SPEC CPU®2017 Integer Speed Result

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Lenovo Global Technology

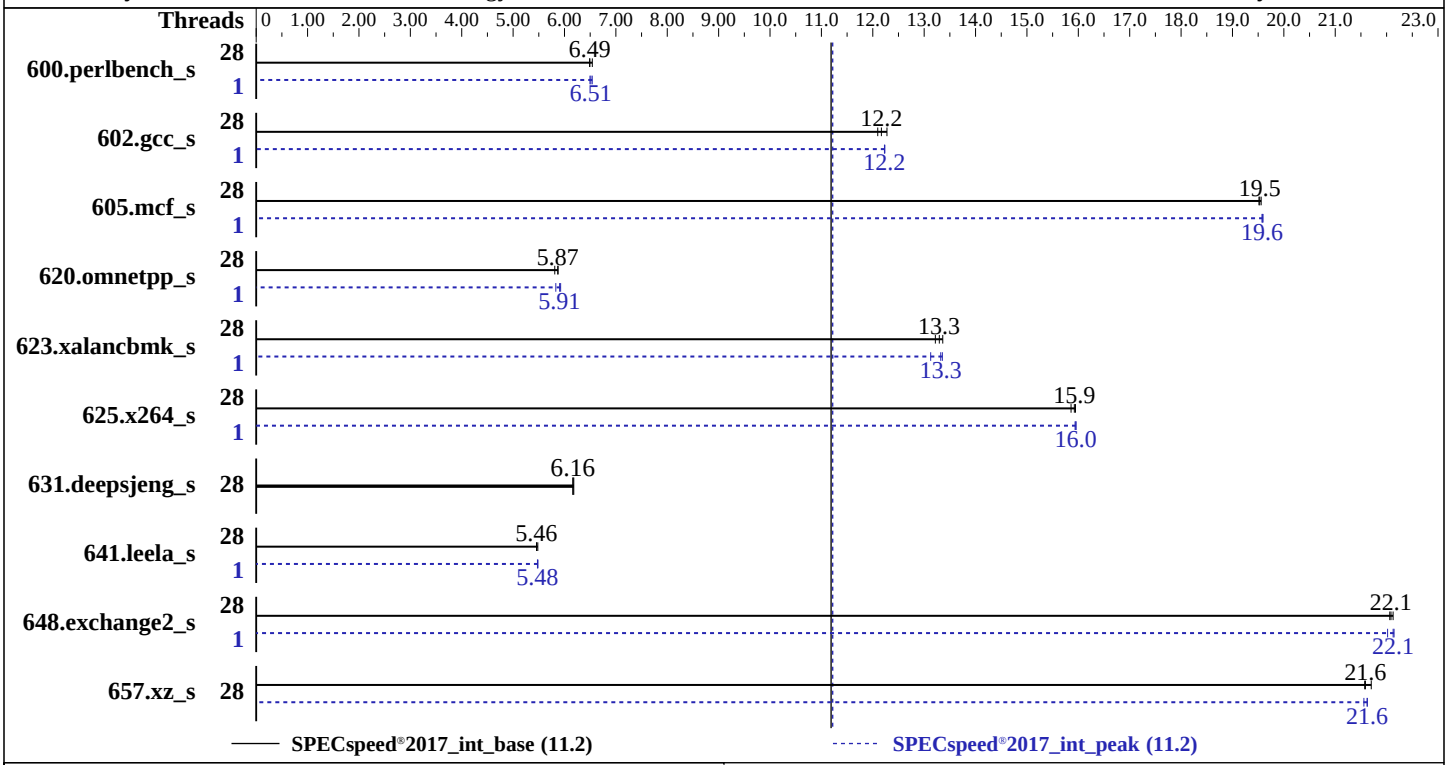
ThinkSystem SR655
2.75 GHz, AMD EPYC 7453

SPECspeed®2017_int_base = 11.2

SPECspeed®2017_int_peak = 11.2

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
Tested by: Lenovo Global Technology

