SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

ThinkSystem SR645
2.00 GHz, AMD EPYC 7663

$SPECrate^{®}2017\_int\_base = 687$

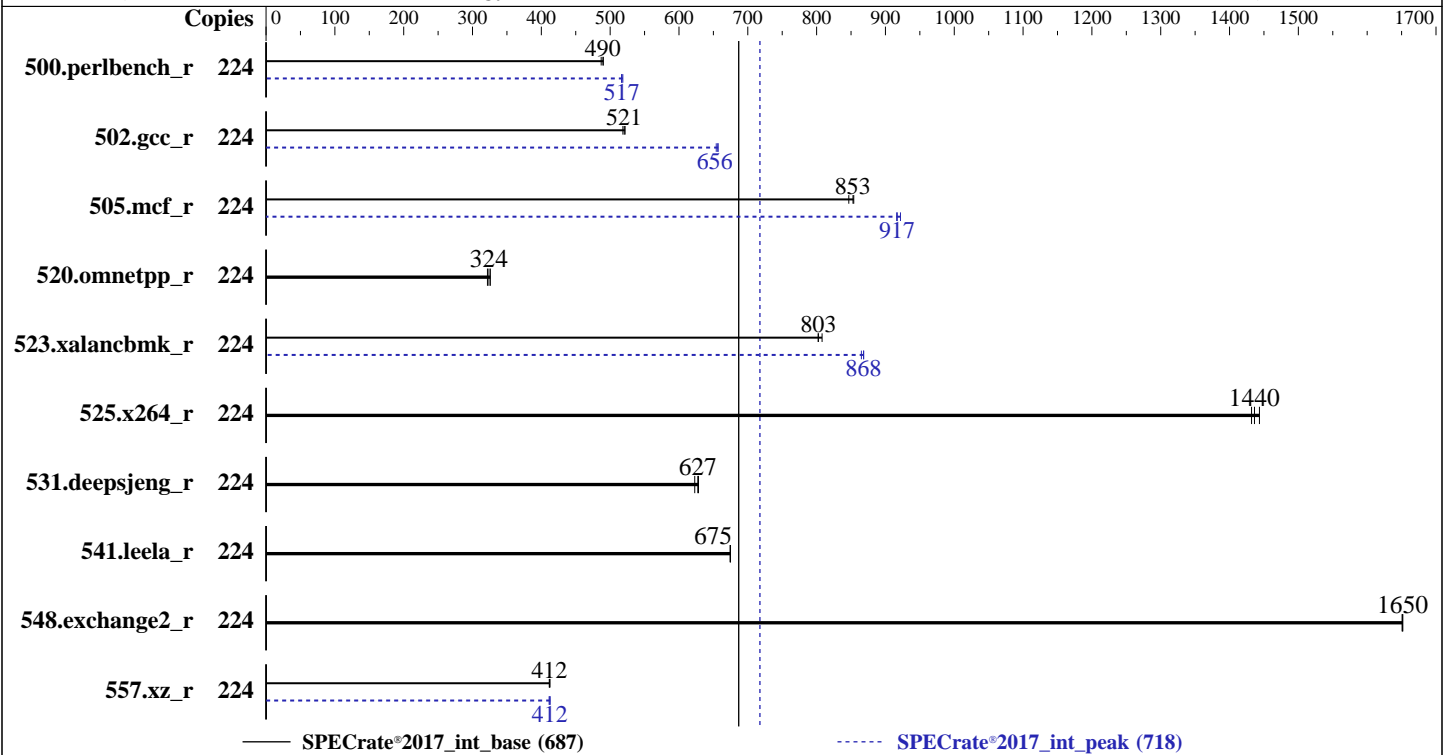$SPECrate^{®}2017\_int\_peak = 718$

CPU2017 License: 9017

Test Sponsor: Lenovo Global Technology

Tested by: Lenovo Global Technology

Test Date: Apr-2021

Hardware Availability: Apr-2021

Software Availability: Mar-2021

Benchmark	Copies	Base	Peak
500.perlbench_r	224	490	517
502.gcc_r	224	521	656
505.mcf_r	224	853	917
520.omnetpp_r	224	324	
523.xalancbmk_r	224	803	868
525.x264_r	224	1440	
531.deepsjeng_r	224	627	
541.leela_r	224	675	
548.exchange2_r	224	1650	
557.xz_r	224	412	412

