

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

In the Principled Technologies labs, we compared the CPU performance of VMware® vCloud® Air™, Microsoft® Azure™, and Amazon Web Services™ (AWS) using the SPEC® CPU™2006 benchmark, including SPECint®2006 and SPECfp®2006. The full report will be available soon.

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, which reports results in both SPECint\_rate2006 and SPECint\_rate\_base2006 scores. The difference between the two 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/](http://www.spec.org/cpu2006/).

Figure 1 presents our SPECint2006 results.

SPECint2006					
	VMware vCloud Air	Microsoft Azure	AWS	% vCloud win vs. Azure	% vCloud win vs. AWS
2 vCPU	43.0	35.7	32.8	20.4%	31.1%
4 vCPU	80.5	65.2	62.2	23.5%	29.4%

Figure 1: SPECint2006 results.

Figure 2 presents our SPECfp2006 results.

SPECfp2006					
	VMware vCloud Air	Microsoft Azure	AWS	% vCloud win vs. Azure	% vCloud win vs. AWS
2 vCPU	43.4	34.9	31.2	24.4%	39.1%
4 vCPU	81.7	64.1	60.7	27.5%	34.6%

Figure 2: SPECfp2006 results.

We configured the instances as close as possible for testing. Figure 3 shows the instances we used for testing. The processor is as reported by the instance.

Compute instance	Virtual CPU	Memory (GB)	Storage (GB)	Processor
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 D2	2	7	30	Intel Xeon processor E5-2660
Azure D3	4	14	30	Intel Xeon processor E5-2660
vCloud Air	2	8	30	Intel Xeon processor E5-2650 v2
vCloud Air	4	16	30	Intel Xeon processor E5-2650 v2

Figure 3: Instance configurations.

We configured the instances using the default templates of CentOS 6.4 and then ran yum update installing all updates. For testing, we used kernel version 2.6.32-504.30.3.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 file below. For each instance we ran SPECint\_rate2006 and SPECfp\_rate2006. We performed three complete runs of SPEC CPU2006. In between runs, we powered off the instances and then powered them back on. We used the median of the three runs for the comparison.

```
#####
# 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:
# Last updated Wed May 7 14:04:33 2014
optmd5=8e5442d510730679cc400286290651ed
baggage=
compile_options=\
@eNqtUElVgZAMvedXWlkHae0N1Uo10DYbEKSWyy6oo2FjI6Qi6bT9+5kytK/b1ChynuWx+/1lpmP6\
8KLqplVgTq4xnfwJdX1TubI/d8emL19V39TvAb2hhMs09+GxqoDhNdMPzwCLdnnMS54XCLMoDosN\
MOEBMDkHVTcH63CQewKmtX7DaK0a42x8kKXr00AJxtJ8Br/PwppzX6k14T5wH1AUQi9YhrCy3wf0\
hypKUCsKwierzQ5rfxVeGGGc8W05kYRHifQBu41U3MeY+b9+ShKR3Y1+XcmHhX14VpWzS8Ss1VP6\
a+nBjiT6tOZ6i2DXdLXflokIB5daTcdBshhc/2b5B0GkrY0=
exemd5=29fb5df3f4b6bc9744c59b6a6cbb99e4

401.bzip2=base=cloud.i686=default:
# Last updated Wed May 7 14:04:35 2014
optmd5=398ec4b92cd3500251cf75b8012d6d9e
baggage=
compile_options=\
@eNqtUElVgZAMvedXWlkHae0N1Uo10DYbEKSWyy6oo2FjI6Qi6bT9+5kytK/b1ChynuWx+/1lpmP6\
8KLqplVgTq4xnfwJdX1TubI/d8emL19V39TvAb2hhMs09+GxqoDhNdMPzwCLdnnMS54XCLMoDosN\
MOEBMDkHVTcH63CQewKmtX7DaK0a42x8kKXr00AJxtJ8Br/PwppzX6k14T5wH1AUQi9YhrCy3wf0\
hypKUCsKwierzQ5rfxVeGGGc8W05kYRHifQBu41U3MeY+b9+ShKR3Y1+XcmHhX14VpWzS8Ss1VP6\
a+nBjiT6tOZ6i2DXdLXflokIB5daTcdBshhc/2b5B0GkrY0=
exemd5=a6bc8d9618cb4ac6ec49425fa14cb82e

403.gcc=base=cloud.i686=default:
# Last updated Wed May 7 14:04:50 2014
optmd5=2a3e0107cb04c38ce219e7d06eef2cfe
baggage=
compile_options=\
@eNqtUElVgZAMvedXWlkHae0N1Uo10DYbEKSWyy6oo2FjI6Qi6bT9+5kytK/b1ChynuWx+/1lpmP6\
8KLqplVgTq4xnfwJdX1TubI/d8emL19V39TvAb2hhMs09+GxqoDhNdMPzwCLdnnMS54XCLMoDosN\
MOEBMDkHVTcH63CQewKmtX7DaK0a42x8kKXr00AJxtJ8Br/PwppzX6k14T5wH1AUQi9YhrCy3wf0\
hypKUCsKwierzQ5rfxVeGGGc8W05kYRHifQBu41U3MeY+b9+ShKR3Y1+XcmHhX14VpWzS8Ss1VP6\
a+nBjiT6tOZ6i2DXdLXflokIB5daTcdBshhc/2b5B0GkrY0=
exemd5=28a44627765558dbb6e1d38ef0c35b8e

