## Lenovo Group Limited

### Lenovo System x3550 M5

(2.40 GHz, Intel Xeon E5-2680 v4)

| Test Date: | Apr-2016 |
| Test Sponsor: | Lenovo Group Limited |
| Hardware Availability: | Mar-2016 |
| Software Availability: | Dec-2015 |

### SPECint Rate Results

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Rate2006</th>
<th>Rate_base2006</th>
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<tbody>
<tr>
<td>perlbench</td>
<td>1170</td>
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<tr>
<td>bzip2</td>
<td>637</td>
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<td>gcc</td>
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<td>933</td>
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<tr>
<td>mcf</td>
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<td>gobmk</td>
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<td>843</td>
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<td>hminer</td>
<td>2030</td>
<td>1810</td>
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<td>libquantum</td>
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<td>h264ref</td>
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<tr>
<td>omnetpp</td>
<td>673</td>
<td>639</td>
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<tr>
<td>astar</td>
<td>719</td>
<td></td>
</tr>
<tr>
<td>xalancbmk</td>
<td>1420</td>
<td></td>
</tr>
</tbody>
</table>

### CPU Information

- **Name:** Intel Xeon E5-2680 v4
- **Characteristics:** Intel Turbo Boost Technology up to 3.30 GHz
- **MHz:** 2400
- **FPU:** Integrated
- **CPU(s) enabled:** 28 cores, 2 chips, 14 cores/chip, 2 threads/core
- **Primary Cache:** 32 KB I + 32 KB D on chip per core
- **Secondary Cache:** 256 KB I+D on chip per core
- **L3 Cache:** 35 MB I+D on chip per chip
- **Memory:** 256 GB (16 x 16 GB 2Rx4 PC4-2400T-R)
- **Disk Subsystem:** 1 x 800 GB SATA SSD
- **Other Hardware:** None

### Software Information

- **Operating System:** SUSE Linux Enterprise Server 12 (x86_64) Kernel 3.12.28-4-default
- **Compiler:** C/C++: Version 16.0.101 of Intel C++ Studio XE for Linux
- **Auto Parallel:** No
- **File System:** xfs
- **System State:** Run level 3 (multi-user)
- **Base Pointers:** 32-bit
- **Peak Pointers:** 32/64-bit
- **Other Software:** Microquill SmartHeap V10.2

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Standard Performance Evaluation Corporation
info@spec.org
http://www.spec.org/
Lenovo Group Limited

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SPECint_rate2006 = 1320
SPECint_rate_base2006 = 1260

CPU2006 license: 9017
Test sponsor: Lenovo Group Limited
Tested by: Lenovo Group Limited

Test date: Apr-2016
Hardware Availability: Mar-2016
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Results Table

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<tr>
<th>Benchmark</th>
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<tr>
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<td>576</td>
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<td>473.astar</td>
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<td>547</td>
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<td>546</td>
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<td>1420</td>
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<td>1420</td>
<td>271</td>
<td>1430</td>
<td>56</td>
<td>272</td>
</tr>
</tbody>
</table>

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

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"
Transparent Huge Pages enabled with:
echo always > /sys/kernel/mm/transparent_hugepage/enabled
Filesystem page cache cleared with:
echo 1 > /proc/sys/vm/drop_caches

Platform Notes

BIOS Configuration:
Operating Mode set to "Maximum Performance"
COD Preference set to Enable
Sysinfo program /home/cpu2006-1.2-ic16.0/config/sysinfo.rev6914
$Rev: 6914 $ $Date:: 2014-06-25 #$ e3fbb8667b5a285932ceab81e28219e1
running on linux-gj7w Wed Apr 27 09:23:39 2016

This section contains SUT (System Under Test) info as seen by some common utilities. To remove or add to this section, see:
http://www.spec.org/cpu2006/Docs/config.html#sysinfo

From /proc/cpuinfo
model name : Intel(R) Xeon(R) CPU E5-2680 v4@ 2.40GHz
Continued on next page
Platform Notes (Continued)

