SPEC CPU®2017 Floating Point Rate Result

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Hewlett Packard Enterprise

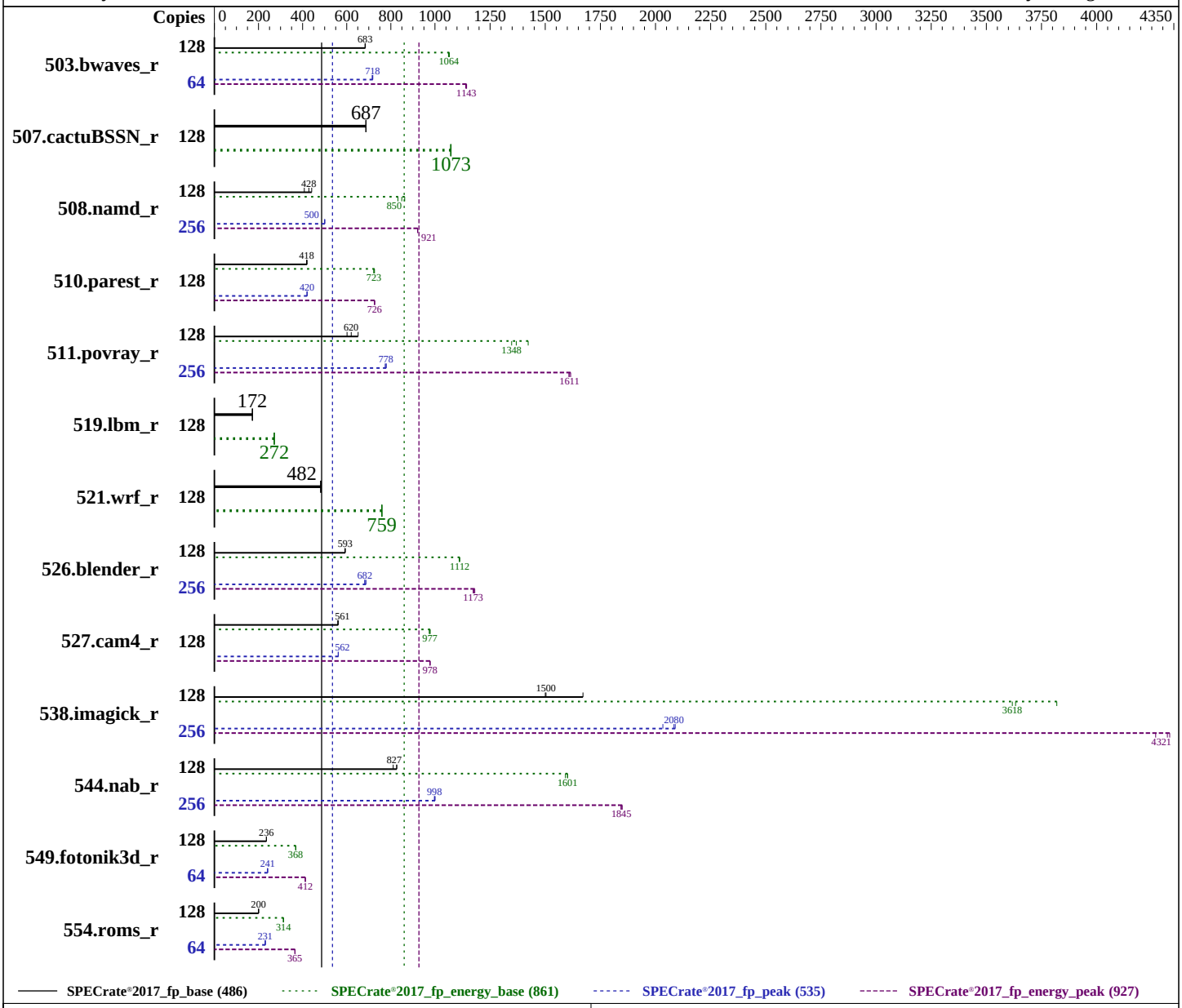
(Test Sponsor: HPE)

ProLiant DL385 Gen10 (2.00 GHz, AMD EPYC 7702)

SPECrate®2017_fp_base =	486
SPECrate®2017_fp_energy_base =	861
SPECrate®2017_fp_peak =	535
SPECrate®2017_fp_energy_peak =	927

CPU2017 License: 003
Test Sponsor: HPE
Tested by: HPE

Test Date: May-2019
Hardware Availability: Oct-2019
Software Availability: Aug-2019



