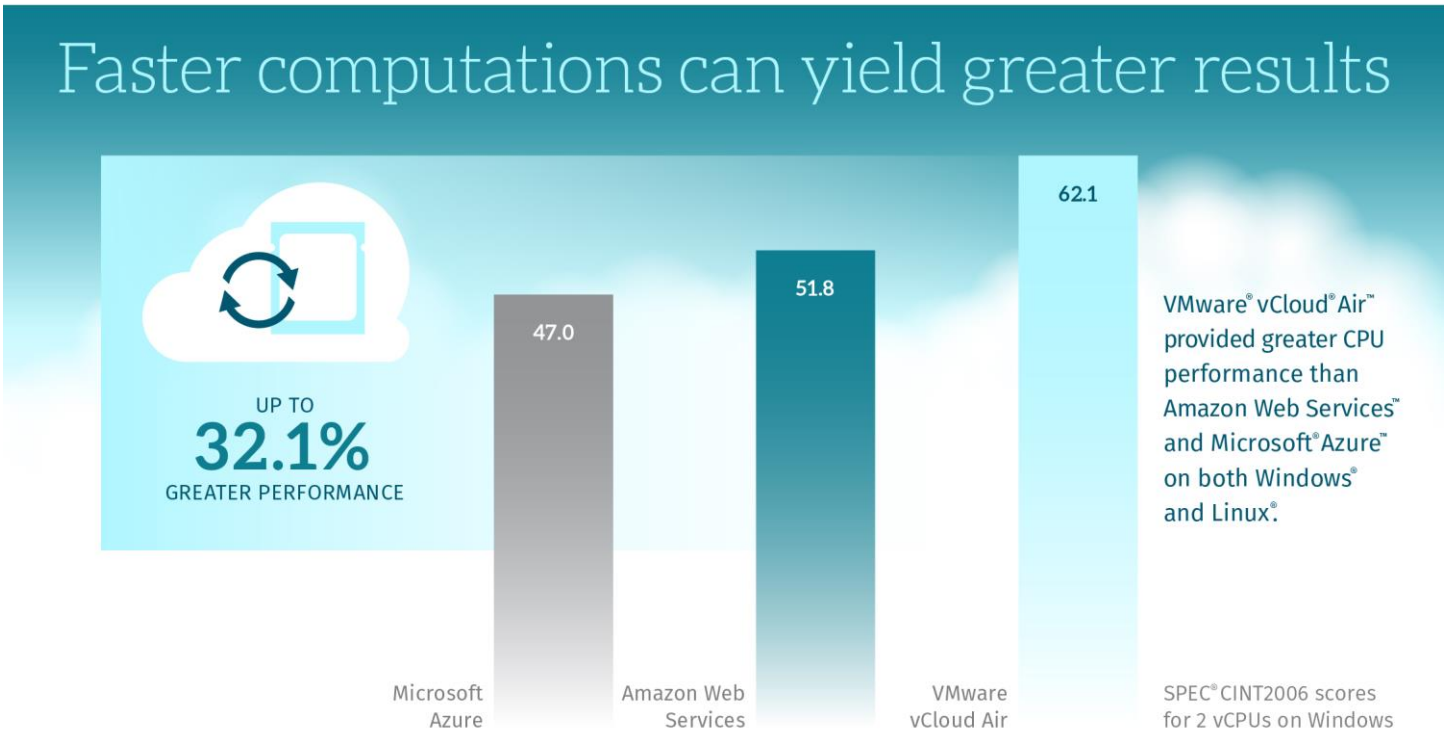
CPU PERFORMANCE COMPARISON: VMWARE VCLOUD AIR, AMAZON WEB SERVICES, AND MICROSOFT AZURE



Many businesses are adopting public cloud solutions to gain flexibility and save money. In the traditional datacenter model, a business must invest in and maintain server hardware on site. By running applications in virtual machines in the cloud instead, businesses can use only the resources they need when they need them.

Public cloud services are proliferating, and they do not all offer the same performance. From the Principled Technologies labs, we tested the compute performance of three public cloud solutions: VMware vCloud Air, Amazon Web Services (AWS), and Microsoft Azure.

When we tested the same Linux CentOS version on all platforms, we found that the SPEC CINT2006 vCPU performance of our vCloud Air instances exceeded that of our AWS and Azure instances by up to 31.1 percent. On Windows Server®, the SPEC CINT2006 vCPU performance of our vCloud Air instances exceeded that of our AWS and Azure instances by up to 32.1 percent. This differential can translate to your needing fewer vCPUs to do a given amount of work if you select VMware vCloud Air, and fewer vCPUs means savings.

AUGUST 2015
A PRINCIPLED TECHNOLOGIES REPORT
Commissioned by VMware, Inc.

THE ADVANTAGES OF CLOUD-BASED COMPUTING

When businesses move their computing to the cloud, they typically gain efficiency and reduce up-front expenses. They also gain enormous flexibility, letting them ramp up resources in response to increased demand—whether planned or unexpected—and reduce resources when demand allows. Being able to fund only the level of compute resources needed at any given time reduces waste and delivers a higher level of service to those who rely on the those resources.

Changing from a datacenter model to infrastructure as a service (IaaS) shifts computing from a capital expenditure to an operating expense and allows companies to devote their internal IT resources to less-routine, more valuable efforts than maintaining and updating servers.

BETTER CPU PERFORMANCE ON BOTH WINDOWS AND LINUX

CPU performance is the amount of useful work a computer system accomplishes in terms of the time and resources used. With IaaS cloud services, we can measure the performance of virtual CPUs (vCPUs). vCPU performance is largely determined by the physical characteristics of the CPU, such as the number of cores and hyperthreading support.

We used the SPEC CPU2006 benchmark tool to measure the performance of vCPUs in the three cloud infrastructure solutions we tested—VMware vCloud Air, AWS, and Microsoft Azure. We began by subscribing to the three services and then setting up comparable Linux CentOS-based and Microsoft Server 2012 R2 virtual machines. We performed all of tests twice, once using Windows VMs and once using Linux VMs. To make sure we were comparing apples to apples, we selected two preset configurations in the Azure and AWS solutions and then used the VMware solution to create customized instances with the same vCPU counts and similar memory.

As we discuss in detail below, the vCloud Air instances scored up to 44.3 percent higher than the AWS instances and up to 27.5 percent higher than the Azure instances on the SPEC CPU2006 benchmark. As an example of the saving this can bring, if a vCPU instance from one provider delivered 33.3 percent greater performance than another delivered, you could achieve the same amount of work using three better-performing instances as you would using four poorer-performing instances. Assuming both cost the same, that means you could cut your spending by one-fourth.

We ran each test three times and report the results from the median run. For detailed system configuration information and test methodology, see Appendix A.

Testing the CPU with SPEC CPU2006

The SPEC CPU2006 benchmark consists of two benchmark suites, each of which focuses on a different aspect of compute-intensive performance. SPEC CINT2006 measures and compares compute-intensive integer performance, while SPEC CFP2006 measures and compares compute-intensive floating-point performance. Below, we present the SPEC CPU2006 results for both of the platforms we tested on the three cloud providers. For detailed test results, see Appendix C.

With Windows instances

For Windows testing, we used Windows Server 2012 R2 templates on each of the three vendors. Other than applying all Windows updates, we made no changes to the default template.

As Figure 1 shows, on the SPEC CINT2006 benchmark, the performance of the Windows vCPUs on the vCloud Air solution exceeded that of the other two solutions at both vCPU counts, with wins of up to 32.1 percent. This means that if you were to use the vCloud Air infrastructure to host your virtual CPUs, you would need fewer vCPUs to perform the same amount of work than you would with either AWS or Azure.

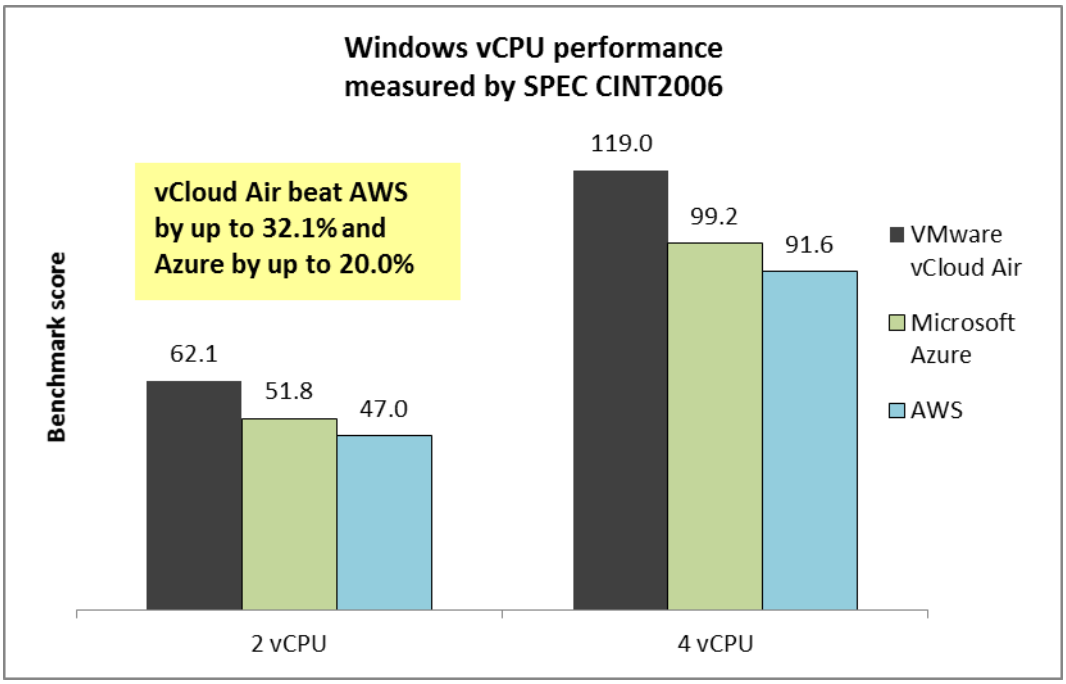


Figure 1: At both vCPU counts we tested, the vCloud Air solution delivered superior SPEC CINT2006 performance to that of the other two solutions.

Our findings with the SPEC CFP2006 benchmark were similar to those with SPEC CINT2006, with the advantage of the VMware solution even more pronounced. As Figure 2 shows, on the SPEC CFP2006 benchmark, the performance of the Windows vCPUs on the vCloud Air solution again exceeded that of the AWS and Azure solutions at both vCPU counts, with wins of up to 44.3 percent.

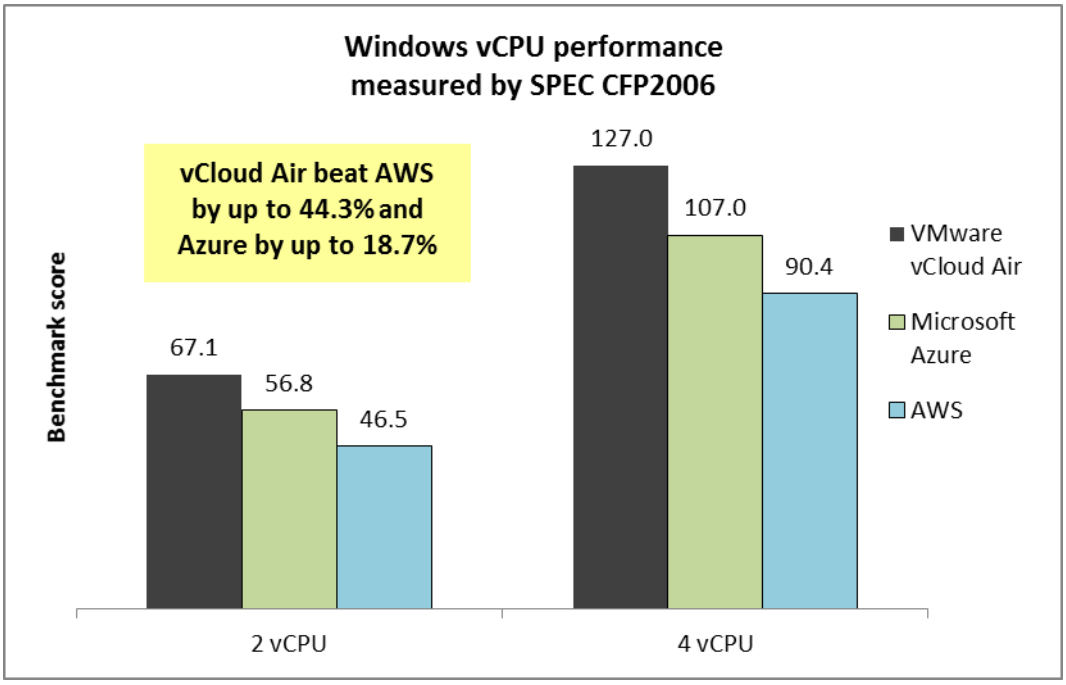


Figure 2: At both vCPU counts we tested, the vCloud Air solution delivered superior SPEC CFP2006 performance to that of the other two solutions.

With Linux instances

For Linux testing, we used the CentOS 6.4 default templates and then updated them to the latest kernel. We added a few programs in order to run SPEC CPU2006, which we outline in Appendix A.

As Figure 3 shows, on the SPEC CINT2006 benchmark, the performance of the Linux vCPUs on the vCloud Air solution exceeded that of the Azure solution at both vCPU counts, with wins of up to 31.1 percent.

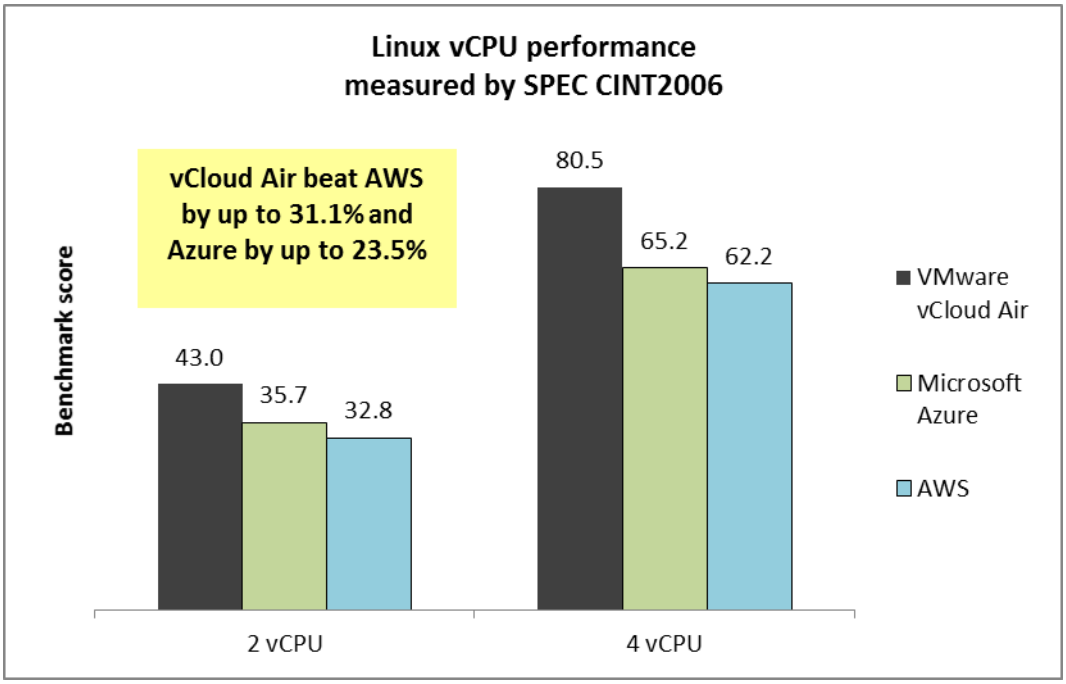


Figure 3: At both vCPU counts we tested, the vCloud Air solution delivered superior SPEC CINT2006 performance to that of the other two solutions.

As with the Windows vCPUs, our findings with the SPEC CFP2006 benchmark were similar to those with SPEC CINT2006, with the advantage of the VMware solution on the Linux vCPUs over the other two solutions even more dramatic. As Figure 4 shows, on the SPEC CFP2006 benchmark, the performance of the vCloud Air solution again exceeded that of the AWS and Azure solutions at both vCPU counts, with wins of up to 39.1 percent.

