Altos Computing Inc.

BrainSphere T350 F4 (Intel Xeon Silver 4216)

SPECratenew_int_base = 94.7
SPECratenew_int_peak = 98.0

CPU 2017 License: 97
Test Sponsor: Altos Computing Inc.
Tested by: Altos Computing Inc.

Hardware

CPU Name: Intel Xeon Silver 4216
Max MHz: 3200
Nominal: 2100
Enabled: 16 cores, 1 chip, 2 threads/core
Orderable: 1 chip
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 22 MB I+D on chip per chip
Other: None
Memory: 192 GB (6 x 32 GB 2Rx4 PC4-2666V-R, running at 2400)
Storage: 1 x 1.6 TB SATA SSD
Other: None

Software

OS: Red Hat Enterprise Linux release 8.1 (Ootpa)
Compiler: C/C++: Version 19.1.1.217 of Intel C/C++, Compiler Build 20200306 for Linux;
Fortran: Version 19.1.1.217 of Intel Fortran Compiler Build 20200306 for Linux
Parallel: No
Firmware: Version 3.3 released Jul-2020
File System: xfs
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 32/64-bit
Other: jemalloc memory allocator V5.0.1
Power Management: BIOS set to prefer performance at the cost of additional power usage
## Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Peak</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
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<tbody>
<tr>
<td>500.perlbench_r</td>
<td>32</td>
<td>816</td>
<td>62.4</td>
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<tr>
<td>520.omnetpp_r</td>
<td>32</td>
<td>640</td>
<td>65.7</td>
<td></td>
<td>638</td>
<td>65.8</td>
<td>639</td>
<td>65.7</td>
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<td>65.7</td>
<td>638</td>
<td>65.8</td>
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<tr>
<td>523.xalancbmk_r</td>
<td>32</td>
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<td>124</td>
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<td>270</td>
<td>125</td>
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<tr>
<td>525.x264_r</td>
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<td>191</td>
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<tr>
<td>531.deepsjeng_r</td>
<td>32</td>
<td>494</td>
<td>74.2</td>
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<td>74.2</td>
<td>493</td>
<td>74.3</td>
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<tr>
<td>541.leela_r</td>
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<td>68.3</td>
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<td>777</td>
<td>68.4</td>
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<td>548.exchange2_r</td>
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<tr>
<td>557.xz_r</td>
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<td>56.3</td>
<td></td>
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<td>56.3</td>
<td>614</td>
<td>56.3</td>
<td></td>
<td>597</td>
<td>57.9</td>
<td>597</td>
<td>57.9</td>
</tr>
</tbody>
</table>

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

## Compiler Notes

The inconsistent Compiler version information under Compiler Version section is due to a discrepancy in Intel Compiler. The correct version of C/C++ compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux. The correct version of Fortran compiler is: Version 19.1.1.217 Build 20200306 Compiler for Linux.

## Submit Notes

The numactl mechanism was used to bind copies to processors. The config file option 'submit' was used to generate numactl commands to bind each copy to a specific processor. For details, please see the config file.