Hardware

CPU Name: AMD EPYC 7702
Max MHz: 3350
Nominal: 2000
Enabled: 128 cores, 2 chips, 2 threads/core
Orderable: 1, 2 chip(s)

(Continued on next page)

Software

OS: SUSE Linux Enterprise Server 15 (x86_64) SP1
Kernel 4.12.14-195-default
Compiler: C/C++/Fortran: Version 2.0.0 of AOCC
Parallel: No
Firmware: HPE BIOS Version A40 07/20/2019 released Aug-2019

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Hardware (Continued)

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, 16 MB shared / 4 cores
Other:	None
Memory:	1 TB (16 x 64 GB 4Rx4 PC4-2933Y-L)
Storage:	1 x HPE 240 GB SATA 6G M.2 SSD
Other:	None

Software (Continued)

File System:	btrfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	64-bit
Other:	jemalloc: jemalloc memory allocator library v5.2.0
Power Management:	Disabled

Power

Max. Power (W):	727.5
Idle Power (W):	204.83
Min. Temperature (C):	23.13
Elevation (m):	132
Line Standard:	208 V / 60 Hz / 1 phase / 2 wires
Provisioning:	Line-powered

Power Settings

Management FW:	Version 1.43 of iLO5 released May 23 2019
Memory Mode:	Normal

Power-Relevant Hardware

Power Supply:	1 x 800 W (non-redundant)
Details:	HPE 800W Flex Slot Titanium Hot Plug Low Halogen Power Supply Kit (865438-B21)
Backplane:	None
Other Storage:	Embedded SATA Controller
Storage Model #s:	875488-B21
NICs Installed:	1 x HPE Ethernet 4-port 331i Adapter @ 1 Gb
NICs Enabled (FW/OS):	4 / 4
NICs Connected/Speed:	2 @ 1 Gb
Other HW Model #s:	6 x High Performance Fans (867810-B21)

Power Analyzer

Power Analyzer:	10.216.1.13:8888
Hardware Vendor:	Yokogawa
Model:	YokogawaWT210
Serial Number:	91GC21887
Input Connection:	GPIB via NI GIPB-USB-HS
Metrology Institute:	NIST
Calibration By:	TRANSCAT
Calibration Label:	5-E62NT-80-1
Calibration Date:	11-Jun-2019
PTDaemon™ Version:	1.9.1 (a2d19f26; 2019-07-17)
Setup Description:	SUT Power Supply 1 via neoXt NXB 20815
Current Ranges Used:	1A, 5A
Voltage Range Used:	300V

Temperature Meter

Temperature Meter:	10.216.1.13:8889
Hardware Vendor:	Digi International Inc.
Model:	DigiWATCHPORT_H
Serial Number:	V45084325
Input Connection:	USB
PTDaemon Version:	1.9.1 (a2d19f26; 2019-07-17)
Setup Description:	5 mm in front of SUT main intake

Base Results Table

Benchmark	Copies	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power

Table continues on next page. Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

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SPECrate®2017_fp_energy_base = 861

SPECrate®2017_fp_peak = 535

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CPU2017 License: 003
Test Sponsor: HPE
Tested by: HPE

Test Date: May-2019
Hardware Availability: Oct-2019
Software Availability: Aug-2019

Base Results Table (Continued)

Benchmark	Copies	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power
503.bwaves_r	128	1875	685	1310	1070	700	710	1878	683	1320	1060	702	720	**1878**	**683**	**1320**	**1060**	**700**	**717**
507.cactuBSSN_r	128	236	687	166	1070	705	713	236	688	166	1070	705	713	**236**	**687**	**166**	**1070**	**704**	**710**
508.namd_r	128	**284**	**428**	**156**	**850**	**550**	**575**	298	408	159	832	534	572	276	441	154	863	557	575
510.parest_r	128	797	420	502	726	630	665	**801**	**418**	**504**	**723**	**629**	**664**	801	418	504	723	629	664
511.povray_r	128	497	601	237	1370	477	506	**482**	**620**	**241**	**1350**	**499**	**506**	459	652	228	1420	497	503
519.lbm_r	128	782	173	565	271	722	728	783	172	565	271	721	727	**783**	**172**	**564**	**272**	**721**	**727**
521.wrf_r	128	592	484	412	760	696	703	**595**	**482**	**412**	**759**	**693**	**705**	595	482	413	759	693	702
526.blender_r	128	329	592	190	1110	578	683	329	593	190	1110	578	684	**329**	**593**	**190**	**1110**	**577**	**682**
527.cam4_r	128	**399**	**561**	**249**	**977**	**625**	**705**	400	559	250	974	625	690	399	561	249	978	625	692
538.imagick_r	128	**212**	**1500**	**95.3**	**3620**	**450**	**621**	190	1670	90.3	3820	474	623	212	1500	94.9	3630	447	628
544.nab_r	128	261	827	146	1600	560	596	**261**	**827**	**146**	**1600**	**560**	**596**	266	811	147	1590	552	596
549.fotonik3d_r	128	**2114**	**236**	**1510**	**368**	**714**	**720**	2115	236	1510	369	712	719	2113	236	1500	369	712	719
554.roms_r	128	1014	200	717	313	707	714	**1015**	**200**	**716**	**314**	**705**	**713**	1016	200	717	313	705	713