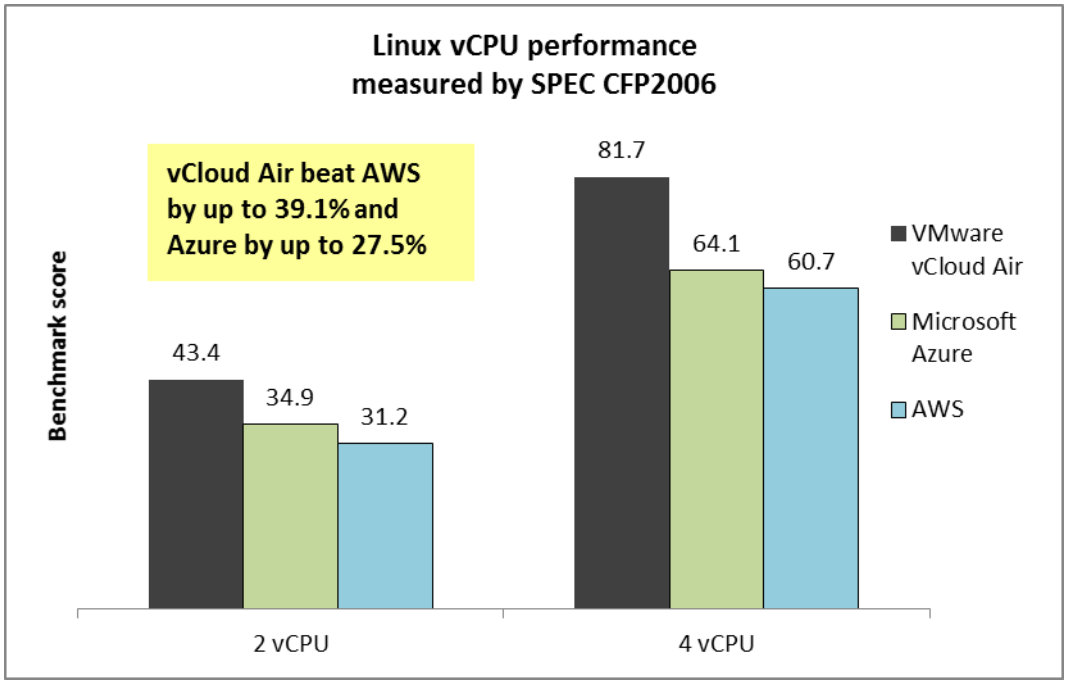


Figure 4: At both vCPU counts we tested, the vCloud Air solution delivered superior SPEC CFP2006 performance to that of the other two solutions.

WHAT WE TESTED

About vCloud Air

According to VMware, vCloud Air, which is built on VMware vSphere®, "quickly and seamlessly extends your data center into the cloud using the tools and processes you already have." It is available in three service offerings: OnDemand, Dedicated Cloud, and the Virtual Private Cloud. (We tested the Dedicated Cloud offering with resource reservations found in the Virtual Private Cloud offering.)

For more information about VMware vCloud Air, see www.vmware.com/products/vcloud-hybrid-service/.

About Microsoft Azure

According to Microsoft, "Azure is an open and flexible cloud platform that enables you to quickly build, deploy and manage applications across a global network of Microsoft-managed datacenters. You can build applications using any language, tool or framework. And you can integrate your public cloud applications with your existing IT environment."

For more information about Microsoft Azure, see azure.microsoft.com.

About Amazon Web Services

According to Amazon, "Amazon Web Services provides a variety of cloud-based computing services including a wide selection of compute instances which can scale up and down automatically to meet the needs of your application, a managed load balancing service as well as fully managed desktops in the cloud."

AWS offers persistent block-level storage through EBS. There are actually three different configurations for EBS: EBS General Purpose (SSD) volumes, EBS Provisioned IOPS (SSD) volumes, and EBS magnetic volumes. We conducted testing against the EBS General Purpose (SSD) volumes across two virtual machine sizes and used "EBS-Optimized" instances on the ones that supported it.

For more information about Amazon Web Services, see aws.amazon.com.

About SPEC CPU2006

SPEC CPU2006 is an industry-standard benchmark that uses a CPU-intensive workload to stress a system's processor(s), memory subsystem, and compiler. SPEC CPU2006 encompasses two types of tests: SPEC CINT2006 and SPEC CFP2006. SPEC CINT2006 reports results in both SPECint_rate2006 and SPECint_rate_base2006 scores; the difference is that SPECint_rate2006 allows for more optimization than SPECint_rate_base2006. Like SPEC CINT2006, SPEC CFP2006 reports results in both SPECfp_rate2006 and SPECfp_rate_base2006 scores. (We report SPECint_rate2006 and SPECfp_rate2006 scores in this report.) These scores help compare a wide range of hardware. For more information about the SPEC CPU2006 benchmark, visit www.spec.org/cpu2006/.

IN CONCLUSION

When the time is right for your business to move some of your computing to the cloud, it is essential that you select the server provider that can bring you the greatest benefits.

Throughout our CPU tests with both Linux and Windows instances, we found that VMware vCloud Hybrid Service™ instances performed dramatically better than Amazon Web Services and Microsoft Azure instances, earning consistently higher SPEC CPU2006 scores.

A cloud service that delivers stronger processing performance will give your applications the necessary vCPU resources to perform well and allow you to make the most of your investment in the cloud platform.

APPENDIX A – DETAILED TEST METHODOLOGY

For Windows testing, we selected two of the default Microsoft Server 2012 R2 instances from AWS and then configured similar instances with the same virtual processors and memory from VMware vCloud Air and Microsoft Azure. Figure 5 shows the configurations we used. Note that Azure did not offer instances with 8 GB or 16 GB of memory, so we used the closest available configurations: 7 GB and 14 GB. For each instance, we looked at the /processor/cpuinfo file to see the processor configuration.

Compute instance	Virtual CPU	Memory (GB)	Storage (GB)	Processor
vCloud Air				
Medium	2	8	30	Intel Xeon processor E5-2650 v2
Large	4	16	30	Intel Xeon processor E5-2650 v2
AWS				
AWS m4.large	2	8	30	Intel Xeon processor E5-2676 v3
AWS m4.xlarge	4	16	30	Intel Xeon processor E5-2676 v3
Azure				
Azure D2	2	7	30	Intel Xeon processor E5-2660
Azure D3	4	14	30	Intel Xeon processor E5-2660

Figure 5: The instance configurations we tested.

For Linux testing, we used the same instance types we show in Figure 5. We configured the instances using the default templates of CentOS 6.4 and then ran yum update and installed all updates. For testing, we used kernel version 2.6.32-431.11.2.el6.x86_64. In addition to the updates, we installed the following packages: glibc.i686 libgcc.i686, libstdc++.i686, libgfortran.x86_64, numactl, sysstat, and screen.

We compiled SPEC CPU2006 using the configuration files in Appendix B. For each instance, we ran SPECint_rate2006 and SPECfp_rate2006. We performed three complete runs of SPEC CPU2006. Between runs, we powered off the instances and then powered them back on. We did this to simulate behavior across different host inside the cloud. We used the median of the three runs for the comparison.

APPENDIX B – SPEC CPU2006 CONFIGURATION FILES

Linux configuration file

```
####################################################################
# Linux Cloud gcc 4.4 config file
# Config file for CPU2006
####################################################################
tune          = all
basepeak      = yes
size          = test,train,ref
output_format = asc,cfgfile,csv,html
flagsurl0     = GCC-4.4.7.xml
reportable    = yes
hw_avail      = Dec-9999
verbose       = 6
makeflags     = -j16
license_num   = 3184
#test_sponsor  = Test Sponsor (Optional, defaults to hw_vendor)
tester        = Principled Technologies, Inc.
submit = numactl --localalloc --physcpubind=$SPECCOPYNUM $command
default:
####################################################################
#
# Compiler selection
#
####################################################################
# NOTE: The path may be different if you use the compiler from
#       the gnu site.
CC                 = gcc
CXX                = g++
FC                 = gfortran
## HW config
# default sysinfo is expected to write hw_cpu_name, hw_memory, hw_nchips,
# hw_disk
hw_model           =
hw_cpu_char        =
hw_cpu_mhz         =
hw_fpu             =
hw_ncores          =
hw_ncoresperchip   =
hw_nthreadspercore =
hw_ncpuorder       =
hw_pcache          =
hw_scache          =
hw_tcache          =
hw_ocache          =
hw_vendor          =
hw_other           =
## SW config
# default sysinfo is expected to write prepared_by, sw_os, sw_file, sw_state
# Descriptions of the different compilers tested
sw_compiler        = gcc version 4.4.7 20120313 (Red Hat 4.4.7-4) (GCC)
sw_avail           = Nov-2013
sw_other           = None
default=default=cloud.i686:
sw_base_ptrsize    = 32-bit
sw_peak_ptrsize    = 32-bit

default=default=cloud.x86_64:
sw_base_ptrsize    = 64-bit
sw_peak_ptrsize    = 64-bit
####################################################################
# Notes
####################################################################
default:
notes_submit_000 ='numactl' was used to bind copies to the cores.
notes_submit_005 =See the configuration file for details.
notes_os_000 ='ulimit -s unlimited' was used to set environment stack size
```

```
######################################################################
# Optimization
######################################################################
default=base:
OPTIMIZE      = -O3 -ffast-math -mmmx -msse -msse2 -msse3 -mfpmath=sse
default=base=cloud.i686:
OPTIMIZE     += -m32
default=base=cloud.x86_64:
OPTIMIZE     += -m64
######################################################################
# 32 bit Portability Flags
######################################################################
400.perlbench=default=cloud.i686:
CPORTABILITY   = -DSPEC_CPU_LINUX
######################################################################
# 64 bit Portability Flags
######################################################################
default=default=cloud.x86_64:
PORTABILITY    = -DSPEC_CPU_LP64
400.perlbench=default=cloud.x86_64:
CPORTABILITY   = -DSPEC_CPU_LINUX_X64
######################################################################
# Portability Flags
######################################################################

462.libquantum=default=default:
CPORTABILITY   =  -DSPEC_CPU_LINUX
483.xalancbmk=default=default:
CXXPORTABILITY = -DSPEC_CPU_LINUX
481.wrf=default=default:
CPORTABILITY   = -DSPEC_CPU_CASE_FLAG -DSPEC_CPU_LINUX
__MD5__

400.perlbench=base=cloud.i686=default:
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exemd5=5a1a16355c7247d6fdcc11580c788063

482.sphinx3=base=cloud.x86_64=default:
# Last updated Wed May  7 14:10:18 2014
optmd5=4199ab0aa1e0879ea73c2b194fc58d80
baggage=
compile_options=\
@eNq9UVlLwzAUfe+vuOQ9Az/woayDNuvWaNcU1wr6ErbaarRZRpOJ/nvTdp+IDyoYwk249yT3nnMS\
tcJy8VpWoi5BrY1QK+062jSiMLzZrB5Fw9/KRlQfHjpDDmGz1IWnogBst9q9GCjA43kaEk7S3F6T\
cRjkU8B0cJqP/LuQE5ZM6JRHfZnWYrkxogYAzC4AV9VCGzuSeQYspXy3Ueuyj+f9YVGyWrcQry9d\
XcJ2HbrxOD2kYajVpinKkUNcIMRDlgHq7iy4ZmnmoRM6yLEk7R+T2J/Obe0rtQ4RhAmJ+A70E67I\
YS7YvnRGH0L79vfEu0FSdpv5AY1pdn88bScBcmKa3PSe/VHhb8QdquVLWRg9aiG13Fuxl7MVOh5v\
Rf9H4rbtzM8iHtOgNaiWqJ+E5a3hR25/ApzV35c=
exemd5=0315dae2aa4c5fd47f4a171ba3bc49bf

998.specrand=base=cloud.x86_64=default:
# Last updated Wed May  7 14:10:19 2014
optmd5=4b62c783978861f681397e52994273bc
baggage=
compile_options=\
@eNq9UU1LxDAQvedXDLlH8AMPZbuwTetS7TbBbQ96KWtMtGqbpcmK/nun7UpXxIuCIUyGzMd78ya3\
LWs2z9rULxrs1te2dQFxvquVr7pde1931avuavMe0mNKuFjJAB6UAobXflYcWWDxWia84rJEN4+T\
qFwCABOnwIzZOI8o/hFY0zRvaJ3Toz0ZH8xqzLZPCcfQ+Rnsz9S4yuT0DTNnd53Sc8ID4DykSIoO\
voguhSxC+oUhJcgbe1xki+UaY9/ZUiICwMJ0ld4mmPF75gOWFNfFIkqztLg5hBtmoCRL86tRxz9K\
```

```
9IM6M3v3pJV3c5jOJEYvUxbvJfvHqQdYUfa7OVjMB+MSvEE=
exemd5=f639e705a1d96ef85782e1b8d885aefb
```

