NEC Corporation

Express5800/R110j-1 (Intel Xeon E-2224)

CPU2017 License: 9006
Test Date: Mar-2020
Test Sponsor: NEC Corporation
Hardware Availability: Jan-2020
Tested by: NEC Corporation
Software Availability: Sep-2019

SPECspeed®2017_int_base = 10.2
SPECspeed®2017_int_peak = 10.4

<table>
<thead>
<tr>
<th>Threads</th>
<th>600.perlbench_s</th>
<th>602.gcc_s</th>
<th>605.mcf_s</th>
<th>620.omnetpp_s</th>
<th>623.xalancbmk_s</th>
<th>625.x264_s</th>
<th>631.deepsjeng_s</th>
<th>641.leela_s</th>
<th>648.exchange2_s</th>
<th>657.xz_s</th>
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</tr>
</tbody>
</table>

**Hardware**

CPU Name: Intel Xeon E-2224
Max MHz: 4600
Nominal: 3400
Enabled: 4 cores, 1 chip
Orderable: 1 chip
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 256 KB I+D on chip per core
L3: 8 MB I+D on chip per chip
Other: None
Memory: 32 GB (2 x 16 GB 2Rx8 PC4-2666V-E)
Storage: 1 x 1 TB SATA, 7200 RPM, RAID 0
Other: None

**Software**

OS: Red Hat Enterprise Linux Server release 7.7 (Maipo)
Kernel 3.10.0-1062.1.1.el7.x86_64
Compiler: C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux;
Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux
Parallel: Yes
Firmware: NEC BIOS Version U43 v2.12 12/06/2019 released Mar-2020
File System: ext4
System State: Run level 3 (multi-user)
Base Pointers: 64-bit
Peak Pointers: 64-bit
Other: jemalloc memory allocator V5.0.1
Power Management: BIOS set to prefer performance at the cost of additional power usage.
SPEC CPU®2017 Integer Speed Result

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Results Table

<table>
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<th>Benchmark</th>
<th>Threads</th>
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<td>657.xz_s</td>
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</tbody>
</table>

SPECspeed®2017_int_base = 10.2
SPECspeed®2017_int_peak = 10.4

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,scatter"
LD_LIBRARY_PATH = "/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-64"
OMP_STACKSIZE = "192M"

General Notes

Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
memory using Redhat Enterprise Linux 7.5
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

Yes: 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

(Continued on next page)
**SPEC CPU®2017 Integer Speed Result**

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---

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---

### General Notes (Continued)

- 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

---

### Platform Notes

- BIOS Settings:
  - Thermal Configuration: Maximum Cooling
  - Intel Virtualization Technology (Intel VT): Disabled

- Sysinfo program: /home/cpu2017/bin/sysinfo
  - Rev: r6365 of 2019-08-21 295195f888a3d7eddb1e6e46a485a0011
  - Running on r110j1 Fri Mar 20 00:30:00 2020

- SUT (System Under Test) info as seen by some common utilities.
  - For more information on this section, see https://www.spec.org/cpu2017/Docs/config.html#sysinfo

- From /proc/cpuinfo:

  - model name : Intel(R) Xeon(R) E-2224 CPU @ 3.40GHz
  - 4 "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 : 4
    - siblings : 4
    - physical 0: cores 0 1 2 3

- From lscpu:

  - Architecture: x86_64
  - CPU op-mode(s): 32-bit, 64-bit
  - Byte Order: Little Endian
  - CPU(s): 4
  - On-line CPU(s) list: 0-3
  - Thread(s) per core: 1
  - Core(s) per socket: 4
  - Socket(s): 1
  - NUMA node(s): 1
  - Vendor ID: GenuineIntel
  - CPU family: 6
  - Model: 158
  - Model name: Intel(R) Xeon(R) E-2224 CPU @ 3.40GHz
  - Stepping: 10
  - CPU MHz: 4450.256
  - CPU max MHz: 4600.0000
  - CPU min MHz: 800.0000
  - BogoMIPS: 6816.00

(Continued on next page)
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<th>Platform Notes (Continued)</th>
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</thead>
<tbody>
<tr>
<td>Virtualization: VT-x</td>
</tr>
<tr>
<td>L1d cache: 32K</td>
</tr>
<tr>
<td>L1i cache: 32K</td>
</tr>
<tr>
<td>L2 cache: 256K</td>
</tr>
<tr>
<td>L3 cache: 8192K</td>
</tr>
<tr>
<td>NUMA node0 CPU(s): 0-3</td>
</tr>
<tr>
<td>Flags: fpu vme de pse tsc msr mce cx8 apic sep mtrr pge mca cmov pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc aperf perfctrperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg fma cx16 xtpr pdcm pcd pcid sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes xsave avx f16c rdrand lahf_lm abm 3dnowprefetch wp ibs ibpb stibp tpr_shadow vnmi flexpriority ept vpid fsgsbase tsc_adjust hle avx2 smep bmi2 ibrm vmpcid rtm mpx rdseed adx smep clflushopt xsaveopt xsavec xgetbv1 dtherm ida arpl pln pts hw hwp notify hwp_act_window hwp_epp md_clear spec_ctrl intel_stibp flush_l1d</td>
</tr>
</tbody>
</table>