SPECrate®2017_fp_base = 486

SPECrate®2017_fp_energy_base = 861

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

Peak Results Table

Benchmark	Copies	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power	Seconds	Ratio	Energy (kJ)	Energy Ratio	Average Power	Maximum Power
503.bwaves_r	64	897	715	614	1140	684	691	**894**	**718**	**612**	**1140**	**684**	**692**	894	718	612	1140	685	691
507.cactuBSSN_r	128	236	687	166	1070	705	713	236	688	166	1070	705	713	**236**	**687**	**166**	**1070**	**704**	**710**
508.namd_r	256	486	500	287	922	592	612	487	500	288	922	591	611	**486**	**500**	**288**	**921**	**592**	**610**
510.parest_r	128	797	420	502	726	630	665	**797**	**420**	**502**	**726**	**630**	**664**	796	420	501	727	629	665
511.povray_r	256	**768**	**778**	**403**	**1610**	**524**	**534**	767	779	402	1620	523	561	772	774	404	1610	523	567
519.lbm_r	128	782	173	565	271	722	728	783	172	565	271	721	727	**783**	**172**	**564**	**272**	**721**	**727**
521.wrf_r	128	592	484	412	760	696	703	**595**	**482**	**412**	**759**	**693**	**705**	595	482	413	759	693	702
526.blender_r	256	567	687	358	1180	631	700	**571**	**682**	**360**	**1170**	**630**	**694**	572	682	359	1180	628	698
527.cam4_r	128	399	561	249	977	625	687	**399**	**562**	**249**	**978**	**625**	**680**	398	562	249	977	626	695
538.imagick_r	256	305	2090	159	4330	522	694	313	2030	162	4270	516	691	**306**	**2080**	**160**	**4320**	**522**	**690**
544.nab_r	256	**432**	**998**	**253**	**1850**	**586**	**603**	432	998	253	1840	587	604	431	1000	253	1850	587	601
549.fotonik3d_r	64	**1034**	**241**	**674**	**412**	**652**	**661**	1034	241	674	412	652	661	1034	241	674	412	652	661
554.roms_r	64	**441**	**231**	**307**	**365**	**697**	**710**	440	231	307	366	697	711	442	230	307	365	696	709

SPECrate®2017_fp_peak = 535

SPECrate®2017_fp_energy_peak = 927

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>

Set dirty_ratio=8 to limit dirty cache to 8% of memory
Set swappiness=1 to swap only if necessary
Set zone_reclaim_mode=1 to free local node memory and avoid remote memory
sync then drop_caches=3 to reset caches before invoking runcpu

dirty_ratio, swappiness, zone_reclaim_mode and drop_caches were
all set using privileged echo (e.g. echo 1 > /proc/sys/vm/swappiness).

Transparent huge pages set to 'always' for this run (OS default)

The date was incorrectly set for this system. The test date should be Aug-2019.
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/cpu2017/amd_rate_aocc200_rome_C_lib/64;/cpu2017/amd_rate_aocc200_rome_
     C_lib/32:"
MALLOC_CONF = "retain:true"
```

General Notes

```
Binaries were compiled on a system with 2x AMD EPYC 7601 CPU + 512GB Memory using Fedora 26

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 v9.1.0 in Ubuntu 19.04 with -O3 -znver2 -flto
jemalloc 5.2.0 is available here:
https://github.com/jemalloc/jemalloc/releases/download/5.2.0/jemalloc-5.2.0.tar.bz2
```

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General Notes (Continued)

```
Submitted_by: "Bucek, James" <james.bucek@hpe.com>
Submitted: Tue Sep 17 00:02:18 EDT 2019
Submission: cpu2017-20190903-17796.sub
```

Platform Notes