```

```
429.mcf=base=cloud.i686=default:
# Last updated Wed May 7 14:04:51 2014
optmd5=3f2172f77d4d0378fe6316c20a2c1d31
baggage=
compile_options=\
@eNqtUVlPgZAUfe+vaPpeE7c3MpZAwQ0FSgRi4ksza1GU0oV2Rv+9l7H5Md/Mmub2pPf03nNpc9NT\
vXlVTdspbLauNb31kHVdK50Ydvlj04g3NbTNh08uCWI8Kzz8JCWmsM3xxYXBNCqLmAlW1ADzKA7r\
FQZ0F+SvKkuIieKWVxxTPse0aTbWQVv3jKnW+h2itWqKs+kAlm62I8WfUvMZP10La3aDVEvEPMY\
T0AW2WMeXvOi8skvjQSBcpB3lQarEnJ/9e4ZYZyztWBfrJMBCOIehuJlJtzHkP//OASlSX4zmXkm\
Wxbm4UVJZ5eAaaeP198ej06k0cGp8w0CVbOgWos0CUfPOk2mRrweP+HHD3wC8H+23g==
exemd5=4f40a78398e1eaaefa5d4528b9c4f38b
```

```
445.gobmk=base=cloud.i686=default:
# Last updated Wed May 7 14:04:56 2014
optmd5=a9e2c83c29ce243ebd97b0b8046a0579
baggage=
compile_options=\
@eNqtUULzgyAQvfrsRGO6k0+TmxMxENGqr4kxiD70wqcGWViQj2mn/fZeYpF+ndsLA8mB3Yd/bXLdE\
bV9ELRuB9L6XujWuY/pOVj3vhnYnO/4q0lme/gaO5RlhYseqwoRmPqUMdGIBOsipJwJcA8CF0y\
AhAv70JOWb5KIh4jkkzsGs2VbKtm2Al7OGNE2AyRut6aHsrqnxBRsr2BNUaMdjpuEKXqvQ3xRtds\
in6OudFDV4mFQ11EqYehbHzAzL9hxcB3D3zhgB5hB+at0Ga3B95vPiCIPcxrzc9AfCWKHuQj+TrLk\
PoT8/7PPTprkt2MvLqTAXD88i6o3C8CkUafrT4mseG1wFpJyRODVbLmJeZr4VtNG4fEjVtoefWnQ\
BxvQyAs=
exemd5=77c1ce55c918e3cf0c78729ffc9c6b61
```

```
456.hmmr=base=cloud.i686=default:
# Last updated Wed May 7 14:04:58 2014
optmd5=afe9b8a1afc1a22dae9a7c784da3678f
baggage=
compile_options=\
@eNqtUElPwzAMvedXWlKhie1WrZPWTixC21TaetmlGiWFQNNMSYbg3+MSJr5uaFFkW/Fz/N6rzMj0\
/ln2apBgDl6Z0UXEeas639rjeK9s+yKt6t9iekkJF2UdwUPXAcNrThMXBl6qTPe8rrBskqzpFkd\
ABNzYH2/dx63+EdgWutXjM7JEGchIUr3hwkSh9Z8Br/Pwpmj7eSS8Ag4jymyoB+1SG5EvY3pD0qU\
IFFkclWslhvs/avHiYgAB/My32WI+D9VSoq8ug2+nEnywtw9yc675WTioE/PX/om5UX66cL5hOCv\
5Wp73RZ5Mrk2aBoWiWYy+Ju77xllp+Q=
