



## m4.4xlarge Amazon EC2 Cloud Benchmarks - December 2017 vs. February 2018

Testing for a future article. Using m4.4xlarge Amazon EC2 instance type in Ohio, comparing older December 2017 Linux results to February 2018 updated Linux distributions performance. Tests by Michael Larabel for a future article.

### Automated Executive Summary

*Feb 18: Clear Linux had the most wins, coming in first place for 40% of the tests.*

*Based on the geometric mean of all complete results, the fastest (Dec 17: Clear Linux) was 3.704x the speed of the slowest (Dec 17: SUSE SLES 12 SP3). Dec 17: Clear Linux was 2.22x the speed of Dec 17: Amazon Linux 2, Dec 17: RHEL Server 7 was 0.337x the speed of Dec 17: Clear Linux, Dec 17: SUSE SLES 12 SP3 was 0.801x the speed of Dec 17: RHEL Server 7, Dec 17: Ubuntu 16.04 LTS was 1.62x the speed of Dec 17: SUSE SLES 12 SP3, Feb 18: Amazon Linux 2 was 0.992x the speed of Dec 17: Ubuntu 16.04 LTS, Feb 18: Clear Linux was 2.148x the speed of Feb 18: Amazon Linux 2, Feb 18: RHEL Server 7 was 0.337x the speed of Feb 18: Clear Linux, Feb 18: SUSE SLES 12 SP3 was 1.049x the speed of Feb 18: RHEL Server 7, Feb 18: Ubuntu 16.04 LTS was 1.314x the speed of Feb 18: SUSE SLES 12 SP3.*

*The results with the greatest spread from best to worst included:*

*Systemd Total Boot Time (Test: Userspace) at 174.606x*

*Systemd Total Boot Time (Test: Total) at 141.168x*

*Systemd Total Boot Time (Test: Kernel) at 109.124x*

PHPBench (PHP Benchmark Suite) at 4.676x

R Benchmark at 4.459x

Stress-NG (Test: Semaphores) at 4.073x

Gzip Compression (2GB File Compression) at 2.898x

Schbench (Message Threads: 32 - Workers Per Message Thread: 16) at 2.556x

Redis (Test: GET) at 2.288x

Rodinia (Test: OpenMP LavaMD) at 2.264x.

## Test Systems:

### Dec 17: Amazon Linux 2

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU, Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 8GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Amazon Linux 2.0, Kernel: 4.9.62-10.57.amzn2.x86\_64 (x86\_64), Compiler: GCC 7.2.1 20170915, File-System: xfs, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86\_64-redhat-linux --disable-libunwind-exceptions --disable-multilib --enable-\_\_cxa\_atexit --enable-bootstrap --enable-checking=release --enable-gnu-indirect-function --enable-gnu-unique-object --enable-initfini-array --enable-languages=c,c++,objc,obj-c++,fortran,ada,go,lto --enable-libatomic --enable-libcilkrt --enable-libitm --enable-libmpx --enable-libquadmath --enable-lsanitizer --enable-plugin --enable-shared --enable-threads=posix --mandir=/usr/share/man --with-arch\_32=x86-64 --with-gcc-major-version-only --with-isl --with-linker-hash-style=gnu --with-tune=generic  
System Notes: Python 2.7.5.

### Dec 17: Clear Linux

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU, Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 10GB, Graphics: Cirrus Logic GD 5446

OS: Clear Linux OS 19700, Kernel: 4.13.12-56.aws (x86\_64), Vulkan: 1.0.39, Compiler: GCC 7.2.1 20170910 + Clang 5.0.0 + LLVM 5.0.0, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86\_64-generic-linux --disable-libmpx --disable-libunwind-exceptions --disable-multiarch --disable-vtable-verify --enable-\_\_cxa\_atexit --enable-bootstrap --enable-clocale=gnu --enable-gnu-indirect-function --enable-languages=c,c++,fortran,go --enable-lto --enable-libstdcxx-pch --enable-lto --enable-multilib --enable-plugin --enable-shared --enable-threads=posix --exec-prefix=/usr --includedir=/usr/include --target=x86\_64-generic-linux --with-arch=westmere --with-glibc-version=2.19 --with-gnu-ld --with-isl --with-ppl=yes --with-tune=haswell  
System Notes: Python 2.7.12.

