### Lenovo Group Limited

**Lenovo ThinkServer RD450**  
(2.20 GHz, Intel Xeon E5-2650 v4)

<table>
<thead>
<tr>
<th>SPECint_rate2006</th>
<th>1040</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPECint_rate_base2006</td>
<td>990</td>
</tr>
</tbody>
</table>

**CPU2006 license:** 9017  
**Test date:** May-2016  
**Test sponsor:** Lenovo Group Limited  
**Hardware Availability:** Mar-2016  
**Tested by:** Lenovo Group Limited  
**Software Availability:** Dec-2015

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Name:</td>
<td>Intel Xeon E5-2650 v4</td>
</tr>
<tr>
<td>CPU Characteristics:</td>
<td>Intel Turbo Boost Technology up to 2.90 GHz</td>
</tr>
<tr>
<td>CPU MHz:</td>
<td>2200</td>
</tr>
<tr>
<td>FPU:</td>
<td>Integrated</td>
</tr>
<tr>
<td>CPU(s) enabled:</td>
<td>24 cores, 2 chips, 12 cores/chip, 2 threads/core</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>
<tr>
<td>L3 Cache:</td>
<td>30 MB I+D on chip per chip</td>
</tr>
<tr>
<td>Other Cache:</td>
<td>None</td>
</tr>
<tr>
<td>Memory:</td>
<td>256 GB (16 x 16 GB 2Rx4 PC4-2400T-R)</td>
</tr>
<tr>
<td>Disk Subsystem:</td>
<td>1 x 800 GB SATA SSD</td>
</tr>
<tr>
<td>Other Hardware:</td>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Software</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating System:</td>
<td>SUSE Linux Enterprise Server 12 SP1 (x86_64) Kernel 3.12.49-11-default</td>
</tr>
<tr>
<td>Compiler:</td>
<td>C/C++: Version 16.0.0.101 of Intel C++ Studio XE for Linux</td>
</tr>
<tr>
<td>Auto Parallel:</td>
<td>No</td>
</tr>
<tr>
<td>File System:</td>
<td>xfs</td>
</tr>
<tr>
<td>System State:</td>
<td>Run level 3 (multi-user)</td>
</tr>
<tr>
<td>Base Pointers:</td>
<td>32-bit</td>
</tr>
<tr>
<td>Peak Pointers:</td>
<td>32/64-bit</td>
</tr>
<tr>
<td>Other Software:</td>
<td>Microquill SmartHeap V10.2</td>
</tr>
</tbody>
</table>
## Lenovo Group Limited

**Lenovo ThinkServer RD450**

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

<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>
<th>Seconds</th>
<th>Ratio</th>
<th>Seconds</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>400.perlbench</td>
<td>48</td>
<td>663</td>
<td>707</td>
<td>661</td>
<td>709</td>
<td>660</td>
<td>710</td>
<td>661</td>
<td>709</td>
<td>661</td>
<td>709</td>
</tr>
<tr>
<td>401.bzip2</td>
<td>48</td>
<td>986</td>
<td>470</td>
<td>984</td>
<td>471</td>
<td>983</td>
<td>471</td>
<td>984</td>
<td>471</td>
<td>983</td>
<td>471</td>
</tr>
<tr>
<td>403.gcc</td>
<td>48</td>
<td>518</td>
<td>745</td>
<td>519</td>
<td>744</td>
<td>521</td>
<td>742</td>
<td>518</td>
<td>745</td>
<td>517</td>
<td>747</td>
</tr>
<tr>
<td>429.mcf</td>
<td>48</td>
<td>326</td>
<td>1340</td>
<td>327</td>
<td>1340</td>
<td>327</td>
<td>1340</td>
<td>326</td>
<td>1340</td>
<td>327</td>
<td>1340</td>
</tr>
<tr>
<td>445.gobmk</td>
<td>48</td>
<td>785</td>
<td>642</td>
<td>785</td>
<td>642</td>
<td>784</td>
<td>642</td>
<td>785</td>
<td>642</td>
<td>784</td>
<td>642</td>
</tr>
<tr>
<td>456.hmmer</td>
<td>48</td>
<td>310</td>
<td>1440</td>
<td>310</td>
<td>1440</td>
<td>311</td>
<td>1440</td>
<td>310</td>
<td>1440</td>
<td>311</td>
<td>1440</td>
</tr>
<tr>
<td>458.sjeng</td>
<td>48</td>
<td>874</td>
<td>665</td>
<td>873</td>
<td>665</td>
<td>874</td>
<td>665</td>
<td>874</td>
<td>665</td>
<td>874</td>
<td>665</td>
</tr>
<tr>
<td>462.libquantum</td>
<td>48</td>
<td>101</td>
<td>9850</td>
<td>101</td>
<td>9850</td>
<td>101</td>
<td>9850</td>
<td>101</td>
<td>9850</td>
<td>101</td>
<td>9850</td>
</tr>
<tr>
<td>464.h264ref</td>
<td>48</td>
<td>885</td>
<td>1200</td>
<td>884</td>
<td>1200</td>
<td>884</td>
<td>1200</td>
<td>884</td>
<td>1200</td>
<td>884</td>
<td>1200</td>
</tr>
<tr>
<td>471.omnetpp</td>
<td>48</td>
<td>570</td>
<td>526</td>
<td>571</td>
<td>525</td>
<td>569</td>
<td>527</td>
<td>570</td>
<td>526</td>
<td>569</td>
<td>527</td>
</tr>
<tr>
<td>473.astar</td>
<td>48</td>
<td>583</td>
<td>578</td>
<td>583</td>
<td>578</td>
<td>583</td>
<td>578</td>
<td>583</td>
<td>578</td>
<td>583</td>
<td>578</td>
</tr>
<tr>
<td>483.xalancbmk</td>
<td>48</td>
<td>277</td>
<td>1190</td>
<td>277</td>
<td>1200</td>
<td>277</td>
<td>1200</td>
<td>277</td>
<td>1200</td>
<td>277</td>
<td>1200</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:  
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 `/home/cpu2006-1.2-ic16.0/config/sysinfo.rev6914`  
$Rev: 6914 $ $Date:: 2014-06-25 ## $e3fbb8667b5a285932ceab81e28219e1` running on RD450-MLK Mon May 23 01:08:07 2016
Lenovo Group Limited