Test Date: Jul-2021
Hardware Availability: Jun-2021
Software Availability: Mar-2021



Hardware

CPU Name:	AMD EPYC 7453
Max MHz:	3450
Nominal:	2750
Enabled:	28 cores, 1 chip, 2 threads/core
Orderable:	1 chip
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	512 KB I+D on chip per core
L3:	64 MB I+D on chip per chip, 16 MB shared / 7 cores
Other:	None
Memory:	256 GB (8 x 32 GB 2Rx4 PC4-3200AA-R)
Storage:	1 x 960 GB SATA SSD
Other:	None

Software

OS:	SUSE Linux Enterprise Server 15 SP2 (x86_64) Kernel 5.3.18-22-default
Compiler:	C/C++/Fortran: Version 3.0.0 of AOCC
Parallel:	Yes
Firmware:	Lenovo BIOS Version CFE125U 6.0 released May-2021
File System:	xfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	jemalloc: jemalloc memory allocator library v5.1.0
Power Management:	BIOS and OS set to prefer performance at the cost of additional power usage

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Results Table

Benchmark	Base							Peak						
	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Threads	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
600.perlbench_s	28	273	6.49	271	6.54	**273**	**6.49**	1	271	6.54	273	6.50	**272**	**6.51**
602.gcc_s	28	324	12.3	**327**	**12.2**	329	12.1	1	325	12.2	**326**	**12.2**	326	12.2
605.mcf_s	28	241	19.6	242	19.5	**242**	**19.5**	1	241	19.6	**241**	**19.6**	241	19.6
620.omnetpp_s	28	278	5.88	**278**	**5.87**	281	5.81	1	280	5.83	**276**	**5.91**	275	5.93
623.xalancbmk_s	28	106	13.4	**107**	**13.3**	107	13.2	1	108	13.1	**106**	**13.3**	106	13.4
625.x264_s	28	111	15.9	111	15.9	**111**	**15.9**	1	**111**	**16.0**	111	15.9	111	16.0
631.deepsjeng_s	28	232	6.18	232	6.16	**232**	**6.16**	28	232	6.18	232	6.16	**232**	**6.16**
641.leela_s	28	311	5.48	313	5.46	**313**	**5.46**	1	**312**	**5.48**	312	5.47	311	5.48
648.exchange2_s	28	133	22.1	133	22.1	**133**	**22.1**	1	134	22.0	133	22.1	**133**	**22.1**
657.xz_s	28	287	21.6	285	21.7	**286**	**21.6**	28	287	21.6	286	21.6	**286**	**21.6**

SPECspeed®2017_int_base = **11.2**

SPECspeed®2017_int_peak = **11.2**

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

Compiler Notes

```
The AMD64 AOCC Compiler Suite is available at
http://developer.amd.com/amd-aocc/
```

Submit Notes

```
The config file option 'submit' was used.
'numactl' was used to bind copies to the cores.
See the configuration file for details.
```

Operating System Notes

```
'ulimit -s unlimited' was used to set environment stack size
'ulimit -l 2097152' was used to set environment locked pages in memory limit
runcpu command invoked through numactl i.e.:
numactl --interleave=all runcpu <etc>
'echo 8 > /proc/sys/vm/dirty_ratio' run as root to limit dirty cache to 8% of
memory.
'echo 1 > /proc/sys/vm/swappiness' run as root to limit swap usage to minimum
necessary.
'echo 1 > /proc/sys/vm/zone_reclaim_mode' run as root to free node-local memory
and avoid remote memory usage.
'sync; echo 3 > /proc/sys/vm/drop_caches' run as root to reset filesystem caches.
'sysctl -w kernel.randomize_va_space=0' run as root to disable address space layout
randomization (ASLR) to reduce run-to-run variability.
To enable Transparent Hugepages (THP) for all allocations,
'echo always > /sys/kernel/mm/transparent_hugepage/enabled' and
```

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Operating System Notes (Continued)

'echo always > /sys/kernel/mm/transparent_hugepage/defrag' run as root.