### Dec 17: RHEL Server 7

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU, Memory: 64512MB, Disk: 10GB, Graphics: cirrusdrmfb

OS: Red Hat Enterprise Linux Server 7.4, Kernel: 3.10.0-693.el7.x86\_64 (x86\_64), Compiler: GCC 4.8.5 20150623, File-System: xfs, Screen Resolution: 1024x768, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86\_64-redhat-linux --disable-libgomp --disable-libunwind-exceptions --enable-\_\_cxa\_atexit --enable-bootstrap --enable-checking=release --enable-gnu-indirect-function --enable-gnu-unique-object --enable-initfini-array --enable-languages=c,c++,objc,obj-c++,java,fortran,ada,go,lto --enable-plugin --enable-shared --enable-threads=posix --mandir=/usr/share/man --with-arch\_32=x86-64 --with-linker-hash-style=gnu --with-tune=generic  
System Notes: Python 2.7.5. SELinux: Enabled.

## Dec 17: SUSE SLES 12 SP3

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU, Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 10GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: SUSE Linux Enterprise Server 12 SP3 12.3, Kernel: 4.4.92-6.30-default (x86\_64), Compiler: GCC 4.8.5, File-System: ext4, Screen Resolution: 1024x768, System Layer: Xen HVM domU 4.2.amazon

Environment Notes: LIBGL\_DEBUG=quiet

Compiler Notes: --build=x86\_64-suse-linux --disable-libgcj --disable-libmudflap --disable-libssp --disable-libstdcxx-pch --disable-plugin --enable-\_\_cxa\_atexit --enable-checking=release --enable-languages=c,c++,objc,fortran,obj-c++,java,ada --enable-libstdcxx-allocator=new --enable-linux-futex --enable-ssp --enable-version-specific-runtime-libs --host=x86\_64-suse-linux --mandir=/usr/share/man --with-arch-32=i586 --with-slibdir=/lib64 --with-tune=generic --without-system-libunwind  
System Notes: Python 2.7.13.

## Dec 17: Ubuntu 16.04 LTS

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU, Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 8GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Ubuntu 16.04, Kernel: 4.4.0-1041-aws (x86\_64), File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86\_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86\_64-linux-gnu --target=x86\_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v  
System Notes: Python 2.7.12.

## Feb 18: Amazon Linux 2

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 8GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Amazon Linux 2, Kernel: 4.9.77-41.59.amzn2.x86\_64 (x86\_64), Compiler: GCC 7.2.1 20170915, File-System: xfs, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86\_64-redhat-linux --disable-libunwind-exceptions --disable-multilib --enable-\_\_cxa\_atexit --enable-bootstrap --enable-checking=release --enable-gnu-indirect-function --enable-gnu-unique-object --enable-initfini-array --enable-languages=c,c++,objc,obj-c++,fortran,ada,go,lto --enable-libatomic --enable-libcilkrt --enable-libitm --enable-libmpx --enable-libquadmath --enable-lsanitizer --enable-plugin --enable-shared --enable-threads=posix --mandir=/usr/share/man --with-arch\_32=x86-64 --with-gcc-major-version-only --with-isl --with-linker-hash-style=gnu --with-tune=generic  
Disk Notes: NOOP / attr2,inode64,noatime,noquota,rw  
Python Notes: Python 2.7.5  
Security Notes: KPTI + Full generic retpoline Protection

## Feb 18: Clear Linux

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 4 x 16384 MB RAM, Disk: 30GB, Graphics: Cirrus Logic GD 5446

OS: Clear Linux OS 20740, Kernel: 4.14.12-59.aws (x86\_64), Vulkan: 1.0.39, Compiler: GCC 7.3.0 + Clang 5.0.1 + LLVM 5.0.1, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Environment

CFFLAGS=-g-O3-feliminate-unused-debug-types-pipe-Wall-Wp-D\_FORTIFY\_SOURCE=2-fexceptions-fstack-protector--param=ssp-buffer-size=32-Wl--copy-dt-needed-entries-m64-fasynchronous-unwind-tables-Wp-D\_REENTRANT-ftree-loop-distribute-patterns-Wl-z-Wl relro-malign-data=abi-fno-semantic-interposition-ftree-vectorize-ftree-loop-vectorize-Wl-sort-common