SPECrate®2017_int_base (687)   SPECrate®2017_int_peak (718)

Hardware

CPU Name: AMD EPYC 7663
Max MHz: 3500
Nominal: 2000
Enabled: 112 cores, 2 chips, 2 threads/core
Orderable: 1,2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 512 KB I+D on chip per core
L3: 256 MB I+D on chip per chip,
32 MB shared / 7 cores
Other: None
Memory: 512 GB (16 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: No
Firmware: Lenovo BIOS Version D8E115E 2.01 released Mar-2021
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other: jemalloc: jemalloc memory allocator library v5.1.0
Power Management: BIOS set to prefer performance at the cost of
additional power usage

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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	224	732	487	**728**	**490**	728	490	224	688	518	690	517	**690**	**517**
502.gcc_r	224	**609**	**521**	612	519	608	522	224	**483**	**656**	483	657	485	654
505.mcf_r	224	424	854	**424**	**853**	427	847	224	393	922	**395**	**917**	395	916
520.omnetpp_r	224	902	326	**907**	**324**	914	322	224	902	326	**907**	**324**	914	322
523.xalancbmk_r	224	295	802	293	808	**295**	**803**	224	**272**	**868**	273	865	272	868
525.x264_r	224	272	1440	**273**	**1440**	274	1430	224	272	1440	**273**	**1440**	274	1430
531.deepsjeng_r	224	412	623	**409**	**627**	409	628	224	412	623	**409**	**627**	409	628
541.leela_r	224	550	674	**550**	**675**	550	675	224	550	674	**550**	**675**	550	675
548.exchange2_r	224	**355**	**1650**	355	1650	356	1650	224	**355**	**1650**	355	1650	356	1650
557.xz_r	224	586	413	588	412	**588**	**412**	224	**587**	**412**	588	411	586	413
SPECrate®2017_int_base =	**687**													
SPECrate®2017_int_peak =	**718**													

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 limit
'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.
'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 for peak
integer runs and all FP runs to enable Transparent Hugepages (THP).
'echo madvise > /sys/kernel/mm/transparent_hugepage/enabled' run as root for base
integer runs to enable THP only on request.
'echo 0 > /proc/sys/kernel/numa_balancing' run as root to eliminate NUMA
location probing; the workloads are all bound to specific NUMA nodes.
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/cpu2017-1.1.5-amd-aocc300-milan-A1/amd_rate_aocc300_milan_A_lib/6
     4;/home/cpu2017-1.1.5-amd-aocc300-milan-A1/amd_rate_aocc300_milan_A_lib/
     32:"
MALLOC_CONF = "retain:true"

Environment variables set by runcpu during the 523.xalancbmk_r peak run:
MALLOC_CONF = "thp:never"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7742 CPU + 512GiB 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:
Operating Mode set to Maximum Performance and then set it to Custom Mode
4-Link xGMI Max Speed set to 16Gbps
SOC P-States set to P0
NUMA nodes per socket set to NPS4
ACPI SRAT L3 Cache as NUMA Domain set to Enable
L2 Stream HW Prefetcher set to Disable
Memory interleaving set to Disabled
```

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Platform Notes (Continued)

```
 Sysinfo program /home/cpu2017-1.1.5-amd-aocc300-milan-A1/bin/sysinfo
 Rev: r6538 of 2020-09-24 e8664e66d2d7080afeaa89d4b38e2f1c
 running on localhost Fri Apr  9 22:08:35 2021

 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 7663 56-Core Processor
       2  "physical id"s (chips)
       224 "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 : 56
       siblings  : 112
       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 32 33 34 35 36 37 38 40 41 42 43 44 45 46 48 49 50 51 52 53 54 56 57 58 59
       60 61 62
       physical 1: 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 32 33 34 35 36 37 38 40 41 42 43 44 45 46 48 49 50 51 52 53 54 56 57 58 59
       60 61 62

 From lscpu:
       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):              224
       On-line CPU(s) list: 0-223
       Thread(s) per core:  2
       Core(s) per socket:  56
       Socket(s):           2
       NUMA node(s):        16
       Vendor ID:           AuthenticAMD
       CPU family:          25
       Model:               1
       Model name:          AMD EPYC 7663 56-Core Processor
       Stepping:            1
       CPU MHz:             1526.049
       CPU max MHz:         2000.0000
       CPU min MHz:         1500.0000
       BogoMIPS:            3992.32
       Virtualization:      AMD-V
       L1d cache:           32K
       L1i cache:           32K
```

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Platform Notes (Continued)

