**Lenovo Group Limited**

Lenovo ThinkServer RD650 (Intel Xeon E5-2660 v3, 2.60 GHz)

| SPECint®_rate2006 = 893 | SPECint_rate_base2006 = 868 |

**CPU2006 license:** 9017  
**Test date:** Nov-2014

**Test sponsor:** Lenovo Group Limited  
**Hardware Availability:** Sep-2014

**Tested by:** Lenovo Group Limited  
**Software Availability:** Jan-2014

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### Hardware

<table>
<thead>
<tr>
<th><strong>CPU Name:</strong></th>
<th>Intel Xeon E5-2660 v3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU Characteristics:</strong></td>
<td>Intel Turbo Boost Technology up to 3.30 GHz</td>
</tr>
<tr>
<td><strong>CPU MHZ:</strong></td>
<td>2600</td>
</tr>
<tr>
<td><strong>FPU:</strong></td>
<td>Integrated</td>
</tr>
<tr>
<td><strong>CPU(s) enabled:</strong></td>
<td>20 cores, 2 chips, 10 cores/chip, 2 threads/core</td>
</tr>
<tr>
<td><strong>CPU(s) orderable:</strong></td>
<td>1,2 chip</td>
</tr>
<tr>
<td><strong>Primary Cache:</strong></td>
<td>32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td><strong>Secondary Cache:</strong></td>
<td>256 KB I+D on chip per core</td>
</tr>
<tr>
<td><strong>L3 Cache:</strong></td>
<td>25 MB I+D on chip per chip</td>
</tr>
<tr>
<td><strong>Other Cache:</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Memory:</strong></td>
<td>256 GB (16 x 16 GB 2Rx4 PC4-2133P-R)</td>
</tr>
<tr>
<td><strong>Disk Subsystem:</strong></td>
<td>1 x 240 GB SATA SSD</td>
</tr>
<tr>
<td><strong>Other Hardware:</strong></td>
<td>None</td>
</tr>
</tbody>
</table>

### Software

| **Operating System:** | Red Hat Enterprise Linux Server release 6.5 (Santiago) |
| **Compiler:** | C/C++: Version 14.0.0.080 of Intel C++ Studio XE for Linux |
| **Auto Parallel:** | No |
| **File System:** | ext4 |
| **System State:** | Run level 3 (multi-user) |
| **Base Pointers:** | 32-bit |
| **Peak Pointers:** | 32/64-bit |
| **Other Software:** | Microquill SmartHeap V10.0 |
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CPU2006 license: 9017
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Results Table

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Copies</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>400.perlbench</td>
<td>40</td>
<td>586</td>
<td>666</td>
<td>587</td>
<td>666</td>
<td>587</td>
<td>666</td>
</tr>
<tr>
<td>401.bzip2</td>
<td>40</td>
<td>906</td>
<td>426</td>
<td>907</td>
<td>426</td>
<td>907</td>
<td>426</td>
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<tr>
<td>403.gcc</td>
<td>40</td>
<td>482</td>
<td>668</td>
<td>486</td>
<td>663</td>
<td>486</td>
<td>663</td>
</tr>
<tr>
<td>429.mcf</td>
<td>40</td>
<td>316</td>
<td>1160</td>
<td>315</td>
<td>1160</td>
<td>315</td>
<td>1160</td>
</tr>
<tr>
<td>445.gobmk</td>
<td>40</td>
<td>711</td>
<td>591</td>
<td>713</td>
<td>588</td>
<td>713</td>
<td>588</td>
</tr>
<tr>
<td>456.hmmer</td>
<td>40</td>
<td>300</td>
<td>1240</td>
<td>300</td>
<td>1240</td>
<td>300</td>
<td>1240</td>
</tr>
<tr>
<td>458.sjeng</td>
<td>40</td>
<td>767</td>
<td>631</td>
<td>766</td>
<td>632</td>
<td>766</td>
<td>632</td>
</tr>
<tr>
<td>462.libquantum</td>
<td>40</td>
<td>98.4</td>
<td>8420</td>
<td>98.5</td>
<td>8420</td>
<td>98.5</td>
<td>8420</td>
</tr>
<tr>
<td>464.h264ref</td>
<td>40</td>
<td>860</td>
<td>1030</td>
<td>863</td>
<td>1030</td>
<td>863</td>
<td>1030</td>
</tr>
<tr>
<td>471.omnetpp</td>
<td>40</td>
<td>541</td>
<td>462</td>
<td>535</td>
<td>467</td>
<td>537</td>
<td>466</td>
</tr>
<tr>
<td>473.astar</td>
<td>40</td>
<td>589</td>
<td>477</td>
<td>587</td>
<td>479</td>
<td>592</td>
<td>474</td>
</tr>
<tr>
<td>483.xalancbmk</td>
<td>40</td>
<td>292</td>
<td>945</td>
<td>292</td>
<td>945</td>
<td>292</td>
<td>945</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.