Notes:

now-Wl-z-Wl

```
CFLAGS=-g-O3-feliminate-unused-debug-types-pipe-Wall-Wp-D_FORTIFY_SOURCE=2-fexceptions-fstack-protector--param=ssp-buffer-size=32-Wformat-Wformat-securit
y-Wl--copy-dt-needed-entries-m64-fasynchronous-unwind-tables-Wp-D_REENTRANT-ftree-loop-distribute-patterns-Wl-z-Wl
now-Wl-z-Wl
relro-fno-semantic-interposition-ffat-lto-objects-fno-signed-zeros-fno-trapping-math-fassociative-math-Wl-sort-common
CXXFLAGS=-g-O3-feliminate-unused-debug-types-pipe-Wall-Wp-D_FORTIFY_SOURCE=2-fexceptions-fstack-protector--param=ssp-buffer-size=32-Wformat-Wformat-sec
urity-Wl--copy-dt-needed-entries-m64-fasynchronous-unwind-tables-Wp-D_REENTRANT-ftree-loop-distribute-patterns-Wl-z-Wl
now-Wl-z-Wl
relro-fno-semantic-interposition-ffat-lto-objects-fno-signed-zeros-fno-trapping-math-fassociative-math-Wl-sort-common-fvisibility-inlines-hidden
FFLAGS=-g-O3-feliminate-unused-debug-types-pipe-Wall-Wp-D_FORTIFY_SOURCE=2-fexceptions-fstack-protector--param=ssp-buffer-size=32-Wl--copy-dt-needed-entri
es-m64-fasynchronous-unwind-tables-Wp-D_REENTRANT-ftree-loop-distribute-patterns-Wl-z-Wl
now-Wl-z-Wl
relro-malign-data=abi-fno-semantic-interposition-ftree-vectorize-ftree-loop-vectorize THEANO_FLAGS=floatX=float32 openmp=true gcc.cxxflags="-ftree-vectorize-maxv"
Compiler Notes: --build=x86_64-generic-linux --disable-libmpx --disable-libunwind-exceptions --disable-multiarch --disable-vtable-verify --enable-__cxa_atexit
--enable-bootstrap --enable-cloCALE=gnu --enable-gnu-indirect-function --enable-languages=c,c++,fortran,go --enable-lid=default --enable-libstdc++-pch --enable-lto
--enable-multilib --enable-plugin --enable-shared --enable-threads=posix --exec-prefix=/usr --includedir=/usr/include --target=x86_64-generic-linux --with-arch=westmere
--with-glibc-version=2.19 --with-gnu-ld --with-isl --with-ppl=yes --with-tune=haswell
Disk Mount Options Notes: data=ordered,relatime,rw,stripe=256
Python Notes: Python 3.6.4
Security Notes: KPTI Protection
```

## Feb 18: RHEL Server 7

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 10GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Red Hat Enterprise Linux Server 7.4, Kernel: 3.10.0-693.17.1.el7.x86\_64 (x86\_64), Compiler: GCC 4.8.5 20150623, File-System: xfs, Screen Resolution: 1024x768, System Layer: Xen HVM domU 4.2.amazon

```
Compiler Notes: --build=x86_64-redhat-linux --disable-libgcj --disable-libunwind-exceptions --enable-__cxa_atexit --enable-bootstrap --enable-checking=release
--enable-gnu-indirect-function --enable-gnu-unique-object --enable-initfini-array --enable-languages=c,c++,objc,obj-c++,java,fortran,ada,go,lto --enable-plugin
--enable-shared --enable-threads=posix --mandir=/usr/share/man --with-arch=x86_64 --with-linker-hash-style=gnu --with-tune=generic
Disk Notes: DEADLINE / attr2,inode64,noquota,relatime,rw,seclabel
Python Notes: Python 2.7.5
Security Notes: SELinux Protection
```

## Feb 18: SUSE SLES 12 SP3

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 10GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: SUSE Linux Enterprise Server 12 SP3 12.3, Kernel: 4.4.114-94.11-default (x86\_64), Compiler: GCC 4.8.5, File-System: ext4, Screen Resolution: 1024x768, System Layer: Xen HVM domU 4.2.amazon

```
Environment Notes: LIBGL_DEBUG=quiet
Compiler Notes: --build=x86_64-suse-linux --disable-libgcj --disable-libmudflap --disable-libssp --disable-libstdc++-pch --disable-plugin --enable-__cxa_atexit
--enable-checking=release --enable-languages=c,c++,objc,fortran,obj-c++,java,ada --enable-libstdc++-allocator=new --enable-linux-futex --enable-ssp
--enable-version-specific-runtime-libs --host=x86_64-suse-linux --mandir=/usr/share/man --with-arch-32=i586 --with-slibdir=/lib64 --with-tune=generic
--without-system-libunwind
Python Notes: Python 2.7.13
Security Notes: KPTI + Barriers + Full generic retpoline Protection
```