```
BIOS Configuration:
 Thermal Configuration set to Optimal Cooling
 Determinism Control set to Manual
 Performance Determinism set to Power Deterministic
 Memory Patrol Scrubbing set to Disabled
 NUMA memory domains per socket set to Four memory domains per socket
 Last-Level Cache (LLC) as NUMA Node set to Enabled
 Workload Profile set to General Throughput Compute
 Minimum Processor Idle Power Core C-State set to C6 State

 Sysinfo program /cpu2017/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
 running on dl385gen10 Mon May 27 20:14:14 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 : AMD EPYC 7702 64-Core Processor
       2  "physical id"s (chips)
       256 "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 : 64
       siblings  : 128
       physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63
       physical 1: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
       25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52
       53 54 55 56 57 58 59 60 61 62 63

 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
```

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Platform Notes (Continued)

```
CPU(s):              256
On-line CPU(s) list: 0-255
Thread(s) per core:  2
Core(s) per socket:  64
Socket(s):           2
NUMA node(s):        32
Vendor ID:           AuthenticAMD
CPU family:          23
Model:               49
Model name:          AMD EPYC 7702 64-Core Processor
Stepping:            0
CPU MHz:             2000.000
CPU max MHz:         2000.0000
CPU min MHz:         1500.0000
BogoMIPS:            3992.35
Virtualization:      AMD-V
L1d cache:           32K
L1i cache:           32K
L2 cache:            512K
L3 cache:            16384K
NUMA node0 CPU(s):   0-3,128-131
NUMA node1 CPU(s):   4-7,132-135
NUMA node2 CPU(s):   8-11,136-139
NUMA node3 CPU(s):   12-15,140-143
NUMA node4 CPU(s):   16-19,144-147
NUMA node5 CPU(s):   20-23,148-151
NUMA node6 CPU(s):   24-27,152-155
NUMA node7 CPU(s):   28-31,156-159
NUMA node8 CPU(s):   32-35,160-163
NUMA node9 CPU(s):   36-39,164-167
NUMA node10 CPU(s):  40-43,168-171
NUMA node11 CPU(s):  44-47,172-175
NUMA node12 CPU(s):  48-51,176-179
NUMA node13 CPU(s):  52-55,180-183
NUMA node14 CPU(s):  56-59,184-187
NUMA node15 CPU(s):  60-63,188-191
NUMA node16 CPU(s):  64-67,192-195
NUMA node17 CPU(s):  68-71,196-199
NUMA node18 CPU(s):  72-75,200-203
NUMA node19 CPU(s):  76-79,204-207
NUMA node20 CPU(s):  80-83,208-211
NUMA node21 CPU(s):  84-87,212-215
NUMA node22 CPU(s):  88-91,216-219
NUMA node23 CPU(s):  92-95,220-223
NUMA node24 CPU(s):  96-99,224-227
```

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Platform Notes (Continued)

```
      NUMA node25 CPU(s):  100-103,228-231
      NUMA node26 CPU(s):  104-107,232-235
      NUMA node27 CPU(s):  108-111,236-239
      NUMA node28 CPU(s):  112-115,240-243
      NUMA node29 CPU(s):  116-119,244-247
      NUMA node30 CPU(s):  120-123,248-251
      NUMA node31 CPU(s):  124-127,252-255
      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 xtopology nonstop_tsc cpuid extd_apicid aperfmperf pni
      pclmulqdq monitor ssse3 fma cx16 sse4_1 sse4_2 x2apic 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_l2 mwaitx cpb cat_l3 cdp_l3 hw_pstate ssbd ibrs ibpb stibp vmmcall fsgsbase
      bmi1 avx2 smep bmi2 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 arat npt lbrv svm_lock nrip_save tsc_scale vmcb_clean flushbyasid
      decodeassists pausefilter pfthreshold avic v_vmsave_vmload vgif umip 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: 32 nodes (0-31)
    node 0 cpus: 0 1 2 3 128 129 130 131
    node 0 size: 32036 MB
    node 0 free: 31702 MB
    node 1 cpus: 4 5 6 7 132 133 134 135
    node 1 size: 32254 MB
    node 1 free: 31971 MB
    node 2 cpus: 8 9 10 11 136 137 138 139
    node 2 size: 32254 MB
    node 2 free: 31974 MB
    node 3 cpus: 12 13 14 15 140 141 142 143
    node 3 size: 32253 MB
    node 3 free: 31959 MB
    node 4 cpus: 16 17 18 19 144 145 146 147
    node 4 size: 32254 MB
    node 4 free: 31973 MB
    node 5 cpus: 20 21 22 23 148 149 150 151
    node 5 size: 32254 MB
    node 5 free: 31974 MB
    node 6 cpus: 24 25 26 27 152 153 154 155
```

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Platform Notes (Continued)