Windows configuration file

```
# Invocation command line:

# C:\cpu2006\bin\runspec --rate 4 -c cpu2006.1.2.ic15.0.winx64.dt.avx.rate.29aug2014.cfg -T all -o all --
flagsurl=Intel-ic15.0-official-windows.xml int

# output_root was not used for this run

############################################################################
# This is a sample config file. It was tested with:
#
#      Compiler name/version:       Intel Compiler 15.0,MS VS 2013
#      Operating system version:    Windows Vista/7/8 (64-bit)
#      Hardware:                    Intel processors supporting
#                                   AVX instructions
#
# If your platform uses different versions, different
# hardware or operates in a different mode (for
# example, 32- vs. 64-bit mode), there is the possibiliy
# that this configuration file may not work as-is.
#
# Note that issues with compilation should be directed
# to the compiler vendor. Information about SPEC technical
# support can be found in the techsupport document in the
# Docs directory of your benchmark installation.
#
# This config file uses the SmartHeap library and if you
# do not have a licensed copy, please remove all
# instances of shlW32M.lib from this config file.
#
# Also note that this is a sample configuration. It
# is expected to work for the environment in which
# it was tested; it is not guaranteed that this is
# the config file that will provide the best performance.
#

# Note that you might find a more recent config file for
# your platform with the posted results at
# http://www.spec.org/cpu2006

############################################################################
# SPEC CPU2006 Intel Windows Vista64/Win7-64 config file
# Aug 29 2014.
# Intel Compiler 15.0
# Visual Studio 2013
############################################################################

action      = validate
tune        = base
PATHSEP     = /
check_md5=1
reportable=1

     #
     ########################################################
     #          ATTENTION     ATTENTION     ATTENTION
     ########################################################
     #
     #     NOTE If you change fail_build then PLEASE also
     #     change the line 'define version', because
     #     SPEC review tools use 'ext' to track binaries.
     #
     ########################################################
%    define version 29aug2014

ext         = ic15.0.winx64.dt.avx.rate.%{version}
     #
```

```
     # vvvvvvvvvvvv # do not change unless you read NOTE above
       fail_build=0 # do not change unless you read NOTE above
     # ^^^^^^^^^^^^ # do not change unless you read NOTE above
     #
     ########################################################


numaCount=1
maxAffMaskNumBits=%copies%
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
maxAffMaskNumBits=%{LOG_CPU_PER_NODE}
numaCount=%{NUM_NUMA}
node= int($SPECCOPYNUM / $maxAffMaskNumBits) % $numaCount
hex=1<<($SPECCOPYNUM % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
notes_submit_100 = This submission used 64-bit perl (ActivePerl installed in c:\perl64) for the submit command
notes_submit_101 = and a modified version of specinvoke that can spawn up to 64 copies per NUMA node%else
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<$SPECCOPYNUM), q{ $command } "
%endif


#############################################################
#
# These are listed as benchmark-tuning-extension-machine
#
#############################################################
# Compiler section
#############################################################

CC  = icl -Qvc12 -Qstd=c99
CXX = icl -Qvc12
FC  = ifort
OBJ = .obj

int=default:
EXTRA_LDFLAGS     = /F512000000

fp=default:
EXTRA_LDFLAGS     = /F1000000000

#############################################################
# Portability section
#############################################################

fp=default:
PORTABILITY       = -DSPEC_CPU_P64

403.gcc=default=default=default:
CPORTABILITY      = -DSPEC_CPU_WIN32
EXTRA_CFLAGS      = -Dalloca=_alloca

436.cactusADM=default=default=default:
FPORTABILITY      = /names:lowercase /assume:underscore

444.namd=default=default=default:
CXXPORTABILITY    =  /TP

447.dealII=default:
CXXPORTABILITY = -DDEAL_II_MEMBER_VAR_SPECIALIZATION_BUG -DSPEC_CPU_BOOST_CONFIG_MSC_VER -DSPEC_NEED_ALGORITHM
srcalt=max_prototype,cxx11_make_pair

450.soplex:
srcalt = getline_test
CXXPORTABILITY = -DSPEC_GETLINE_TEST

454.calculix=default=default=default:
FPORTABILITY      = /names:lowercase
CPORTABILITY      = -DSPEC_CPU_NOZMODIFIER
```

```
464.h264ref=default=default=default:
CPORTABILITY      = -DWIN32

481.wrf=default:
CPORTABILITY      = -DSPEC_CPU_WINDOWS_ICL

483.xalancbmk=default=default=default:
CXXPORTABILITY    = -Qoption,cpp,--no_wchar_t_keyword

######################################################################
# Library Tuning Flags
######################################################################

471.omnetpp,473.astar,483.xalancbmk=default:
EXTRA_LIBS=  shlW32M.lib
LDOUT=          -Fe$@ -link /FORCE:MULTIPLE

######################################################################
# Baseline Tuning Flags
# default baseline for int and fp 2006
######################################################################

int=base=default=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qopt-prefetch
COPTIMIZE=
CXXOPTIMIZE=    -Qcxx-features

fp=base=default=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch
COPTIMIZE=      -Qauto-ilp32
CXXOPTIMIZE=    -Qcxx-features -Qauto-ilp32
EXTRA_CXXLIBS=  shlW64M.lib
LDOUT=          -Fe$@ -link /FORCE:MULTIPLE

######################################################################
# Peak Tuning Flags
# default peak for int and fp 2006
######################################################################

######################################################################
# Peak Tuning Flags int 2006 fast
######################################################################

int=peak=default=default:

OPTIMIZE=        -Qipo -O3 -Qprec-div- -Qopt-prefetch
COPTIMIZE=
CXXOPTIMIZE=
PASS1_CFLAGS=    -Qprof_gen
PASS2_CFLAGS=    -QxAVX   -Qprof_use
PASS1_CXXFLAGS=  -Qprof_gen
PASS2_CXXFLAGS=  -QxAVX   -Qprof_use
PASS1_LDFLAGS=   -Qprof_gen
PASS2_LDFLAGS=   -QxAVX   -Qprof_use

400.perlbench=peak=default:
OPTIMIZE=    -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch
EXTRA_LIBS=  shlW32M.lib
LDOUT=       -Fe$@ -link /FORCE:MULTIPLE

401.bzip2=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qopt-prefetch -Qansi-alias
429.mcf=peak=default:

basepeak=yes

445.gobmk=peak=default:
OPTIMIZE= -Qipo -O2 -Qprec-div- -Qansi-alias

456.hmmer=peak=default:
```

```
PORTABILITY       =  -DSPEC_CPU_P64

ICL64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/bin/intel64"
LIB64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/compiler/lib/intel64"
VS12PATH           =  "C:/Program Files (x86)/Microsoft Visual Studio 12.0/VC"

CC                =  $(ICL64PATH)/icl.exe -Qauto-ilp32
LDOUT             =  -Fe$@ -link -LIBPATH:$(LIB64PATH) -link -LIBPATH:$(VS12PATH)/lib/AMD64 -link -
LIBPATH:"C:\Program Files (x86)\Microsoft SDKs\Windows\v7.1A\Lib\x64"

458.sjeng=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qunroll4

PORTABILITY       =  -DSPEC_CPU_P64

ICL64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/bin/intel64"
LIB64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/compiler/lib/intel64"
VS12PATH           =  "C:/Program Files (x86)/Microsoft Visual Studio 12.0/VC"

CC                =  $(ICL64PATH)/icl.exe -Qauto-ilp32
LDOUT             =  -Fe$@ -link -LIBPATH:$(LIB64PATH) -link -LIBPATH:$(VS12PATH)/lib/AMD64 -link -
LIBPATH:"C:\Program Files (x86)\Microsoft SDKs\Windows\v7.1A\Lib\x64"


462.libquantum=peak=default:
PORTABILITY       =  -DSPEC_CPU_P64


OPTIMIZE          =  -QxAVX   -Qipo -O3 -Qprec-div- -Qopt-prefetch
feedback=no

ICL64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/bin/intel64"
LIB64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/compiler/lib/intel64"
VS12PATH           =  "C:/Program Files (x86)/Microsoft Visual Studio 12.0/VC"


CC                =  $(ICL64PATH)/icl.exe -Qauto-ilp32 -Qstd=c99
LDOUT             =  -Fe$@ -link -LIBPATH:$(LIB64PATH) -link -LIBPATH:$(VS12PATH)/lib/AMD64 -link -
LIBPATH:"C:\Program Files (x86)\Microsoft SDKs\Windows\v7.1A\Lib\x64"

464.h264ref=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qunroll2 -Qansi-alias

471.omnetpp=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-ra-region-strategy=block

473.astar=peak=default:
PORTABILITY       =  -DSPEC_CPU_P64
EXTRA_LIBS        =  shlW64M.lib

OPTIMIZE          =  -QxAVX   -Qipo -O3 -Qprec-div- -Qopt-prefetch
feedback=no

ICL64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/bin/intel64"
LIB64PATH         =  "C:\Program Files (x86)\Intel\Composer XE 2015/compiler/lib/intel64"
VS12PATH           =  "C:/Program Files (x86)/Microsoft Visual Studio 12.0/VC"


CXX               =  $(ICL64PATH)/icl.exe -Qauto-ilp32
LDOUT             =  -Fe$@ -link /FORCE:MULTIPLE -link -LIBPATH:$(LIB64PATH) -link -
LIBPATH:$(VS12PATH)/lib/AMD64 -link -LIBPATH:"C:\Program Files (x86)\Microsoft SDKs\Windows\v7.1A\Lib\x64"

483.xalancbmk=peak=default:
basepeak=yes

#############################################################
# Peak Tuning Flags fp 2006 fast
#############################################################

fp=peak:
```

```
fp=peak=default=default:
OPTIMIZE=       -Qipo -O3 -Qprec-div-
COPTIMIZE=      -Qauto-ilp32
CXXOPTIMIZE=    -Qauto-ilp32
PASS1_CFLAGS=   -Qprof_gen
PASS2_CFLAGS=   -QxAVX   -Qprof_use
PASS1_CXXFLAGS= -Qprof_gen
PASS2_CXXFLAGS= -QxAVX   -Qprof_use
PASS1_FFLAGS=   -Qprof_gen
PASS2_FFLAGS=   -QxAVX   -Qprof_use
PASS1_LDFLAGS=  -Qprof_gen
PASS2_LDFLAGS=  -QxAVX   -Qprof_use
EXTRA_CXXLIBS=  shlW64M.lib
LDOUT=          -Fe$@ -link /FORCE:MULTIPLE


410.bwaves=peak=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch

############################################################
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif
############################################################

416.gamess=peak=default:
basepeak=yes

433.milc=peak=default:
basepeak=yes

434.zeusmp=peak=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch

############################################################
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif

############################################################

435.gromacs=peak=default:
basepeak=yes

436.cactusADM=peak=default:
basepeak=yes

437.leslie3d=peak=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch
############################################################
```

```
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif

##########################################################
444.namd=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Oa

447.dealII=peak=default:
basepeak=yes

453.povray=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qunroll4 -Qansi-alias

450.soplex=peak=default:
OPTIMIZE=       -Qipo -O3

##########################################################
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif

##########################################################
453.povray=peak=default:
OPTIMIZE=       -Qipo -O3 -Qprec-div- -Qopt-prefetch

454.calculix=peak=default:
basepeak=yes

459.GemsFDTD=peak=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch

##########################################################
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif

##########################################################
465.tonto=peak=default:
OPTIMIZE= -Qipo -O3 -Qprec-div- -Qunroll4 -Qauto
```

```
470.lbm=peak=default:
OPTIMIZE=       -QxAVX  -Qipo -O3 -Qprec-div- -Qansi-alias -Qopt-prefetch
COPTIMIZE=      -Qauto-ilp32

########################################################
%ifdef %{smt-on}
copies=%{cores}
%if defined (%{LOG_CPU_PER_NODE}) && defined(%{NUM_NUMA})
node= int((2*$SPECCOPYNUM) / $maxAffMaskNumBits) % $numaCount
hex=1<<((2*$SPECCOPYNUM) % $maxAffMaskNumBits)
submit= C:\Perl64\bin\perl.exe -e "system(sprintf(qq{start /b /wait /node %d /affinity %x %s}, ($node), ($hex),
q{ $command }))"
%else
%warning "NUMA topology not set, check environment variables perhaps coreinfo availability"
submit= specperl -e "system sprintf qq{start /b /wait /affinity %x %s}, (1<<(2*$SPECCOPYNUM)), q{ $command } "
%endif

%endif

########################################################
481.wrf=peak=default:
basepeak=yes

482.sphinx3=peak=default:
basepeak=yes
```

APPENDIX C – SPEC CPU2006 OUTPUT FILES

In this appendix, we present text of the output files from each of the SPEC CPU2006 runs.

AWS 2vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	2	646	30.2	*	2	543	36.0	S
400.perlbench	2	646	30.2	S	2	542	36.0	S
400.perlbench	2	644	30.4	S	2	542	36.0	*
401.bzip2	2	784	24.6	*	2	771	25.0	S
401.bzip2	2	784	24.6	S	2	771	25.0	*
401.bzip2	2	785	24.6	S	2	769	25.0	S
403.gcc	2	418	38.6	S	2	395	40.8	*
403.gcc	2	411	39.2	S	2	395	40.8	S
403.gcc	2	417	38.6	*	2	392	41.0	S
429.mcf	2	306	59.6	S	2	306	59.6	S
429.mcf	2	309	59.0	S	2	309	59.0	S
429.mcf	2	308	59.4	*	2	308	59.4	*
445.gobmk	2	735	28.6	S	2	700	30.0	*
445.gobmk	2	736	28.6	*	2	700	30.0	S
445.gobmk	2	736	28.6	S	2	700	30.0	S
456.hmmer	2	338	55.2	S	2	273	68.4	S
456.hmmer	2	340	54.8	S	2	273	68.4	*
456.hmmer	2	339	55.2	*	2	273	68.4	S
458.sjeng	2	828	29.2	*	2	828	29.2	*
458.sjeng	2	828	29.2	S	2	818	29.6	S
458.sjeng	2	826	29.2	S	2	831	29.2	S
462.libquantum	2	153	272	S	2	147	282	S
462.libquantum	2	152	272	S	2	147	282	*
462.libquantum	2	152	272	*	2	147	282	S
464.h264ref	2	877	50.4	S	2	849	52.2	S
464.h264ref	2	876	50.6	S	2	847	52.2	*
464.h264ref	2	876	50.6	*	2	844	52.4	S
471.omnetpp	2	383	32.6	*	2	334	37.4	S
471.omnetpp	2	386	32.4	S	2	339	36.8	*
471.omnetpp	2	378	33.0	S	2	345	36.2	S
473.astar	2	522	27.0	S	2	463	30.4	*
473.astar	2	519	27.0	*	2	462	30.4	S
473.astar	2	518	27.0	S	2	465	30.2	S
483.xalancbmk	2	254	54.4	S	2	254	54.4	S
483.xalancbmk	2	255	54.0	S	2	255	54.0	S
483.xalancbmk	2	255	54.2	*	2	255	54.2	*
400.perlbench	2	646	30.2	*	2	542	36.0	*
401.bzip2	2	784	24.6	*	2	771	25.0	*
403.gcc	2	417	38.6	*	2	395	40.8	*
429.mcf	2	308	59.4	*	2	308	59.4	*
445.gobmk	2	736	28.6	*	2	700	30.0	*
456.hmmer	2	339	55.2	*	2	273	68.4	*
458.sjeng	2	828	29.2	*	2	828	29.2	*
462.libquantum	2	152	272	*	2	147	282	*
464.h264ref	2	876	50.6	*	2	847	52.2	*
471.omnetpp	2	383	32.6	*	2	339	36.8	*
473.astar	2	519	27.0	*	2	463	30.4	*
483.xalancbmk	2	255	54.2	*	2	255	54.2	*
Est. SPECint(R)_rate_base2006			43.9					
Est. SPECint_rate2006							47.0	

AWS 4vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	4	650	60.0	*	4	545	71.6	*
400.perlbench	4	649	60.4	S	4	546	71.6	S
400.perlbench	4	651	60.0	S	4	544	72.0	S
401.bzip2	4	788	48.8	S	4	777	49.6	S
401.bzip2	4	790	48.8	S	4	778	49.6	*
401.bzip2	4	789	48.8	*	4	778	49.6	S
403.gcc	4	427	75.2	S	4	410	78.4	*
403.gcc	4	437	73.6	S	4	409	78.8	S
403.gcc	4	433	74.4	*	4	411	78.4	S
429.mcf	4	321	114	*	4	321	114	*
429.mcf	4	320	114	S	4	320	114	S
429.mcf	4	326	112	S	4	326	112	S
445.gobmk	4	740	56.8	S	4	702	59.6	S
445.gobmk	4	739	56.8	S	4	703	59.6	S
445.gobmk	4	739	56.8	*	4	702	59.6	*
456.hmmer	4	340	110	S	4	273	137	S
456.hmmer	4	341	110	*	4	273	137	*
456.hmmer	4	341	110	S	4	273	136	S
458.sjeng	4	826	58.4	*	4	830	58.4	*
458.sjeng	4	828	58.4	S	4	825	58.8	S
458.sjeng	4	826	58.4	S	4	830	58.4	S
462.libquantum	4	153	541	S	4	148	562	*
462.libquantum	4	153	540	S	4	148	562	S
462.libquantum	4	153	541	*	4	147	562	S
464.h264ref	4	893	99.2	S	4	849	104	*
464.h264ref	4	888	99.6	*	4	858	103	S
464.h264ref	4	886	100	S	4	848	104	S
471.omnetpp	4	439	56.8	S	4	391	64.0	S
471.omnetpp	4	441	56.8	*	4	394	63.6	S
471.omnetpp	4	443	56.4	S	4	394	63.6	*
473.astar	4	532	52.8	S	4	480	58.4	S
473.astar	4	533	52.8	*	4	480	58.4	*
473.astar	4	534	52.4	S	4	480	58.4	S
483.xalancbmk	4	260	106	S	4	260	106	S
483.xalancbmk	4	261	106	S	4	261	106	S
483.xalancbmk	4	261	106	*	4	261	106	*
400.perlbench	4	650	60.0	*	4	545	71.6	*
401.bzip2	4	789	48.8	*	4	778	49.6	*
403.gcc	4	433	74.4	*	4	410	78.4	*
429.mcf	4	321	114	*	4	321	114	*
445.gobmk	4	739	56.8	*	4	702	59.6	*
456.hmmer	4	341	110	*	4	273	137	*
458.sjeng	4	826	58.4	*	4	830	58.4	*
462.libquantum	4	153	541	*	4	148	562	*
464.h264ref	4	888	99.6	*	4	849	104	*
471.omnetpp	4	441	56.8	*	4	394	63.6	*
473.astar	4	533	52.8	*	4	480	58.4	*
483.xalancbmk	4	261	106	*	4	261	106	*
Est. SPECint(R)_rate_base2006			85.6					
Est. SPECint_rate2006							91.6	

AWS 2vCPU Windows SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	2	392	69.4	S	2	408	66.6	S
410.bwaves	2	395	68.8	S	2	402	67.6	*
410.bwaves	2	394	69.0	*	2	394	69.0	S
416.gamess	2	1229	31.8	S	2	1229	31.8	S
416.gamess	2	1232	31.8	S	2	1232	31.8	S
416.gamess	2	1230	31.8	*	2	1230	31.8	*
433.milc	2	286	64.2	*	2	286	64.2	*
433.milc	2	286	64.2	S	2	286	64.2	S
433.milc	2	286	64.0	S	2	286	64.0	S

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434.zeusmp          2         376       48.4 S       2         429       42.4 S
434.zeusmp          2         376       48.4 *       2         431       42.2 *
434.zeusmp          2         378       48.2 S       2         432       42.2 S
435.gromacs         2         339       42.2 S       2         339       42.2 S
435.gromacs         2         335       42.6 S       2         335       42.6 S
435.gromacs         2         336       42.6 *       2         336       42.6 *
436.cactusADM       2         629       38.0 *       2         629       38.0 *
436.cactusADM       2         624       38.4 S       2         624       38.4 S
436.cactusADM       2         635       37.6 S       2         635       37.6 S
437.leslie3d        2         509       37.0 S       2         518       36.4 *
437.leslie3d        2         510       36.8 *       2         517       36.4 S
437.leslie3d        2         517       36.4 S       2         518       36.4 S
444.namd            2         636       25.2 S       2         620       25.8 S
444.namd            2         636       25.2 *       2         621       25.8 *
444.namd            2         636       25.2 S       2         622       25.8 S
447.dealII          2         418       54.6 S       2         418       54.6 S
447.dealII          2         415       55.2 S       2         415       55.2 S
447.dealII          2         415       55.0 *       2         415       55.0 *
450.soplex          2         376       44.4 S       2         368       45.4 S
450.soplex          2         375       44.4 *       2         366       45.6 *
450.soplex          2         374       44.6 S       2         365       45.6 S
453.povray          2         241       44.2 *       2         206       51.6 S
453.povray          2         240       44.2 S       2         205       52.0 *
453.povray          2         241       44.2 S       2         204       52.0 S
454.calculix        2         342       48.2 S       2         342       48.2 S
454.calculix        2         343       48.2 S       2         343       48.2 S
454.calculix        2         342       48.2 *       2         342       48.2 *
459.GemsFDTD        2         663       32.0 S       2         480       44.2 *
459.GemsFDTD        2         662       32.0 S       2         486       43.8 S
459.GemsFDTD        2         662       32.0 *       2         476       44.6 S
465.tonto           2         506       38.8 S       2         474       41.4 S
465.tonto           2         508       38.8 *       2         478       41.2 S
465.tonto           2         510       38.6 S       2         476       41.4 *
470.lbm             2         480       57.2 *       2         469       58.6 S
470.lbm             2         480       57.2 S       2         468       58.8 S
470.lbm             2         482       57.0 S       2         468       58.6 *
481.wrf             2         328       68.2 S       2         328       68.2 S
481.wrf             2         323       69.2 S       2         323       69.2 S
481.wrf             2         325       68.6 *       2         325       68.6 *
482.sphinx3         2         728       53.6 S       2         728       53.6 S
482.sphinx3         2         728       53.6 *       2         728       53.6 *
482.sphinx3         2         729       53.4 S       2         729       53.4 S
==========================================================================================
410.bwaves          2         394       69.0 *       2         402       67.6 *
416.gamess          2        1230       31.8 *       2        1230       31.8 *
433.milc            2         286       64.2 *       2         286       64.2 *
434.zeusmp          2         376       48.4 *       2         431       42.2 *
435.gromacs         2         336       42.6 *       2         336       42.6 *
436.cactusADM       2         629       38.0 *       2         629       38.0 *
437.leslie3d        2         510       36.8 *       2         518       36.4 *
444.namd            2         636       25.2 *       2         621       25.8 *
447.dealII          2         415       55.0 *       2         415       55.0 *
450.soplex          2         375       44.4 *       2         366       45.6 *
453.povray          2         241       44.2 *       2         205       52.0 *
454.calculix        2         342       48.2 *       2         342       48.2 *
459.GemsFDTD        2         662       32.0 *       2         480       44.2 *
465.tonto           2         508       38.8 *       2         476       41.4 *
470.lbm             2         480       57.2 *       2         468       58.6 *
481.wrf             2         325       68.6 *       2         325       68.6 *
482.sphinx3         2         728       53.6 *       2         728       53.6 *
 Est. SPECfp(R)_rate_base2006          45.2
 Est. SPECfp_rate2006                                                    46.5
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AWS 4vCPU Windows SPECfp_rate2006