## Feb 18: Ubuntu 16.04 LTS

Processor: Intel Xeon E5-2686 v4 @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 64512MB, Disk: 8GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86\_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

```
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-cloCALE=gnu
--enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx
--enable-libstdc++-debug --enable-libstdc++-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared
--enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdc++-abi=new
```

--with-multilib-list=m32,m64,mx32 --with-tune=generic -v  
Disk Notes: none / data=ordered,discard,relatime,rw  
Python Notes: Python 2.7.12 + Python 3.5.2  
Security Notes: KPTI Protection

	Dec 17: Amazon Linux 2	Dec 17: Clear Linux	Dec 17: RHEL Server 7	Dec 17: SUSE SLES 12 SP3	Dec 17: Ubuntu 16.04 LTS	Feb 18: Amazon Linux 2	Feb 18: Clear Linux	Feb 18: RHEL Server 7	Feb 18: SUSE SLES 12 SP3	Feb 18: Ubuntu 16.04 LTS
<b>Rodinia - OpenMP LavaMD (sec)</b>	<b>142.20</b>	62.97		132.77	128.28	129.53	<b>62.81</b>		132.57	128.67
Normalized	44.17%	99.75%		47.31%	48.96%	48.49%	100%		47.38%	48.81%
Standard Deviation	0.6%	0%		0%	0%	0.2%	0%		0.6%	0.1%
<b>Rodinia - OpenMP CFD Solver (sec)</b>	31.46	33.35		46.14	42.24	<b>29.46</b>	31.31		41.71	<b>46.94</b>
Normalized	93.64%	88.34%		63.85%	69.74%	100%	94.09%		70.63%	62.76%
Standard Deviation	0.5%	0.4%		0.3%	0.2%	0.3%	2.9%		0.3%	0.7%
<b>Go Benchmarks - http (ns/op)</b>	9029	7895				8944	<b>9529</b>			7005
Normalized	72.11%	82.47%			100%	72.8%	68.33%			92.95%
Standard Deviation	0.2%	0.3%			0.5%	1.4%	1.2%			0.3%
<b>Go Benchmarks - json (ns/op)</b>	1177499	1005980			1193434	1058490	<b>1003396</b>			<b>1199081</b>
Normalized	5	9			9	4	<b>6</b>			<b>3</b>
Standard Deviation	85.21%	99.74%			84.08%	94.8%	100%			83.68%
Standard Deviation	0.1%	0.2%			0.5%	0.2%	0.1%			1.8%
<b>Go Benchmarks - build (ns/op)</b>	<b>1821177</b>	1891636			2266265	1849745	1847704			<b>2266288</b>
Normalized	<b>2783</b>	3867			6196	3157	8057			<b>3888</b>
Standard Deviation	100%	96.28%			80.36%	98.46%	98.56%			80.36%
Standard Deviation	0.3%	0.7%			0.3%	0.4%	0.3%			1.2%
<b>Go Benchmarks - garbage (ns/op)</b>	<b>2458881</b>	2248314			2393988	2254882	<b>2240359</b>			2431212
Normalized	91.11%	99.65%			93.58%	99.36%	100%			92.15%
Standard Deviation	0.3%	0.1%			0.3%	0.1%	0.2%			0.1%
<b>Himeno Benchmark - P.P.S (MFLOPS)</b>	1634	1589		1519	1534	<b>1671</b>	1668		1615	<b>1509</b>
Normalized	97.78%	95.08%		90.91%	91.78%	100%	99.79%		96.65%	90.3%
Standard Deviation	1.7%	0.1%		0.1%	0.1%	0.2%	0.3%		0%	0.1%
<b>Timed Linux Kernel Compilation - Time To Compile (sec)</b>	<b>107.48</b>	92.39	89.49	<b>84.82</b>	89.15	98.47	91.50	91.16	85.44	92.09
Normalized	78.92%	91.81%	94.78%	100%	95.14%	86.14%	92.7%	93.05%	99.27%	92.11%
Standard Deviation	0.7%	1.8%	1.9%	1.9%	1.7%	1.7%	2%	1.8%	1.9%	2%
<b>Gzip Compression - 2.F.C (sec)</b>	14.41	5.50	15.53	12.36	14.44	14.49	<b>5.37</b>	<b>15.56</b>	12.39	14.47
Normalized	37.27%	97.64%	34.58%	43.45%	37.19%	37.06%	100%	34.51%	43.34%	37.11%
Standard Deviation	0%	0.1%	0.1%	0.1%	0.1%	0%	0.1%	0%	0.3%	0.2%