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
GOMP_CPU_AFFINITY = "0-55"
LD_LIBRARY_PATH =
     "/home/cpu2017-1.1.8-amd-aocc300-milan-B1/amd_speed_aocc300_milan_B_lib/
     64;/home/cpu2017-1.1.8-amd-aocc300-milan-B1/amd_speed_aocc300_milan_B_li
     b/32:"
MALLOC_CONF = "retain:true"
OMP_DYNAMIC = "false"
OMP_SCHEDULE = "static"
OMP_STACKSIZE = "128M"
OMP_THREAD_LIMIT = "56"

Environment variables set by runcpu during the 600.perlbench_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 602.gcc_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 605.mcf_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 620.omnetpp_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 623.xalancbmk_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 625.x264_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 641.leela_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 648.exchange2_s peak run:
GOMP_CPU_AFFINITY = "0"

Environment variables set by runcpu during the 657.xz_s peak run:
GOMP_CPU_AFFINITY = "0-27"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 1TiB Memory using openSUSE 15.2

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: configured and built with GCC v4.8.2 in RHEL 7.4 (No options specified)
jemalloc 5.1.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.1.0/jemalloc-5.1.0.tar.bz2
```

Platform Notes

```
 BIOS configuration:
 Choose Operating Mode set to Maximum Performance
 LLC as NUMA Node set to Enabled
 NUMA nodes per socket set to NPS2
 SOC P-states set to P0

 Sysinfo program /home/cpu2017-1.1.8-amd-aocc300-milan-B1/bin/sysinfo
 Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acafc64d
 running on localhost Fri Apr 17 21:24:16 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
    model name : AMD EPYC 7453 28-Core Processor
       1  "physical id"s (chips)
       56 "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 : 28
       siblings  : 56
       physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14 16 17 18 19 20 21 22 24 25 26 27
       28 29 30

 From lscpu from util-linux 2.33.1:
      Architecture:        x86_64
      CPU op-mode(s):      32-bit, 64-bit
      Byte Order:          Little Endian
      Address sizes:       48 bits physical, 48 bits virtual
      CPU(s):              56
```

(Continued on next page)

Platform Notes (Continued)

```
      On-line CPU(s) list: 0-55
      Thread(s) per core:  2
      Core(s) per socket:  28
      Socket(s):           1
      NUMA node(s):        2
      Vendor ID:           AuthenticAMD
      CPU family:          25
      Model:               1
      Model name:          AMD EPYC 7453 28-Core Processor
      Stepping:            1
      CPU MHz:             2607.981
      CPU max MHz:         2750.0000
      CPU min MHz:         1500.0000
      BogoMIPS:            5489.51
      Virtualization:      AMD-V
      L1d cache:           32K
      L1i cache:           32K
      L2 cache:            512K
      L3 cache:            16384K
      NUMA node0 CPU(s):   0-13,28-41
      NUMA node1 CPU(s):   14-27,42-55
      Flags:               fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
      pat pse36 clflush mmx fxsr sse sse2 ht syscall nx mmxext fxsr_opt pdpe1gb rdtscp lm
      constant_tsc rep_good nopl nonstop_tsc cpuid extd_apicid aperfmperf pni pclmulqdq
      monitor ssse3 fma cx16 pcid sse4_1 sse4_2 movbe popcnt aes xsave avx f16c rdrand
      lahf_lm cmp_legacy svm extapic cr8_legacy abm sse4a misalignsse 3dnowprefetch osvw
      ibs skinit wdt tce topoext perfctr_core perfctr_nb bpext perfctr_llc mwaitx cpb
      cat_l3 cdp_l3 invpcid_single hw_pstate ssbd mba ibrs ibpb stibp vmmcall fsgsbase
      bmi1 avx2 smep bmi2 erms invpcid cqm rdt_a rdseed adx smap clflushopt clwb sha_ni
      xsaveopt xsavec xgetbv1 xsaves cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local
      clzero irperf xsaveerptr wbnoinvd arat npt lbrv svm_lock nrip_save tsc_scale
      vmcb_clean flushbyasid decodeassists pausefilter pfthreshold v_vmsave_vmload vgif
      umip pku ospke vaes vpclmulqdq rdpid overflow_recov succor smca