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                  Base      Base        Base          Peak      Peak        Peak
Benchmarks      Copies  Run Time      Rate          Copies  Run Time      Rate
--------------- ------  ---------  ---------       ------  ---------  ---------
410.bwaves           4        408       133    *        4        425       128    S
410.bwaves           4        418       130    S        4        419       130    *
410.bwaves           4        406       134    S        4        409       133    S
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416.gamess          4       1238       63.2 S       4       1238       63.2 S
416.gamess          4       1239       63.2 S       4       1239       63.2 S
416.gamess          4       1238       63.2 *       4       1238       63.2 *
433.milc            4        297      124   S       4        297      124   S
433.milc            4        297      124   *       4        297      124   *
433.milc            4        297      124   S       4        297      124   S
434.zeusmp          4        387       94.0 *       4        440       82.8 S
434.zeusmp          4        387       94.0 S       4        444       82.0 S
434.zeusmp          4        386       94.4 S       4        444       82.0 *
435.gromacs         4        338       84.4 S       4        338       84.4 S
435.gromacs         4        340       84.0 *       4        340       84.0 *
435.gromacs         4        344       83.2 S       4        344       83.2 S
436.cactusADM       4        632       75.6 S       4        632       75.6 S
436.cactusADM       4        631       76.0 *       4        631       76.0 *
436.cactusADM       4        630       76.0 S       4        630       76.0 S
437.leslie3d        4        552       68.0 S       4        530       70.8 S
437.leslie3d        4        533       70.4 S       4        531       70.8 S
437.leslie3d        4        539       69.6 *       4        530       70.8 *
444.namd            4        637       50.4 S       4        623       51.6 S
444.namd            4        636       50.4 S       4        622       51.6 S
444.namd            4        637       50.4 *       4        622       51.6 *
447.dealII          4        421      109   S       4        421      109   S
447.dealII          4        423      108   *       4        423      108   *
447.dealII          4        425      108   S       4        425      108   S
450.soplex          4        427       78.0 S       4        421       79.2 S
450.soplex          4        425       78.4 S       4        421       79.2 *
450.soplex          4        426       78.4 *       4        421       79.2 S
453.povray          4        244       87.2 S       4        206      104   *
453.povray          4        244       87.2 *       4        206      103   S
453.povray          4        246       86.4 S       4        206      104   S
454.calculix        4        347       95.2 S       4        347       95.2 S
454.calculix        4        345       95.6 *       4        345       95.6 *
454.calculix        4        343       96.0 S       4        343       96.0 S
459.GemsFDTD        4        686       62.0 *       4        488       86.8 S
459.GemsFDTD        4        687       62.0 S       4        497       85.2 S
459.GemsFDTD        4        681       62.4 S       4        494       86.0 *
465.tonto           4        520       75.6 S       4        484       81.2 S
465.tonto           4        514       76.4 S       4        487       80.8 S
465.tonto           4        519       76.0 *       4        485       81.2 *
470.lbm             4        489      112   S       4        476      116   S
470.lbm             4        489      112   *       4        477      115   S
470.lbm             4        490      112   S       4        477      115   *
481.wrf             4        340      132   S       4        340      132   S
481.wrf             4        340      131   S       4        340      131   S
481.wrf             4        340      131   *       4        340      131   *
482.sphinx3         4        750      104   S       4        750      104   S
482.sphinx3         4        748      104   S       4        748      104   S
482.sphinx3         4        749      104   *       4        749      104   *
==============================================================================
410.bwaves          4        408      133   *       4        419      130   *
416.gamess          4       1238       63.2 *       4       1238       63.2 *
433.milc            4        297      124   *       4        297      124   *
434.zeusmp          4        387       94.0 *       4        444       82.0 *
435.gromacs         4        340       84.0 *       4        340       84.0 *
436.cactusADM       4        631       76.0 *       4        631       76.0 *
437.leslie3d        4        539       69.6 *       4        530       70.8 *
444.namd            4        637       50.4 *       4        622       51.6 *
447.dealII          4        423      108   *       4        423      108   *
450.soplex          4        426       78.4 *       4        421       79.2 *
453.povray          4        244       87.2 *       4        206      104   *
454.calculix        4        345       95.6 *       4        345       95.6 *
459.GemsFDTD        4        686       62.0 *       4        494       86.0 *
465.tonto           4        519       76.0 *       4        485       81.2 *
470.lbm             4        489      112   *       4        477      115   *
481.wrf             4        340      131   *       4        340      131   *
482.sphinx3         4        749      104   *       4        749      104   *
 Est. SPECfp(R)_rate_base2006          87.9
 Est. SPECfp_rate2006                                                  90.4
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Azure 2vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	2	556	35.2	S	2	442	44.2	S
400.perlbench	2	552	35.4	*	2	440	44.4	S
400.perlbench	2	548	35.6	S	2	440	44.4	*
401.bzip2	2	736	26.2	*	2	718	26.8	*
401.bzip2	2	732	26.4	S	2	719	26.8	S
401.bzip2	2	737	26.2	S	2	717	27.0	S
403.gcc	2	392	41.0	S	2	394	40.8	S
403.gcc	2	402	40.0	S	2	373	43.2	S
403.gcc	2	401	40.2	*	2	388	41.6	*
429.mcf	2	268	68.2	*	2	268	68.2	*
429.mcf	2	266	68.8	S	2	266	68.8	S
429.mcf	2	271	67.4	S	2	271	67.4	S
445.gobmk	2	664	31.6	S	2	643	32.6	S
445.gobmk	2	662	31.6	S	2	642	32.6	S
445.gobmk	2	664	31.6	*	2	642	32.6	*
456.hmmer	2	297	62.8	*	2	274	68.0	*
456.hmmer	2	297	62.8	S	2	274	68.0	S
456.hmmer	2	299	62.4	S	2	275	68.0	S
458.sjeng	2	761	31.8	S	2	755	32.0	*
458.sjeng	2	760	31.8	*	2	755	32.0	S
458.sjeng	2	756	32.0	S	2	755	32.0	S
462.libquantum	2	117	354	S	2	112	370	S
462.libquantum	2	116	356	S	2	112	370	*
462.libquantum	2	117	354	*	2	112	369	S
464.h264ref	2	697	63.6	S	2	694	63.8	S
464.h264ref	2	701	63.2	S	2	682	64.8	S
464.h264ref	2	699	63.2	*	2	685	64.6	*
471.omnetpp	2	402	31.2	*	2	359	34.8	*
471.omnetpp	2	406	30.8	S	2	359	34.8	S
471.omnetpp	2	401	31.2	S	2	360	34.8	S
473.astar	2	483	29.0	S	2	431	32.6	S
473.astar	2	484	29.0	*	2	430	32.6	*
473.astar	2	485	29.0	S	2	429	32.6	S
483.xalancbmk	2	251	55.0	S	2	251	55.0	S
483.xalancbmk	2	239	57.8	*	2	239	57.8	*
483.xalancbmk	2	238	58.2	S	2	238	58.2	S
400.perlbench	2	552	35.4	*	2	440	44.4	*
401.bzip2	2	736	26.2	*	2	718	26.8	*
403.gcc	2	401	40.2	*	2	388	41.6	*
429.mcf	2	268	68.2	*	2	268	68.2	*
445.gobmk	2	664	31.6	*	2	642	32.6	*
456.hmmer	2	297	62.8	*	2	274	68.0	*
458.sjeng	2	760	31.8	*	2	755	32.0	*
462.libquantum	2	117	354	*	2	112	370	*
464.h264ref	2	699	63.2	*	2	685	64.6	*
471.omnetpp	2	402	31.2	*	2	359	34.8	*
473.astar	2	484	29.0	*	2	430	32.6	*
483.xalancbmk	2	239	57.8	*	2	239	57.8	*
Est. SPECint(R)_rate_base2006			48.9					
Est. SPECint_rate2006							51.8	

Azure 4vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	4	567	68.8	S	4	453	86.4	S
400.perlbench	4	568	68.8	S	4	454	86.0	S
400.perlbench	4	567	68.8	*	4	454	86.0	*
401.bzip2	4	758	50.8	S	4	745	52.0	S
401.bzip2	4	758	50.8	*	4	749	51.6	S
401.bzip2	4	771	50.0	S	4	748	51.6	*
403.gcc	4	421	76.4	S	4	397	81.2	*
403.gcc	4	416	77.6	S	4	395	81.6	S
403.gcc	4	418	77.2	*	4	409	78.8	S

429.mcf	4	296	123	S	4	296	123	S
429.mcf	4	303	120	S	4	303	120	S
429.mcf	4	301	121	*	4	301	121	*
445.gobmk	4	672	62.4	S	4	654	64.0	*
445.gobmk	4	673	62.4	S	4	654	64.0	S
445.gobmk	4	672	62.4	*	4	656	64.0	S
456.hmmer	4	302	124	*	4	280	133	S
456.hmmer	4	302	124	S	4	278	134	S
456.hmmer	4	300	124	S	4	279	134	*
458.sjeng	4	758	64.0	*	4	752	64.4	S
458.sjeng	4	765	63.2	S	4	753	64.4	*
458.sjeng	4	755	64.0	S	4	758	64.0	S
462.libquantum	4	120	692	*	4	115	723	S
462.libquantum	4	121	684	S	4	115	720	*
462.libquantum	4	119	699	S	4	116	716	S
464.h264ref	4	709	125	S	4	702	126	*
464.h264ref	4	708	125	*	4	702	126	S
464.h264ref	4	703	126	S	4	708	125	S
471.omnetpp	4	430	58.0	S	4	387	64.4	S
471.omnetpp	4	435	57.6	*	4	388	64.4	*
471.omnetpp	4	435	57.6	S	4	398	62.8	S
473.astar	4	512	54.8	S	4	467	60.0	S
473.astar	4	515	54.4	*	4	470	59.6	S
473.astar	4	515	54.4	S	4	468	60.0	*
483.xalancbmk	4	273	101	S	4	273	101	S
483.xalancbmk	4	256	108	*	4	256	108	*
483.xalancbmk	4	256	108	S	4	256	108	S
400.perlbench	4	567	68.8	*	4	454	86.0	*
401.bzip2	4	758	50.8	*	4	748	51.6	*
403.gcc	4	418	77.2	*	4	397	81.2	*
429.mcf	4	301	121	*	4	301	121	*
445.gobmk	4	672	62.4	*	4	654	64.0	*
456.hmmer	4	302	124	*	4	279	134	*
458.sjeng	4	758	64.0	*	4	753	64.4	*
462.libquantum	4	120	692	*	4	115	720	*
464.h264ref	4	708	125	*	4	702	126	*
471.omnetpp	4	435	57.6	*	4	388	64.4	*
473.astar	4	515	54.4	*	4	468	60.0	*
483.xalancbmk	4	256	108	*	4	256	108	*
Est. SPECint(R)_rate_base2006			93.9					
Est. SPECint_rate2006							99.2	

Azure 2vCPU Windows SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	2	367	74.2	S	2	359	75.6	S
410.bwaves	2	354	76.6	*	2	352	77.2	*
410.bwaves	2	349	78.0	S	2	351	77.4	S
416.gamess	2	955	41.0	*	2	955	41.0	*
416.gamess	2	958	40.8	S	2	958	40.8	S
416.gamess	2	953	41.0	S	2	953	41.0	S
433.milc	2	270	68.0	*	2	270	68.0	*
433.milc	2	270	68.0	S	2	270	68.0	S
433.milc	2	270	68.2	S	2	270	68.2	S
434.zeusmp	2	336	54.2	S	2	395	46.0	*
434.zeusmp	2	341	53.4	S	2	397	45.8	S
434.zeusmp	2	338	53.8	*	2	393	46.4	S
435.gromacs	2	279	51.2	*	2	279	51.2	*
435.gromacs	2	280	51.0	S	2	280	51.0	S
435.gromacs	2	277	51.6	S	2	277	51.6	S
436.cactusADM	2	467	51.2	*	2	467	51.2	*
436.cactusADM	2	480	49.8	S	2	480	49.8	S
436.cactusADM	2	460	52.0	S	2	460	52.0	S
437.leslie3d	2	312	60.2	*	2	316	59.6	S
437.leslie3d	2	316	59.4	S	2	317	59.4	*
437.leslie3d	2	312	60.4	S	2	320	58.8	S
444.namd	2	554	29.0	*	2	537	29.8	S
444.namd	2	555	28.8	S	2	540	29.6	*

444.namd	2	551	29.2	S	2	541	29.6	S
447.dealII	2	381	60.2	*	2	381	60.2	*
447.dealII	2	383	59.8	S	2	383	59.8	S
447.dealII	2	377	60.8	S	2	377	60.8	S
450.soplex	2	392	42.6	*	2	389	42.8	S
450.soplex	2	395	42.2	S	2	399	41.8	S
450.soplex	2	391	42.6	S	2	394	42.4	*
453.povray	2	194	54.8	*	2	161	66.0	S
453.povray	2	193	55.0	S	2	171	62.2	S
453.povray	2	223	47.8	S	2	163	65.4	*
454.calculix	2	289	57.0	S	2	289	57.0	S
454.calculix	2	289	57.2	*	2	289	57.2	*
454.calculix	2	287	57.4	S	2	287	57.4	S
459.GemsFDTD	2	497	42.8	*	2	342	62.2	S
459.GemsFDTD	2	500	42.4	S	2	345	61.4	S
459.GemsFDTD	2	493	43.0	S	2	343	62.0	*
465.tonto	2	483	40.8	S	2	475	41.4	S
465.tonto	2	484	40.6	*	2	443	44.4	*
465.tonto	2	519	38.0	S	2	430	45.8	S
470.lbm	2	302	91.0	S	2	273	101	*
470.lbm	2	305	90.2	*	2	271	101	S
470.lbm	2	305	90.0	S	2	280	98.4	S
481.wrf	2	291	76.8	*	2	291	76.8	*
481.wrf	2	292	76.6	S	2	292	76.6	S
481.wrf	2	290	77.0	S	2	290	77.0	S
482.sphinx3	2	542	72.0	S	2	542	72.0	S
482.sphinx3	2	547	71.2	S	2	547	71.2	S
482.sphinx3	2	547	71.2	*	2	547	71.2	*
410.bwaves	2	354	76.6	*	2	352	77.2	*
416.gamess	2	955	41.0	*	2	955	41.0	*
433.milc	2	270	68.0	*	2	270	68.0	*
434.zeusmp	2	338	53.8	*	2	395	46.0	*
435.gromacs	2	279	51.2	*	2	279	51.2	*
436.cactusADM	2	467	51.2	*	2	467	51.2	*
437.leslie3d	2	312	60.2	*	2	317	59.4	*
444.namd	2	554	29.0	*	2	540	29.6	*
447.dealII	2	381	60.2	*	2	381	60.2	*
450.soplex	2	392	42.6	*	2	394	42.4	*
453.povray	2	194	54.8	*	2	163	65.4	*
454.calculix	2	289	57.2	*	2	289	57.2	*
459.GemsFDTD	2	497	42.8	*	2	343	62.0	*
465.tonto	2	484	40.6	*	2	443	44.4	*
470.lbm	2	305	90.2	*	2	273	101	*
481.wrf	2	291	76.8	*	2	291	76.8	*
482.sphinx3	2	547	71.2	*	2	547	71.2	*
Est. SPECfp(R)_rate_base2006			54.8					
Est. SPECfp_rate2006							56.8	