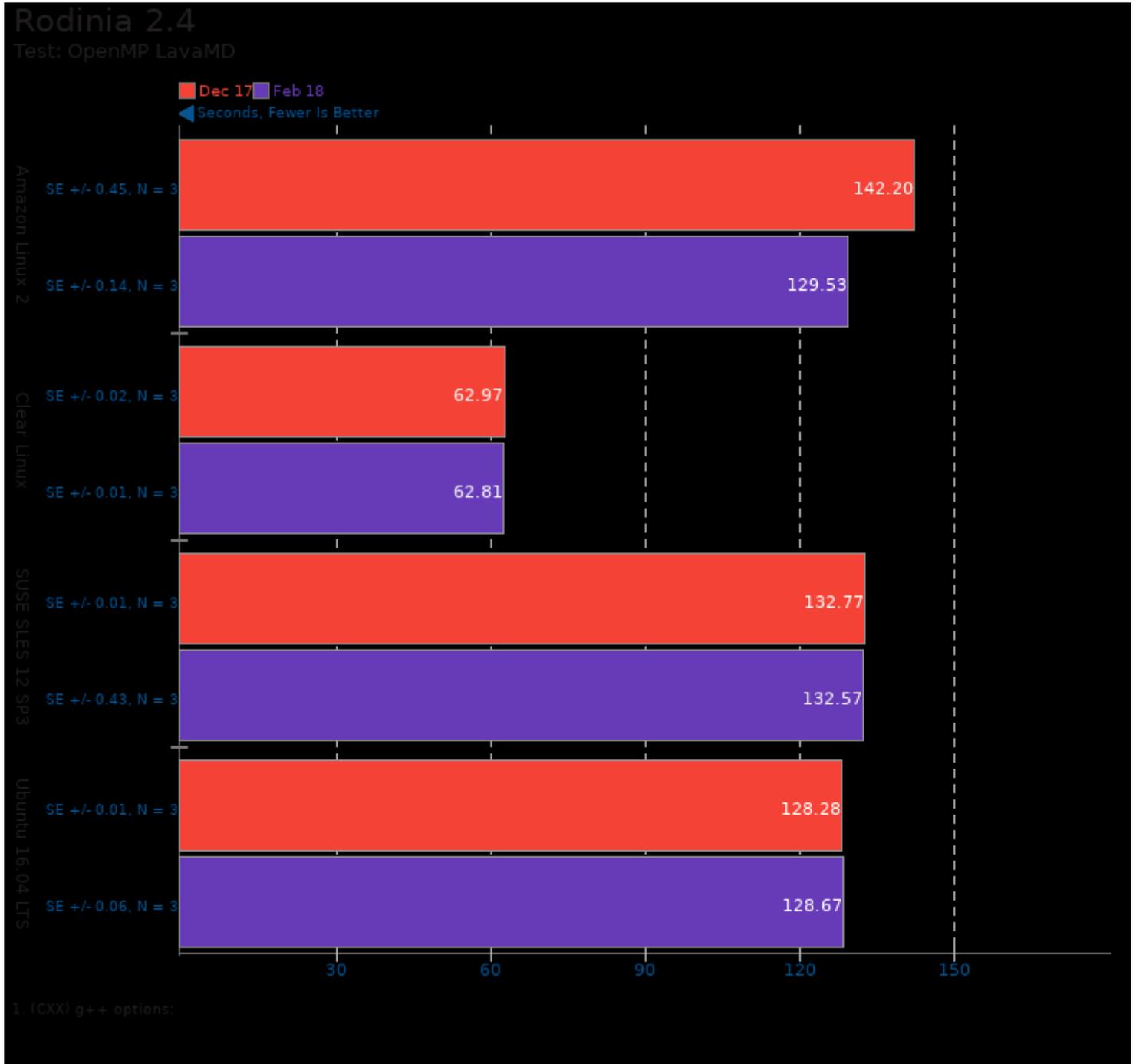
<b>FLAC Audio</b>	8.77	<b>8.41</b>	10.08	10.03	8.65	8.79	<b>8.41</b>	<b>10.15</b>		8.68
<b>Encoding - WAV To FLAC (sec)</b>										
Normalized	95.9%	100%	83.43%	83.85%	97.23%	95.68%	100%	82.86%		96.89%
Standard Deviation	0.2%	0.3%	0.3%	0.1%	0.1%	0%	0.1%	0.3%		0.1%
<b>LAME MP3</b>	13.86	13.48	17.08	17.14	15.52	13.86	<b>13.47</b>	17.16	<b>17.93</b>	15.74
<b>Encoding - WAV To MP3 (sec)</b>										
Normalized	97.19%	99.93%	78.86%	78.59%	86.79%	97.19%	100%	78.5%	75.13%	85.58%
Standard Deviation	0.1%	0.1%	0.1%	1.3%	0.8%	0.1%	0.1%	0.1%	0.8%	0.7%
<b>FFmpeg - H.2.H.T.N.D (sec)</b>		8.91		<b>9.10</b>	9.03		8.93		<b>8.86</b>	9.08
Normalized		99.44%		97.36%	98.12%		99.22%		100%	97.58%
Standard Deviation		2.6%		0.9%	1.6%		1.3%		0.6%	2.3%
<b>OpenSSL - R.4.b.P (Signs/sec)</b>	<b>913.67</b>	981.97	974.63	<b>987.93</b>	985.67	983.67	982.40	972.23		985.03
Normalized	92.48%	99.4%	98.65%	100%	99.77%	99.57%	99.44%	98.41%		99.71%
Standard Deviation	0.3%	0.1%	0%	0.1%	0%	0%	0.1%	0%		0.1%
<b>Perl Benchmarks -</b>	0.197074	0.197149	0.208948	0.193703	0.197134	0.197282	<b>0.191628</b>	<b>0.209123</b>	0.198937	0.199783
<b>Pod2html</b>	10	43	97	66	20	41	<b>08</b>	<b>33</b>	83	81
Normalized	97.24%	97.2%	91.71%	98.93%	97.21%	97.13%	100%	91.63%	96.33%	95.92%
Standard Deviation	2.7%	1.3%	1.3%	1%	2.7%	2.6%	1.9%	1.2%	1.3%	1.4%
<b>Perl Benchmarks -</b>	0.001362	0.001222	0.001567	0.000965	<b>0.000952</b>	0.001516	0.001233	<b>0.001843</b>	0.001062	0.001093
<b>Interpreter</b>	37	07	85	75	<b>12</b>	85	46	<b>99</b>	51	00
