NEC Corporation

Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Sep-2018
Hardware Availability: Jun-2018
Software Availability: Mar-2018

603.bwaves_s 607.cactuBSSN_s 619.lbm_s 621.wrf_s 627.cam4_s 628.pop2_s 638.imagick_s 644.nab_s 649.fotonik3d_s 654.roms_s

Threads

<table>
<thead>
<tr>
<th>Thread</th>
<th>Threads</th>
<th>SPECspeed2017_fp_base</th>
<th>SPECspeed2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>24</td>
<td>95.7</td>
<td>95.7</td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>24</td>
<td>37.1</td>
<td>37.1</td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>24</td>
<td>63.1</td>
<td>63.1</td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>24</td>
<td>66.8</td>
<td>66.8</td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>24</td>
<td>48.9</td>
<td>48.9</td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>24</td>
<td>51.4</td>
<td>51.4</td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>24</td>
<td>61.2</td>
<td>61.2</td>
</tr>
<tr>
<td>644.nab_s</td>
<td>24</td>
<td>119</td>
<td>119</td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>24</td>
<td>70.0</td>
<td>70.0</td>
</tr>
<tr>
<td>654.roms_s</td>
<td>24</td>
<td>81.5</td>
<td>81.5</td>
</tr>
</tbody>
</table>

Hardware

CPU Name: Intel Xeon Silver 4116
Max MHz.: 3000
Nominal: 2100
Enabled: 24 cores, 2 chips
Orderable: 1.2 chips
Cache L1: 32 KB I + 32 KB D on chip per core
L2: 1 MB I+D on chip per core
L3: 16.5 MB I+D on chip per core
Other: None
Memory: 192 GB (24 x 8 GB 2Rx8 PC4-2666V-R, running at 2400)
Storage: 1 x 1 TB SATA, 7200 RPM, RAID 0
Other: None

Software

OS: Red Hat Enterprise Linux Server release 7.4 (Maipo)
Kernel 3.10.0-693.21.1.el7.x86_64
Compiler: C/C++: Version 18.0.2.199 of Intel C/C++ Compiler for Linux;
Fortran: Version 18.0.2.199 of Intel Fortran Compiler for Linux
Parallel: Yes
Firmware: NEC BIOS Version U30 02/15/2018 released Mar-2018
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
SPEC CPU2017 Floating Point Speed Result

NEC Corporation

Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Threads</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Base</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>603.bwaves_s</td>
<td>24</td>
<td>159 372</td>
<td>159 371</td>
<td>160 368</td>
<td>24</td>
<td>159 372</td>
<td>159 371</td>
<td>160 368</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>607.cactuBSSN_s</td>
<td>24</td>
<td>175 95.1</td>
<td>168 99.0</td>
<td>174 95.7</td>
<td>24</td>
<td>175 95.1</td>
<td>168 99.0</td>
<td>174 95.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>619.lbm_s</td>
<td>24</td>
<td>141 37.1</td>
<td>141 37.1</td>
<td>141 37.1</td>
<td>24</td>
<td>141 37.1</td>
<td>141 37.1</td>
<td>141 37.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>621.wrf_s</td>
<td>24</td>
<td>210 63.1</td>
<td>209 63.2</td>
<td>210 63.0</td>
<td>24</td>
<td>198 66.6</td>
<td>198 67.0</td>
<td>198 66.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>627.cam4_s</td>
<td>24</td>
<td>181 48.9</td>
<td>181 48.9</td>
<td>181 49.0</td>
<td>24</td>
<td>181 48.9</td>
<td>181 48.9</td>
<td>181 49.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>628.pop2_s</td>
<td>24</td>
<td>229 51.9</td>
<td>231 51.4</td>
<td>232 51.3</td>
<td>24</td>
<td>223 53.3</td>
<td>222 53.6</td>
<td>221 53.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>638.imagick_s</td>
<td>24</td>
<td>236 61.2</td>
<td>236 61.1</td>
<td>236 61.0</td>
<td>24</td>
<td>236 61.2</td>
<td>236 61.1</td>
<td>236 61.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>644.nab_s</td>
<td>24</td>
<td>146 119</td>
<td>146 119</td>
<td>146 119</td>
<td>24</td>
<td>146 119</td>
<td>146 119</td>
<td>146 119</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>649.fotonik3d_s</td>
<td>24</td>
<td>130 70.1</td>
<td>130 69.9</td>
<td>130 70.0</td>
<td>24</td>
<td>130 70.1</td>
<td>130 69.9</td>
<td>130 70.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>654.roms_s</td>
<td>24</td>
<td>193 81.5</td>
<td>193 81.7</td>
<td>194 81.2</td>
<td>24</td>
<td>195 80.7</td>
<td>193 81.5</td>
<td>193 81.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