```
node 6 size: 32254 MB
node 6 free: 31972 MB
node 7 cpus: 28 29 30 31 156 157 158 159
node 7 size: 32253 MB
node 7 free: 31973 MB
node 8 cpus: 32 33 34 35 160 161 162 163
node 8 size: 32254 MB
node 8 free: 31948 MB
node 9 cpus: 36 37 38 39 164 165 166 167
node 9 size: 32254 MB
node 9 free: 31976 MB
node 10 cpus: 40 41 42 43 168 169 170 171
node 10 size: 32254 MB
node 10 free: 31963 MB
node 11 cpus: 44 45 46 47 172 173 174 175
node 11 size: 32253 MB
node 11 free: 31974 MB
node 12 cpus: 48 49 50 51 176 177 178 179
node 12 size: 32254 MB
node 12 free: 31973 MB
node 13 cpus: 52 53 54 55 180 181 182 183
node 13 size: 32254 MB
node 13 free: 31975 MB
node 14 cpus: 56 57 58 59 184 185 186 187
node 14 size: 32254 MB
node 14 free: 31982 MB
node 15 cpus: 60 61 62 63 188 189 190 191
node 15 size: 32241 MB
node 15 free: 31970 MB
node 16 cpus: 64 65 66 67 192 193 194 195
node 16 size: 32254 MB
node 16 free: 31979 MB
node 17 cpus: 68 69 70 71 196 197 198 199
node 17 size: 32254 MB
node 17 free: 31975 MB
node 18 cpus: 72 73 74 75 200 201 202 203
node 18 size: 32254 MB
node 18 free: 31974 MB
node 19 cpus: 76 77 78 79 204 205 206 207
node 19 size: 32253 MB
node 19 free: 31975 MB
node 20 cpus: 80 81 82 83 208 209 210 211
node 20 size: 32254 MB
node 20 free: 31973 MB
node 21 cpus: 84 85 86 87 212 213 214 215
```

(Continued on next page)

Platform Notes (Continued)

```
node 21 size: 32254 MB
node 21 free: 31973 MB
node 22 cpus: 88 89 90 91 216 217 218 219
node 22 size: 32254 MB
node 22 free: 31974 MB
node 23 cpus: 92 93 94 95 220 221 222 223
node 23 size: 32253 MB
node 23 free: 31977 MB
node 24 cpus: 96 97 98 99 224 225 226 227
node 24 size: 32254 MB
node 24 free: 31979 MB
node 25 cpus: 100 101 102 103 228 229 230 231
node 25 size: 32254 MB
node 25 free: 31978 MB
node 26 cpus: 104 105 106 107 232 233 234 235
node 26 size: 32254 MB
node 26 free: 31974 MB
node 27 cpus: 108 109 110 111 236 237 238 239
node 27 size: 32253 MB
node 27 free: 31976 MB
node 28 cpus: 112 113 114 115 240 241 242 243
node 28 size: 32224 MB
node 28 free: 31946 MB
node 29 cpus: 116 117 118 119 244 245 246 247
node 29 size: 32254 MB
node 29 free: 31979 MB
node 30 cpus: 120 121 122 123 248 249 250 251
node 30 size: 32254 MB
node 30 free: 31974 MB
node 31 cpus: 124 125 126 127 252 253 254 255
node 31 size: 32250 MB
node 31 free: 31973 MB
node distances:
node   0   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16  17  18  19
20  21  22  23  24  25  26  27  28  29  30  31
  0:  10  11  11  11  12  12  12  12  12  12  12  12  12  12  12  12  32  32  32  32
  32  32  32  32  32  32  32  32  32  32  32  32
  1:  11  10  11  11  12  12  12  12  12  12  12  12  12  12  12  12  32  32  32  32
  32  32  32  32  32  32  32  32  32  32  32  32
  2:  11  11  10  11  12  12  12  12  12  12  12  12  12  12  12  12  32  32  32  32
  32  32  32  32  32  32  32  32  32  32  32  32
  3:  11  11  11  10  12  12  12  12  12  12  12  12  12  12  12  12  32  32  32  32
  32  32  32  32  32  32  32  32  32  32  32  32
  4:  12  12  12  12  10  11  11  11  12  12  12  12  12  12  12  12  32  32  32  32
  32  32  32  32  32  32  32  32  32  32  32  32
```

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Platform Notes (Continued)