## Operating System Notes

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

## Environment Variables Notes

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

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

MALLOC_CONF = "retain:true"
```
Altos Computing Inc.  
BrainSphere T350 F4 (Intel Xeon Silver 4216)  

<table>
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<tr>
<th>SPECrate®2017_int_base = 94.7</th>
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</table>

CPU2017 License: 97  
Test Sponsor: Altos Computing Inc.  
Tested by: Altos Computing Inc.  

Test Date: Apr-2021  
Hardware Availability: Feb-2020  
Software Availability: Apr-2020

**General Notes**

Binaries compiled on a system with 1x Intel Core i9-7980XE CPU + 64GB 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`  
runcpu command invoked through numactl i.e.:  
`numactl --interleave=all runcpu <etc>`

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  

**Platform Notes**

BIOS Configuration:  
Power Policy Quick Settings set to Best Performance  
IMC set to 1-way Interleave  
Sub_NUMA Cluster set to Enabled

Sysinfo program /home/cpu2017/bin/sysinfo  
Rev: r6622 of 2021-04-07 982a61ec0915b55891ef0e16acaf64d  
running on rhel81 Fri Apr 23 16:46:15 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](https://www.spec.org/cpu2017/Docs/config.html#sysinfo)

From /proc/cpuinfo  
```
  model name : Intel(R) Xeon(R) Silver 4216 CPU @ 2.10GHz
  1 "physical id"s (chips)
    32 "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 : 16
    siblings : 32
    physical 0: cores 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
```

From lscpu from util-linux 2.32.1:  
```
  Architecture: x86_64
  CPU op-mode(s): 32-bit, 64-bit
```

(Continued on next page)
Altos Computing Inc.

BrainSphere T350 F4 (Intel Xeon Silver 4216)

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CPU2017 License: 97
Test Sponsor: Altos Computing Inc.
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Test Date: Apr-2021
Hardware Availability: Feb-2020
Software Availability: Apr-2020

Platform Notes (Continued)

Byte Order: Little Endian
CPU(s): 32
On-line CPU(s) list: 0-31
Thread(s) per core: 2
Core(s) per socket: 16
Socket(s): 1
NUMA node(s): 2
Vendor ID: GenuineIntel
CPU family: 6
Model: 85
Model name: Intel(R) Xeon(R) Silver 4216 CPU @ 2.10GHz
Stepping: 7
CPU MHz: 2843.265
CPU max MHz: 3200.0000
CPU min MHz: 800.0000
BogoMIPS: 4200.00
Virtualization: VT-x
L1d cache: 32K
L1i cache: 32K
L2 cache: 1024K
L3 cache: 22528K
NUMA node0 CPU(s): 0-3,8-11,16-19,24-27
NUMA node1 CPU(s): 4-7,12-15,20-23,28-31
Flags:

fpu vme de pse tsc msr pae mce cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc arch_perfmon pebs bts rep_good xtopology nonstop_tsc cpuid aperfmperf pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 fma cx16 xtrunc pmcmov dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave pxring rdrand lahf_lm abm 3dnowprefetch cpuid_fault ebpx cat_l3 cd Fl

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 8 9 10 11 16 17 18 19 24 25 26 27
node 0 size: 94930 MB
node 0 free: 83750 MB
node 1 cpus: 4 5 6 7 12 13 14 15 20 21 22 23 28 29 30 31
node 1 size: 96738 MB

(Continued on next page)
### SPEC CPU®2017 Integer Rate Result

**Altos Computing Inc.**  
**BrainSphere T350 F4 (Intel Xeon Silver 4216)**  

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base</th>
<th>SPECrate®2017_int_peak</th>
</tr>
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<tbody>
<tr>
<td>94.7</td>
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</tbody>
</table>

**CPU2017 License:** 97  
**Test Sponsor:** Altos Computing Inc.  
**Tested by:** Altos Computing Inc.  
**Test Date:** Apr-2021  
**Hardware Availability:** Feb-2020  
**Software Availability:** Apr-2020

### Platform Notes (Continued)

- **node 1 free:** 87466 MB  
- **node distances:**  
  0: 10 11  
  1: 11 10

From `/proc/meminfo`  
- **MemTotal:** 196269516 kB  
- **HugePages_Total:** 0  
- **Hugepagesize:** 2048 kB

```
/sbin/tuned-adm active
  Current active profile: throughput-performance
```

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

From `/etc/*release* /etc/*version*`  
**os-release:**  
- **NAME**="Red Hat Enterprise Linux"  
- **VERSION**="8.1 (Ootpa)"  
- **ID**="rhel"  
- **ID_LIKE**="fedora"  
- **VERSION_ID**="8.1"  
- **PLATFORM_ID**="platform:el8"  
- **PRETTY_NAME**="Red Hat Enterprise Linux 8.1 (Ootpa)"  
- **ANSI_COLOR**="0;31"

**redhat-release:** Red Hat Enterprise Linux release 8.1 (Ootpa)  
**system-release:** Red Hat Enterprise Linux release 8.1 (Ootpa)  
**system-release-cpe:** cpe:/o:redhat:enterprise_linux:8.1:ga