Azure 4vCPU Windows SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	4	384	142	S	4	384	142	S
410.bwaves	4	378	144	S	4	382	142	*
410.bwaves	4	379	144	*	4	381	143	S
416.gamess	4	969	80.8	S	4	969	80.8	S
416.gamess	4	960	81.6	S	4	960	81.6	S
416.gamess	4	965	81.2	*	4	965	81.2	*
433.milc	4	292	126	*	4	292	126	*
433.milc	4	286	128	S	4	286	128	S
433.milc	4	294	125	S	4	294	125	S
434.zeusmp	4	342	106	S	4	405	90.0	S
434.zeusmp	4	345	106	S	4	398	91.2	S
434.zeusmp	4	344	106	*	4	401	90.8	*
435.gromacs	4	284	101	*	4	284	101	*
435.gromacs	4	282	101	S	4	282	101	S
435.gromacs	4	284	101	S	4	284	101	S
436.cactusADM	4	524	91.2	S	4	524	91.2	S
436.cactusADM	4	526	90.8	S	4	526	90.8	S

436.cactusADM	4	524	91.2	*	4	524	91.2	*
437.leslie3d	4	337	112	S	4	341	110	S
437.leslie3d	4	344	109	S	4	338	111	*
437.leslie3d	4	340	110	*	4	335	112	S
444.namd	4	560	57.2	S	4	547	58.8	S
444.namd	4	557	57.6	*	4	544	58.8	*
444.namd	4	555	58.0	S	4	539	59.6	S
447.dealII	4	385	119	S	4	385	119	S
447.dealII	4	412	111	S	4	412	111	S
447.dealII	4	391	117	*	4	391	117	*
450.soplex	4	430	77.6	S	4	428	78.0	*
450.soplex	4	428	78.0	S	4	428	78.0	S
450.soplex	4	429	78.0	*	4	421	79.2	S
453.povray	4	195	109	*	4	168	127	S
453.povray	4	209	102	S	4	160	133	S
453.povray	4	195	109	S	4	160	133	*
454.calculix	4	292	113	S	4	292	113	S
454.calculix	4	296	112	S	4	296	112	S
454.calculix	4	293	112	*	4	293	112	*
459.GemsFDTD	4	527	80.4	S	4	404	105	S
459.GemsFDTD	4	528	80.4	*	4	400	106	*
459.GemsFDTD	4	532	79.6	S	4	397	107	S
465.tonto	4	522	75.6	*	4	469	84.0	S
465.tonto	4	490	80.4	S	4	446	88.4	*
465.tonto	4	523	75.2	S	4	437	90.0	S
470.lbm	4	312	176	S	4	293	188	S
470.lbm	4	318	173	*	4	296	186	*
470.lbm	4	325	169	S	4	297	185	S
481.wrf	4	309	145	*	4	309	145	*
481.wrf	4	306	146	S	4	306	146	S
481.wrf	4	309	145	S	4	309	145	S
482.sphinx3	4	700	111	S	4	700	111	S
482.sphinx3	4	715	109	*	4	715	109	*
482.sphinx3	4	747	104	S	4	747	104	S
410.bwaves	4	379	144	*	4	382	142	*
416.gamess	4	965	81.2	*	4	965	81.2	*
433.milc	4	292	126	*	4	292	126	*
434.zeusmp	4	344	106	*	4	401	90.8	*
435.gromacs	4	284	101	*	4	284	101	*
436.cactusADM	4	524	91.2	*	4	524	91.2	*
437.leslie3d	4	340	110	*	4	338	111	*
444.namd	4	557	57.6	*	4	544	58.8	*
447.dealII	4	391	117	*	4	391	117	*
450.soplex	4	429	78.0	*	4	428	78.0	*
453.povray	4	195	109	*	4	160	133	*
454.calculix	4	293	112	*	4	293	112	*
459.GemsFDTD	4	528	80.4	*	4	400	106	*
465.tonto	4	522	75.6	*	4	446	88.4	*
470.lbm	4	318	173	*	4	296	186	*
481.wrf	4	309	145	*	4	309	145	*
482.sphinx3	4	715	109	*	4	715	109	*
Est. SPECfp(R)_rate_base2006			103					
Est. SPECfp_rate2006							107	

vCloud Air 2vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	2	458	42.8	*	2	367	53.2	S
400.perlbench	2	457	42.8	S	2	366	53.4	*
400.perlbench	2	465	42.0	S	2	364	53.6	S
401.bzip2	2	606	31.8	*	2	589	32.8	*
401.bzip2	2	603	32.0	S	2	600	32.2	S
401.bzip2	2	614	31.4	S	2	588	32.8	S
403.gcc	2	342	47.0	S	2	316	51.0	S
403.gcc	2	330	48.8	S	2	331	48.6	S
403.gcc	2	331	48.6	*	2	321	50.2	*
429.mcf	2	255	71.6	S	2	255	71.6	S
429.mcf	2	236	77.2	*	2	236	77.2	*

429.mcf	2	235	77.6	S	2	235	77.6	S
445.gobmk	2	554	37.8	*	2	536	39.2	*
445.gobmk	2	553	38.0	S	2	537	39.0	S
445.gobmk	2	555	37.8	S	2	534	39.2	S
456.hmmer	2	236	79.0	S	2	212	88.0	*
456.hmmer	2	235	79.2	*	2	212	87.8	S
456.hmmer	2	234	79.6	S	2	212	88.0	S
458.sjeng	2	625	38.8	S	2	633	38.2	*
458.sjeng	2	627	38.6	*	2	635	38.2	S
458.sjeng	2	628	38.6	S	2	632	38.2	S
462.libquantum	2	96.3	430	S	2	92.7	447	S
462.libquantum	2	95.7	433	S	2	92.6	448	S
462.libquantum	2	95.8	433	*	2	92.6	448	*
464.h264ref	2	562	78.6	*	2	547	80.8	*
464.h264ref	2	562	78.8	S	2	549	80.6	S
464.h264ref	2	565	78.4	S	2	547	81.0	S
471.omnetpp	2	359	34.8	S	2	325	38.4	S
471.omnetpp	2	391	32.0	S	2	321	38.8	S
471.omnetpp	2	360	34.8	*	2	324	38.6	*
473.astar	2	400	35.0	S	2	368	38.2	S
473.astar	2	408	34.4	S	2	363	38.8	S
473.astar	2	405	34.6	*	2	368	38.2	*
483.xalancbmk	2	200	68.8	*	2	200	68.8	*
483.xalancbmk	2	201	68.8	S	2	201	68.8	S
483.xalancbmk	2	198	69.6	S	2	198	69.6	S
400.perlbench	2	458	42.8	*	2	366	53.4	*
401.bzip2	2	606	31.8	*	2	589	32.8	*
403.gcc	2	331	48.6	*	2	321	50.2	*
429.mcf	2	236	77.2	*	2	236	77.2	*
445.gobmk	2	554	37.8	*	2	536	39.2	*
456.hmmer	2	235	79.2	*	2	212	88.0	*
458.sjeng	2	627	38.6	*	2	633	38.2	*
462.libquantum	2	95.8	433	*	2	92.6	448	*
464.h264ref	2	562	78.6	*	2	547	80.8	*
471.omnetpp	2	360	34.8	*	2	324	38.6	*
473.astar	2	405	34.6	*	2	368	38.2	*
483.xalancbmk	2	200	68.8	*	2	200	68.8	*
Est. SPECint(R)_rate_base2006			58.7					
Est. SPECint_rate2006							62.1	

vCloud Air 4vCPU Windows SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	4	462	84.4	S	4	375	104	S
400.perlbench	4	464	84.4	*	4	374	104	S
400.perlbench	4	469	83.2	S	4	375	104	*
401.bzip2	4	611	63.2	S	4	624	62.0	*
401.bzip2	4	623	62.0	*	4	630	61.2	S
401.bzip2	4	625	61.6	S	4	611	63.2	S
403.gcc	4	364	88.4	S	4	357	90.0	S
403.gcc	4	364	88.4	*	4	366	88.0	S
403.gcc	4	370	86.8	S	4	359	89.6	*
429.mcf	4	257	142	S	4	257	142	S
429.mcf	4	259	141	S	4	259	141	S
429.mcf	4	258	142	*	4	258	142	*
445.gobmk	4	554	75.6	S	4	566	74.0	S
445.gobmk	4	557	75.2	S	4	537	78.0	S
445.gobmk	4	555	75.6	*	4	539	78.0	*
456.hmmer	4	236	158	S	4	213	175	S
456.hmmer	4	235	159	*	4	212	176	*
456.hmmer	4	235	159	S	4	212	176	S
458.sjeng	4	640	75.6	S	4	640	75.6	S
458.sjeng	4	630	76.8	*	4	635	76.0	S
458.sjeng	4	627	77.2	S	4	639	75.6	*
462.libquantum	4	97.1	854	S	4	94.2	880	S
462.libquantum	4	96.8	856	S	4	93.4	887	S
462.libquantum	4	97.0	854	*	4	93.5	886	*
464.h264ref	4	563	157	*	4	549	161	*

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464.h264ref          4      563        157   S       4      551        161   S
464.h264ref          4      564        157   S       4      549        161   S
471.omnetpp          4      384         65.2 S       4      355         70.4 S
471.omnetpp          4      392         64.0 S       4      349         71.6 S
471.omnetpp          4      390         64.0 *       4      350         71.6 *
473.astar            4      424         66.0 S       4      396         70.8 *
473.astar            4      451         62.4 S       4      412         68.0 S
473.astar            4      434         64.8 *       4      390         72.0 S
483.xalancbmk        4      209        132   S       4      209        132   S
483.xalancbmk        4      212        130   *       4      212        130   *
483.xalancbmk        4      216        128   S       4      216        128   S
==========================================================================================
400.perlbench        4      464         84.4 *       4      375        104   *
401.bzip2            4      623         62.0 *       4      624         62.0 *
403.gcc              4      364         88.4 *       4      359         89.6 *
429.mcf              4      258        142   *       4      258        142   *
445.gobmk            4      555         75.6 *       4      539         78.0 *
456.hmmer            4      235        159   *       4      212        176   *
458.sjeng            4      630         76.8 *       4      639         75.6 *
462.libquantum       4       97.0      854   *       4       93.5      886   *
464.h264ref          4      563        157   *       4      549        161   *
471.omnetpp          4      390         64.0 *       4      350         71.6 *
473.astar            4      434         64.8 *       4      396         70.8 *
483.xalancbmk        4      212        130   *       4      212        130   *
 Est. SPECint(R)_rate_base2006        113
 Est. SPECint_rate2006                                                  119
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vCloud Air 2vCPU Windows SPECfp_rate2006

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                 Base      Base        Base          Peak      Peak        Peak
Benchmarks       Copies    Run Time    Rate          Copies    Run Time    Rate
---------------- ------    ---------   ---------     ------    ---------   ---------
410.bwaves           2         258      106   S         2         268      101   *
410.bwaves           2         261      104   S         2         286       95.0 S
410.bwaves           2         259      105   *         2         263      103   S
416.gamess           2         780       50.2 *         2         780       50.2 *
416.gamess           2         780       50.2 S         2         780       50.2 S
416.gamess           2         784       50.0 S         2         784       50.0 S
433.milc             2         234       78.4 *         2         234       78.4 *
433.milc             2         236       77.8 S         2         236       77.8 S
433.milc             2         233       78.6 S         2         233       78.6 S
434.zeusmp           2         281       64.8 *         2         321       56.6 S
434.zeusmp           2         281       64.8 S         2         319       57.2 *
434.zeusmp           2         280       65.0 S         2         318       57.4 S
435.gromacs          2         235       60.8 S         2         235       60.8 S
435.gromacs          2         234       61.2 *         2         234       61.2 *
435.gromacs          2         232       61.4 S         2         232       61.4 S
436.cactusADM        2         392       61.0 S         2         392       61.0 S
436.cactusADM        2         415       57.6 *         2         415       57.6 *
436.cactusADM        2         416       57.4 S         2         416       57.4 S
437.leslie3d         2         259       72.6 *         2         262       71.8 *
437.leslie3d         2         261       72.0 S         2         263       71.4 S
437.leslie3d         2         255       73.6 S         2         260       72.2 S
444.namd             2         460       34.8 S         2         446       36.0 *
444.namd             2         460       35.0 *         2         445       36.0 S
444.namd             2         458       35.0 S         2         447       35.8 S
447.dealII           2         308       74.2 *         2         308       74.2 *
447.dealII           2         309       74.2 S         2         309       74.2 S
447.dealII           2         305       75.0 S         2         305       75.0 S
450.soplex           2         324       51.4 *         2         319       52.4 *
450.soplex           2         330       50.6 S         2         320       52.0 S
450.soplex           2         320       52.0 S         2         316       52.8 S
453.povray           2         160       66.6 *         2         133       80.0 *
453.povray           2         161       66.0 S         2         134       79.6 S
453.povray           2         159       66.8 S         2         133       80.2 S
454.calculix         2         246       67.2 *         2         246       67.2 *
454.calculix         2         247       66.8 S         2         247       66.8 S
454.calculix         2         246       67.2 S         2         246       67.2 S
459.GemsFDTD         2         450       47.2 *         2         321       66.2 S
459.GemsFDTD         2         451       47.0 S         2         319       66.4 S
459.GemsFDTD         2         448       47.4 S         2         320       66.4 *
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465.tonto	2	394	50.0	*	2	356	55.4	S
465.tonto	2	392	50.2	S	2	359	54.8	S
465.tonto	2	411	48.0	S	2	358	55.0	*
470.lbm	2	280	98.2	*	2	250	110	S
470.lbm	2	282	97.6	S	2	251	110	*
470.lbm	2	274	100	S	2	254	108	S
481.wrf	2	241	92.6	*	2	241	92.6	*
481.wrf	2	242	92.4	S	2	242	92.4	S
481.wrf	2	239	93.4	S	2	239	93.4	S
482.sphinx3	2	556	70.0	S	2	556	70.0	S
482.sphinx3	2	553	70.6	S	2	553	70.6	S
482.sphinx3	2	554	70.4	*	2	554	70.4	*
410.bwaves	2	259	105	*	2	268	101	*
416.gamess	2	780	50.2	*	2	780	50.2	*
433.milc	2	234	78.4	*	2	234	78.4	*
434.zeusmp	2	281	64.8	*	2	319	57.2	*
435.gromacs	2	234	61.2	*	2	234	61.2	*
436.cactusADM	2	415	57.6	*	2	415	57.6	*
437.leslie3d	2	259	72.6	*	2	262	71.8	*
444.namd	2	460	35.0	*	2	446	36.0	*
447.dealII	2	308	74.2	*	2	308	74.2	*
450.soplex	2	324	51.4	*	2	319	52.4	*
453.povray	2	160	66.6	*	2	133	80.0	*
454.calculix	2	246	67.2	*	2	246	67.2	*
459.GemsFDTD	2	450	47.2	*	2	320	66.4	*
465.tonto	2	394	50.0	*	2	358	55.0	*
470.lbm	2	280	98.2	*	2	251	110	*
481.wrf	2	241	92.6	*	2	241	92.6	*
482.sphinx3	2	554	70.4	*	2	554	70.4	*
Est. SPECfp(R)_rate_base2006			64.8					
Est. SPECfp_rate2006							67.1	

vCloud Air 4vCPU Windows SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	4	280	194	S	4	286	190	*
410.bwaves	4	282	193	S	4	284	191	S
410.bwaves	4	281	193	*	4	289	188	S
416.gamess	4	776	101	S	4	776	101	S
416.gamess	4	781	100	*	4	781	100	*
416.gamess	4	781	100	S	4	781	100	S
433.milc	4	264	139	S	4	264	139	S
433.milc	4	262	140	*	4	262	140	*
433.milc	4	262	140	S	4	262	140	S
434.zeusmp	4	282	129	*	4	321	113	S
434.zeusmp	4	285	128	S	4	324	112	S
434.zeusmp	4	280	130	S	4	323	113	*
435.gromacs	4	233	122	*	4	233	122	*
435.gromacs	4	231	124	S	4	231	124	S
435.gromacs	4	234	122	S	4	234	122	S
436.cactusADM	4	446	107	S	4	446	107	S
436.cactusADM	4	447	107	*	4	447	107	*
436.cactusADM	4	459	104	S	4	459	104	S
437.leslie3d	4	288	131	S	4	297	126	S
437.leslie3d	4	289	130	S	4	291	129	S
437.leslie3d	4	288	130	*	4	295	127	*
444.namd	4	456	70.4	S	4	440	72.8	S
444.namd	4	452	71.2	S	4	449	71.6	S
444.namd	4	452	70.8	*	4	441	72.8	*
447.dealII	4	304	151	S	4	304	151	S
447.dealII	4	307	149	S	4	307	149	S
447.dealII	4	305	150	*	4	305	150	*
450.soplex	4	358	93.2	S	4	351	95.2	*
450.soplex	4	354	94.4	S	4	350	95.2	S
450.soplex	4	355	94.0	*	4	352	94.8	S
453.povray	4	157	136	S	4	136	157	*
453.povray	4	160	133	*	4	137	155	S
453.povray	4	163	131	S	4	133	160	S

