161 169
  node 1 size: 96763 MB
  node 1 free: 96521 MB
  node 2 cpus: 2 10 18 26 34 42 50 58 66 74 82 90 98 106 114 122 130 138 146 154 162 170
  node 2 size: 96763 MB
  node 2 free: 96522 MB
  node 3 cpus: 3 11 19 27 35 43 51 59 67 75 83 91 99 107 115 123 131 139 147 155 163 171
  node 3 size: 96742 MB
  node 3 free: 94661 MB
  node 4 cpus: 4 12 20 28 36 44 52 60 68 76 84 92 100 108 116 124 132 140 148 156 164 172
  node 4 size: 96763 MB
  node 4 free: 96544 MB
  node 5 cpus: 5 13 21 29 37 45 53 61 69 77 85 93 101 109 117 125 133 141 149 157 165 173
  node 5 size: 96763 MB
  node 5 free: 96493 MB
  node 6 cpus: 6 14 22 30 38 46 54 62 70 78 86 94 102 110 118 126 134 142 150 158 166 174
  node 6 size: 96763 MB
  node 6 free: 94672 MB
  node 7 cpus: 7 15 23 31 39 47 55 63 71 79 87 95 103 111 119 127 135 143 151 159 167 175
  node 7 size: 96762 MB
  node 7 free: 96509 MB
  node distances:
  node   0   1   2   3   4   5   6   7
    0:  10  21  21  21  11  21  21  21
    1:  21  10  21  21  21  11  21  21
    2:  21  21  10  21  21  21  11  21
    3:  21  21  21  10  21  21  21  11
    4:  11  21  21  21  10  21  21  21
    5:  21  11  21  21  21  10  21  21
    6:  21  21  11  21  21  21  10  21
    7:  21  21  21  11  21  21  21  10

From /proc/meminfo
   MemTotal:       791031516 kB
   HugePages_Total:        0
   Hugepagesize:        2048 kB

/usr/bin/lsb_release -d
```

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Platform Notes (Continued)

```
     Ubuntu 18.04.2 LTS

 From /etc/*release* /etc/*version*
    debian_version: buster/sid
    os-release:
       NAME="Ubuntu"
       VERSION="18.04.2 LTS (Bionic Beaver)"
       ID=ubuntu
       ID_LIKE=debian
       PRETTY_NAME="Ubuntu 18.04.2 LTS"
       VERSION_ID="18.04"
       HOME_URL="https://www.ubuntu.com/"
       SUPPORT_URL="https://help.ubuntu.com/"

 uname -a:
    Linux intel-sut 4.15.0-45-generic #48-Ubuntu SMP Tue Jan 29 16:28:13 UTC 2019 x86_64
    x86_64 x86_64 GNU/Linux

 Kernel self-reported vulnerability status:

 CVE-2017-5754 (Meltdown):          Not affected
 CVE-2017-5753 (Spectre variant 1): Mitigation: __user pointer sanitization
 CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB

 run-level 5 Jun 27 15:26

 SPEC is set to: /home/cpu2017
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sda2       ext4  439G   28G  389G   7% /

 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.
    BIOS Dell Inc. 2.1.8 04/30/2019
   Memory:
    12x 002C069D002C 36ASF4G72PZ-2G9E2 32 GB 2 rank 2933
    12x 00AD063200AD HMA84GR7CJR4N-WM 32 GB 2 rank 2933
    24x Not Specified Not Specified

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
 CC   502.gcc_r(peak)
```

(Continued on next page)

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Compiler Version Notes (Continued)

```
--------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on IA-32, Version
  19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
 CC   500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
      525.x264_r(base, peak) 557.xz_r(base, peak)
--------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
CC   500.perlbench_r(peak)
--------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
CXXC 523.xalancbmk_r(peak)
--------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on IA-32, Version
  19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
 CXXC 520.omnetpp_r(base, peak) 523.xalancbmk_r(base) 531.deepsjeng_r(base,
      peak) 541.leela_r(base, peak)
--------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------


==========================================================================
 FC  548.exchange2_r(base, peak)
--------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.1.144 Build 20181018
Copyright (C) 1985-2018 Intel Corporation.  All rights reserved.
--------------------------------------------------------------------------
```

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Base Compiler Invocation

C benchmarks:
`icc -m64 -std=c11`

C++ benchmarks:
`icpc -m64`

Fortran benchmarks:
`ifort -m64`

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:
```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

C++ benchmarks:
```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

Fortran benchmarks:
```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

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Peak Compiler Invocation

C benchmarks (except as noted below):
```
icc -m64 -std=c11
```

502.gcc_r: `icc -m32 -std=c11 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/ia32_lin`

C++ benchmarks (except as noted below):
```
icpc -m64
```

523.xalancbmk_r: `icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/ia32_lin`

Fortran benchmarks:
```
ifort -m64
```

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: `-D_FILE_OFFSET_BITS=64 -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) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4 -fno-strict-overflow -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64 -lqkmalloc`

   502.gcc_r: `-Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4 -L/usr/local/je5.0.1-32/lib -ljemalloc`

   505.mcf_r: `-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-mem-layout-trans=4`

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Peak Optimization Flags (Continued)

505.mcf_r (continued):
```
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

525.x264_r: `-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div`
```
-qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

557.xz_r: `Same as 505.mcf_r`

C++ benchmarks:

520.omnetpp_r: `-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div`
```
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

523.xalancbmk_r: `-Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2) `-ipo`
```
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4
-L/usr/local/je5.0.1-32/lib -ljemalloc
```

531.deepsjeng_r: `Same as 520.omnetpp_r`

541.leela_r: `Same as 520.omnetpp_r`

Fortran benchmarks:
```
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.1.144/linux/compiler/lib/intel64
-lqkmalloc
```

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2019-04-02.html
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE3.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2019-04-02.xml
http://www.spec.org/cpu2017/flags/Dell-Platform-Flags-PowerEdge14G-revE3.xml

Standard Performance Evaluation Corporation (info@spec.org)

https://www.spec.org/

SPEC CPU2017 Integer Rate Result

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Dell Inc.

PowerEdge R940 (Intel Xeon Gold 6238, 2.10GHz)

SPECrate2017_int_base = 485

SPECrate2017_int_peak = 507

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

Test Date: Jun-2019
Hardware Availability: Apr-2019
Software Availability: Feb-2019

Tested with SPEC CPU2017 v1.0.5 on 2019-06-27 11:31:44-0400.
Report generated on 2019-07-23 15:01:52 by CPU2017 PDF formatter v6067.
Originally published on 2019-07-23.