exemd5=c4aad157890c4ea6178037340bd7bffc
```

```
458.sjeng=base=cloud.i686=default:
# Last updated Wed May 7 14:05:00 2014
optmd5=398ec4b92cd3500251cf75b8012d6d9e
baggage=
compile_options=\
@eNqtKFFPwyAQx9/5FBfeMXF7a9YljnZLXVeazL740kyEiy6yADP67b2uGqd7W0bIceHu4Pf/V65j\
dvOmtNkpcPtoXbcSEqI3Mrb+0D0b374rb/RnSm8p4WJVJ7CvEhhu9zNx44Bl6zrnLa8bTKssnzUL\
AGBiDezrTYj4S3wBzQ39wBiCGuJoOLDL6n3fkg618Qj+r0lwBy/VlPAEOE8pUtBjLmb3on5I6R8k\
ShAUaeb13WKNtXM8SkQCofIisiscCoY5HpaQsquXgy5Ukt9zTq5IxTE/ufsXlssvs24LrqTi+Kpre\
yhMfvwDiT6H9
exemd5=1459f8b581e61330578589979e8b8cdf
```

```
462.libquantum=base=cloud.i686=default:
# Last updated Wed May 7 14:05:02 2014
optmd5=dd2d18aa19b4ee31f2e2aa4070ddb523
baggage=
compile_options=\
@eNq9Ud9PgZAUfu9fcek7Jm5vZCyBghMFSHwk6guZWBSldKGd0f/ew445Y3zRxKa5u/z+ffddpnpH\
bp5F03YC1Na0qtcu0WZoa1MNU/6+HaoXmbTNm0dPKWE8zVl4qGtw8Kop40SBE67ziFUsL9HMwigo\
VwDg8Dk4TbPRBrUyR3CklK8otRZwzqzCKNlsxxDPuuYzmM5n5Sqs/J6+19otRtqsSTMBcY8iqjo\
h82DC54XHv0CkRIEjjXOEn+1Rt93uJRwFzAxTuPbCCN+D33fi18VfhAncXFz3M8OQmqS0v1Xln6\
gaCFunsStdHLMaSTBzoPlIxxkJeGeuH+dHRUnfnGOz2DcRsepXcLLcW1HO3sH2+bEwg==
exemd5=1bdfb20d8c111ef9fe052430dc08afb9
```

```
464.h264ref=base=cloud.i686=default:
# Last updated Wed May 7 14:05:11 2014
optmd5=afe9b8a1afc1a22dae9a7c784da3678f
baggage=
compile_options=\
@eNqtUElPwzAMvedXWlKhie1WrZPWTixC21TaetmlGiWFQNNMSYbg3+MSJr5uaFFkW/Fz/N6rzMj0\
/ln2apBgDl6Z0UXEeas639rjeK9s+yKt6t9iekkJF2UdwUPXAcNrThMXBl6qTPe8rrBskqzpFkd\
ABNzYH2/dx63+EdgWutXjM7JEGchIUr3hwkSh9Z8Br/Pwpmj7eSS8Ag4jymyoB+1SG5EvY3pD0qU\
IFFkclWslhvs/avHiYgAB/My32WI+D9VSoq8ug2+nEnywtw9yc675WTioE/PX/om5UX66cL5hOCv\
5Wp73RZ5Mrk2aBoWiWYy+Ju77xllp+Q=
```