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"

General Notes

Environment variables set by runcpu before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
LD_LIBRARY_PATH = "/home/cpu2017/lib/ia32:/home/cpu2017/lib/intel64:/home/cpu2017/je5.0.1-32:/home/cpu2017/je5.0.1-64"
OMP_STACKSIZE = "192M"

Binaries compiled on a system with 1x Intel Core i7-6700K 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 built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
**NEC Corporation**

**Express5800/R120h-2M (Intel Xeon Silver 4116)**

<table>
<thead>
<tr>
<th>SPECspeed2017_fp_base</th>
<th>SPECspeed2017_fp_peak</th>
</tr>
</thead>
<tbody>
<tr>
<td>78.4</td>
<td>79.1</td>
</tr>
</tbody>
</table>

**CPU2017 License:** 9006  
**Test Date:** Sep-2018  
**Hardware Availability:** Jun-2018  
**Test Sponsor:** NEC Corporation  
**Software Availability:** Mar-2018  
**Tested by:** NEC Corporation

---

**Platform Notes**

**BIOS Settings:**
- Thermal Configuration: Maximum Cooling
- Workload Profile: General Peak Frequency Compute
- Intel Hyper-Threading: Disabled
- Memory Patrol Scrubbing: Disabled
- Energy/Performance Bias: Maximum Performance
- LLC Dead Line Allocation: Disabled
- Workload Profile: Custom
- NUMA Group Size Optimization: Flat
- Adjacent Sector Prefetch: Disabled
- DCU Stream Prefetcher: Disabled
- Sysinfo program: /home/cpu2017/bin/sysinfo

Revison: r5974 of 2018-05-19 9bcde8f2999c33d61f64985e45859ea9
running on r120h2m Tue Sep 18 07:31:21 2018

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) Silver 4116 CPU @ 2.10GHz
  2 "physical id"s (chips)
  24 "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 : 12
siblings : 12
  physical 0: cores 0 1 2 3 4 5 8 9 10 11 12 13
  physical 1: cores 0 1 2 3 4 5 8 9 10 11 12 13
```

From lscpu:

```
Architecture:         x86_64
CPU op-mode(s):       32-bit, 64-bit
Byte Order:           Little Endian
CPU(s):               24
On-line CPU(s) list:  0-23
Thread(s) per core:   1
Core(s) per socket:   12
Socket(s):            2
NUMA node(s):         2
Vendor ID:            GenuineIntel
CPU family:           6
Model:                85
Model name:           Intel(R) Xeon(R) Silver 4116 CPU @ 2.10GHz
Stepping:             4
CPU MHz:              2100.000
BogoMIPS:             4200.00
```

(Continued on next page)
SPEC CPU2017 Floating Point Speed Result
Copyright 2017-2018 Standard Performance Evaluation Corporation

NEC Corporation

Express5800/R120h-2M (Intel Xeon Silver 4116)

**SPECspeed2017_fp_base** = 78.4

**SPECspeed2017_fp_peak** = 79.1

<table>
<thead>
<tr>
<th>CPU2017 License:</th>
<th>9006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Sponsor:</td>
<td>NEC Corporation</td>
</tr>
<tr>
<td>Tested by:</td>
<td>NEC Corporation</td>
</tr>
<tr>
<td>Test Date:</td>
<td>Sep-2018</td>
</tr>
<tr>
<td>Hardware Availability:</td>
<td>Jun-2018</td>
</tr>
<tr>
<td>Software Availability:</td>
<td>Mar-2018</td>
</tr>
</tbody>
</table>

Platform Notes (Continued)