Operating System Notes

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

Platform Notes

BIOS configuration:
Cluster On Die set to Enabled
Early Snoop set to Disabled
Performance Profile set to Custom
C1E Support set to Disabled
Core C3 set to Disabled
Core C6 set to Disabled
Thermal Profile set to High Fan Speed
Memory Power Savings set to Disabled
Sysinfo program /usr/cpu2006/config/sysinfo.rev6818
$Rev: 6818 $ $Date:: 2012-07-17 #$ e86d102572650a6e4d596a3cee98f191 running on RD650 Tue Nov 4 00:54:08 2014

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

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Lenovo ThinkServer RD650 (Intel Xeon E5-2660 v3, 2.60 GHz)

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CPU2006 license: 9017
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Test date: Nov-2014
Hardware Availability: Sep-2014
Software Availability: Jan-2014

Platform Notes (Continued)

From /proc/cpuinfo
model name : Intel(R) Xeon(R) CPU E5-2660 v3 @ 2.60GHz
  2 "physical id"s (chips)
  40 "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 : 10
siblings : 20
physical 0: cores 0 1 2 3 4 8 9 10 11 12
physical 1: cores 0 1 2 3 4 8 9 10 11 12
cache size : 12800 KB

From /proc/meminfo
MemTotal: 264412024 kB
HugePages_Total: 0
Hugepagesize: 2048 kB

/usr/bin/lsb_release -d
Red Hat Enterprise Linux Server release 6.5 (Santiago)

From /etc/*release* /etc/*version*
redhat-release: Red Hat Enterprise Linux Server release 6.5 (Santiago)
system-release: Red Hat Enterprise Linux Server release 6.5 (Santiago)

uname -a:
Linux RD650 2.6.32-431.el6.x86_64 #1 SMP Sun Nov 10 22:19:54 EST 2013 x86_64
x86_64 x86_64 GNU/Linux
run-level 3 Nov 4 00:53

SPEC is set to: /usr/cpu2006
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda2 ext4 217G 13G 193G 7% /

Additional information from dmidecode:
BIOS LENOVO PB2TS110 10/06/2014
Memory:
16x 16 GB
16x Hynix Semiconductor HMA42GR7MFR4N-TFTD 16 GB 2133 MHz 2 rank
8x NO DIMM NO DIMM

(Red of data from sysinfo program)
RD650 support 4 channels and 12 DIMMs per processor, total 8 channels and
24 DIMMs. 16 DIMM slots installed with 16 GB DIMM for this run.
# Lenovo Group Limited

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## General Notes

Environment variables set by runspec before the start of the run:
LD_LIBRARY_PATH = "/usr/cpu2006/libs/32:/usr/cpu2006/libs/64:/usr/cpu2006/sh"

Binaries compiled on a system with 1x Core i7-860 CPU + 8GB memory using RedHat EL 6.4.  
Transparent Huge Pages enabled with:
echo always > /sys/kernel/mm/redhat_transparent_hugepage/enabled  
Filesystem page cache cleared with:
echo 1> /proc/sys/vm/drop_caches  
runcspec command invoked through numactl i.e.:  
numactl --interleave=all runspec <etc>

## Base Compiler Invocation

### C benchmarks
- icc -m32

### C++ benchmarks
- icpc -m32

## Base Portability Flags

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Portability Flag</th>
</tr>
</thead>
<tbody>
<tr>
<td>400.perlbmk</td>
<td>-DSPEC_CPU_LINUX_IA32</td>
</tr>
<tr>
<td>462.libquantum</td>
<td>-DSPEC_CPU_LINUX</td>
</tr>
<tr>
<td>483.xalancbmk</td>
<td>-DSPEC_CPU_LINUX</td>
</tr>
</tbody>
</table>

## Base Optimization Flags

### C benchmarks
- -xCORE-AVX2 -ipo -O3 -no-prec-div -opt-prefetch  
- opt-mem-layout-trans=3

### 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
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**Peak Compiler Invocation**

C benchmarks (except as noted below):

```
icc   -m32
```

```
400.perlbench: icc   -m64
```

```
401.bzip2: icc   -m64
```

```
456.hmmer: icc   -m64
```

```
458.sjeng: icc   -m64
```

C++ benchmarks:

```
icpp  -m32
```

---

**Peak Portability Flags**

```
400.perlbench:  -DSPEC_CPU_LP64  -DSPEC_CPU_LINUX_X64
401.bzip2:  -DSPEC_CPU_LP64
456.hmmer:  -DSPEC_CPU_LP64
458.sjeng:  -DSPEC_CPU_LP64
462.libquantum: -DSPEC_CPU_LINUX
483.xalancbmk: -DSPEC_CPU_LINUX
```

---

**Peak Optimization Flags**

C benchmarks:

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

```
401.bzip2:  -xCORE-AVX2(pass 2)  -prof-gen(pass 1)  -ipo(pass 2)
                 -O3(pass 2)  -no-prec-div(pass 2)  -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(pass 1)  -prof-use(pass 2)
                 -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(pass 1)  -ipo(pass 2)
                 -O3(pass 2)  -no-prec-div(pass 2)  -prof-use(pass 2)
                 -unroll4  -auto-ilp32
```

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SPECint_rate2006 = 893
SPECint_rate_base2006 = 868

Peak Optimization Flags (Continued)

462.libquantum: basepeak = yes
464.h264ref:
   -xCORE-AVX2(pass 2) -prof-gen(pass 1) -ipo(pass 2)
   -O3(pass 2) -no-prec-div(pass 2) -prof-use(pass 2)
   -unroll2 -ansi-alias

C++ benchmarks:
471.omnetpp:
   -xCORE-AVX2(pass 2) -prof-gen(pass 1) -ipo(pass 2)
   -O3(pass 2) -no-prec-div(pass 2) -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

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-ic14.0-official-linux64.20140128.html
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Settings-V1.2-RD650-revA.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2006/flags/Intel-ic14.0-official-linux64.20140128.xml
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Settings-V1.2-RD650-revA.xml

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