  /proc/cpuinfo cache data
     cache size : 512 KB

  From numactl --hardware
  WARNING: a numactl 'node' might or might not correspond to a physical chip.
    available: 2 nodes (0-1)
    node 0 cpus: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 28 29 30 31 32 33 34 35 36 37 38 39 40 41
    node 0 size: 128822 MB
    node 0 free: 128373 MB
    node 1 cpus: 14 15 16 17 18 19 20 21 22 23 24 25 26 27 42 43 44 45 46 47 48 49 50 51 52
    53 54 55
    node 1 size: 128969 MB
    node 1 free: 128400 MB
```

(Continued on next page)

Platform Notes (Continued)

```
  node distances:
  node   0   1
    0:  10  12
    1:  12  10

From /proc/meminfo
   MemTotal:       263979436 kB
   HugePages_Total:       0
   Hugepagesize:       2048 kB

/sys/devices/system/cpu/cpu*/cpufreq/scaling_governor has
   performance

/usr/bin/lsb_release -d
   SUSE Linux Enterprise Server 15 SP2

From /etc/*release* /etc/*version*
   os-release:
      NAME="SLES"
      VERSION="15-SP2"
      VERSION_ID="15.2"
      PRETTY_NAME="SUSE Linux Enterprise Server 15 SP2"
      ID="sles"
      ID_LIKE="suse"
      ANSI_COLOR="0;32"
      CPE_NAME="cpe:/o:suse:sles:15:sp2"

uname -a:
   Linux localhost 5.3.18-22-default #1 SMP Wed Jun 3 12:16:43 UTC 2020 (720aeba) x86_64
   x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-12207 (iTLB Multihit):                          Not affected
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: Full AMD retpoline,
                                                       IBPB: conditional, IBRS_FW, STIBP:
                                                         always-on, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
```

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Platform Notes (Continued)

```
 CVE-2019-11135 (TSX Asynchronous Abort):              Not affected

 run-level 3 Apr 17 21:14

 SPEC is set to: /home/cpu2017-1.1.8-amd-aocc300-milan-B1
    Filesystem     Type  Size  Used Avail Use% Mounted on
    /dev/sdb3      xfs   891G   82G  810G  10% /

 From /sys/devices/virtual/dmi/id
     Vendor:          Lenovo
     Product:         ThinkSystem SR655 -[7Y00000000]-
     Product Family: ThinkSystem
     Serial:          0123456789

 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:
     8x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200
     8x Unknown Unknown

 BIOS:
    BIOS Vendor:       Lenovo
    BIOS Version:      CFE125U
    BIOS Date:         05/28/2021
    BIOS Revision:     6.0

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 600.perlbench_s(base, peak) 602.gcc_s(base, peak) 605.mcf_s(base,
        | peak) 625.x264_s(base, peak) 657.xz_s(base, peak)
------------------------------------------------------------------------------
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
  LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++     | 620.omnetpp_s(base, peak) 623.xalancbmk_s(base, peak)
        | 631.deepsjeng_s(base, peak) 641.leela_s(base, peak)
```

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Compiler Version Notes (Continued)

```
------------------------------------------------------------------------------
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
  LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran | 648.exchange2_s(base, peak)
------------------------------------------------------------------------------
AMD clang version 12.0.0 (CLANG: AOCC_3.0.0-Build#78 2020_12_10) (based on
  LLVM Mirror.Version.12.0.0)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Base Portability Flags

