# Lenovo Global Technology

## ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

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

<table>
<thead>
<tr>
<th>Threads</th>
<th>SPECspeed®2017_fp_base</th>
<th>SPECspeed®2017_fp_peak</th>
</tr>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>128</td>
<td>528</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>128</td>
<td>528</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>128</td>
<td>281</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>128</td>
<td>207</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>128</td>
<td>248</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>128</td>
<td>114</td>
</tr>
<tr>
<td>638.imagick_s</td>
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<td>875</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>128</td>
<td>887</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
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</tr>
<tr>
<td>654.roms_s</td>
<td>128</td>
<td>749</td>
</tr>
</tbody>
</table>

## Hardware

**CPU Name:** Intel Xeon Platinum 8593Q  
**Max MHz:** 3900  
**Nominal:** 2200  
**Enabled:** 128 cores, 2 chips  
**Orderable:** 2 chips  
**Cache L1:** 32 KB I + 48 KB D on chip per core  
**L2:** 2 MB I+D on chip per core  
**L3:** 320 MB I+D on chip per chip  
**Other:** None  
**Memory:** 1 TB (16 x 64 GB 2Rx4 PC5-5600B-R)  
**Storage:** 1 x 1.92 TB SATA SSD  
**Other:** None

## Software

**OS:** SUSE Linux Enterprise Server 15 SP5  
**Kernel:** 5.14.21-150500.53-default  
**Compiler:** C/C++: Version 2023.2.3 of Intel oneAPI DPC++/C++ Compiler for Linux; Fortran: Version 2023.2.3 of Intel Fortran Compiler for Linux;  
**Parallel:** Yes  
**Firmware:** Lenovo BIOS Version USE125B 4.10 released Nov-2023  
**File System:** xfs  
**System State:** Run level 3 (multi-user)  
**Base Pointers:** 64-bit  
**Peak Pointers:** Not Applicable  
**Other:** jemalloc memory allocator V5.0.1  
**Power Management:** BIOS and OS set to prefer performance at the cost of additional power usage
Lenovo Global Technology  
ThinkSystem SD650 V3  
(2.20 GHz, Intel Xeon Platinum 8593Q)  

**SPECspeed®2017_fp_base** = 413  
**SPECspeed®2017_fp_peak** = Not Run

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tr>
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<tr>
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<td>537</td>
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<tr>
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<tr>
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<td>128</td>
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<td>207</td>
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<td>208</td>
<td>63.8</td>
<td>207</td>
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<tr>
<td>cam4_s</td>
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<td>36.1</td>
<td>246</td>
<td>35.6</td>
<td>249</td>
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<tr>
<td>pop2_s</td>
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<td>104.0</td>
<td>114</td>
<td>104.0</td>
<td>114</td>
<td>105.0</td>
<td>114</td>
</tr>
<tr>
<td>imagick_s</td>
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<td>877</td>
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<td>nab_s</td>
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<tr>
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<td>749</td>
<td>21.0</td>
<td>751</td>
<td>21.0</td>
<td>748</td>
</tr>
</tbody>
</table>

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

**Operating System Notes**

Stack size set to unlimited using "ulimit -s unlimited"

**Environment Variables Notes**

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

- KMP_AFFINITY = "granularity=fine,compact"
- LD_LIBRARY_PATH = "/home/cpu2017-1.1.9-ic2023.2.3/lib/intel64:/home/cpu2017-1.1.9-ic2023.2.3/je5.0.1-64"
- MALLOC_CONF = "retain:true"
- OMP_STACKSIZE = "192M"

**General Notes**

Binaries compiled on a system with 2x Intel Xeon Platinum 8280M CPU + 384GB RAM memory using Redhat Enterprise Linux 8.0

- 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`
- 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, 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
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CPU2017 License: 9017
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Test Date: Nov-2023
Hardware Availability: Feb-2024
Software Availability: Dec-2023

Benchmark Results

SPECspeed®2017_fp_base = 413
SPECspeed®2017_fp_peak = Not Run

Platform Notes

BIOS configuration:
Choose Operating Mode set to Maximum Performance and then set it to Custom Mode
C-States set to Legacy
Hyper-Threading set to Disabled

Sysinfo program /home/cpu2017-1.1.9-ic2023.2.3/bin/sysinfo
Rev: r6732 of 2022-11-07 fe91c89b7ed5c36ae2c92cc097bec197
running on localhost Fri Nov 24 22:20:29 2023

SUT (System Under Test) info as seen by some common utilities.

