## Lenovo Group Limited

**Lenovo ThinkServer RD650**  
(2.30 GHz, Intel Xeon E5-2697 v4)

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

### Test date: Feb-2017  
**Hardware Availability:** Mar-2016  
**Software Availability:** Sep-2016

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>SPECfp2006</th>
<th>SPECfp_base2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.bwaves</td>
<td>46.8</td>
<td>67.9</td>
</tr>
<tr>
<td>416.gamess</td>
<td>42.3</td>
<td></td>
</tr>
<tr>
<td>433.milc</td>
<td>205</td>
<td></td>
</tr>
<tr>
<td>434.zeusmp</td>
<td>48.2</td>
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<tr>
<td>435.gromacs</td>
<td>392</td>
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<tr>
<td>436.cactusADM</td>
<td>1110</td>
<td></td>
</tr>
<tr>
<td>437.leslie3d</td>
<td>32.5</td>
<td></td>
</tr>
<tr>
<td>444.namd</td>
<td>31.7</td>
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<tr>
<td>447.dealII</td>
<td>63.9</td>
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<tr>
<td>450.soplex</td>
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<td>453.povray</td>
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<td>454.calculix</td>
<td>62.3</td>
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<td>459.GemsFDFTD</td>
<td>59.0</td>
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<td>465.tonto</td>
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<td>470.lbm</td>
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<tr>
<td>481.wrf</td>
<td>123</td>
<td></td>
</tr>
<tr>
<td>482.sphinx3</td>
<td>71.7</td>
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</tbody>
</table>

---

### Hardware

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Name:</td>
<td>Intel Xeon E5-2697 v4</td>
</tr>
<tr>
<td>CPU Characteristics:</td>
<td>Intel Turbo Boost Technology up to 3.60 GHz</td>
</tr>
<tr>
<td>CPU MHz:</td>
<td>2300</td>
</tr>
<tr>
<td>FPU:</td>
<td>Integrated</td>
</tr>
<tr>
<td>CPU(s) enabled:</td>
<td>36 cores, 2 chips, 18 cores/chip</td>
</tr>
<tr>
<td>CPU(s) orderable:</td>
<td>1.2 chips</td>
</tr>
<tr>
<td>Primary Cache:</td>
<td>32 KB I + 32 KB D on chip per core</td>
</tr>
<tr>
<td>Secondary Cache:</td>
<td>256 KB I+D on chip per core</td>
</tr>
</tbody>
</table>

---

### Software

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
</table>
| Operating System: | SUSE Linux Enterprise Server 12 SP1 (x86_64)  
Kernel 3.12.49-11-default |
| Compiler: | C/C++: Version 17.0.0.098 of Intel C/C++ Compiler for Linux;  
Fortran: Version 17.0.0.098 of Intel Fortran Compiler for Linux |
| Auto Parallel: | Yes |
| File System: | xfs |
| System State: | Run level 3 (multi-user) |
Lenovo Group Limited  
Lenovo ThinkServer RD650  
(2.30 GHz, Intel Xeon E5-2697 v4)

**SPECfp2006 =** 127  
**SPECfp_base2006 =** 121

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

<table>
<thead>
<tr>
<th>L3 Cache:</th>
<th>45 MB I+D on chip per chip</th>
<th>Base Pointers:</th>
<th>64-bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Cache:</td>
<td>None</td>
<td>Peak Pointers:</td>
<td>32/64-bit</td>
</tr>
<tr>
<td>Memory:</td>
<td>256 GB (16 x 16 GB 2Rx4 PC4-2400T-R)</td>
<td>Other Software:</td>
<td>None</td>
</tr>
<tr>
<td>Disk Subsystem:</td>
<td>1 x 800 GB SATA SSD</td>
<td>Hardware Availability:</td>
<td>Mar-2016</td>
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<tr>
<td>Other Hardware:</td>
<td>None</td>
<td>Test date:</td>
<td>Feb-2017</td>
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</table>

**Results Table**

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
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<tr>
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<td>653</td>
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<td>416.gamess</td>
<td>463</td>
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<td>42.5</td>
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<td>392</td>
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<td>391</td>
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<td>444.namd</td>
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<td>447.dealII</td>
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<tr>
<td>482.sphinx3</td>
<td>271</td>
<td>71.8</td>
<td>272</td>
<td>71.7</td>
<td>272</td>
<td>71.6</td>
</tr>
</tbody>
</table>

**Operating System Notes**

Stack size set to unlimited using "ulimit -s unlimited"  
Transparent Huge Pages disabled with:  
```bash  
echo never > /sys/kernel/mm/transparent_hugepage/enabled  
```

**Platform Notes**

BIOS Configuration:  
Hyper_Threading set to Disabled  
Cluster On Die set to Disabled  
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

Continued on next page
Lenovo Group Limited

Lenovo ThinkServer RD650
(2.30 GHz, Intel Xeon E5-2697 v4)

| SPECfp2006 =  | 127 |
| SPECfp_base2006 =  | 121 |

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

| Test date: | Feb-2017 |
| Hardware Availability: | Mar-2016 |
| Software Availability: | Sep-2016 |

Platform Notes (Continued)

CPU Performance and Energy Bias set to Disabled
Thermal Profile set to High Fan Speed
Memory Power Savings set to Disabled
Sysinfo program /home/cpu2006-1.2-ic16.0/config/sysinfo.rev6993
Revision 6993 of 2015-11-06 (b5e8d4b4eb51ed28d7f98696cebe290c1)
running on RD650-MLK Tue Feb 21 23:31:30 2017