Normalized	69.89%	77.91%	60.73%	98.59%	100%	62.77%	77.19%	51.63%	89.61%	87.11%
Standard Deviation	0.2%	0.3%	0.2%	0.3%	0.3%	0.4%	0.1%	0.1%	0.3%	0.6%
<b>Redis - GET (Reqs/sec)</b>	1162050	<b>1627782</b>	1116937	1375590	1274925	720298	914671	<b>711524</b>	772643	765510
Normalized	71.39%	100%	68.62%	84.51%	78.32%	44.25%	56.19%	43.71%	47.47%	47.03%
Standard Deviation	1.4%	0.1%	0.7%	0.9%	2.4%	0.5%	0.8%	2.4%	0.9%	0.4%
<b>Redis - SET (Reqs/sec)</b>	898315	<b>1202463</b>	860253	1051987	976316	<b>608437</b>	780646	616529	666079	639295
Normalized	74.71%	100%	71.54%	87.49%	81.19%	50.6%	64.92%	51.27%	55.39%	53.17%
Standard Deviation	1.4%	0.9%	4.8%	1.2%	1.1%	1%	0.3%	0.4%	0.3%	1%
<b>PyBench - T.F.A.T.T (Milliseconds)</b>	2393	<b>1847</b>	2439	2183	2109	2394		<b>2442</b>	2189	2009
Normalized	77.18%	100%	75.73%	84.61%	87.58%	77.15%		75.63%	84.38%	91.94%
Standard Deviation	0.3%	0.2%	0.3%	0.1%	0.1%	0.1%		0.2%	0.3%	0.4%
<b>PHPBench - P.B.S (Score)</b>	146108	423815	140237	<b>109406</b>	320707	144601	<b>511571</b>	139663		
Normalized	28.56%	82.85%	27.41%	21.39%	62.69%	28.27%	100%	27.3%		
Standard Deviation	0.3%	0.4%	0.5%	1.3%	0.5%	0.6%	0.6%	0.5%		
<b>Dolfyn - C.F.D (sec)</b>			30.79	30.50	30.25			29.84	<b>31.10</b>	<b>29.83</b>
Normalized			96.88%	97.8%	98.61%			99.97%	95.92%	100%
Standard Deviation			0.6%	0.5%	0.9%			0.6%	1.2%	1.1%
<b>GraphicsMagick - Sharpen (Iterations/min)</b>	116	117		<b>102</b>	119	118	<b>122</b>			119
Normalized	95.08%	95.9%		83.61%	97.54%	96.72%	100%			97.54%