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454.calculix        4        245      134   *       4        245      134   *
454.calculix        4        252      131   S       4        252      131   S
454.calculix        4        244      136   S       4        244      136   S
459.GemsFDTD        4        473       89.6 S       4        372      114   S
459.GemsFDTD        4        473       89.6 *       4        365      116   *
459.GemsFDTD        4        475       89.2 S       4        365      116   S
465.tonto           4        422       93.2 S       4        375      105   *
465.tonto           4        416       94.8 S       4        389      101   S
465.tonto           4        419       94.0 *       4        371      106   S
470.lbm             4        285      193   S       4        271      203   *
470.lbm             4        288      191   *       4        270      204   S
470.lbm             4        290      189   S       4        274      201   S
481.wrf             4        252      178   S       4        252      178   S
481.wrf             4        253      176   S       4        253      176   S
481.wrf             4        253      177   *       4        253      177   *
482.sphinx3         4        615      127   S       4        615      127   S
482.sphinx3         4        614      127   *       4        614      127   *
482.sphinx3         4        612      127   S       4        612      127   S
==========================================================================
410.bwaves          4        281      193   *       4        286      190   *
416.gamess          4        781      100   *       4        781      100   *
433.milc            4        262      140   *       4        262      140   *
434.zeusmp          4        282      129   *       4        323      113   *
435.gromacs         4        233      122   *       4        233      122   *
436.cactusADM       4        447      107   *       4        447      107   *
437.leslie3d        4        288      130   *       4        295      127   *
444.namd            4        452       70.8 *       4        441       72.8 *
447.dealII          4        305      150   *       4        305      150   *
450.soplex          4        355       94.0 *       4        351       95.2 *
453.povray          4        160      133   *       4        136      157   *
454.calculix        4        245      134   *       4        245      134   *
459.GemsFDTD        4        473       89.6 *       4        365      116   *
465.tonto           4        419       94.0 *       4        375      105   *
470.lbm             4        288      191   *       4        271      203   *
481.wrf             4        253      177   *       4        253      177   *
482.sphinx3         4        614      127   *       4        614      127   *
 Est. SPECfp(R)_rate_base2006        124
 Est. SPECfp_rate2006                                          127
```

AWS 2vCPU Linux SPECint_rate2006

```
                 Base     Base        Base          Peak     Peak        Peak
Benchmarks     Copies  Run Time     Rate         Copies  Run Time     Rate
-------------- ------  ---------  ---------     ------  ---------  ---------
400.perlbench       2        625       31.3 *       2        625       31.3 *
400.perlbench       2        657       29.8 S       2        657       29.8 S
400.perlbench       2        616       31.7 S       2        616       31.7 S
401.bzip2           2        875       22.1 *       2        875       22.1 *
401.bzip2           2        936       20.6 S       2        936       20.6 S
401.bzip2           2        872       22.1 S       2        872       22.1 S
403.gcc             2        424       37.9 *       2        424       37.9 *
403.gcc             2        430       37.4 S       2        430       37.4 S
403.gcc             2        414       38.9 S       2        414       38.9 S
429.mcf             2        275       66.3 S       2        275       66.3 S
429.mcf             2        278       65.5 *       2        278       65.5 *
429.mcf             2        280       65.1 S       2        280       65.1 S
445.gobmk           2        793       26.5 *       2        793       26.5 *
445.gobmk           2        807       26.0 S       2        807       26.0 S
445.gobmk           2        790       26.6 S       2        790       26.6 S
456.hmmer           2        906       20.6 S       2        906       20.6 S
456.hmmer           2        932       20.0 S       2        932       20.0 S
456.hmmer           2        907       20.6 *       2        907       20.6 *
458.sjeng           2        884       27.4 S       2        884       27.4 S
458.sjeng           2        913       26.5 S       2        913       26.5 S
458.sjeng           2        891       27.2 *       2        891       27.2 *
462.libquantum      2        715       58.0 *       2        715       58.0 *
462.libquantum      2        738       56.1 S       2        738       56.1 S
462.libquantum      2        712       58.2 S       2        712       58.2 S
464.h264ref         2       1136       38.9 *       2       1136       38.9 *
464.h264ref         2       1159       38.2 S       2       1159       38.2 S
464.h264ref         2       1102       40.2 S       2       1102       40.2 S
```

```
471.omnetpp          2         406       30.8 *        2         406       30.8 *
471.omnetpp          2         423       29.6 S        2         423       29.6 S
471.omnetpp          2         393       31.8 S        2         393       31.8 S
473.astar            2         646       21.7 S        2         646       21.7 S
473.astar            2         637       22.0 *        2         637       22.0 *
473.astar            2         632       22.2 S        2         632       22.2 S
483.xalancbmk        2         374       36.9 S        2         374       36.9 S
483.xalancbmk        2         348       39.6 S        2         348       39.6 S
483.xalancbmk        2         350       39.5 *        2         350       39.5 *
==========================================================================================
400.perlbench        2         625       31.3 *        2         625       31.3 *
401.bzip2            2         875       22.1 *        2         875       22.1 *
403.gcc              2         424       37.9 *        2         424       37.9 *
429.mcf              2         278       65.5 *        2         278       65.5 *
445.gobmk            2         793       26.5 *        2         793       26.5 *
456.hmmer            2         907       20.6 *        2         907       20.6 *
458.sjeng            2         891       27.2 *        2         891       27.2 *
462.libquantum       2         715       58.0 *        2         715       58.0 *
464.h264ref          2        1136       38.9 *        2        1136       38.9 *
471.omnetpp          2         406       30.8 *        2         406       30.8 *
473.astar            2         637       22.0 *        2         637       22.0 *
483.xalancbmk        2         350       39.5 *        2         350       39.5 *
 SPECint(R)_rate_base2006               32.8
 SPECint_rate2006                                                         32.8
```

AWS 4vCPU Linux SPECint_rate2006

```
                  Base      Base        Base         Peak      Peak        Peak
Benchmarks      Copies  Run Time      Rate       Copies  Run Time      Rate
--------------- ------  ---------  ---------    ------  ---------  ---------
400.perlbench        4         623       62.7 S        4         623       62.7 S
400.perlbench        4         626       62.4 *        4         626       62.4 *
400.perlbench        4         627       62.4 S        4         627       62.4 S
401.bzip2            4         891       43.3 S        4         891       43.3 S
401.bzip2            4         882       43.8 S        4         882       43.8 S
401.bzip2            4         885       43.6 *        4         885       43.6 *
403.gcc              4         440       73.1 S        4         440       73.1 S
403.gcc              4         442       72.9 S        4         442       72.9 S
403.gcc              4         442       72.9 *        4         442       72.9 *
429.mcf              4         301      121   S        4         301      121   S
429.mcf              4         293      124   *        4         293      124   *
429.mcf              4         292      125   S        4         292      125   S
445.gobmk            4         795       52.8 S        4         795       52.8 S
445.gobmk            4         791       53.0 S        4         791       53.0 S
445.gobmk            4         792       53.0 *        4         792       53.0 *
456.hmmer            4         906       41.2 S        4         906       41.2 S
456.hmmer            4         911       41.0 S        4         911       41.0 S
456.hmmer            4         907       41.2 *        4         907       41.2 *
458.sjeng            4         893       54.2 *        4         893       54.2 *
458.sjeng            4         893       54.2 S        4         893       54.2 S
458.sjeng            4         900       53.8 S        4         900       53.8 S
462.libquantum       4         733      113   S        4         733      113   S
462.libquantum       4         731      113   S        4         731      113   S
462.libquantum       4         732      113   *        4         732      113   *
464.h264ref          4        1104       80.1 S        4        1104       80.1 S
464.h264ref          4        1112       79.6 *        4        1112       79.6 *
464.h264ref          4        1127       78.6 S        4        1127       78.6 S
471.omnetpp          4         493       50.7 S        4         493       50.7 S
471.omnetpp          4         492       50.8 *        4         492       50.8 *
471.omnetpp          4         491       51.0 S        4         491       51.0 S
473.astar            4         693       40.5 S        4         693       40.5 S
473.astar            4         692       40.6 S        4         692       40.6 S
473.astar            4         693       40.5 *        4         693       40.5 *
483.xalancbmk        4         391       70.6 S        4         391       70.6 S
483.xalancbmk        4         385       71.6 S        4         385       71.6 S
483.xalancbmk        4         387       71.2 *        4         387       71.2 *
==========================================================================================
400.perlbench        4         626       62.4 *        4         626       62.4 *
401.bzip2            4         885       43.6 *        4         885       43.6 *
403.gcc              4         442       72.9 *        4         442       72.9 *
429.mcf              4         293      124   *        4         293      124   *
```

445.gobmk	4	792	53.0	*	4	792	53.0	*
456.hmmer	4	907	41.2	*	4	907	41.2	*
458.sjeng	4	893	54.2	*	4	893	54.2	*
462.libquantum	4	732	113	*	4	732	113	*
464.h264ref	4	1112	79.6	*	4	1112	79.6	*
471.omnetpp	4	492	50.8	*	4	492	50.8	*
473.astar	4	693	40.5	*	4	693	40.5	*
483.xalancbmk	4	387	71.2	*	4	387	71.2	*
SPECint(R)_rate_base2006			62.9					
SPECint_rate2006							62.9	

AWS 2vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	2	925	29.4	S	2	925	29.4	S
410.bwaves	2	921	29.5	S	2	921	29.5	S
410.bwaves	2	922	29.5	*	2	922	29.5	*
416.gamess	2	1370	28.6	S	2	1370	28.6	S
416.gamess	2	1370	28.6	*	2	1370	28.6	*
416.gamess	2	1362	28.7	S	2	1362	28.7	S
433.milc	2	608	30.2	S	2	608	30.2	S
433.milc	2	603	30.5	*	2	603	30.5	*
433.milc	2	601	30.6	S	2	601	30.6	S
434.zeusmp	2	623	29.2	S	2	623	29.2	S
434.zeusmp	2	618	29.4	*	2	618	29.4	*
434.zeusmp	2	616	29.6	S	2	616	29.6	S
435.gromacs	2	645	22.2	S	2	645	22.2	S
435.gromacs	2	642	22.2	*	2	642	22.2	*
435.gromacs	2	641	22.3	S	2	641	22.3	S
436.cactusADM	2	1040	23.0	S	2	1040	23.0	S
436.cactusADM	2	1022	23.4	*	2	1022	23.4	*
436.cactusADM	2	1018	23.5	S	2	1018	23.5	S
437.leslie3d	2	588	32.0	*	2	588	32.0	*
437.leslie3d	2	538	35.0	S	2	538	35.0	S
437.leslie3d	2	588	31.9	S	2	588	31.9	S
444.namd	2	696	23.1	S	2	696	23.1	S
444.namd	2	690	23.2	S	2	690	23.2	S
444.namd	2	690	23.2	*	2	690	23.2	*
447.dealII	2	476	48.1	S	2	476	48.1	S
447.dealII	2	477	48.0	S	2	477	48.0	S
447.dealII	2	476	48.1	*	2	476	48.1	*
450.soplex	2	332	50.3	S	2	332	50.3	S
450.soplex	2	333	50.1	S	2	333	50.1	S
450.soplex	2	332	50.2	*	2	332	50.2	*
453.povray	2	294	36.2	S	2	294	36.2	S
453.povray	2	292	36.4	S	2	292	36.4	S
453.povray	2	292	36.4	*	2	292	36.4	*
454.calculix	2	717	23.0	S	2	717	23.0	S
454.calculix	2	751	22.0	S	2	751	22.0	S
454.calculix	2	748	22.1	*	2	748	22.1	*
459.GemsFDTD	2	678	31.3	S	2	678	31.3	S
459.GemsFDTD	2	679	31.2	*	2	679	31.2	*
459.GemsFDTD	2	679	31.2	S	2	679	31.2	S
465.tonto	2	749	26.3	S	2	749	26.3	S
465.tonto	2	751	26.2	*	2	751	26.2	*
465.tonto	2	760	25.9	S	2	760	25.9	S
470.lbm	2	568	48.4	S	2	568	48.4	S
470.lbm	2	567	48.5	*	2	567	48.5	*
470.lbm	2	567	48.5	S	2	567	48.5	S
481.wrf	2	779	28.7	*	2	779	28.7	*
481.wrf	2	780	28.6	S	2	780	28.6	S
481.wrf	2	779	28.7	S	2	779	28.7	S
482.sphinx3	2	977	39.9	S	2	977	39.9	S
482.sphinx3	2	979	39.8	S	2	979	39.8	S
482.sphinx3	2	978	39.9	*	2	978	39.9	*
410.bwaves	2	922	29.5	*	2	922	29.5	*
416.gamess	2	1370	28.6	*	2	1370	28.6	*
433.milc	2	603	30.5	*	2	603	30.5	*

434.zeusmp	2	618	29.4 *	2	618	29.4 *
435.gromacs	2	642	22.2 *	2	642	22.2 *
436.cactusADM	2	1022	23.4 *	2	1022	23.4 *
437.leslie3d	2	588	32.0 *	2	588	32.0 *
444.namd	2	690	23.2 *	2	690	23.2 *
447.dealII	2	476	48.1 *	2	476	48.1 *
450.soplex	2	332	50.2 *	2	332	50.2 *
453.povray	2	292	36.4 *	2	292	36.4 *
454.calculix	2	748	22.1 *	2	748	22.1 *
459.GemsFDTD	2	679	31.2 *	2	679	31.2 *
465.tonto	2	751	26.2 *	2	751	26.2 *
470.lbm	2	567	48.5 *	2	567	48.5 *
481.wrf	2	779	28.7 *	2	779	28.7 *
482.sphinx3	2	978	39.9 *	2	978	39.9 *
SPECfp(R)_rate_base2006			31.2			
SPECfp_rate2006						31.2

AWS 4vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate	Peak Copies	Peak Run Time	Peak Rate
410.bwaves	4	930	58.4 *	4	930	58.4 *
410.bwaves	4	931	58.4 S	4	931	58.4 S
410.bwaves	4	930	58.4 S	4	930	58.4 S
416.gamess	4	1359	57.6 *	4	1359	57.6 *
416.gamess	4	1356	57.7 S	4	1356	57.7 S
416.gamess	4	1359	57.6 S	4	1359	57.6 S
433.milc	4	640	57.4 S	4	640	57.4 S
433.milc	4	639	57.4 *	4	639	57.4 *
433.milc	4	638	57.6 S	4	638	57.6 S
434.zeusmp	4	629	57.9 S	4	629	57.9 S
434.zeusmp	4	630	57.8 S	4	630	57.8 S
434.zeusmp	4	629	57.9 *	4	629	57.9 *
435.gromacs	4	642	44.5 S	4	642	44.5 S
435.gromacs	4	644	44.4 S	4	644	44.4 S
435.gromacs	4	642	44.5 *	4	642	44.5 *
436.cactusADM	4	1058	45.2 *	4	1058	45.2 *
436.cactusADM	4	1059	45.1 S	4	1059	45.1 S
436.cactusADM	4	1053	45.4 S	4	1053	45.4 S
437.leslie3d	4	599	62.7 S	4	599	62.7 S
437.leslie3d	4	602	62.5 S	4	602	62.5 S
437.leslie3d	4	601	62.6 *	4	601	62.6 *
444.namd	4	695	46.2 S	4	695	46.2 S
444.namd	4	694	46.2 *	4	694	46.2 *
444.namd	4	691	46.4 S	4	691	46.4 S
447.dealII	4	483	94.7 S	4	483	94.7 S
447.dealII	4	482	94.9 *	4	482	94.9 *
447.dealII	4	481	95.1 S	4	481	95.1 S
450.soplex	4	391	85.3 S	4	391	85.3 S
450.soplex	4	398	83.7 S	4	398	83.7 S
450.soplex	4	397	84.1 *	4	397	84.1 *
453.povray	4	295	72.2 S	4	295	72.2 S
453.povray	4	295	72.2 *	4	295	72.2 *
453.povray	4	294	72.3 S	4	294	72.3 S
454.calculix	4	751	44.0 *	4	751	44.0 *
454.calculix	4	754	43.7 S	4	754	43.7 S
454.calculix	4	748	44.1 S	4	748	44.1 S
459.GemsFDTD	4	709	59.9 S	4	709	59.9 S
459.GemsFDTD	4	714	59.5 S	4	714	59.5 S
459.GemsFDTD	4	712	59.6 *	4	712	59.6 *
465.tonto	4	755	52.1 *	4	755	52.1 *
465.tonto	4	755	52.1 S	4	755	52.1 S
465.tonto	4	754	52.2 S	4	754	52.2 S
470.lbm	4	598	91.9 S	4	598	91.9 S
470.lbm	4	596	92.2 *	4	596	92.2 *
470.lbm	4	596	92.3 S	4	596	92.3 S
481.wrf	4	788	56.7 *	4	788	56.7 *
481.wrf	4	789	56.7 S	4	789	56.7 S
481.wrf	4	787	56.7 S	4	787	56.7 S
482.sphinx3	4	1004	77.6 S	4	1004	77.6 S