```
Virtualization:        VT-x
L1d cache:             32K
L1i cache:             32K
L2 cache:              1024K
L3 cache:              16896K
NUMA node0 CPU(s):     0-11
NUMA node1 CPU(s):     12-23
Flags:                 fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
                       pat pse36 cklflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtxsc
                       lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
                       aperfmperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 fma
                       cx16 xtrr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
                       xsave avx f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 invvpcl_single
                       intel_pt spec_ctrl ibp_shadow tpr_shadow vmi flexpriority ept vpid fsgsbase
                       tsc_adjust bmi1 hle avx2 smep bmi2 erms invvpcl rtm cqm mpx rdt_a avx512f avx512dq
                       rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsave xgetbv1
                       cqm_llc cqm_occup_llc cqm_mbb_total cqm_mbb_local dtherm ida arat pln pts
```

/proc/cpuinfo cache data
```
cache size : 16896 KB
```

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 4 5 6 7 8 9 10 11
node 0 size: 97964 MB
node 0 free: 95515 MB
node 1 cpus: 12 13 14 15 16 17 18 19 20 21 22 23
node 1 size: 98303 MB
node 1 free: 95940 MB
node distances:
node 0 1
0: 10 21
1: 21 10
```

From /proc/meminfo
```
MemTotal:       197749748 kB
HugePages_Total:       0
Hugepagesize:       2048 KB
```

From /etc/*release* /etc/*version*
```
os-release:
NAME="Red Hat Enterprise Linux Server"
VERSION="7.4 (Maipo)"
ID="rhel"
ID_LIKE="fedora"
VARIANT="Server"
```

(Continued on next page)
SPEC CPU2017 Floating Point Speed Result

NEC Corporation

Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

VARIANT_ID="server"
VERSION_ID="7.4"
PRETTY_NAME="Red Hat Enterprise Linux Server 7.4 (Maipo)"
redhat-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release: Red Hat Enterprise Linux Server release 7.4 (Maipo)
system-release-cpe: cpe:/o:redhat:enterprise_linux:7.4:ga:server

uname -a:
Linux r120h2m 3.10.0-693.21.1.el7.x86_64 #1 SMP Fri Feb 23 18:54:16 UTC 2018 x86_64
x86_64 x86_64 GNU/Linux

Kernel self-reported vulnerability status:
CVE-2017-5754 (Meltdown): Mitigation: PTI
CVE-2017-5753 (Spectre variant 1): Mitigation: Load fences
CVE-2017-5715 (Spectre variant 2): Mitigation: IBRS (kernel)

run-level 3 Sep 18 07:25

SPEC is set to: /home/cpu2017

Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 ext4 909G 454G 409G 53% /

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.
BIOS NEC U30 02/15/2018
Memory:
24x HPE 876319-081 8 GB 2 rank 2666, configured at 2400

(End of data from sysinfo program)

Compiler Version Notes

==============================================================================
CC 619.lbm_s(base) 638.imagick_s(base, peak) 644.nab_s(base, peak)
------------------------------------------------------------------------------
icc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
==============================================================================

==============================================================================
CC 619.lbm_s(peak)
------------------------------------------------------------------------------
icc (ICC) 18.0.2 20180210

(Continued on next page)
-spec

SPEC CPU2017 Floating Point Speed Result

Copyright 2017-2018 Standard Performance Evaluation Corporation

NEC Corporation

Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Test Date: Sep-2018
Tested by: NEC Corporation
Hardware Availability: Jun-2018
Software Availability: Mar-2018

Compiler Version Notes (Continued)

Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
FC  607.cactuBSSN_s(base, peak)
--
icpc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
icc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
ifort (IFORT) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
FC  603.bwaves_s(base) 649.fotonik3d_s(base) 654.roms_s(base, peak)
--
ifort (IFORT) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
FC  603.bwaves_s(peak) 649.fotonik3d_s(peak)
--
ifort (IFORT) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
CC  621.wrf_s(base) 627.cam4_s(base, peak) 628.pop2_s(base)
--
ifort (IFORT) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
icc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.