exemd5=cb7d87072aeb92cb65b3173b7a878950

471.omnetpp=base=cloud.i686=default:  
# Last updated Wed May 7 14:05:18 2014  
optmd5=ce797cb647de7e8f63b165eefdbb6e2e  
baggage=  
compile\_options=  
@eNqtKfFwiAUhu95ihNuDs7Tu2Y1WwnnutXSRJuY3TRa6cZWwAA129sPrUaXXSxZJOHA4fzAf75c\  
KyJXH7wRLQe9dUIrGyDrjKhdZTq1EabacSOarxDfYkTzrAjgdTAAUGPRpxtDDSSeFwmtaFH6bR4n\  
UTkFkg791FJxVwlvT92G+7wVa3vD1U4YAMLGQJpmZZ134d6ASCk/fbSW93HUL14lm+1eEval8QjO\  
487qztR8gmgAdLkMsTeIjwmLnlixCPEPvxj5LrzVh+x+Ove1394PiijJ6WN1Ev3RDEYSAP9VoktF\  
Ei//f2cYZWn+3GO+FiG9fue1s50Lsz0OPaosPmK7XheHVlm5h39B/hv/3bth  
exemd5=f506dd491b15c8d5615ddf3f636f11d8

473.astar=base=cloud.i686=default:  
# Last updated Wed May 7 14:05:20 2014  
optmd5=3062caf89235eab99ad0a9e002e3dee3  
baggage=  
compile\_options=  
@eNqtKfFwiAQx9/5FBdeDUumb81qYilzbBwa2CZmL0Qr3bqtxRRctm8/ajXW+LbIwwF3f7j//YRp\  
SL3+1GX1pcHsXGUaGyDr2qpwt0326pV37qyty8Q32NE5SIN4G00AlIAMacXdwZIVewZVTTN/VHE\  
LMrng5xKeJYlTDER85kAIHICpCzXlvnu7h1IXdc/Plqr+zjuN6+qy10nCFvSZAzn9WDNvi30FNEA\  
6GoVYm8MHY8yepZpFuILnxh5997OYzKbL33t2vNBETFBn9SV6HIIjGQAvGVf8FfmZf+fCKOEi5ce\  
663ImM2HLpydDnJnDB2iJD7iut0Uh1913kefEP8DA/izNw==  
exemd5=ba27e6d937a6228ee9c9c90fdd7613ce

483.xalancbmk=base=cloud.i686=default:  
# Last updated Wed May 7 14:05:48 2014  
optmd5=7717b057a25e3609370b011815e9b6aa  
baggage=  
compile\_options=  
@eNrtVf1vmzAUfedXWLxWFC3dU9RUcsBL3RmMMFR0LxYjppqXDOMKkav99DYSErn3qtD3NEvh+HF/M\  
PccOvePi/JcoqloAteSq1e1lpbu2Kjre7ptt1fIn0Vbly8r+YlseDaIluD87A04BHDWtOFFa8VmE\  
PO5FqTFDH63TDTAWjCIeUp5cxwj6zAQySGDIcRiggAdswmFPoqBg8/N8yzaQujizLlbJd96biV3\  
9Syk8+eZt++q2g30PVH5VrTaxU0gpGpfockbd7oQo2YQjVPPSCv86Zwq6ao91ththrf9IZnAYlg\  
zPotHgNpgsnkjkk2uQxmX72Zs5hsnwaTeQsJ9mFCh1WmHE8Z4iFM8C3iSxQxD5tGhJcfcVUIMbhB\  
U8PoBXDKMted4a97AI6U0nRCai3G92KcDEqWux6yG1MXC9CPE1+c4DDNhiC41Gpv2nRleUvgZdnK\  
NlTbB4eub2iUrOw3zNuW0Ymp8o3ADTO59yoYEGsUetfcFDni/gvj7wjDtugSGJ5wgH8g0+jPy2Sk\  
NssiGidwjQl07uYeJ7KxLTN9H6+EP9Xkx5IEl+rnogy6fQVO4yTAXpzEPwj1H//68Gma9mdiDiBe\  
AWxnoCc=  
exemd5=0748b31b591299e6d2d4e4d33b95d50a

999.specrand=base=cloud.i686=default:  
# Last updated Wed May 7 14:05:49 2014  
optmd5=398ec4b92cd3500251cf75b8012d6d9e  
baggage=  
compile\_options=  
@eNqtKfFwYQAQx9/5FBfeMXF7a9Y1jnZLXVeazL740kyEiY6yADP67b2uGgd7W0bIceHu4Pf/V65j\  
dvOmtNkpcPtoXBCSEqI3Mrb+0D0b374rb/RnSm8p4WJVJ7CvEhhu9zNx44B16zrnLa8bTKssnzUL\  
AGBiDezrTYj4S3wBZq39wBiCGuJoOLDL6n3fkg618Qj+r0lwBy/v1PAEOE8pUtBjLmb3on5I6R8k\  
ShAUaeb13WKNtXM8S8KQCOfisiscCOy5HpaQsqxgy5UkT9zTq5IXtE/ufsx1ssvs24LrqTi+Kpre\  
yhMfvwDiT6H9  
exemd5=5a4e32331a09f7ed93bface48d594d69