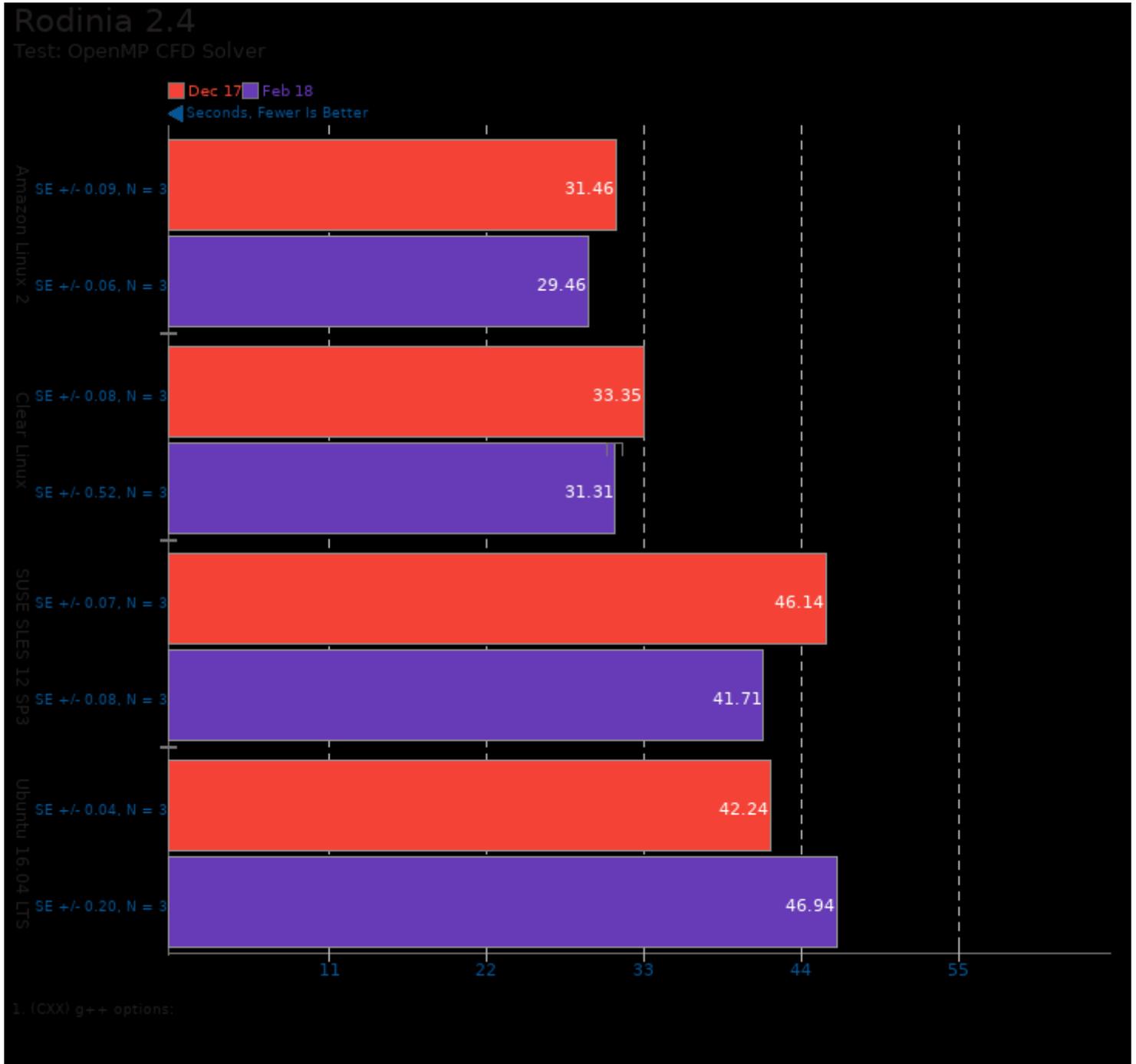
<b>GraphicsMagick - Resizing (Iterations/min)</b>	<b>147</b>	<b>147</b>		152	153	<b>147</b>	<b>155</b>			153
Normalized	94.84%	94.84%		98.06%	98.71%	94.84%	100%			98.71%
<b>GraphicsMagick - HWB Color Space (Iterations/min)</b>	<b>160</b>	<b>160</b>		167	164	161	<b>170</b>			164
Normalized	94.12%	94.12%		98.24%	96.47%	94.71%	100%			96.47%
Standard Deviation							0.3%			
<b>GraphicsMagick - L.A.T</b>	<b>66</b>	<b>69</b>		<b>69</b>	<b>69</b>	<b>66</b>	<b>69</b>			68
Normalized	95.65%	100%		100%	100%	95.65%	100%			98.55%
<b>C-Ray - Total Time (sec)</b>	<b>18.26</b>	14.69	15.83	15.61	15.57	16.94	<b>14.68</b>	15.89	15.60	15.56
Normalized	80.39%	99.93%	92.74%	94.04%	94.28%	86.66%	100%	92.39%	94.1%	94.34%
Standard Deviation	0.1%	0.1%	0.1%	0%	0.1%	0%	0%	0.2%	0%	0.1%
<b>Stockfish - Total Time (ms)</b>	4601	4702	4478	4683	<b>4835</b>	4551	4645	4478	<b>4428</b>	4718
Normalized	96.24%	94.17%	98.88%	94.55%	91.58%	97.3%	95.33%	98.88%	100%	93.85%
Standard Deviation	0%	0%	0.1%	0.2%	0.2%	0.1%	0.1%	0.3%	0.2%	0.4%