```
482.sphinx3          4       1002       77.8 *       4       1002       77.8 *
482.sphinx3          4        998       78.1 S       4        998       78.1 S
==========================================================================================
410.bwaves           4        930       58.4 *       4        930       58.4 *
416.gamess           4       1359       57.6 *       4       1359       57.6 *
433.milc             4        639       57.4 *       4        639       57.4 *
434.zeusmp           4        629       57.9 *       4        629       57.9 *
435.gromacs          4        642       44.5 *       4        642       44.5 *
436.cactusADM        4       1058       45.2 *       4       1058       45.2 *
437.leslie3d         4        601       62.6 *       4        601       62.6 *
444.namd             4        694       46.2 *       4        694       46.2 *
447.dealII           4        482       94.9 *       4        482       94.9 *
450.soplex           4        397       84.1 *       4        397       84.1 *
453.povray           4        295       72.2 *       4        295       72.2 *
454.calculix         4        751       44.0 *       4        751       44.0 *
459.GemsFDTD         4        712       59.6 *       4        712       59.6 *
465.tonto            4        755       52.1 *       4        755       52.1 *
470.lbm              4        596       92.2 *       4        596       92.2 *
481.wrf              4        788       56.7 *       4        788       56.7 *
482.sphinx3          4       1002       77.8 *       4       1002       77.8 *
 SPECfp(R)_rate_base2006              60.7
 SPECfp_rate2006                                                        60.7
```

Azure 2vCPU Linux SPECint_rate2006

```
                  Base      Base        Base         Peak      Peak        Peak
Benchmarks      Copies  Run Time      Rate        Copies  Run Time      Rate
--------------- ------  ---------  ---------     ------  ---------  ---------
400.perlbench        2        528       37.0 S       2        528       37.0 S
400.perlbench        2        528       37.0 *       2        528       37.0 *
400.perlbench        2        530       36.9 S       2        530       36.9 S
401.bzip2            2        792       24.4 *       2        792       24.4 *
401.bzip2            2        792       24.4 S       2        792       24.4 S
401.bzip2            2        789       24.5 S       2        789       24.5 S
403.gcc              2        389       41.4 S       2        389       41.4 S
403.gcc              2        389       41.3 *       2        389       41.3 *
403.gcc              2        393       41.0 S       2        393       41.0 S
429.mcf              2        316       57.8 S       2        316       57.8 S
429.mcf              2        319       57.2 S       2        319       57.2 S
429.mcf              2        319       57.2 *       2        319       57.2 *
445.gobmk            2        701       29.9 S       2        701       29.9 S
445.gobmk            2        705       29.8 *       2        705       29.8 *
445.gobmk            2        706       29.7 S       2        706       29.7 S
456.hmmer            2        687       27.2 S       2        687       27.2 S
456.hmmer            2        689       27.1 S       2        689       27.1 S
456.hmmer            2        688       27.1 *       2        688       27.1 *
458.sjeng            2        772       31.3 S       2        772       31.3 S
458.sjeng            2        774       31.2 S       2        774       31.2 S
458.sjeng            2        773       31.3 *       2        773       31.3 *
462.libquantum       2        627       66.1 S       2        627       66.1 S
462.libquantum       2        628       66.0 S       2        628       66.0 S
462.libquantum       2        628       66.0 *       2        628       66.0 *
464.h264ref          2        924       47.9 S       2        924       47.9 S
464.h264ref          2        922       48.0 S       2        922       48.0 S
464.h264ref          2        923       47.9 *       2        923       47.9 *
471.omnetpp          2        435       28.7 S       2        435       28.7 S
471.omnetpp          2        435       28.8 *       2        435       28.8 *
471.omnetpp          2        434       28.8 S       2        434       28.8 S
473.astar            2        612       22.9 S       2        612       22.9 S
473.astar            2        612       22.9 *       2        612       22.9 *
473.astar            2        609       23.0 S       2        609       23.0 S
483.xalancbmk        2        358       38.6 *       2        358       38.6 *
483.xalancbmk        2        366       37.7 S       2        366       37.7 S
483.xalancbmk        2        354       39.0 S       2        354       39.0 S
==========================================================================================
400.perlbench        2        528       37.0 *       2        528       37.0 *
401.bzip2            2        792       24.4 *       2        792       24.4 *
403.gcc              2        389       41.3 *       2        389       41.3 *
429.mcf              2        319       57.2 *       2        319       57.2 *
445.gobmk            2        705       29.8 *       2        705       29.8 *
456.hmmer            2        688       27.1 *       2        688       27.1 *
```

```
458.sjeng           2        773       31.3 *       2        773       31.3 *
462.libquantum      2        628       66.0 *       2        628       66.0 *
464.h264ref         2        923       47.9 *       2        923       47.9 *
471.omnetpp         2        435       28.8 *       2        435       28.8 *
473.astar           2        612       22.9 *       2        612       22.9 *
483.xalancbmk       2        358       38.6 *       2        358       38.6 *
 SPECint(R)_rate_base2006              35.7
 SPECint_rate2006                                                      35.7
```

Azure 4vCPU Linux SPECint_rate2006

```
                  Base     Base        Base         Peak     Peak        Peak
Benchmarks      Copies  Run Time     Rate         Copies  Run Time     Rate
--------------- ------  ---------  ---------     ------  ---------  ---------
400.perlbench        4        573       68.2 S        4        573       68.2 S
400.perlbench        4        557       70.1 S        4        557       70.1 S
400.perlbench        4        570       68.6 *        4        570       68.6 *
401.bzip2            4        831       46.5 S        4        831       46.5 S
401.bzip2            4        833       46.3 *        4        833       46.3 *
401.bzip2            4        835       46.2 S        4        835       46.2 S
403.gcc              4        425       75.8 S        4        425       75.8 S
403.gcc              4        427       75.3 S        4        427       75.3 S
403.gcc              4        427       75.4 *        4        427       75.4 *
429.mcf              4        379       96.2 S        4        379       96.2 S
429.mcf              4        382       95.4 *        4        382       95.4 *
429.mcf              4        386       94.5 S        4        386       94.5 S
445.gobmk            4        727       57.7 S        4        727       57.7 S
445.gobmk            4        728       57.6 *        4        728       57.6 *
445.gobmk            4        730       57.4 S        4        730       57.4 S
456.hmmer            4        702       53.2 S        4        702       53.2 S
456.hmmer            4        704       53.0 *        4        704       53.0 *
456.hmmer            4        712       52.4 S        4        712       52.4 S
458.sjeng            4        809       59.8 S        4        809       59.8 S
458.sjeng            4        805       60.1 S        4        805       60.1 S
458.sjeng            4        805       60.1 *        4        805       60.1 *
462.libquantum       4        718      115   S        4        718      115   S
462.libquantum       4        710      117   S        4        710      117   S
462.libquantum       4        714      116   *        4        714      116   *
464.h264ref          4        948       93.3 *        4        948       93.3 *
464.h264ref          4        952       93.0 S        4        952       93.0 S
464.h264ref          4        947       93.5 S        4        947       93.5 S
471.omnetpp          4        511       48.9 S        4        511       48.9 S
471.omnetpp          4        516       48.5 *        4        516       48.5 *
471.omnetpp          4        518       48.3 S        4        518       48.3 S
473.astar            4        667       42.1 S        4        667       42.1 S
473.astar            4        678       41.4 S        4        678       41.4 S
473.astar            4        676       41.6 *        4        676       41.6 *
483.xalancbmk        4        422       65.3 S        4        422       65.3 S
483.xalancbmk        4        426       64.8 *        4        426       64.8 *
483.xalancbmk        4        427       64.7 S        4        427       64.7 S
==========================================================================================
400.perlbench        4        570       68.6 *        4        570       68.6 *
401.bzip2            4        833       46.3 *        4        833       46.3 *
403.gcc              4        427       75.4 *        4        427       75.4 *
429.mcf              4        382       95.4 *        4        382       95.4 *
445.gobmk            4        728       57.6 *        4        728       57.6 *
456.hmmer            4        704       53.0 *        4        704       53.0 *
458.sjeng            4        805       60.1 *        4        805       60.1 *
462.libquantum       4        714      116   *        4        714      116   *
464.h264ref          4        948       93.3 *        4        948       93.3 *
471.omnetpp          4        516       48.5 *        4        516       48.5 *
473.astar            4        676       41.6 *        4        676       41.6 *
483.xalancbmk        4        426       64.8 *        4        426       64.8 *
 SPECint(R)_rate_base2006              65.2
 SPECint_rate2006                                                      65.2
```

Azure 2vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	2	746	36.4	S	2	746	36.4	S
410.bwaves	2	743	36.6	S	2	743	36.6	S
410.bwaves	2	745	36.5	*	2	745	36.5	*
416.gamess	2	1080	36.3	S	2	1080	36.3	S
416.gamess	2	1077	36.4	S	2	1077	36.4	S
416.gamess	2	1078	36.3	*	2	1078	36.3	*
433.milc	2	563	32.6	*	2	563	32.6	*
433.milc	2	564	32.5	S	2	564	32.5	S
433.milc	2	563	32.6	S	2	563	32.6	S
434.zeusmp	2	574	31.7	S	2	574	31.7	S
434.zeusmp	2	572	31.8	S	2	572	31.8	S
434.zeusmp	2	572	31.8	*	2	572	31.8	*
435.gromacs	2	712	20.1	*	2	712	20.1	*
435.gromacs	2	711	20.1	S	2	711	20.1	S
435.gromacs	2	713	20.0	S	2	713	20.0	S
436.cactusADM	2	883	27.1	S	2	883	27.1	S
436.cactusADM	2	900	26.6	*	2	900	26.6	*
436.cactusADM	2	919	26.0	S	2	919	26.0	S
437.leslie3d	2	501	37.5	*	2	501	37.5	*
437.leslie3d	2	502	37.5	S	2	502	37.5	S
437.leslie3d	2	501	37.5	S	2	501	37.5	S
444.namd	2	612	26.2	S	2	612	26.2	S
444.namd	2	623	25.7	S	2	623	25.7	S
444.namd	2	614	26.1	*	2	614	26.1	*
447.dealII	2	419	54.5	S	2	419	54.5	S
447.dealII	2	424	54.0	S	2	424	54.0	S
447.dealII	2	421	54.4	*	2	421	54.4	*
450.soplex	2	347	48.1	S	2	347	48.1	S
450.soplex	2	354	47.1	S	2	354	47.1	S
450.soplex	2	354	47.1	*	2	354	47.1	*
453.povray	2	253	42.0	S	2	253	42.0	S
453.povray	2	249	42.7	S	2	249	42.7	S
453.povray	2	251	42.4	*	2	251	42.4	*
454.calculix	2	607	27.2	S	2	607	27.2	S
454.calculix	2	610	27.0	*	2	610	27.0	*
454.calculix	2	611	27.0	S	2	611	27.0	S
459.GemsFDTD	2	524	40.5	S	2	524	40.5	S
459.GemsFDTD	2	525	40.4	S	2	525	40.4	S
459.GemsFDTD	2	525	40.5	*	2	525	40.5	*
465.tonto	2	674	29.2	S	2	674	29.2	S
465.tonto	2	676	29.1	S	2	676	29.1	S
465.tonto	2	676	29.1	*	2	676	29.1	*
470.lbm	2	536	51.3	*	2	536	51.3	*
470.lbm	2	534	51.5	S	2	534	51.5	S
470.lbm	2	537	51.1	S	2	537	51.1	S
481.wrf	2	774	28.9	*	2	774	28.9	*
481.wrf	2	776	28.8	S	2	776	28.8	S
481.wrf	2	774	28.9	S	2	774	28.9	S
482.sphinx3	2	829	47.0	*	2	829	47.0	*
482.sphinx3	2	832	46.9	S	2	832	46.9	S
482.sphinx3	2	827	47.1	S	2	827	47.1	S
410.bwaves	2	745	36.5	*	2	745	36.5	*
416.gamess	2	1078	36.3	*	2	1078	36.3	*
433.milc	2	563	32.6	*	2	563	32.6	*
434.zeusmp	2	572	31.8	*	2	572	31.8	*
435.gromacs	2	712	20.1	*	2	712	20.1	*
436.cactusADM	2	900	26.6	*	2	900	26.6	*
437.leslie3d	2	501	37.5	*	2	501	37.5	*
444.namd	2	614	26.1	*	2	614	26.1	*
447.dealII	2	421	54.4	*	2	421	54.4	*
450.soplex	2	354	47.1	*	2	354	47.1	*
453.povray	2	251	42.4	*	2	251	42.4	*
454.calculix	2	610	27.0	*	2	610	27.0	*
459.GemsFDTD	2	525	40.5	*	2	525	40.5	*
465.tonto	2	676	29.1	*	2	676	29.1	*

```
470.lbm              2        536       51.3 *       2        536       51.3 *
481.wrf              2        774       28.9 *       2        774       28.9 *
482.sphinx3          2        829       47.0 *       2        829       47.0 *
 SPECfp(R)_rate_base2006              34.9
 SPECfp_rate2006                                                        34.9
```

Azure 4vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	4	794	68.5	S	4	794	68.5	S
410.bwaves	4	795	68.3	S	4	795	68.3	S
410.bwaves	4	794	68.5	*	4	794	68.5	*
416.gamess	4	1114	70.3	S	4	1114	70.3	S
416.gamess	4	1111	70.5	*	4	1111	70.5	*
416.gamess	4	1109	70.6	S	4	1109	70.6	S
433.milc	4	637	57.7	*	4	637	57.7	*
433.milc	4	634	57.9	S	4	634	57.9	S
433.milc	4	639	57.5	S	4	639	57.5	S
434.zeusmp	4	601	60.6	S	4	601	60.6	S
434.zeusmp	4	603	60.4	*	4	603	60.4	*
434.zeusmp	4	610	59.7	S	4	610	59.7	S
435.gromacs	4	736	38.8	S	4	736	38.8	S
435.gromacs	4	739	38.7	*	4	739	38.7	*
435.gromacs	4	748	38.2	S	4	748	38.2	S
436.cactusADM	4	1122	42.6	S	4	1122	42.6	S
436.cactusADM	4	1120	42.7	*	4	1120	42.7	*
436.cactusADM	4	1092	43.8	S	4	1092	43.8	S
437.leslie3d	4	540	69.7	S	4	540	69.7	S
437.leslie3d	4	537	70.0	S	4	537	70.0	S
437.leslie3d	4	537	70.0	*	4	537	70.0	*
444.namd	4	633	50.7	*	4	633	50.7	*
444.namd	4	632	50.8	S	4	632	50.8	S
444.namd	4	641	50.0	S	4	641	50.0	S
447.dealII	4	438	104	S	4	438	104	S
447.dealII	4	441	104	S	4	441	104	S
447.dealII	4	439	104	*	4	439	104	*
450.soplex	4	414	80.5	S	4	414	80.5	S
450.soplex	4	415	80.5	*	4	415	80.5	*
450.soplex	4	416	80.1	S	4	416	80.1	S
453.povray	4	260	81.9	*	4	260	81.9	*
453.povray	4	259	82.2	S	4	259	82.2	S
453.povray	4	261	81.5	S	4	261	81.5	S
454.calculix	4	630	52.4	S	4	630	52.4	S
454.calculix	4	634	52.0	S	4	634	52.0	S
454.calculix	4	631	52.3	*	4	631	52.3	*
459.GemsFDTD	4	585	72.6	S	4	585	72.6	S
459.GemsFDTD	4	582	72.9	*	4	582	72.9	*
459.GemsFDTD	4	581	73.1	S	4	581	73.1	S
465.tonto	4	700	56.2	*	4	700	56.2	*
465.tonto	4	700	56.3	S	4	700	56.3	S
465.tonto	4	704	55.9	S	4	704	55.9	S
470.lbm	4	682	80.6	S	4	682	80.6	S
470.lbm	4	673	81.7	S	4	673	81.7	S
470.lbm	4	677	81.2	*	4	677	81.2	*
481.wrf	4	817	54.7	*	4	817	54.7	*
481.wrf	4	811	55.1	S	4	811	55.1	S
481.wrf	4	823	54.3	S	4	823	54.3	S
482.sphinx3	4	965	80.8	S	4	965	80.8	S
482.sphinx3	4	965	80.8	*	4	965	80.8	*
482.sphinx3	4	979	79.7	S	4	979	79.7	S
410.bwaves	4	794	68.5	*	4	794	68.5	*
416.gamess	4	1111	70.5	*	4	1111	70.5	*
433.milc	4	637	57.7	*	4	637	57.7	*
434.zeusmp	4	603	60.4	*	4	603	60.4	*
435.gromacs	4	739	38.7	*	4	739	38.7	*
436.cactusADM	4	1120	42.7	*	4	1120	42.7	*
437.leslie3d	4	537	70.0	*	4	537	70.0	*
444.namd	4	633	50.7	*	4	633	50.7	*