410.bwaves=base=cloud.x86\_64=default:  
# Last updated Wed May 7 14:05:52 2014  
optmd5=8f598a26cf4f1f73f8c7ef8d57a9871f  
baggage=  
compile\_options=  
@eNq9UUIPwzAMvfdXWLkHCY4Vouk9WNTIWSi1h7gUpWSQIAOU5Ih+PekLd06K0jzWzHs9/yc50J3\  
WDXvXMGpDnrnpO5sGFhnZotqsg++epak/uZHi00KXKEjohoXwIrRxpukAt4D1gXahAdMZyCEa6/xQ\  
9wpYKfX1s7V8zFfj41FK7HpINLZurmFu9d60fBEkIaySCB1E0FCg8S11ZYROFFHg101YtSLL9db3\  
0i3LktoXAKdFmsXVGyU0BE/MN/lj5hF/32/QYvS+XMY5yucHqVxNWA8geXE3Medfbnj26Xj4jbl+\  
euOtsws4xtGR3iusts074/8HbVr1V5qc6AfK0r10  
exemd5=d89c13e979876929258f22cafd5ff0c0

416.games=base=cloud.x86\_64=default:  
# Last updated Wed May 7 14:06:29 2014  
optmd5=4a85b738b8b57c6044cfee81fc0c8dc8  
baggage=  
compile\_options=  
@eNq9UUIPwzAMvfdXWLkHCY4Vouk9WNTIWSi1h7gUpWSQIAOU5Ih+PekLd06K0jzWzHs9/yc50J3\  
WDXvXMGpDnrnpO5sGFhnZotqsg++epak/uZHi00KXKEjohoXwIrRxpukAt4D1gXahAdMZyCEa6/xQ\  
9wpYKfX1s7V8zFfj41FK7HpINLZurmFu9d60fBEkIaySCB1E0FCg8S11ZYROFFHg101YtSLL9db3\  
0i3LktoXAKdFmsXVGyU0BE/MN/lj5hF/32/QYvS+XMY5yucHqVxNWA8geXE3Medfbnj26Xj4jbl+\  
euOtsws4xtGR3iusts074/8HbVr1V5qc6AfK0r10  
exemd5=d89c13e979876929258f22cafd5ff0c0

```
@eNq9kl9PgZAUxd/5FDd9Z41/YiIZSwZj09pRsrEHfSGTtYqutKHMTD+97XAToyaLJvJQmtsD59zf\
bSIRVyyfGC/XDKRqSllpZ9FNXRZNXm+qVvnnz6wu+YuPTpAzTlMPTGKFUGDuaJ5GYR6mizyheUwJ\
iWY4izt1s01GubCYdLUkvTgHgL6Wm7pgA3DlYd/jSpWvbNXj11vHOAVREsa5MR2T4WTuox8ckdWa\
4hfVwX+nSOksGwaY4Ozm069sIOSEdGo091zWTb2swC1ssHciPQkuPQOX86VuDK/mAVvhxNasWrN2\
PWLfRiW4shK/PTLN7ttzQg/GoY/2JmhXoMEVTTOTqOt4TEvUA/MhnuLbyCh+n+8IOAQn1x04f6IB\
3lyG3dOXd4+saPTAstZiX/6AYnGRUZffPyIw3tNhFucEB3Yga4HaOHRhZ9cZ3Bsg6P1O
exemd5=460104d3d4572647353a1db8d26d1939
```

```
433.milc=base=cloud.x86_64=default:
# Last updated Wed May 7 14:06:31 2014
optmd5=e6f86cb1e67d58e27787938eb7158d34
baggage=
compile_options=\
@eNq9UVtPgZAUfudXNH3vEi/xgYw1UNiGAm3Wbom+NBn0bEulBn9957Cbsb4MhMbctqefrTfJdNr\
Ui/firJaFUhv2kqvjueYtqnyVjXb9VPVqPeiqcpPD19gh7KUu+g5zxGBT+//GGHEQsEjqiifwzIL\
o2A+QSQewGac2eILCRN12Wmhm0qmXC0iKt1MQDcUis+mXTOJszuBEGFXiJT10rTArn1BpK7rD6jG\
FH297CdA1eXGQrz+6OYa7caRkEr4sY2GRm+bvBg51EWUehjE4G7Ng1vGpYe/KcMO6IU7xok/EXD2\
U2WHCKKMTtUedKZs7DAXAYU4jR8iuOZ8DzpOnM2kH8RJLO9PiXduYMe+2Cf5R7N/8XmoH1+LvDUJ\