```
         L2 cache:              512K
         L3 cache:              32768K
         NUMA node0 CPU(s):     0-6,112-118
         NUMA node1 CPU(s):     7-13,119-125
         NUMA node2 CPU(s):     14-20,126-132
         NUMA node3 CPU(s):     21-27,133-139
         NUMA node4 CPU(s):     28-34,140-146
         NUMA node5 CPU(s):     35-41,147-153
         NUMA node6 CPU(s):     42-48,154-160
         NUMA node7 CPU(s):     49-55,161-167
         NUMA node8 CPU(s):     56-62,168-174
         NUMA node9 CPU(s):     63-69,175-181
         NUMA node10 CPU(s):    70-76,182-188
         NUMA node11 CPU(s):    77-83,189-195
         NUMA node12 CPU(s):    84-90,196-202
         NUMA node13 CPU(s):    91-97,203-209
         NUMA node14 CPU(s):    98-104,210-216
         NUMA node15 CPU(s):    105-111,217-223
         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: 16 nodes (0-15)
   node 0 cpus: 0 1 2 3 4 5 6 112 113 114 115 116 117 118
   node 0 size: 32064 MB
   node 0 free: 31830 MB
   node 1 cpus: 7 8 9 10 11 12 13 119 120 121 122 123 124 125
   node 1 size: 32250 MB
   node 1 free: 32089 MB
   node 2 cpus: 14 15 16 17 18 19 20 126 127 128 129 130 131 132
   node 2 size: 32252 MB
   node 2 free: 32104 MB
   node 3 cpus: 21 22 23 24 25 26 27 133 134 135 136 137 138 139
```

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Platform Notes (Continued)

```
      node 3 size: 32250 MB
      node 3 free: 32104 MB
      node 4 cpus: 28 29 30 31 32 33 34 140 141 142 143 144 145 146
      node 4 size: 32252 MB
      node 4 free: 31974 MB
      node 5 cpus: 35 36 37 38 39 40 41 147 148 149 150 151 152 153
      node 5 size: 32250 MB
      node 5 free: 31918 MB
      node 6 cpus: 42 43 44 45 46 47 48 154 155 156 157 158 159 160
      node 6 size: 32252 MB
      node 6 free: 32060 MB
      node 7 cpus: 49 50 51 52 53 54 55 161 162 163 164 165 166 167
      node 7 size: 32238 MB
      node 7 free: 32102 MB
      node 8 cpus: 56 57 58 59 60 61 62 168 169 170 171 172 173 174
      node 8 size: 32252 MB
      node 8 free: 32128 MB
      node 9 cpus: 63 64 65 66 67 68 69 175 176 177 178 179 180 181
      node 9 size: 32250 MB
      node 9 free: 32126 MB
      node 10 cpus: 70 71 72 73 74 75 76 182 183 184 185 186 187 188
      node 10 size: 32252 MB
      node 10 free: 32096 MB
      node 11 cpus: 77 78 79 80 81 82 83 189 190 191 192 193 194 195
      node 11 size: 32250 MB
      node 11 free: 32074 MB
      node 12 cpus: 84 85 86 87 88 89 90 196 197 198 199 200 201 202
      node 12 size: 32218 MB
      node 12 free: 32085 MB
      node 13 cpus: 91 92 93 94 95 96 97 203 204 205 206 207 208 209
      node 13 size: 32250 MB
      node 13 free: 32118 MB
      node 14 cpus: 98 99 100 101 102 103 104 210 211 212 213 214 215 216
      node 14 size: 32252 MB
      node 14 free: 32119 MB
      node 15 cpus: 105 106 107 108 109 110 111 217 218 219 220 221 222 223
      node 15 size: 32249 MB
      node 15 free: 32108 MB
      node distances:
      node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15
        0:  10  11  12  12  12  12  12  12  32  32  32  32  32  32  32  32
        1:  11  10  12  12  12  12  12  12  32  32  32  32  32  32  32  32
        2:  12  12  10  11  12  12  12  12  32  32  32  32  32  32  32  32
        3:  12  12  11  10  12  12  12  12  32  32  32  32  32  32  32  32
        4:  12  12  12  12  10  11  12  12  32  32  32  32  32  32  32  32
        5:  12  12  12  12  11  10  12  12  32  32  32  32  32  32  32  32
        6:  12  12  12  12  12  12  10  11  32  32  32  32  32  32  32  32
```

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Platform Notes (Continued)