```
 5:  12  12  12  12  11  10  11  11  12  12  12  12  12  12  12  12  32  32  32  32
 32  32  32  32  32  32  32  32  32  32  32  32
 6:  12  12  12  12  11  11  10  11  12  12  12  12  12  12  12  12  32  32  32  32
 32  32  32  32  32  32  32  32  32  32  32  32
 7:  12  12  12  12  11  11  11  10  12  12  12  12  12  12  12  12  32  32  32  32
 32  32  32  32  32  32  32  32  32  32  32  32
 8:  12  12  12  12  12  12  12  12  10  11  11  11  12  12  12  12  32  32  32  32
 32  32  32  32  32  32  32  32  32  32  32  32
 9:  12  12  12  12  12  12  12  12  11  10  11  11  12  12  12  12  32  32  32  32
 32  32  32  32  32  32  32  32  32  32  32  32
10:  12  12  12  12  12  12  12  12  11  11  10  11  12  12  12  12  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
11:  12  12  12  12  12  12  12  12  11  11  11  10  12  12  12  12  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
12:  12  12  12  12  12  12  12  12  12  12  12  12  10  11  11  11  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
13:  12  12  12  12  12  12  12  12  12  12  12  12  11  10  11  11  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
14:  12  12  12  12  12  12  12  12  12  12  12  12  11  11  10  11  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
15:  12  12  12  12  12  12  12  12  12  12  12  12  11  11  11  10  32  32  32  32
32  32  32  32  32  32  32  32  32  32  32  32
16:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  10  11  11  11
12  12  12  12  12  12  12  12  12  12  12  12
17:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  11  10  11  11
12  12  12  12  12  12  12  12  12  12  12  12
18:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  11  11  10  11
12  12  12  12  12  12  12  12  12  12  12  12
19:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  11  11  11  10
12  12  12  12  12  12  12  12  12  12  12  12
20:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
10  11  11  11  12  12  12  12  12  12  12  12
21:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
11  10  11  11  12  12  12  12  12  12  12  12
22:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
11  11  10  11  12  12  12  12  12  12  12  12
23:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
11  11  11  10  12  12  12  12  12  12  12  12
24:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
12  12  12  12  10  11  11  11  12  12  12  12
25:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
12  12  12  12  11  10  11  11  12  12  12  12
26:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
12  12  12  12  11  11  10  11  12  12  12  12
27:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
```

(Continued on next page)

Platform Notes (Continued)

```
    12  12  12  12  11  11  11  10  12  12  12  12
    28:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
    12  12  12  12  12  12  12  12  10  11  11  11
    29:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
    12  12  12  12  12  12  12  12  11  10  11  11
    30:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
    12  12  12  12  12  12  12  12  11  11  10  11
    31:  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  32  12  12  12  12
    12  12  12  12  12  12  12  12  11  11  11  10

  From /proc/meminfo
     MemTotal:       1056634372 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:
     Linux dl385gen10 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: Full AMD retpoline, IBPB:
                                           conditional, IBRS_FW, STIBP: conditional, RSB
                                            filling

  run-level 3 May 27 09:25

  SPEC is set to: /cpu2017
```

(Continued on next page)

Platform Notes (Continued)

```
    Filesystem     Type   Size  Used Avail Use% Mounted on
    /dev/sda2      btrfs  222G   43G  178G  20% /

 From /sys/devices/virtual/dmi/id
      BIOS:    HPE A40 07/20/2019
      Vendor:  HPE
      Product: ProLiant DL385 Gen10
      Product Family: ProLiant
      Serial:  7CE724P4SJ

 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 UNKNOWN NOT AVAILABLE
     16x UNKNOWN NOT AVAILABLE 64 GB 4 rank 2933

 (End of data from sysinfo program)
```

Power Settings Notes

```
PTDaemon to measure power and temperature was run on a ProLiant DL360 Gen9 as a controller
with 2x Intel Xeon E5-2660 v3 CPU and 128 GB of memory using Windows Server 2012 R2.
Power management in the OS was disabled by setting Linux CPU governor to performance for all cores:
 cpupower frequency-set -r -g performance
Power management in the BIOS was default except for any settings mentioned in BIOS Configuration.
No power management settings were set in the management firmware.
The Embedded SATA controller was the HPE Smart Array S100i SR Gen10 SW RAID.
The system was configured with 3 drive cage blanks, 6 High Performance Fans,
16 DIMM blanks, 2 high performance heatsinks (882098-B21) and baffles that fit over
the high performance heatsinks in order to produce correct airflow and cooling.
The run was started and observed through the management firmware.
```

Compiler Version Notes