ClnVh1QOzlrPk3Dn/z8Kh2dTX07B8sBmtapxz4TNbfYnwX8B91X1YQ==
exemd5=a2b45cd40a043249b27a03c181200ef3
```

```
434.zeusmp=base=cloud.x86_64=default:
# Last updated Wed May 7 14:06:34 2014
optmd5=4953ddd4d0db69456081eb61a49f3e21
baggage=
compile_options=\
@eNq9UctOwzAQvOcrVr47Eg8hETWV2jStAmls0eQAL6ikNhhIbNkuKw9TkJpDj1UIOHDerUe7+zM\
ZrLB9fgVcfHGQCORZGMCz1gtKlvqbbMRUnxnWvCPEJ0hb05pAEaxSiKAwLMVjaMyooVLS1k8LRaD\
WpnSq0uHghm51RUbA5Y/uc+vEps4/PrnedaOvg8nSxWITrSE7UISu7yyTRJk/x+COPIkBerpcM8\
camtXjeAq5bsW44vAZMLwJyvvXV17TPguq53LhrD+njeXw5Vc9VCwv7JCdiP7EUBzKMq7U1QVYDT\
G0JzN9GQEZ0giQTgPibL5CF2iN/Pd4I5aZLdDs5kxtwZMHdGcnHF1ZMZ4bDOTjSepXOhub9o/6O\
mxTtlgYr+gLBaERO
exemd5=c6be4e90e9decbdee6e48ff8c5aa93cd
```

```
435.gromacs=base=cloud.x86_64=default:
# Last updated Wed May 7 14:06:42 2014
optmd5=83149b556d072f8dbc56ec54626eb427
baggage=
compile_options=\
@eNq9kl1vgjAUhu/5FU3vs7KPLBLRE6gg3ZCSiUu2m8bVdmMTSgAXt1+/VtSQ6BKjib1oS/vSc97n\
nFgVKJ99CZktBFB1k6midqy6qTLESgPzZLOKfYsqkz99eAwTIEkcUJeClyUAAA0niY8ZTqZ6Gw99\
bZrqnlEoubvVq16tlhUXA4DUbm/Lssx+xdyW9ytLP6nlQeSOJn144E1oFAl9S12PRCR96YrWQaCF\
6Vhr3qWqmpWAMRNsI0dWwFEbWCSclY32mz+zAVCe5ys917Vo5+t20apclkbSb6+0gW3KFnZAgPtw\
GwSuD6j3QJNUZ9SNCl+wRB2gfyRj8uprxen5HQ+H830uBwoLELHLV+g++wzTOCAjFp4FcDP2G6Md\
Xb7Y8OV8jRafjFYrPD/GIcNblb6jixYgIvFjppzvPpPkPyJ56+xS8qQdGssh32HfoDNRo2G3gS/ag\
A8ZuGrKIEKYgixy26dCpQXcNvH8xufZx
exemd5=92a924c6219e4ce77a2274c6809a1b49
```

```
436.cactusADM=base=cloud.x86_64=default:
# Last updated Wed May 7 14:06:48 2014
optmd5=50702756905b047fe98e8df22da44f41
baggage=
compile_options=\
@eNq9kl1vgjAYhu/5FU3vy7JDloyoiRTUbkjJxIvthrjabmxACv1269fK0pIdIvRxF6UUh6+w/t+\
oSxQvvjgIs04kGWdykI51qqrlnVJtSgWaZV88ioV3314Ca1RFD1AlZyVJQAeBPIxwm05voYer47\
H3fukiC6vdFUT81VxfGAINmebVGV6Q9f2uLuy9IhNT4KhuNZH+6JcQ0R0cd46JKAxE9daJ0EWphO\
NfMqZFXxiwIgzpJt2rElQPQaICEWqtbN1m8A5Xn+pXe1eLNFNQ9N5aI0SL/5pBvYlmxhB4xwH26T\
wPUFde9pFOuKuhnhAS1RB+gfyZQ8+5o4vr7DxWfSv5c9BgJE0oJlq6WOT2z7on3xMKaef5KwM7U7\
I83qSo2N1IytVcZHq6wJ1w/xJMFb6t/mzmpLQMKHszsyeKOWfmvbkzytntRoYJMTbBl0vjb6B1x3r\
c06mAb6DeJIExDXeZD1syqFzY3bH6V9Yq17j
exemd5=2f69aa03ea5792418158a8e8994a56e2
```