/cache data

```
cache size : 8192 KB
```

From `numactl --hardware` WARNING: a numactl 'node' might or might not correspond to a physical chip.

```
available: 1 nodes (0)  
node 0 cpus: 0 1 2 3  
node 0 size: 32618 MB  
node 0 free: 31420 MB  
node distances:  
node 0  
  0: 10
```

From `/proc/meminfo`

```
MemTotal: 32791964 kB  
MemFree: 31420 MB  
MemAvailable: 31420 MB
```

From `/etc/*release*`

```
NAME="Red Hat Enterprise Linux Server"  
VERSION="7.7 (Maipo)"  
ID="rhel"  
ID_LIKE="fedora"  
VARIANT="Server"  
VARIANT_ID="server"  
VERSION_ID="7.7"  
PRETTY_NAME="Red Hat Enterprise Linux Server 7.7 (Maipo)"
```

(Continued on next page)
Platform Notes (Continued)

```plaintext
uname -a:
 Linux r110j1 3.10.0-1062.1.1.el7.x86_64 #1 SMP Tue Aug 13 18:39:59 UTC 2019 x86_64
 x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:

CVE-2018-3620 (L1 Terminal Fault):         Mitigation: PTE Inversion
Microarchitectural Data Sampling:           Mitigation: Clear CPU buffers; SMT disabled
CVE-2017-5754 (Meltdown):                  Mitigation: PTI
CVE-2018-3639 (Speculative Store Bypass):  Mitigation: Speculative Store Bypass disabled
                                              via prctl and seccomp
CVE-2017-5753 (Spectre variant 1):         Mitigation: Load fences, usercopy/swapgs
CVE-2017-5715 (Spectre variant 2):         Mitigation: Full retpoline, IBPB
run-level 3 Mar 20 00:24
```

```
SPEC is set to: /home/cpu2017
Filesystem     Type  Size  Used Avail Use% Mounted on
/dev/sda3      ext4  908G   47G  816G   6% /
```

From /sys/devices/virtual/dmi/id
BIOS: NEC U43 12/06/2019
Vendor: NEC
Product: Express5800/R110j-1
Serial: CN69380JHR

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:
2x UNKNOWN NOT AVAILABLE
2x UNKNOWN NOT AVAILABLE 16 GB 2 rank 2666

(End of data from sysinfo program)

---

Compiler Version Notes

```
C       600.perlbench_s(base, peak) 602.gcc_s(base, peak) 605.mcf_s(base, peak)
        625.x264_s(base, peak) 657.xz_s(base, peak)
```

Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
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Compiler Version Notes (Continued)

Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Compiler Version Notes (Continued)

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

Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Fortran | 648.exchange2_s(base, peak)

Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation. All rights reserved.

Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

C++ benchmarks:
icpc -m64

Fortran benchmarks:
ifort -m64

Base Portability Flags

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

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**SPECspeed®2017_int_peak = 10.4**

---

**Base Portability Flags (Continued)**

657.xz_s: -DSPEC_LP64

---

**Base Optimization Flags**

C benchmarks:
- Wl, -z, muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
- qopt-mem-layout-trans=4 -qopenmp -DSPEC_OPENMP
- L/usr/local/je5.0.1-64/lib -ljemalloc

C++ benchmarks:
- Wl, -z, muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
- qopt-mem-layout-trans=4
- L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
  -lqkmalloc

Fortran benchmarks:
- xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-mem-layout-trans=4
  -nostandard-realloc-lhs

---

**Peak Compiler Invocation**

C benchmarks:
- icc -m64 -std=c11

C++ benchmarks:
- icpc -m64

Fortran benchmarks:
- ifort -m64

---

**Peak Portability Flags**

Same as Base Portability Flags
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Peak Optimization Flags

C benchmarks:

600.perlbench_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -O2
-xCORE-AVX2 -qopt-mem-layout-trans=4 -ipo -O3
-no-prec-div -DSPEC_SUPPRESS_OPENMP -gopenmp

602.gcc_s: basepeak = yes

605.mcf_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX2 -O3 -no-prec-div -qopt-mem-layout-trans=4
-DSPEC_SUPPRESS_OPENMP -gopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc

625.x264_s: -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -gopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc

657.xz_s: basepeak = yes

C++ benchmarks:

620.omnetpp_s: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX2 -O3 -no-prec-div -qopt-mem-layout-trans=4
-DSPEC_SUPPRESS_OPENMP
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

623.xalancbmk_s: -Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -gopenmp -DSPEC_OPENMP
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

631.deepsjeng_s: basepeak = yes

641.leela_s: Same as 623.xalancbmk_s

Fortran benchmarks:

-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-mem-layout-trans=4
-nostandard-realloc-lhs

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