600.perlbench_s: -DSPEC_LINUX_X64 -DSPEC_LP64
602.gcc_s: -DSPEC_LP64
605.mcf_s: -DSPEC_LP64
620.omnetpp_s: -DSPEC_LP64
623.xalancbmk_s: -DSPEC_LINUX -DSPEC_LP64
625.x264_s: -DSPEC_LP64
631.deepsjeng_s: -DSPEC_LP64
641.leela_s: -DSPEC_LP64
648.exchange2_s: -DSPEC_LP64
657.xz_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:

```
-m64 -mno-adx -mno-sse4a -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -mllvm -inline-threshold=1000
-fremap-arrays -mllvm -function-specialize -flv-function-specialization
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=true
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3 -z muldefs
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang -lflangrti
```

C++ benchmarks:

```
-m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -mllvm -enable-partial-unswitch
-mllvm -unroll-threshold=100 -finline-aggressive
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -extra-vectorizer-passes -mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true -mllvm -convert-pow-exp-to-int=false
-z muldefs -mllvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
-lflangrti
```

Fortran benchmarks:

```
-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-inline-recursion=4
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -z muldefs
-mllvm -unroll-aggressive -mllvm -unroll-threshold=150 -DSPEC_OPENMP
-fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc -lflang
-lflangrti
```

Base Other Flags

C benchmarks:
```
-Wno-unused-command-line-argument -Wno-return-type
```

C++ benchmarks:
```
-Wno-unused-command-line-argument -Wno-return-type
```

Fortran benchmarks:
```
-Wno-return-type
```

Peak Compiler Invocation

C benchmarks:
```
clang
```

C++ benchmarks:
```
clang++
```

Fortran benchmarks:
```
flang
```

Peak Portability Flags

```
Same as Base Portability Flags
```

Peak Optimization Flags

C benchmarks:
```
-m64 -mno-adx -mno-sse4a -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -fstruct-layout=5
-mllvm -unroll-threshold=50 -fremap-arrays -flv-function-specialization
-mllvm -inline-threshold=1000 -mllvm -enable-gvn-hoist
-mllvm -global-vectorize-slp=true -mllvm -function-specialize
-mllvm -enable-licm-vrp -mllvm -reduce-array-computations=3
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm -ljemalloc
-lflang
```

(Continued on next page)

Peak Optimization Flags (Continued)

C++ benchmarks:

620.omnetpp_s: -m64 -std=c++98 -mno-adx -mno-sse4a
-Wl,-mllvm -Wl,-do-block-reorder=aggressive
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver3 -fveclib=AMDLIBM -ffast-math -flto
-finline-aggressive -mllvm -unroll-threshold=100
-flv-function-specialization -mllvm -enable-licm-vrp
-mllvm -reroll-loops -mllvm -aggressive-loop-unswitch
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp=true
-mllvm -do-block-reorder=aggressive
-fvirtual-function-elimination -fvisibility=hidden
-DSPEC_OPENMP -fopenmp -fopenmp=libomp -lomp -lamdlibm
-ljemalloc -lflang

623.xalancbmk_s: Same as 620.omnetpp_s

631.deepsjeng_s: basepeak = yes

641.leela_s: Same as 620.omnetpp_s

Fortran benchmarks:
-m64 -mno-adx -mno-sse4a -Wl,-mllvm -Wl,-inline-recursion=4
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver3
-fveclib=AMDLIBM -ffast-math -flto -mllvm -unroll-aggressive
-mllvm -unroll-threshold=150 -DSPEC_OPENMP -fopenmp -fopenmp=libomp
-lomp -lamdlibm -ljemalloc -lflang

Peak Other Flags

C benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

C++ benchmarks:
-Wno-unused-command-line-argument -Wno-return-type

Fortran benchmarks:
-Wno-return-type

The flags files that were used to format this result can be browsed at

http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Milan1P-G.html
http://www.spec.org/cpu2017/flags/aocc300-flags-A1.html

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

http://www.spec.org/cpu2017/flags/Lenovo-Platform-SPECcpu2017-Flags-V1.2-Milan1P-G.xml
http://www.spec.org/cpu2017/flags/aocc300-flags-A1.xml

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