2 "physical id"s (chips)
56 "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 : 7
siblings : 14
physical 0: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14
physical 1: cores 0 1 2 3 4 5 6 8 9 10 11 12 13 14
cache size : 17920 KB

From /proc/meminfo
MemTotal:       263825084 kB
HugePages_Total:       0
Hugepagesize:       2048 kB

From /etc/*release* /etc/*version*
SuSE-release:
SUSE Linux Enterprise Server 12 (x86_64)
VERSION = 12
PATCHLEVEL = 0
# This file is deprecated and will be removed in a future service pack or release.
# Please check /etc/os-release for details about this release.
os-release:
NAME="SLES"
VERSION="12"
VERSION_ID="12"
PRETTY_NAME="SUSE Linux Enterprise Server 12"
ID="sles"
ANSI_COLOR="0;32"
CPE_NAME="cpe:/o:suse:sles:12"

uname -a:
Linux linux-gj7w 3.12.28-4-default #1 SMP Thu Sep 25 17:02:34 UTC 2014
(9879bd4) x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Apr 27 09:22

SPEC is set to: /home/cpu2006-1.2-ic16.0
Filesystem  Type Size Used Avail Use% Mounted on
/dev/sda4  xfs  703G 11G 693G 2% /home

Additional information from dmidecode:

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 LENOVO -[TBE123H-2.10]- 03/25/2016
Memory:
  8x NO DIMM Unknown

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<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECint_rate2006</td>
<td>1320</td>
</tr>
<tr>
<td>SPECint_rate_base2006</td>
<td>1260</td>
</tr>
</tbody>
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**CPU2006 license:** 9017  
**Test sponsor:** Lenovo Group Limited  
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**Test date:** Apr-2016  
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**Software Availability:** Dec-2015

### Platform Notes (Continued)

16x Samsung M393A2G40DB1-CRC 16 GB 2 rank 2400 MHz

(End of data from sysinfo program)

### General Notes

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

- `LD_LIBRARY_PATH = */home/cpu2006-1.2-ic16.0/libs/32:/home/cpu2006-1.2-ic16.0/libs/64:/home/cpu2006-1.2-ic16.0/sh`

Binaries compiled on a system with 1x Intel Core i5-4670K CPU + 32GB memory using RedHat EL 7.1

- Transparent Huge Pages enabled with:
  - `echo always > /sys/kernel/mm/transparent_hugepage/enabled`

- Filesystem page cache cleared with:
  - `echo 1 > /proc/sys/vm/drop_caches`

- Run `runspec` command invoked through `numactl` i.e.:
  - `numactl --interleave=all runspec <etc>`

### Base Compiler Invocation

#### C benchmarks:

- `icc -m32 -L/opt/intel/compilers_and_libraries_2016/linux/compiler/lib/ia32_lin`

#### C++ benchmarks:

- `icpc -m32 -L/opt/intel/compilers_and_libraries_2016/linux/compiler/lib/ia32_lin`

### Base Portability Flags

- 400.perlbench: `-D_FILE_OFFSET_BITS=64` `-DSPEC_CPU_LINUX_IA32`
- 401.bzip2: `-D_FILE_OFFSET_BITS=64`
- 403.gcc: `-D_FILE_OFFSET_BITS=64`
- 429.mcf: `-D_FILE_OFFSET_BITS=64`
- 445.gobmk: `-D_FILE_OFFSET_BITS=64`
- 456.hmmer: `-D_FILE_OFFSET_BITS=64`
- 458.sjeng: `-D_FILE_OFFSET_BITS=64`
- 462.libquantum: `-D_FILE_OFFSET_BITS=64` `-DSPEC_CPU_LINUX`
- 464.h264ref: `-D_FILE_OFFSET_BITS=64`
- 471.omnetpp: `-D_FILE_OFFSET_BITS=64`
- 473.astar: `-D_FILE_OFFSET_BITS=64`
- 483.xalancbmk: `-D_FILE_OFFSET_BITS=64` `-DSPEC_CPU_LINUX`