```
447.dealII          4        439      104   *       4        439      104   *
450.soplex          4        415       80.5 *       4        415       80.5 *
453.povray          4        260       81.9 *       4        260       81.9 *
454.calculix        4        631       52.3 *       4        631       52.3 *
459.GemsFDTD        4        582       72.9 *       4        582       72.9 *
465.tonto           4        700       56.2 *       4        700       56.2 *
470.lbm             4        677       81.2 *       4        677       81.2 *
481.wrf             4        817       54.7 *       4        817       54.7 *
482.sphinx3         4        965       80.8 *       4        965       80.8 *
 SPECfp(R)_rate_base2006              64.1
 SPECfp_rate2006                                                      64.1
```

vCloud Air 2vCPU Linux SPECint_rate2006

```
                 Base     Base        Base          Peak     Peak        Peak
Benchmarks     Copies  Run Time     Rate          Copies  Run Time     Rate
-------------- ------  ---------  ---------      ------  ---------  ---------
400.perlbench       2        449       43.5 S         2        449       43.5 S
400.perlbench       2        447       43.7 *         2        447       43.7 *
400.perlbench       2        445       43.9 S         2        445       43.9 S
401.bzip2           2        692       27.9 S         2        692       27.9 S
401.bzip2           2        656       29.4 *         2        656       29.4 *
401.bzip2           2        655       29.5 S         2        655       29.5 S
403.gcc             2        341       47.2 S         2        341       47.2 S
403.gcc             2        315       51.0 S         2        315       51.0 S
403.gcc             2        321       50.2 *         2        321       50.2 *
429.mcf             2        269       67.8 *         2        269       67.8 *
429.mcf             2        267       68.2 S         2        267       68.2 S
429.mcf             2        272       67.0 S         2        272       67.0 S
445.gobmk           2        581       36.1 S         2        581       36.1 S
445.gobmk           2        588       35.7 *         2        588       35.7 *
445.gobmk           2        593       35.4 S         2        593       35.4 S
456.hmmer           2        547       34.1 *         2        547       34.1 *
456.hmmer           2        553       33.8 S         2        553       33.8 S
456.hmmer           2        545       34.3 S         2        545       34.3 S
458.sjeng           2        643       37.6 *         2        643       37.6 *
458.sjeng           2        641       37.7 S         2        641       37.7 S
458.sjeng           2        649       37.3 S         2        649       37.3 S
462.libquantum      2        495       83.7 *         2        495       83.7 *
462.libquantum      2        492       84.3 S         2        492       84.3 S
462.libquantum      2        498       83.2 S         2        498       83.2 S
464.h264ref         2        751       59.0 S         2        751       59.0 S
464.h264ref         2        763       58.0 S         2        763       58.0 S
464.h264ref         2        757       58.5 *         2        757       58.5 *
471.omnetpp         2        385       32.4 *         2        385       32.4 *
471.omnetpp         2        389       32.1 S         2        389       32.1 S
471.omnetpp         2        377       33.1 S         2        377       33.1 S
473.astar           2        511       27.5 *         2        511       27.5 *
473.astar           2        515       27.2 S         2        515       27.2 S
473.astar           2        503       27.9 S         2        503       27.9 S
483.xalancbmk       2        299       46.2 *         2        299       46.2 *
483.xalancbmk       2        305       45.2 S         2        305       45.2 S
483.xalancbmk       2        298       46.3 S         2        298       46.3 S
==========================================================================================
400.perlbench       2        447       43.7 *         2        447       43.7 *
401.bzip2           2        656       29.4 *         2        656       29.4 *
403.gcc             2        321       50.2 *         2        321       50.2 *
429.mcf             2        269       67.8 *         2        269       67.8 *
445.gobmk           2        588       35.7 *         2        588       35.7 *
456.hmmer           2        547       34.1 *         2        547       34.1 *
458.sjeng           2        643       37.6 *         2        643       37.6 *
462.libquantum      2        495       83.7 *         2        495       83.7 *
464.h264ref         2        757       58.5 *         2        757       58.5 *
471.omnetpp         2        385       32.4 *         2        385       32.4 *
473.astar           2        511       27.5 *         2        511       27.5 *
483.xalancbmk       2        299       46.2 *         2        299       46.2 *
 SPECint(R)_rate_base2006             43.0
 SPECint_rate2006                                                     43.0
```

vCloud Air 4vCPU Linux SPECint_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
400.perlbench	4	450	86.9	S	4	450	86.9	S
400.perlbench	4	452	86.5	S	4	452	86.5	S
400.perlbench	4	451	86.6	*	4	451	86.6	*
401.bzip2	4	673	57.4	S	4	673	57.4	S
401.bzip2	4	677	57.0	*	4	677	57.0	*
401.bzip2	4	677	57.0	S	4	677	57.0	S
403.gcc	4	340	94.7	S	4	340	94.7	S
403.gcc	4	342	94.2	S	4	342	94.2	S
403.gcc	4	342	94.3	*	4	342	94.3	*
429.mcf	4	315	116	S	4	315	116	S
429.mcf	4	317	115	*	4	317	115	*
429.mcf	4	320	114	S	4	320	114	S
445.gobmk	4	593	70.8	*	4	593	70.8	*
445.gobmk	4	595	70.6	S	4	595	70.6	S
445.gobmk	4	593	70.8	S	4	593	70.8	S
456.hmmer	4	552	67.7	S	4	552	67.7	S
456.hmmer	4	553	67.5	*	4	553	67.5	*
456.hmmer	4	554	67.3	S	4	554	67.3	S
458.sjeng	4	653	74.1	*	4	653	74.1	*
458.sjeng	4	654	74.0	S	4	654	74.0	S
458.sjeng	4	651	74.4	S	4	651	74.4	S
462.libquantum	4	581	143	S	4	581	143	S
462.libquantum	4	581	143	*	4	581	143	*
462.libquantum	4	582	142	S	4	582	142	S
464.h264ref	4	760	116	*	4	760	116	*
464.h264ref	4	758	117	S	4	758	117	S
464.h264ref	4	760	116	S	4	760	116	S
471.omnetpp	4	441	56.6	S	4	441	56.6	S
471.omnetpp	4	443	56.4	*	4	443	56.4	*
471.omnetpp	4	444	56.3	S	4	444	56.3	S
473.astar	4	544	51.6	S	4	544	51.6	S
473.astar	4	546	51.4	*	4	546	51.4	*
473.astar	4	547	51.3	S	4	547	51.3	S
483.xalancbmk	4	340	81.3	S	4	340	81.3	S
483.xalancbmk	4	341	80.9	S	4	341	80.9	S
483.xalancbmk	4	340	81.1	*	4	340	81.1	*
400.perlbench	4	451	86.6	*	4	451	86.6	*
401.bzip2	4	677	57.0	*	4	677	57.0	*
403.gcc	4	342	94.3	*	4	342	94.3	*
429.mcf	4	317	115	*	4	317	115	*
445.gobmk	4	593	70.8	*	4	593	70.8	*
456.hmmer	4	553	67.5	*	4	553	67.5	*
458.sjeng	4	653	74.1	*	4	653	74.1	*
462.libquantum	4	581	143	*	4	581	143	*
464.h264ref	4	760	116	*	4	760	116	*
471.omnetpp	4	443	56.4	*	4	443	56.4	*
473.astar	4	546	51.4	*	4	546	51.4	*
483.xalancbmk	4	340	81.1	*	4	340	81.1	*
SPECint(R)_rate_base2006			80.5					
SPECint_rate2006							80.5	

vCloud Air 2vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate		Peak Copies	Peak Run Time	Peak Rate	
410.bwaves	2	601	45.2	S	2	601	45.2	S
410.bwaves	2	601	45.2	S	2	601	45.2	S
410.bwaves	2	601	45.2	*	2	601	45.2	*
416.gamess	2	861	45.5	*	2	861	45.5	*
416.gamess	2	865	45.3	S	2	865	45.3	S
416.gamess	2	859	45.6	S	2	859	45.6	S
433.milc	2	487	37.7	S	2	487	37.7	S
433.milc	2	502	36.6	S	2	502	36.6	S
433.milc	2	488	37.7	*	2	488	37.7	*

434.zeusmp	2	444	41.0 S	2	444	41.0 S
434.zeusmp	2	443	41.1 *	2	443	41.1 *
434.zeusmp	2	443	41.1 S	2	443	41.1 S
435.gromacs	2	467	30.6 S	2	467	30.6 S
435.gromacs	2	463	30.8 S	2	463	30.8 S
435.gromacs	2	464	30.7 *	2	464	30.7 *
436.cactusADM	2	826	28.9 *	2	826	28.9 *
436.cactusADM	2	823	29.0 S	2	823	29.0 S
436.cactusADM	2	841	28.4 S	2	841	28.4 S
437.leslie3d	2	354	53.0 *	2	354	53.0 *
437.leslie3d	2	354	53.2 S	2	354	53.2 S
437.leslie3d	2	356	52.9 S	2	356	52.9 S
444.namd	2	494	32.4 *	2	494	32.4 *
444.namd	2	493	32.5 S	2	493	32.5 S
444.namd	2	496	32.3 S	2	496	32.3 S
447.dealII	2	343	66.6 S	2	343	66.6 S
447.dealII	2	344	66.6 *	2	344	66.6 *
447.dealII	2	348	65.8 S	2	348	65.8 S
450.soplex	2	285	58.6 S	2	285	58.6 S
450.soplex	2	286	58.3 *	2	286	58.3 *
450.soplex	2	293	56.9 S	2	293	56.9 S
453.povray	2	203	52.4 S	2	203	52.4 S
453.povray	2	206	51.7 *	2	206	51.7 *
453.povray	2	207	51.4 S	2	207	51.4 S
454.calculix	2	514	32.1 S	2	514	32.1 S
454.calculix	2	514	32.1 *	2	514	32.1 *
454.calculix	2	513	32.1 S	2	513	32.1 S
459.GemsFDTD	2	457	46.4 *	2	457	46.4 *
459.GemsFDTD	2	455	46.6 S	2	455	46.6 S
459.GemsFDTD	2	469	45.3 S	2	469	45.3 S
465.tonto	2	544	36.2 S	2	544	36.2 S
465.tonto	2	543	36.3 S	2	543	36.3 S
465.tonto	2	544	36.2 *	2	544	36.2 *
470.lbm	2	432	63.6 *	2	432	63.6 *
470.lbm	2	432	63.7 S	2	432	63.7 S
470.lbm	2	433	63.5 S	2	433	63.5 S
481.wrf	2	579	38.6 S	2	579	38.6 S
481.wrf	2	583	38.3 S	2	583	38.3 S
481.wrf	2	579	38.6 *	2	579	38.6 *
482.sphinx3	2	722	54.0 S	2	722	54.0 S
482.sphinx3	2	725	53.8 *	2	725	53.8 *
482.sphinx3	2	726	53.7 S	2	726	53.7 S
410.bwaves	2	601	45.2 *	2	601	45.2 *
416.gamess	2	861	45.5 *	2	861	45.5 *
433.milc	2	488	37.7 *	2	488	37.7 *
434.zeusmp	2	443	41.1 *	2	443	41.1 *
435.gromacs	2	464	30.7 *	2	464	30.7 *
436.cactusADM	2	826	28.9 *	2	826	28.9 *
437.leslie3d	2	354	53.0 *	2	354	53.0 *
444.namd	2	494	32.4 *	2	494	32.4 *
447.dealII	2	344	66.6 *	2	344	66.6 *
450.soplex	2	286	58.3 *	2	286	58.3 *
453.povray	2	206	51.7 *	2	206	51.7 *
454.calculix	2	514	32.1 *	2	514	32.1 *
459.GemsFDTD	2	457	46.4 *	2	457	46.4 *
465.tonto	2	544	36.2 *	2	544	36.2 *
470.lbm	2	432	63.6 *	2	432	63.6 *
481.wrf	2	579	38.6 *	2	579	38.6 *
482.sphinx3	2	725	53.8 *	2	725	53.8 *
SPECfp(R)_rate_base2006			43.4			
SPECfp_rate2006						43.4

vCloud Air 4vCPU Linux SPECfp_rate2006

Benchmarks	Base Copies	Base Run Time	Base Rate	Peak Copies	Peak Run Time	Peak Rate
410.bwaves	4	617	88.1 *	4	617	88.1 *
410.bwaves	4	617	88.2 S	4	617	88.2 S
410.bwaves	4	620	87.6 S	4	620	87.6 S

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416.gamess          4        861       91.0 S       4        861       91.0 S
416.gamess          4        863       90.8 *       4        863       90.8 *
416.gamess          4        864       90.7 S       4        864       90.7 S
433.milc            4        539       68.1 S       4        539       68.1 S
433.milc            4        541       67.9 *       4        541       67.9 *
433.milc            4        544       67.5 S       4        544       67.5 S
434.zeusmp          4        449       81.1 S       4        449       81.1 S
434.zeusmp          4        452       80.5 S       4        452       80.5 S
434.zeusmp          4        451       80.7 *       4        451       80.7 *
435.gromacs         4        464       61.5 S       4        464       61.5 S
435.gromacs         4        469       60.9 *       4        469       60.9 *
435.gromacs         4        469       60.8 S       4        469       60.8 S
436.cactusADM       4        991       48.2 S       4        991       48.2 S
436.cactusADM       4        956       50.0 S       4        956       50.0 S
436.cactusADM       4        985       48.5 *       4        985       48.5 *
437.leslie3d        4        378       99.5 S       4        378       99.5 S
437.leslie3d        4        383       98.3 S       4        383       98.3 S
437.leslie3d        4        378       99.5 *       4        378       99.5 *
444.namd            4        494       65.0 S       4        494       65.0 S
444.namd            4        498       64.5 S       4        498       64.5 S
444.namd            4        494       64.9 *       4        494       64.9 *
447.dealII          4        348      132   *       4        348      132   *
447.dealII          4        347      132   S       4        347      132   S
447.dealII          4        348      131   S       4        348      131   S
450.soplex          4        337       98.9 S       4        337       98.9 S
450.soplex          4        339       98.5 *       4        339       98.5 *
450.soplex          4        340       98.1 S       4        340       98.1 S
453.povray          4        203      105   S       4        203      105   S
453.povray          4        205      104   *       4        205      104   *
453.povray          4        206      103   S       4        206      103   S
454.calculix        4        507       65.1 S       4        507       65.1 S
454.calculix        4        521       63.4 S       4        521       63.4 S
454.calculix        4        516       63.9 *       4        516       63.9 *
459.GemsFDTD        4        494       85.9 *       4        494       85.9 *
459.GemsFDTD        4        495       85.8 S       4        495       85.8 S
459.GemsFDTD        4        493       86.1 S       4        493       86.1 S
465.tonto           4        549       71.7 *       4        549       71.7 *
465.tonto           4        546       72.1 S       4        546       72.1 S
465.tonto           4        550       71.6 S       4        550       71.6 S
470.lbm             4        565       97.3 S       4        565       97.3 S
470.lbm             4        564       97.4 *       4        564       97.4 *
470.lbm             4        561       98.0 S       4        561       98.0 S
481.wrf             4        585       76.4 S       4        585       76.4 S
481.wrf             4        589       75.9 *       4        589       75.9 *
481.wrf             4        591       75.6 S       4        591       75.6 S
482.sphinx3         4        798       97.7 *       4        798       97.7 *
482.sphinx3         4        800       97.5 S       4        800       97.5 S
482.sphinx3         4        791       98.6 S       4        791       98.6 S
==============================================================================
410.bwaves          4        617       88.1 *       4        617       88.1 *
416.gamess          4        863       90.8 *       4        863       90.8 *
433.milc            4        541       67.9 *       4        541       67.9 *
434.zeusmp          4        451       80.7 *       4        451       80.7 *
435.gromacs         4        469       60.9 *       4        469       60.9 *
436.cactusADM       4        985       48.5 *       4        985       48.5 *
437.leslie3d        4        378       99.5 *       4        378       99.5 *
444.namd            4        494       64.9 *       4        494       64.9 *
447.dealII          4        348      132   *       4        348      132   *
450.soplex          4        339       98.5 *       4        339       98.5 *
453.povray          4        205      104   *       4        205      104   *
454.calculix        4        516       63.9 *       4        516       63.9 *
459.GemsFDTD        4        494       85.9 *       4        494       85.9 *
465.tonto           4        549       71.7 *       4        549       71.7 *
470.lbm             4        564       97.4 *       4        564       97.4 *
481.wrf             4        589       75.9 *       4        589       75.9 *
482.sphinx3         4        798       97.7 *       4        798       97.7 *
 SPECfp(R)_rate_base2006              81.7
 SPECfp_rate2006                                                       81.7
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ABOUT PRINCIPLED TECHNOLOGIES

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