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10. who -r
11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
12. Services, from systemctl list-unit-files
13. Linux kernel boot-time arguments, from /proc/cmdline
14. cpupower frequency-info
15. sysctl
16. /sys/kernel/mm/transparent_hugepage
17. /sys/kernel/mm/transparent_hugepage/khugepaged
18. OS release
19. Disk information
20. /sys/devices/virtual/dmi/id
21. dmidecode
22. BIOS

-------------------------------------------------------------------------------
1. uname -a
Linux localhost 5.14.21-150500.53-default #1 SMP PREEMPT_DYNAMIC Wed May 10 07:56:26 UTC 2023 (b630043) x86_64 x86_64 x86_64 GNU/Linux

-------------------------------------------------------------------------------
2. w
22:20:29 up 1 min, 1 user, load average: 0.30, 0.16, 0.06
USER TTY FROM LOGIN@ IDLE JCPU PCPU WHAT
root tty1 - 22:19 29.00s 0.86s 0.00s -bash

-------------------------------------------------------------------------------
3. Username
From environment variable $USER: root

-------------------------------------------------------------------------------
4. ulimit -a
core file size (blocks, -c) unlimited
data seg size (kbytes, -d) unlimited
file size (blocks, -f) unlimited
pending signals (-l) 4126878

(Continued on next page)
Platform Notes (Continued)

max locked memory       (kbytes, -l) 64
max memory size         (kbytes, -m) unlimited
open files              (-n) 1024
pipe size              (512 bytes, -p) 8
POSIX message queues    (bytes, -q) 819200
real-time priority      (-r) 0
stack size              (kbytes, -s) unlimited
cpu time                (seconds, -t) unlimited
max user processes      (-u) 4126878
virtual memory          (kbytes, -v) unlimited
file locks              (-x) unlimited

5. sysinfo process ancestry
   /usr/lib/systemd/systemd --switched-root --system --deserialize 30
   login -- root
   -bash
   -bash
   -bash
   runcpu --nobuild --action validate --define default-platform-flags -c
   ic2023.2.3-lin-core-avx512-speed=20231121.cfg --define cores=128 --tune base --o all --define drop_caches
   fpspeed
   runcpu --nobuild --action validate --define default-platform-flags --configfile
   ic2023.2.3-lin-core-avx512-speed=20231121.cfg --define cores=128 --tune base --o all --define drop_caches
   --nopower --runmode speed --tune base --size refspeed fpspeed --nopreenv --note-preenv
   --logfile $SPEC/tmp/CPU2017.008/templogs/preenv.fpspeed.008.0.log --lognum 008.0 --from_runcpu 2
   specperl $SPEC/bin/sysinfo
   $SPEC = /home/cpu2017-1.1.9-ic2023.2.3

6. /proc/cpuinfo
   model name : INTEL(R) XEON(R) PLATINUM 8593Q
   vendor_id : GenuineIntel
   cpu family : 6
   model : 207
   stepping : 2
   microcode : 0x21000190
   bugs : specstore_bypass swapgs eibrs_pbrsb
   cpu cores : 64
   siblings : 64
   2 physical ids (chips)
   128 processors (hardware threads)
   physical id 0: core ids 0-63
   physical id 1: core ids 0-63
   physical id 0: apicids
   0,2,4,6,8,10,12,14,16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,50,52,54,56,58,60,62,64,66,68,70,72
   74,76,78,80,82,84,86,88,90,92,94,96,98,100,102,104,106,108,110,112,114,116,118,120,122,124,126
   physical id 1: apicids
   80,182,184,186,188,190,192,194,196,198,200,202,204,206,208,210,212,214,216,218,220,222,224,226,228,230,23
   2,234,236,238,240,242,244,246,248,250,252,254
   Caution: /proc/cpuinfo data regarding chips, cores, and threads is not necessarily reliable, especially for
   virtualized systems. Use the above data carefully.

7. lsccpu

From lsccpu from util-linux 2.37.4:
   Architecture: x86_64
   CPU op-mode(s): 32-bit, 64-bit

(Continued on next page)
Platform Notes (Continued)

Address sizes: 46 bits physical, 57 bits virtual
Byte Order: Little Endian
CPU(s): 128
On-line CPU(s) list: 0-127
Vendor ID: GenuineIntel
Model name: INTEL(R) XEON(R) PLATINUM 8593Q
CPU family: 6
Model: 207
Thread(s) per core: 1
Core(s) per socket: 64
Socket(s): 2
Stepping: 2
BogoMIPS: 4400.00
Flags:

Virtualization: VT-x
L1d cache: 6 MiB (128 instances)
L1i cache: 4 MiB (128 instances)
L2 cache: 256 MiB (128 instances)
L3 cache: 640 MiB (2 instances)
NUMA node0 CPU(s): 2
NUMA node1 CPU(s): 64-127
Vulnerability Itlb multihit: Not affected
Vulnerability Lltf: Not affected
Vulnerability Mds: Not affected
Vulnerability Meltdown: Not affected
Vulnerability Mmio stale data: Not affected
Vulnerability Retbleed: Not affected
Vulnerability Spec store bypass: Mitigation; Speculative Store Bypass disabled via prctl and seccomp
Vulnerability Spectre v1: Mitigation; usercopy/swapsgs barriers and __user pointer sanitization
Vulnerability Spectre v2: Mitigation; Enhanced IBRS, IBFS conditional, RSB filling, PEBSE-eIBRS SW sequence
Vulnerability Srbds: Not affected
Vulnerability Tax async abort: Not affected

From lscpu --cache:

<table>
<thead>
<tr>
<th>NAME</th>
<th>ONE-SIZE</th>
<th>ALL-SIZE</th>
<th>WAYS</th>
<th>TYPE</th>
<th>LEVEL</th>
<th>SETS</th>
<th>PHY-LINE</th>
<th>COHERENCY-SIZE</th>
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</thead>
<tbody>
<tr>
<td>L1d</td>
<td>48K</td>
<td>8</td>
<td>12</td>
<td>Data</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L1i</td>
<td>32K</td>
<td>4</td>
<td>8</td>
<td>Instruction</td>
<td>1</td>
<td>64</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L2</td>
<td>2M</td>
<td>256M</td>
<td>16</td>
<td>Unified</td>
<td>2</td>
<td>2048</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>L3</td>
<td>320M</td>
<td>640M</td>
<td>20</td>
<td>Unified</td>
<td>3</td>
<td>262144</td>
<td>1</td>
<td>64</td>
</tr>
</tbody>
</table>

8. numactl --hardware

(Continued on next page)
Lenovo Global Technology
ThinkSystem SD650 V3
(2.20 GHz, Intel Xeon Platinum 8593Q)

SPECspeed®2017_fp_base = 413
SPECspeed®2017_fp_peak = Not Run

CPU2017 License: 9017
Test Sponsor: Lenovo Global Technology
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Platform Notes (Continued)

NOTE: a numactl 'node' might or might not correspond to a physical chip.
available: 2 nodes (0-1)
node 0 cpus: 0-63
node 0 size: 515743 MB
node 0 free: 514426 MB
node 1 cpus: 64-127
node 1 size: 516006 MB
node 1 free: 514340 MB
node distances:
node 0 1
0: 10 21
1: 21 10

9. /proc/meminfo
MemTotal: 1056511916 kB

10. who -r
run-level 3 Nov 24 22:19

11. Systemd service manager version: systemd 249 (249.16+suse.171.gdad0071f15)
Default Target Status
multi-user running

12. Services, from systemctl list-unit-files
STATE UNIT FILES
enabled YaST2-Firstboot YaST2-Second-Stage apparmor auditd cron getty@ irqbalance issue-generator
kdsettings klog lvm2-monitor nscd postfix purge-kernels rollback rsyslog systemd smartd sshd
systemd-pstore wicked wickedd-auto4 wickedd-dhcp4 wickedd-dhcpc6 wickedd-nanny
enabled-runtime systemd-remount-fs
disabled autofs autoyast-initscripts blk-availability boot-sysctl ca-certificates chrony-wait
chronyD console-getty cups cups-browsed debug-shell ebtables exchange-bmc-os-info
firewalld gpm grub2-once haveged haveged-switch-root ipmi ipmiemon issue-add-ssh-keys
kexec-load lumnask man-db-create multipathd nfs nfs-bkmap rpcbind rpmconfigcheck rsysd
serial-getty@ smartd_generate_opts snmpd smntrapd systemd-boot-check-no-failures
systemd-network-generator systemd-sysext systemd-time-wait-sync systemd-timesyncd
indirect wickedd

13. Linux kernel boot-time arguments, from /proc/cmdline
BOOT_IMAGE=/boot/vmlinuz-5.14.21-150500.53-default
root=UUID=d7791671-9fd7-462e-99cf-2cc433d1f618
splash=silent
mitigations=auto
quiet
security=apparmor

14. cpupower frequency-info
analyzing CPU 0:
Unable to determine current policy
boost state support:
Supported: yes
Active: yes