Lenovo ThinkServer RD450
(2.20 GHz, Intel Xeon E5-2650 v4)

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

Specint_rate2006 = 1040
Specint_rate_base2006 = 990

Test date: May-2016
Hardware Availability: Mar-2016
Software Availability: Dec-2015

Platform Notes (Continued)

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 E5-2650 v4@ 2.20GHz
2 "physical id"s (chips)
48 "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 : 24
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
cache size : 15360 KB

From /proc/meminfo
MemTotal: 264554040 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 May 23 01:04

SPEC is set to: /home/cpu2006-1.2-ic16.0
Filesystem Type Size Used Avail Use% Mounted on
/dev/sda3 xfs 693G 4.0G 689G 1% /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
Continued on next page
Lenovo Group Limited
Lenovo ThinkServer RD450
(2.20 GHz, Intel Xeon E5-2650 v4)

SPECint_rate2006 = 1040
SPECint_rate_base2006 = 990

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

Platform Notes (Continued)

determined", but the intent may not be met, as there are frequent changes to
hardware, firmware, and the "DMTF SMBIOS" standard.

BIOS LENOVO VB3TS332 12/28/2015
Memory: 16x Hynix Semiconductor HMA42GR7AFR4N-UH 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:
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
SPEC CINT2006 Result

Lenovo Group Limited
Lenovo ThinkServer RD450
(2.20 GHz, Intel Xeon E5-2650 v4)

SPECint_rate2006 = 1040
SPECint_rate_base2006 = 990

CPU2006 license: 9017
Test sponsor: Lenovo Group Limited
Test date: May-2016
Tested by: Lenovo Group Limited
Hardware Availability: Mar-2016
Software Availability: Dec-2015

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

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

Continued on next page

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

Lenovo ThinkServer RD450
(2.20 GHz, Intel Xeon E5-2650 v4)

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

Test date: May-2016
Hardware Availability: Mar-2016
Software Availability: Dec-2015

Peak Portability Flags (Continued)

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)
-prof-use(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

Continued on next page
Lenovo Group Limited
Lenovo ThinkServer RD450
(2.20 GHz, Intel Xeon E5-2650 v4)

SPECint_rate2006 = 1040
SPECint_rate_base2006 = 990

CPU2006 license: 9017
Test date: May-2016
Test sponsor: Lenovo Group Limited
Hardware Availability: Mar-2016
Tested by: Lenovo Group Limited
Software Availability: Dec-2015

Peak Optimization Flags (Continued)

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-ic16.0-official-linux64.html
http://www.spec.org/cpu2006/flags/Lenovo-Platform-Settings-V1.2-BDW-revC.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-Settings-V1.2-BDW-revC.xml

SPEC and SPECint are registered trademarks of the Standard Performance Evaluation Corporation. All other brand and product names appearing in this result are trademarks or registered trademarks of their respective holders.

For questions about this result, please contact the tester.
For other inquiries, please contact webmaster@spec.org.

Tested with SPEC CPU2006 v1.2.
Originally published on 28 June 2016.