```
==============================================================================
C               | 519.lbm_r(base, peak) 538.imagick_r(base, peak)
                | 544.nab_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
```

(Continued on next page)

Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++             | 508.namd_r(base, peak) 510.parest_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++, C          | 511.povray_r(base, peak) 526.blender_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
C++, C, Fortran | 507.cactuBSSN_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
```

(Continued on next page)

Compiler Version Notes (Continued)

```
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran         | 503.bwaves_r(base, peak) 549.fotonik3d_r(base, peak)
                | 554.roms_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------

==============================================================================
Fortran, C      | 521.wrf_r(base, peak) 527.cam4_r(base, peak)
------------------------------------------------------------------------------
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
AOCC.LLVM.2.0.0.B191.2019_07_19 clang version 8.0.0 (CLANG: Jenkins
  AOCC_2_0_0-Build#191) (based on LLVM AOCC.LLVM.2.0.0.B191.2019_07_19)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /sppo/dev/compilers/aocc-compiler-2.0.0/bin
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`clang`

C++ benchmarks:
`clang++`

Fortran benchmarks:
`flang`

Benchmarks using both Fortran and C:
`flang clang`

(Continued on next page)

Base Compiler Invocation (Continued)

Benchmarks using both C and C++:
clang++ clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang

Base Portability Flags

503.bwaves_r: -DSPEC_LP64
507.cactuBSSN_r: -DSPEC_LP64
508.namd_r: -DSPEC_LP64
510.parest_r: -DSPEC_LP64
511.povray_r: -DSPEC_LP64
519.lbm_r: -DSPEC_LP64
521.wrf_r: -DSPEC_CASE_FLAG -Mbyteswapio -DSPEC_LP64
526.blender_r: -funsigned-char -D__BOOL_DEFINED -DSPEC_LP64
527.cam4_r: -DSPEC_CASE_FLAG -DSPEC_LP64
538.imagick_r: -DSPEC_LP64
544.nab_r: -DSPEC_LP64
549.fotonik3d_r: -DSPEC_LP64
554.roms_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -z muldefs -lmvec -lamdlibm -ljemalloc
-lflang

C++ benchmarks:
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize

(Continued on next page)

Base Optimization Flags (Continued)

C++ benchmarks (continued):
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC
-mllvm -unroll-threshold=100 -flv-function-specialization
-mllvm -enable-partial-unswitch -z muldefs -lmvec -lamdlibm
-ljemalloc -lflang

Fortran benchmarks:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang

Benchmarks using both Fortran and C:
-flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3 -ffast-math
-march=znver2 -fstruct-layout=3 -mllvm -unroll-threshold=50
-fremap-arrays -mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -funroll-loops -Mrecursive -z muldefs
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc -lflang

Benchmarks using both C and C++:
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -z muldefs
-lmvec -lamdlibm -ljemalloc -lflang

Benchmarks using Fortran, C, and C++:
-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3

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Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++ (continued):
-Wl,-mllvm -Wl,-suppress-fmas -O3 -ffast-math -march=znver2
-fstruct-layout=3 -mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp
-mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000
-flv-function-specialization -mllvm -loop-unswitch-threshold=200000
-mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch
-funroll-loops -Mrecursive -z muldefs -Kieee -fno-finite-math-only
-lmvec -lamdlibm -ljemalloc -lflang

Peak Compiler Invocation

C benchmarks:
clang

C++ benchmarks:
clang++

Fortran benchmarks:
flang

Benchmarks using both Fortran and C:
flang clang

Benchmarks using both C and C++:
clang++ clang

Benchmarks using Fortran, C, and C++:
clang++ clang flang

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

519.lbm_r: `basepeak = yes`