```
   7:  12  12  12  12  12  12  11  10  32  32  32  32  32  32  32  32
   8:  32  32  32  32  32  32  32  32  10  11  12  12  12  12  12  12
   9:  32  32  32  32  32  32  32  32  11  10  12  12  12  12  12  12
  10:  32  32  32  32  32  32  32  32  12  12  10  11  12  12  12  12
  11:  32  32  32  32  32  32  32  32  12  12  11  10  12  12  12  12
  12:  32  32  32  32  32  32  32  32  12  12  12  12  10  11  12  12
  13:  32  32  32  32  32  32  32  32  12  12  12  12  11  10  12  12
  14:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  10  11
  15:  32  32  32  32  32  32  32  32  12  12  12  12  12  12  11  10


From /proc/meminfo
   MemTotal:       528169088 kB
   HugePages_Total:        0
   Hugepagesize:        2048 kB


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


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:
```

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Platform Notes (Continued)

```
                                            always-on, RSB filling
 CVE-2020-0543 (Special Register Buffer Data Sampling): Not affected
 CVE-2019-11135 (TSX Asynchronous Abort):               Not affected

 run-level 3 Apr 9 22:06

 SPEC is set to: /home/cpu2017-1.1.5-amd-aocc300-milan-A1
    Filesystem      Type  Size  Used Avail Use% Mounted on
    /dev/sdb3       xfs   889G   80G  810G   9% /

 From /sys/devices/virtual/dmi/id
    Vendor:         Lenovo
    Product:        ThinkSystem SR645 MB
    Product Family: ThinkSystem
    Serial:         1234567890

 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:
     16x Samsung M393A4K40DB3-CWE 32 GB 2 rank 3200
     16x Unknown Unknown

 BIOS:
    BIOS Vendor:      Lenovo
    BIOS Version:     D8E115E-2.01
    BIOS Date:        03/04/2021
    BIOS Revision:    2.1
    Firmware Revision: 3.1

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 502.gcc_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------


==============================================================================
```

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Compiler Version Notes (Continued)

```
C        | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
         | 525.x264_r(base, peak) 557.xz_r(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        | 502.gcc_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------


==============================================================================
C        | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
         | 525.x264_r(base, peak) 557.xz_r(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++      | 523.xalancbmk_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------------


==============================================================================
C++      | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
         | 531.deepsjeng_r(base, peak) 541.leela_r(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)
```

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Compiler Version Notes (Continued)

```
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------


==============================================================================
C++      | 523.xalancbmk_r(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: i386-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/AMD/aocc-compiler-3.0.0/bin
------------------------------------------------------------------------


==============================================================================
C++      | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
         | 531.deepsjeng_r(base, peak) 541.leela_r(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
------------------------------------------------------------------------