```
uname -a:
Linux rhel81 4.18.0-147.el8.x86_64 #1 SMP Thu Sep 26 15:52:44 UTC 2019 x86_64 x86_64 x86_64 GNU/Linux
```

**Kernel self-reported vulnerability status:**

<table>
<thead>
<tr>
<th>CVE</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVE-2018-12207 (iTLB Multihit)</td>
<td>No status reported</td>
</tr>
<tr>
<td>CVE-2018-3620 (L1 Terminal Fault)</td>
<td>Not affected</td>
</tr>
<tr>
<td>Microarchitectural Data Sampling:</td>
<td>Not affected</td>
</tr>
<tr>
<td>CVE-2017-5754 (Meltdown):</td>
<td>Not affected</td>
</tr>
<tr>
<td>CVE-2018-3639 (Speculative Store Bypass):</td>
<td>Mitigation: Speculative Store Bypass disabled via prctl and seccomp</td>
</tr>
<tr>
<td>CVE-2017-5753 (Spectre variant 1):</td>
<td>Mitigation: usercopy/swaps barriers and __user pointer sanitization</td>
</tr>
</tbody>
</table>

(Continued on next page)
Altos Computing Inc.
BrainSphere T350 F4 (Intel Xeon Silver 4216)

SPECrater2017_int_base = 94.7
SPECrater2017_int_peak = 98.0

CPU2017 License: 97
Test Sponsor: Altos Computing Inc.
Tested by: Altos Computing Inc.

Platform Notes (Continued)

CVE-2017-5715 (Spectre variant 2): Mitigation: Enhanced IBRS, IBPB: conditional, RSB filling
CVE-2020-0543 (Special Register Buffer Data Sampling): No status reported
CVE-2019-11135 (TSX Asynchronous Abort): No status reported

run-level 3 Apr 23 01:50
SPEC is set to: /home/cpu2017
Filesysten Type Size Used Avail Use% Mounted on
/dev/mapper/rhel-home xfs 1.5T 177G 1.3T 13% /home

From /sys/devices/virtual/dmi/id
Vendor: Altos
Product: BrainSphere T350 F4
Product Family: Altos Server
Serial: 123456789

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:
10x NO DIMM NO DIMM
6x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666, configured at 2400

BIOS:
BIOS Vendor: American Megatrends Inc.
BIOS Version: 3.3
BIOS Date: 07/31/2020
BIOS Revision: 5.14

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
C | 502.gcc_r(peak)
==============================================================================

Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

==============================================================================
C | 500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
  525.x264_r(base, peak) 557.xz_r(base)

(Continued on next page)
Altos Computing Inc.

BrainSphere T350 F4 (Intel Xeon Silver 4216)

SPECrates®2017_int_base = 94.7
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CPU2017 License: 97
Test Sponsor: Altos Computing Inc.
Tested by: Altos Computing Inc.

Test Date: Apr-2021
Hardware Availability: Feb-2020
Software Availability: Apr-2020

Compiler Version Notes (Continued)

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

****************************************************************************
C   |   500.perlbench_r(peak) 557.xz_r(peak)
****************************************************************************

Intel(R) C Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

****************************************************************************
C   |   502.gcc_r(peak)
****************************************************************************

Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen
Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

****************************************************************************
C   |   500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak)
        |   525.x264_r(base, peak) 557.xz_r(base)
****************************************************************************

Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1
NextGen Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

****************************************************************************
C   |   500.perlbench_r(peak) 557.xz_r(peak)
****************************************************************************

Intel(R) C Compiler for applications running on IA-32, Version 2021.1 NextGen
Build 20200304
Copyright (C) 1985-2020 Intel Corporation. All rights reserved.

****************************************************************************
C   |   502.gcc_r(peak)
****************************************************************************

(Continued on next page)
Altos Computing Inc.

BrainSphere T350 F4 (Intel Xeon Silver 4216)

**SPECraten 2017 Integer Rate Result**

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<tr>
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- **Test Sponsor**: Altos Computing Inc.
- **Tested by**: Altos Computing Inc.
- **Test Date**: Apr-2021
- **Hardware Availability**: Feb-2020
- **Software Availability**: Apr-2020

---

**Compiler Version Notes (Continued)**