538.imagick_r: `-flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC -Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver2 -mno-sse4a -fstruct-layout=5 -mllvm -vectorize-memory-aggressively -mllvm -function-specialize -mllvm -enable-gvn-hoist -mllvm -unroll-threshold=50 -fremap-arrays -mllvm -vector-library=LIBMVEC -mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp -mllvm -inline-threshold=1000 -flv-function-specialization -lmvec -lamdlibm -ljemalloc -lflang`

544.nab_r: `Same as 538.imagick_r`

C++ benchmarks:

508.namd_r: `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC -Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver2 -flv-function-specialization -mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000 -lmvec -lamdlibm -ljemalloc -lflang`

510.parest_r: `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC -Wl,-mllvm -Wl,-reduce-array-computations=3 -Wl,-mllvm -Wl,-suppress-fmas -Ofast -march=znver2 -flv-function-specialization -mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -mllvm -loop-unswitch-threshold=200000 -mllvm -vector-library=LIBMVEC -mllvm -inline-threshold=1000 -lmvec -lamdlibm -ljemalloc`

(Continued on next page)

Peak Optimization Flags (Continued)

510.parest_r (continued):
-lflang

Fortran benchmarks:

503.bwaves_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -O3
-march=znver2 -funroll-loops -Mrecursive
-mllvm -vector-library=LIBMVEC -Kieee
-fno-finite-math-only -lmvec -lamdlibm -ljemalloc
-lflang

549.fotonik3d_r: Same as 503.bwaves_r

554.roms_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3
-Wl,-mllvm -Wl,-enable-X86-prefetching -O3 -march=znver2
-funroll-loops -Mrecursive -mllvm -vector-library=LIBMVEC
-Kieee -fno-finite-math-only -lmvec -lamdlibm -ljemalloc
-lflang

Benchmarks using both Fortran and C:

521.wrf_r: basepeak = yes

527.cam4_r: -flto -Wl,-mllvm -Wl,-function-specialize
-Wl,-mllvm -Wl,-region-vectorize
-Wl,-mllvm -Wl,-vector-library=LIBMVEC
-Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast
-march=znver2 -mno-sse4a -fstruct-layout=5
-mllvm -vectorize-memory-aggressively
-mllvm -function-specialize -mllvm -enable-gvn-hoist
-mllvm -unroll-threshold=50 -fremap-arrays
-mllvm -vector-library=LIBMVEC
-mllvm -reduce-array-computations=3
-mllvm -global-vectorize-slp -mllvm -inline-threshold=1000
-flv-function-specialization -O3 -funroll-loops
-Mrecursive -Kieee -fno-finite-math-only -lmvec
-lamdlibm -ljemalloc -lflang

(Continued on next page)

Peak Optimization Flags (Continued)

Benchmarks using both C and C++:

511.povray_r: `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC -Wl,-mllvm -Wl,-reduce-array-computations=3 -Wl,-mllvm -Wl,-x86-use-vzeroupper=false -Ofast -march=znver2 -mno-sse4a -fstruct-layout=5 -mllvm -vectorize-memory-aggressively -mllvm -function-specialize -mllvm -enable-gvn-hoist -mllvm -unroll-threshold=50 -fremap-arrays -mllvm -vector-library=LIBMVEC -mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp -mllvm -inline-threshold=1000 -flv-function-specialization -mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -mllvm -loop-unswitch-threshold=200000 -lmvec -lamdlibm -ljemalloc -lflang`

526.blender_r: `-std=c++98 -flto -Wl,-mllvm -Wl,-function-specialize -Wl,-mllvm -Wl,-region-vectorize -Wl,-mllvm -Wl,-vector-library=LIBMVEC -Wl,-mllvm -Wl,-reduce-array-computations=3 -Ofast -march=znver2 -mno-sse4a -fstruct-layout=5 -mllvm -vectorize-memory-aggressively -mllvm -function-specialize -mllvm -enable-gvn-hoist -mllvm -unroll-threshold=50 -fremap-arrays -mllvm -vector-library=LIBMVEC -mllvm -reduce-array-computations=3 -mllvm -global-vectorize-slp -mllvm -inline-threshold=1000 -flv-function-specialization -mllvm -unroll-threshold=100 -mllvm -enable-partial-unswitch -mllvm -loop-unswitch-threshold=200000 -lmvec -lamdlibm -ljemalloc -lflang`

Benchmarks using Fortran, C, and C++:

507.cactuBSSN_r: `basepeak = yes`

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

`http://www.spec.org/cpu2017/flags/aocc200-flags-B1.html`

`http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revF.html`

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

http://www.spec.org/cpu2017/flags/aocc200-flags-B1.xml
http://www.spec.org/cpu2017/flags/HPE-Platform-Flags-AMD-V1.2-EPYC-revF.xml

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

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