==============================================================================
Fortran  | 548.exchange2_r(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
```

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SPEC CPU®2017 Integer Rate Result

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Lenovo Global Technology

ThinkSystem SR645
2.00 GHz, AMD EPYC 7663

SPECrate®2017_int_base = 687

SPECrate®2017_int_peak = 718

CPU2017 License: 9017　　　　　　　　　　　　　　　　　　　**Test Date:** Apr-2021
Test Sponsor: Lenovo Global Technology　　　　　　　　**Hardware Availability:** Apr-2021
Tested by: Lenovo Global Technology　　　　　　　　　**Software Availability:** Mar-2021

Base Portability Flags

500.perlbench_r: -DSPEC_LINUX_X64 -DSPEC_LP64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LINUX -DSPEC_LP64
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 -Wl,-allow-multiple-definition -Wl,-mllvm -Wl,-enable-licm-vrp
-flto -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 -ffast-math
-march=znver3 -fveclib=AMDLIBM -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
-lamdlibm -ljemalloc -lflang -lflangrti

C++ benchmarks:
-m64 -std=c++98 -Wl,-mllvm -Wl,-do-block-reorder=aggressive -flto
-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 -ffast-math
-march=znver3 -fveclib=AMDLIBM -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 -lamdlibm
-ljemalloc -lflang -lflangrti

Fortran benchmarks:
-m64 -Wl,-mllvm -Wl,-inline-recursion=4
-Wl,-mllvm -Wl,-lsr-in-nested-loop -Wl,-mllvm -Wl,-enable-iv-split

(Continued on next page)

Lenovo Global Technology

ThinkSystem SR645
2.00 GHz, AMD EPYC 7663

SPECrate®2017_int_base = 687

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CPU2017 License: 9017		**Test Date:**	Apr-2021
Test Sponsor:	Lenovo Global Technology	**Hardware Availability:**	Apr-2021
Tested by:	Lenovo Global Technology	**Software Availability:**	Mar-2021

Base Optimization Flags (Continued)

Fortran benchmarks (continued):
```
-flto -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 -ffast-math
-march=znver3 -fveclib=AMDLIBM -z muldefs -mllvm -unroll-aggressive
-mllvm -unroll-threshold=500 -lamdlibm -ljemalloc -lflang -lflangrti
```

Base Other Flags

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

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

Peak Compiler Invocation

C benchmarks:
```
clang
```

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

Fortran benchmarks:
```
flang
```

Peak Portability Flags

500.perlbench_r: `-DSPEC_LINUX_X64 -DSPEC_LP64`
502.gcc_r: `-D_FILE_OFFSET_BITS=64`
505.mcf_r: `-DSPEC_LP64`
520.omnetpp_r: `-DSPEC_LP64`
523.xalancbmk_r: `-DSPEC_LINUX -DSPEC_LP64`
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`

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SPECrate®2017_int_base = 687

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SPECrate®2017_int_peak = 718

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

Test Date: Apr-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021

Peak Optimization Flags

C benchmarks:

```
500.perlbench_r: -m64 -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-align-all-nofallthru-blocks=6
-Wl,-mllvm -Wl,-reduce-array-computations=3
-fprofile-instr-generate(pass 1)
-fprofile-instr-use(pass 2) -Ofast -march=znver3
-fveclib=AMDLIBM -fstruct-layout=7
-mllvm -unroll-threshold=50 -fremap-arrays
-flv-function-specialization -mllvm -inline-threshold=1000
-mllvm -enable-gvn-hoist -mllvm -global-vectorize-slp=false
-mllvm -function-specialize -mllvm -enable-licm-vrp
-mllvm -reduce-array-computations=3 -lamdlibm -ljemalloc
```

```
502.gcc_r: -m32 -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-Wl,-mllvm -Wl,-function-specialize -Ofast -march=znver3
-fveclib=AMDLIBM -fstruct-layout=7
-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 -fgnu89-inline
-ljemalloc
```

```
505.mcf_r: -m64 -Wl,-allow-multiple-definition
-Wl,-mllvm -Wl,-enable-licm-vrp -flto
-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 -fstruct-layout=7
-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 -lamdlibm -ljemalloc
```

```
525.x264_r: basepeak = yes
```

```
557.xz_r: Same as 505.mcf_r
```

C++ benchmarks:

(Continued on next page)

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Lenovo Global Technology

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

Test Date: Apr-2021
Hardware Availability: Apr-2021
Software Availability: Mar-2021

Peak Optimization Flags (Continued)

520.omnetpp_r: basepeak = yes

523.xalancbmk_r: `-m32 -Wl,-mllvm -Wl,-do-block-reorder=aggressive -flto`
`-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 -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`
`-ljemalloc`

531.deepsjeng_r: basepeak = yes

541.leela_r: basepeak = yes

Fortran benchmarks:

548.exchange2_r: basepeak = yes

Peak Other Flags

C benchmarks (except as noted below):
`-Wno-unused-command-line-argument`

502.gcc_r: `-L/usr/lib -Wno-unused-command-line-argument`
`-L/sppo/bin/cpu2017v115aocc3/amd_rate_aocc300_milan_A_lib/32`

C++ benchmarks (except as noted below):
`-Wno-unused-command-line-argument`

523.xalancbmk_r: `-L/usr/lib -Wno-unused-command-line-argument`
`-L/sppo/bin/cpu2017v115aocc3/amd_rate_aocc300_milan_A_lib/32`

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-Milan-D.html
http://www.spec.org/cpu2017/flags/aocc300-flags-A1.html

SPEC CPU®2017 Integer Rate Result

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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-Milan-D.xml
http://www.spec.org/cpu2017/flags/aocc300-flags-A1.xml

For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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