==============================================================================
CC  621.wrf_s(peak) 628.pop2_s(peak)
--
ifort (IFORT) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
icc (ICC) 18.0.2 20180210
Copyright (C) 1985-2018 Intel Corporation. All rights reserved.
SPEC CPU2017 Floating Point Speed Result

NEC Corporation
Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Test Date: Sep-2018
Hardware Availability: Jun-2018
Tested by: NEC Corporation
Software Availability: Mar-2018

Base Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Base Portability Flags

603.bwaves_s: -DSPEC_LP64
607.cactuBSSN_s: -DSPEC_LP64
619.lbm_s: -DSPEC_LP64
621.wrf_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
627.cam4_s: -DSPEC_LP64 -DSPEC_CASE_FLAG
628.pop2_s: -DSPEC_LP64 -DSPEC_CASE_FLAG -convert big_endian
-assume byterecl
638.imagick_s: -DSPEC_LP64
644.nab_s: -DSPEC_LP64
649.fotonik3d_s: -DSPEC_LP64
654.roms_s: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -gopenmp -DSPEC_OPENMP
-L/usr/local/je5.0.1-64/lib -ljemalloc

Fortran benchmarks:
-Wl,-z,muldefs -DSPEC_OPENMP -xCORE-AVX2 -ipo -O3 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3 -gopenmp
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc

Benchmarks using both Fortran and C:
-Wl,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -gopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc

(Continued on next page)
SPEC CPU2017 Floating Point Speed Result
Copyright 2017-2018 Standard Performance Evaluation Corporation

NEC Corporation
Express5800/R120h-2M (Intel Xeon Silver 4116)

SPECspeed2017_fp_base = 78.4
SPECspeed2017_fp_peak = 79.1

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Sep-2018
Hardware Availability: Jun-2018
Software Availability: Mar-2018

Base Optimization Flags (Continued)

Benchmarks using Fortran, C, and C++:
-W1,-z,muldefs -xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp -DSPEC_OPENMP
-nostandard-realloc-lhs -L/usr/local/je5.0.1-64/lib -ljemalloc

Peak Compiler Invocation

C benchmarks:
icc -m64 -std=c11

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
ifort -m64 icc -m64 -std=c11

Benchmarks using Fortran, C, and C++:
icpc -m64 icc -m64 -std=c11 ifort -m64

Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:
619.lbm_s: basepeak = yes
638.imagick_s: basepeak = yes
644.nab_s: basepeak = yes

Fortran benchmarks:
603.bwaves_s: basepeak = yes

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

649.fotonik3d_s: basepeak = yes

654.roms_s: -DSPEC_OPENMP -xCORE-AVX2 -ipo -03 -no-prec-div
-qopt-prefetch -ffinite-math-only -qopt-mem-layout-trans=3
-qopenmp -nostandard-realloc-lhs

Benchmarks using both Fortran and C:

621.wrf_s: -prof-gen(pass 1) -prof-use(pass 2) -O2 -xCORE-AVX2
-qopt-prefetch -ipo -03 -ffinite-math-only -no-prec-div
-qopt-mem-layout-trans=3 -DSPEC_SUPPRESS_OPENMP -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs

627.cam4_s: -xCORE-AVX2 -ipo -03 -no-prec-div -qopt-prefetch
-ffinite-math-only -qopt-mem-layout-trans=3 -qopenmp
-DSPEC_OPENMP -nostandard-realloc-lhs

628.pop2_s: Same as 621.wrf_s

Benchmarks using Fortran, C, and C++:

607.cactuBSSN_s: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120h-RevB.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic18.0-official-linux64.2017-12-21.xml
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-V1.2-R120h-RevB.xml