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437.leslie3d=base=cloud.x86_64=default:
# Last updated Wed May 7 14:06:53 2014
optmd5=8f598a26cf4f1f73f8c7ef8d57a9871f
baggage=
compile_options=\
@eNq9UU1PwzAMvfdXWlkHCYY4Vouk9WNTIwsi1h7gUpWSQIAOU5Ih+PekLdO6K0jzwZHS9/yc50J3\
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9wpYKfX1s7V8zFfj41FK7HpINLZurmFu9d60fBEkIaySCB1E0FCg8S11ZYROFFHg101YtSLL9db3\
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```
euOtsws4xtGR3iuSTs074/8HbVr1V5qc6AfK0r10
exemd5=847e46840b9c5a39aa391c3dfe5cd236
```

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444.namd=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:01 2014
optmd5=0c46b969c416c9adae32501e2eae441f
baggage=
compile_options=\
@eNq9Uc1OwzAQvfsrRr5WRmIRh6ip1CxUhjS2aCIVL1EJNgRIXMUgr9nkrS0CE4gMYfxMst78yY1\
DatXz0pXLwrM2lWmsR6xrq1KV7Sb5r5qi1fVvVrdp8eUhGIuPXgYjYCVwMyu4sgAixYyDotQ5nhN\
ozjIZwDaxCkwrVfWIYp7BFbX9Rt6a9XgT4YDs2q971L8IXR+B135Z9MikcMX2tiaTVuqCQk9CJdL\
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IOIf9f1zHhibuydVOjuBve3F6IRKqo1o/zh1DyvybjcHi/kAeGu63g==
exemd5=b4861d8de61102ce03d95b0a2a0db697
```

```
447.dealII=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:22 2014
optmd5=b116d89bce0a3477670ed5b192b420c8
baggage=
compile_options=\
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5E5SzP1k2FV4YexPBTY51J1HmljCbgTBZuwxxC7nS9ChSvsg8cz0WsezhFHonCLEiFt/3c/yj1r9L\
DSP99Crz1ozhaEdhd6JHwX4A/8i6+5YvdmM+GfIX6fPj6g==
exemd5=ce19a064ded65deb33a85a25c81ea77d
```

```
450.soplex=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:27 2014
optmd5=0c46b969c416c9adae32501e2eae441f
baggage=
compile_options=\
@eNq9Uc1OwzAQvfsrRr5WRmIRh6ip1CxUhjS2aCIVL1EJNgRIXMUgr9nkrS0CE4gMYfxMst78yY1\
DatXz0pXLwrM2lWmsR6xrq1KV7Sb5r5qi1fVvVrdp8eUhGIuPXgYjYCVwMyu4sgAixYyDotQ5nhN\
ozjIZwDaxCkwrVfWIYp7BFbX9Rt6a9XgT4YDs2q971L8IXR+B135Z9MikcMX2tiaTVuqCQk9CJdL\
nyIfun2I4FLIzKdf6FGCpLHJRTKdLTD2nSolwgMs5HN+G2PG72n3WFJcZ9OAJzy7OYTrh6Ak4enV\
IOIf9f1zHhibuydVOjuBve3F6IRKqo1o/zh1DyvybjcHi/kAeGu63g==
exemd5=50866441530d18e729cf9d14969436db
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```
453.povray=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:33 2014
optmd5=0c46b969c416c9adae32501e2eae441f
baggage=
compile_options=\
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ozjIZwDaxCkwrVfWIYp7BFbX9Rt6a9XgT4YDs2q971L8IXR+B135Z9MikcMX2tiaTVuqCQk9CJdL\
nyIfun2I4FLIzKdf6FGCpLHJRTKdLTD2nSolwgMs5HN+G2PG72n3WFJcZ9OAJzy7OYTrh6Ak4enV\
IOIf9f1zHhibuydVOjuBve3F6IRKqo1o/zh1DyvybjcHi/kAeGu63g==
exemd5=3d5c9b939fedc35f0197f8ec690419f4
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```
454.calculix=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:42 2014
optmd5=a415db3e25b10c1817f5f8fclcd12de2
baggage=
compile_options=\
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9xbTXiwn6c21Vg2V3FSMjwCS3XsgyjL74quBuN1aOqWWT0J3GjvwSE5oFJQ8JK4XhEHY2BftikAL\
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OdyZ5vSBYwOcsR1r/M9Zh0F039vWMxH+QG8on984q9XISNZ5x7rjZUiG4/4a/+W62WduJrM0DDwz\
hnUOGztkYcbam+k3fhda8Q==