15. sysctl

(Continued on next page)
## Platform Notes (Continued)

```
kernel.numa_balancing               1
kernel.randomize_va_space           2
vm.com plantation_proactiveness     20
vm.dirty_background_bytes           0
vm.dirty_background_ratio           10
vm.dirty_bytes                      0
vm.dirty_expire_centisecs           3000
vm.dirty_ratio                      20
vm.dirty_writeback_centisecs        500
vm dirtytime_expire_seconds        43200
vm.exfrag_threshold                500
vm.min_unmapped_ratio               1
vm.nr_hugepages                    0
vm.nr_hugepages_mempolicy          0
vm.nr_overcommit_hugepages         0
vm.swappiness                      60
vm.watermark_boost_factor          15000
vm.watermark_scale_factor          10
vm.zone_reclaim_mode               0
```

```
16. /sys/kernel/mm/transparent_hugepage
   defrag          always defer defer+madvise [madvise] never
   enabled         [always] madvise never
   hpage_pmd_size  2097152
   shmem_enabled   always within_size advise [never] deny force
```

```
17. /sys/kernel/mm/transparent_hugepage/hugepaged
   alloc_sleep_millisecs   60000
   defrag                  1
   max_ptes_none           511
   max_ptes_shared         256
   max_ptes_swap           64
   pages_to_scan           4096
   scan_sleep_millisecs    10000
```

```
18. OS release
   From /etc/*-release /etc/*-version
   os-release SUSE Linux Enterprise Server 15 SP5
```

```
19. Disk information
   SPEC is set to: /home/cpu2017-1.1.9-ic2023.2.3
   Filesystem     Type  Size  Used Avail Use% Mounted on
   /dev/sda3      xfs   1.8T   57G  1.7T   4% /
```

```
20. /sys/devices/virtual/dmi/id
   Vendor:         Lenovo
   Product:        ThinkSystem SD650 V3
   Product Family: ThinkSystem
   Serial:         123456789
```

```
21. dmidecode
   Additional information from dmidecode 3.4 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
```
(Continued on next page)
Platform Notes (Continued)

"DMTF SMBIOS" standard.
Memory:
  19x Samsung M321R8GA0PB0-CWMKH 64 GB 2 rank 5600
  1x Samsung M321R8GA0PB0-CWMXH 64 GB 2 rank 5600

Compiler Version Notes

C               | 619.lbm_s(base) 638.imagick_s(base) 644.nab_s(base)
---------------|-----------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

C++, C, Fortran | 607.cactuBSSN_s(base)
----------------|-----------------------------------------------------
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran         | 603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base)
----------------|-----------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Fortran, C      | 621.wrf_s(base) 627.cam4_s(base) 628.pop2_s(base)
----------------|-----------------------------------------------------
Intel(R) Fortran Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.
Intel(R) oneAPI DPC++/C++ Compiler for applications running on Intel(R) 64, Version 2023.2.3 Build x
Copyright (C) 1985-2023 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icx

(Continued on next page)
## Base Compiler Invocation (Continued)

Fortran benchmarks:
- ifx

Benchmarks using both Fortran and C:
- ifx icx

Benchmarks using Fortran, C, and C++:
- icpx icx ifx

## Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
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<tbody>
<tr>
<td>603.bwaves_s</td>
<td>-DSPEC_LP64</td>
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<tr>
<td>607.cactuBSSN_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>-DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian -assume byterecl</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>644.nab_s</td>
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<td>654.roms_s</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

## Base Optimization Flags

### C benchmarks:
- `-w` `-std=c11` `-m64` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast` `-ffast-math`
- `-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4` `-fiopenmp`
- `-DSPEC_OPENMP` `-Wno-implicit-int` `-L/usr/local/jemalloc64-5.0.1/lib` `-ljemalloc`

### Fortran benchmarks:
- `-w` `-m64` `-Wl,-z,muldefs` `-DSPEC_OPENMP` `-xCORE-AVX512` `-Ofast`
- `-ffast-math` `-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4` `-fiopenmp` `-nostandard-realloc-lhs`
- `-align array32byte` `-auto` `-L/usr/local/jemalloc64-5.0.1/lib` `-ljemalloc`

### Benchmarks using both Fortran and C:
- `-w` `-std=c11` `-Wl,-z,muldefs` `-xCORE-AVX512` `-Ofast` `-ffast-math`
- `-flto` `-mfpmath=sse` `-funroll-loops` `-qopt-mem-layout-trans=4` `-fiopenmp`

(Continued on next page)
Base Optimization Flags (Continued)

Benchmarks using both Fortran and C (continued):
-DSPEC_OPENMP -Wno-implicit-int -nostandard-realloc-lhs
-align array32byte -auto -L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

Benchmarks using Fortran, C, and C++:
-w -std=c++14 -m64 -std=cl1 -Wl,-z,muldefs -xCORE-AVX512 -Ofast
-ffast-math -flto -mfpmath=sse -funroll-loops
-qopt-mem-layout-trans=4 -fiopenmp -DSPEC_OPENMP -Wno-implicit-int
-nostandard-realloc-lhs -align array32byte -auto
-L/usr/local/jemalloc64-5.0.1/lib -ljemalloc

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-Eaglestream-AA.html
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.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-Eaglestream-AA.xml
http://www.spec.org/cpu2017/flags/Intel-ic2023p2-official-linux64.xml