### Base Optimization Flags

#### C benchmarks:

- `-xCORE-AVX2`
- `-ipo`
- `-no-prec-div`
- `-opt-prefetch`
- `-opt-mem-layout-trans=3`

Continued on next page
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SPECint\_rate\_base\_2006 = \(1260\)

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Base Optimization Flags (Continued)

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -opt-prefetch
-opt-mem-layout-trans=3 -Wl,-z,muldefs -L/sh -lsmartheap

Base Other Flags

C benchmarks:
403.gcc: -Dalloca=_alloca

Peak Compiler Invocation

C benchmarks (except as noted below):
icc -m32 -L/opt/intel/compilers_and_libraries_2016/linux/compiler/lib/ia32_lin
400.perlbench: icc -m64
401.bzip2: icc -m64
456.hmmer: icc -m64
458.sjeng: icc -m64

C++ benchmarks:
icpc -m32 -L/opt/intel/compilers_and_libraries_2016/linux/compiler/lib/ia32_lin

Peak Portability Flags

400.perlbench: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LP64 -DSPEC\_CPU\_LINUX\_X64
401.bzip2: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LP64
403.gcc: -D\_FILE\_OFFSET\_BITS=64
429.mcf: -D\_FILE\_OFFSET\_BITS=64
445.gobmk: -D\_FILE\_OFFSET\_BITS=64
456.hmmer: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LP64
458.sjeng: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LP64
462.libquantum: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LP64
464.h264ref: -D\_FILE\_OFFSET\_BITS=64
471.omnetpp: -D\_FILE\_OFFSET\_BITS=64
473.astar: -D\_FILE\_OFFSET\_BITS=64
483.xalancbmk: -D\_FILE\_OFFSET\_BITS=64 -DSPEC\_CPU\_LINUX
## Peak Optimization Flags

### C benchmarks:

400.perlbench:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `O3` (pass 2)
- `no-prec-div` (pass 2)
- `par-num-threads=1` (pass 1)
- `prof-use` (pass 2)
- `auto-ilp32`

401.bzip2:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `O3` (pass 2)
- `no-prec-div` (pass 2)
- `par-num-threads=1` (pass 1)
- `prof-use` (pass 2)
- `opt-prefetch`
- `auto-ilp32`
- `ansi-alias`

403.gcc:
- `xCORE-AVX2`
- `ipo`
- `O3`
- `no-prec-div`

429.mcf:
- `basepeak = yes`

445.gobmk:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `par-num-threads=1` (pass 1)
- `ansi-alias`
- `opt-mem-layout-trans=3`

456.hmmer:
- `xCORE-AVX2`
- `ipo`
- `O3`
- `no-prec-div`
- `unroll2`
- `auto-ilp32`

458.sjeng:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `O3` (pass 2)
- `no-prec-div` (pass 2)
- `par-num-threads=1` (pass 1)
- `prof-use` (pass 2)
- `unroll4`
- `auto-ilp32`

462.libquantum:
- `basepeak = yes`

464.h264ref:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `O3` (pass 2)
- `no-prec-div` (pass 2)
- `par-num-threads=1` (pass 1)
- `prof-use` (pass 2)
- `unroll2`
- `ansi-alias`

### C++ benchmarks:

471.omnetpp:
- `xCORE-AVX2` (pass 2)
- `prof-gen:threadsafe` (pass 1)
- `ipo` (pass 2)
- `O3` (pass 2)
- `no-prec-div` (pass 2)
- `par-num-threads=1` (pass 1)
- `prof-use` (pass 2)
- `ansi-alias`
- `opt-ra-region-strategy=block`
- `-Wl,-z,muldefs`
- `-L/sh -lsmartheap`

473.astar:
- `basepeak = yes`

483.xalancbmk:
- `basepeak = yes`
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Peak Other Flags

C benchmarks:

403.gcc -Dalloca=_alloca

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2006/flags/Intel-ic16.0-official-linux64.html
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Flags-V1.2-BDW-B.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2006/flags/Intel-ic16.0-official-linux64.xml
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Flags-V1.2-BDW-B.xml

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