```markdown
<table>
<thead>
<tr>
<th>C</th>
<th>500.perlbench_r(base) 502.gcc_r(base) 505.mcf_r(base, peak) 525.x264_r(base, peak) 557.xz_r(base)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Intel(R) C Compiler for applications running on Intel(R) 64, Version 2021.1 NextGen Build 20200304 Copyright (C) 1985-2020 Intel Corporation. All rights reserved.</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>C</td>
<td>500.perlbench_r(peak) 557.xz_r(peak)</td>
</tr>
<tr>
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<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>C++</td>
<td>520.omnetpp_r(base, peak) 523.xalancbmk_r(base, peak) 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>-------</td>
<td>------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Fortran</td>
<td>548.exchange2_r(base, peak)</td>
</tr>
<tr>
<td></td>
<td>Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R) 64, Version 19.1.1.217 Build 20200306 Copyright (C) 1985-2020 Intel Corporation. All rights reserved.</td>
</tr>
</tbody>
</table>
```

---

**Base Compiler Invocation**

- **C benchmarks**: icc
- **C++ benchmarks**: icpc
- **Fortran benchmarks**: ifort
## SPEC CPU®2017 Integer Rate Result

### Altos Computing Inc.

**BrainSphere T350 F4 (Intel Xeon Silver 4216)**

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</table>

### SPECrate®2017_int_base = 94.7

### SPECrate®2017_int_peak = 98.0

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<tr>
<th>Test Date:</th>
<th>Apr-2021</th>
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<tbody>
<tr>
<td>Hardware Availability:</td>
<td>Feb-2020</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Apr-2020</td>
</tr>
</tbody>
</table>

### Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>500.perlbench_r</td>
<td>-DSPEC_LP64 -DSPEC_LINUX_X64</td>
</tr>
<tr>
<td>502gcc_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>505.mcf_r</td>
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</tr>
<tr>
<td>548.exchange2_r</td>
<td>-DSPEC_LP64</td>
</tr>
<tr>
<td>557.xz_r</td>
<td>-DSPEC_LP64</td>
</tr>
</tbody>
</table>

### Base Optimization Flags

#### C benchmarks:

- `m64 -gnextgen -std=c11`
- `Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`
- `xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse -funroll-loops`
- `fuse-ld=gold -qopt-mem-layout-trans=4`
- `L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin -lqkmalloc`

#### C++ benchmarks:

- `m64 -gnextgen -Wl,-plugin-opt=-x86-branches-within-32B-boundaries`
- `Wl,-z,muldefs -xCORE-AVX512 -O3 -ffast-math -flto -mfpmath=sse`
- `funroll-loops -fuse-ld=gold -qopt-mem-layout-trans=4`
- `L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin -lqkmalloc`

#### Fortran benchmarks:

- `m64 -Wl,-plugin-opt=-x86-branches-within-32B-boundaries -Wl,-z,muldefs`
- `xCORE-AVX512 -O3 -ipo -no-prec-div -qopt-mem-layout-trans=4`
- `nostandard-realloc-lhs -align array32byte -auto`
- `mbranches-within-32B-boundaries`
- `L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin -lqkmalloc`

### Peak Compiler Invocation

#### C benchmarks:

- `icc`

(Continued on next page)
Altos Computing Inc.
BrainSphere T350 F4 (Intel Xeon Silver 4216)

SPECrate®2017_int_base = 94.7
SPECrate®2017_int_peak = 98.0

CPU2017 License: 97
Test Sponsor: Altos Computing Inc.
Tested by: Altos Computing Inc.
Test Date: Apr-2021
Hardware Availability: Feb-2020
Software Availability: Apr-2020

Peak Compiler Invocation (Continued)

C++ benchmarks:
icpc

Fortran benchmarks:
ifort

Peak Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -D_FILE_OFFSET_BITS=64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Peak Optimization Flags

C benchmarks:

500.perlbench_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2)
-xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-strict-overflow
-mbranches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc

502.gcc_r: -m32
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/ia32_lin
-std=gnu89
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,,-z,muldefs -fprofile-generate(pass 1)
-fprofile-use=default.profdatalpas -xCORE-AVX512 -flto
-Ofast(pass 1) -O3 -ffast-math -qnextgen -fuse-ld=gold
-qopt-mem-layout-trans=4 -L/usr/local/jemalloc32-5.0.1/lib
-ljemalloc

505.mcf_r: basepeak = yes

(Continued on next page)
### Altos Computing Inc.

**BrainSphere T350 F4 (Intel Xeon Silver 4216)**

<table>
<thead>
<tr>
<th>SPECrate®2017_int_base</th>
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<tr>
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#### CPU2017 License: 97

**Test Sponsor:** Altos Computing Inc.

**Tested by:** Altos Computing Inc.

**Test Date:** Apr-2021

**Hardware Availability:** Feb-2020

**Software Availability:** Apr-2020

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### Peak Optimization Flags (Continued)

```
525.x264_r: -m64 -qnextgen -std=c11
-Wl,-plugin-opt=-x86-branches-within-32B-boundaries
-Wl,-z,muldefSX-512 -flto -O3 -ffast-math
-fuse-ld=gold -qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc

557.xz_r: -Wl,-z,muldefSX-512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -mbranches-within-32B-boundaries
-L/usr/local/IntelCompiler19/compilers_and_libraries_2020.1.217/linux/compiler/lib/intel64_lin
-lqkmalloc
```

**C++ benchmarks:**

- 520.omnetpp_r: basepeak = yes
- 523.xalancbmk_r: basepeak = yes
- 531.deepsjeng_r: basepeak = yes
- 541.leela_r: basepeak = yes

**Fortran benchmarks:**

- 548.exchange2_r: basepeak = yes

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


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


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Tested with SPEC CPU®2017 v1.1.8 on 2021-04-23 04:46:14-0400.


Originally published on 2021-05-11.