exemd5=85a1ebec9dd144bd861c1b2bd86878ba
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```
459.GemsFDTD=base=cloud.x86_64=default:
# Last updated Wed May 7 14:07:59 2014
optmd5=4953ddd4d0db69456081eb61a49f3e21
baggage=
compile_options=\
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G0JzN9QEQEZ0giQTgPibL5CF2iN/Pd4I5aZLDsz5kxtwZMhdGcnHF1ZM4bDOTjSepXOhub9o/60\
mxTtlgYr+gLBAeRO
exemd5=ed9c5b9df50f3b3b47b8b35b5baf796f
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```
465.tonto=base=cloud.x86_64=default:
# Last updated Wed May 7 14:09:18 2014
optmd5=f6c0fd6aaa8c815d3fabe721bda8be5e
baggage=
compile_options=\
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J8w12PMTn+B4d4qiiEQstLG9QCHCCRGvErJ22x1N1W/kqKWYsi9mCKXuTRVKfaQky5Geyygf+cA\
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0nsVeGPz/rH+gZukfZdGLfoANeU8A==
exemd5=0958738f8cae69d85990a0c7f858200e
```

```
470.lbm=base=cloud.x86_64=default:
# Last updated Wed May 7 14:09:19 2014
optmd5=d1eb52389405453fef84729bdd70d0c9
baggage=
compile_options=\
@eNq9U1lPhDAQvfdXTHqviR/xQJZNo0BaLbRx4aAXsiIoSumGdo3+ewusu2uMF01smumk82bmzZtU\
d0StXqq6aSvQa9voznjI2L4pbdFvuoemL16rvqnfXyMERWJ9OCxLIG4qz8zjjSQAcljWlCZOzeN\
4jBfAAARp0DqemWs62KfgCil3pwlpprsyfQ4lKrXA8SfQudnsD37wgWX+2+YGb3py2qOqAeU+tiR\
wqMvwishMx9/YiR4+1qXPBgsXsX72wxEh64RJawu9ghfs987CXFTRaEjLPs9rDdOANGnKXXk45/\
lOgHdWb6/rkqrZkPkFbttNzPMsJFo61q/zi4a5sE2WXBWTisoVV4YiLyYWMH6/oAY2XCKA==
exemd5=4bc6792deb472d46cc7426efc2fa78d0
```

```
481.wrf=base=cloud.x86_64=default:
# Last updated Wed May 7 14:10:16 2014
optmd5=9f89282b17f118816f38bb4350de567c
baggage=
compile_options=\
@eNrdU1lvmzAUfedXWlXDM6yalmhUAM6b2BbQLRSL1bmmI0tFahI1+3X1yakIWsQVY20h/rB9rkC\
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zWpj1wWwsA0sH5MUU71+prGf4K/IuVioPKLhESIohX6gNijikMbImehgNIBLBSB1I5YcMFqyAwhm\
lzxJXek7ISWoZ5MA33BvEfaQEefdzDZV0chdcP9GLiYJD5xpn4Ny4kYoxEnKWawurmIJQ5BDttCf\
feQtbkYxHrK3V2MM3QTxIHSPSZgs1gCA9221bYs8Blb1sLezus7/yrWdze4MpaWHCPzAlaz6kMQx\
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ZSEW2UVEis12LYFF3wArylZtp5qj+6EsKY07Nbet3M3T3aJYRVZriR7pKpj77QB5yCAjrnPbfYB\
6n2kLFXHX1/kmQoNtTKQTt7cN0gocqA40nVgnvGOZ3gyaCvEY1lPddFpqc/SehgVbdB+jP2C2i8h\
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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=\
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tcJy8VpWoi5BrY1QK+062jSiMLzZrB5Fw9/KR1QfHjpDDmGz1IWNogBst9q9GCjA43kaEk7S3F6T\
cRjkU8B0cJqP/LuQE5ZM6JRhfZnWYrKxogYAzC4AV9VCGzuSeQYspXy3Ueuyj+f9YVGYWrcQry9d\
XcJ2HbrxOD2kYajVpinKkUNcIMRD1gHq7iy4ZmmorM6yLEk7R+T2J/Obe0rtQ4RhAmJ+A70E67I\
YS7YvnRGH0L79vfeU0FSDpv5AY1pdn88bScBcmKa3PSe/VHhb8QdquVLWRg9aiG13Fux17MV0h5v\
Rf9H4rbtzm8iHtOgNaiWqJ+E5a3hR25/ApzV35c=
exemd5=0315dae2aa4c5fd47f4a171ba3bc49bf
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998.specrand=base=cloud.x86_64=default:
# Last updated Wed May 7 14:10:19 2014
optmd5=4b62c783978861f681397e52994273bc
baggage=
compile_options=\
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exemd5=f639e705a1d96ef85782e1b8d885aefb

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