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 E5-2697 v4 @ 2.30GHz
- 2 "physical id"s (chips)
- 36 "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: 18
  - siblings: 18
  - physical 0: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
  - physical 1: cores 0 1 2 3 4 8 9 10 11 16 17 18 19 20 24 25 26 27
- cache size: 46080 KB

From /proc/meminfo
- MemTotal: 264555276 kB
- HugePages_Total: 0
- Hugepagesize: 2048 kB

From /etc/*release* /etc/*version*
- SuSE-release:
  - SUSE Linux Enterprise Server 12 (x86_64)
  - VERSION = 12
  - PATCHLEVEL = 1
  - # 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-SP1" |
| VERSION_ID="12.1" |
| PRETTY_NAME="SUSE Linux Enterprise Server 12 SP1" |
| ID="sles" |
| ANSI_COLOR="0;32" |
| CPE_NAME="cpe:/o:suse:sles:12:sp1" |

uname -a:
  (8d714a0) x86_64 x86_64 x86_64 GNU/Linux

run-level 3 Feb 21 23:29

Continued on next page
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Platform Notes (Continued)

SPEC is set to: /home/cpu2006-1.2-ic16.0
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 691G 176G 516G 26% /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 PB1TS362 03/24/2016
Memory:
16x Hynix Semiconductor HMA42GR7AFR4N-UH 16 GB 2 rank 2400 MHz
8x NO DIMM NO DIMM

(End of data from sysinfo program)

General Notes

Environment variables set by runspec before the start of the run:
KMP_AFFINITY = "granularity=fine,compact"
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/sh10.2"
OMP_NUM_THREADS = "36"

Binaries compiled on a system with 1x Intel Core i7-4790 CPU + 32GB RAM memory using Redhat Enterprise Linux 7.2

Base Compiler Invocation

C benchmarks:
  icc -m64

C++ benchmarks:
  icpc -m64

Fortran benchmarks:
  ifort -m64

Benchmarks using both Fortran and C:
  icc -m64 ifort -m64

Base Portability Flags

410.bwaves: -DSPEC_CPU_LP64
416.gamess: -DSPEC_CPU_LP64
433.milc: -DSPEC_CPU_LP64

Continued on next page
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Base Portability Flags (Continued)

434.zeusmp: -DSPEC_CPU_LP64
435.gromacs: -DSPEC_CPU_LP64 -nofor_main
436.cactusADM: -DSPEC_CPU_LP64 -nofor_main
437.leslie3d: -DSPEC_CPU_LP64
444.namd: -DSPEC_CPU_LP64
447.dealII: -DSPEC_CPU_LP64
450.soplex: -DSPEC_CPU_LP64
453.povray: -DSPEC_CPU_LP64
454.calculix: -DSPEC_CPU_LP64 -nofor_main
459.GemsFDTD: -DSPEC_CPU_LP64
465.tonto: -DSPEC_CPU_LP64
481.wrf: -DSPEC_CPU_LP64 -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX
482.sphinx3: -DSPEC_CPU_LP64

Base Optimization Flags

C benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -qopt-prefetch

C++ benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -qopt-prefetch

Fortran benchmarks:
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -qopt-prefetch

 Benchmarks using both Fortran and C:
-xCORE-AVX2 -ipo -O3 -no-prec-div -parallel -qopt-prefetch

Peak Compiler Invocation

C benchmarks:
icc -m64

C++ benchmarks:
icpc -m64

Fortran benchmarks:
ifort -m64

Benchmarks using both Fortran and C:
icc -m64 ifort -m64
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Peak Portability Flags

Same as Base Portability Flags

Peak Optimization Flags

C benchmarks:

433.milc: basepeak = yes
470.lbm: basepeak = yes
482.sphinx3: basepeak = yes

C++ benchmarks:

444.namd: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2(pass 2)
-par-num-threads=1(pass 1) -ipo(pass 2) -O3(pass 2)
-no-prec-div(pass 2) -fno-alias -auto-ilp32

447.dealII: basepeak = yes
450.soplex: basepeak = yes
453.povray: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2(pass 2)
-par-num-threads=1(pass 1) -ipo(pass 2) -O3(pass 2)
-no-prec-div(pass 2) -unroll4 -ansi-alias

Fortran benchmarks:

410.bwaves: basepeak = yes
416.gamess: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2(pass 2)
-par-num-threads=1(pass 1) -ipo(pass 2) -O3(pass 2)
-no-prec-div(pass 2) -unroll2 -inline-level=0 -scalar-rep-

434.zeusmp: basepeak = yes
437.leslie3d: basepeak = yes

459.GemsFDTD: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2(pass 2)
-par-num-threads=1(pass 1) -ipo(pass 2) -O3(pass 2)
-no-prec-div(pass 2) -unroll2 -inline-level=0 -qopt-prefetch -parallel

465.tonto: -prof-gen(pass 1) -prof-use(pass 2) -xCORE-AVX2(pass 2)
-par-num-threads=1(pass 1) -ipo(pass 2) -O3(pass 2)
-no-prec-div(pass 2) -inline-calloc -qopt-malloc-options=3
-auto -unroll4

Continued on next page
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Peak Optimization Flags (Continued)

Benchmarks using both Fortran and C:

435.gromacs: basepeak = yes
436.cactusADM: basepeak = yes
454.calculix: -xCORE-AVX2 -ipo -O3 -no-prec-div -auto-ilp32
481.wrf: basepeak = yes

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2006/flags/Intel-ic17.0-official-linux64.html
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Settings-V1.2-BDW-revE.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2006/flags/Intel-ic17.0-official-linux64.xml
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Settings-V1.2-BDW-revE.xml

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For other inquiries, please contact webmaster@spec.org.

Tested with SPEC CPU2006 v1.2.