<b>R Benchmark (sec)</b>		0.2580			<b>1.1358</b>		<b>0.2547</b>			
Normalized		98.72%			22.42%		100%			
Standard Deviation		0.1%			1.3%		0.8%			
<b>Systemd Total Boot Time - Total (ms)</b>	9749	612.30	37473	<b>84221</b>	11013	7799	<b>596.60</b>	33753	41029	7650
Normalized	6.12%	97.44%	1.59%	0.71%	5.42%	7.65%	100%	1.77%	1.45%	7.8%
<b>Systemd Total Boot Time - Userspace (ms)</b>	6936	<b>326.10</b>	33785	<b>56939</b>	7279	5246	346.60	29797	38040	3884
Normalized	4.7%	100%	0.97%	0.57%	4.48%	6.22%	94.09%	1.09%	0.86%	8.4%
<b>Systemd Total Boot Time - Kernel (ms)</b>	1517	286.10	2129	<b>27281</b>	3733	1752	<b>250</b>	2351	2419	3766
Normalized	16.48%	87.38%	11.74%	0.92%	6.7%	14.27%	100%	10.63%	10.33%	6.64%
<b>SQLite - D.T.D (sec)</b>						<b>20.66</b>	22.81	<b>25.68</b>		24.40
Normalized						100%	90.57%	80.45%		84.67%
Standard Deviation						0.4%	1.7%	0.1%		0.7%
<b>Stress-NG - Memory Copying (Bogo Ops/s)</b>						6611	6906	<b>4922</b>	<b>7542</b>	6633
Normalized						87.66%	91.57%	65.27%	100%	87.95%
Standard Deviation						1.1%	2.1%	2.8%	5.1%	1.5%
<b>Stress-NG - Forking (Bogo Ops/s)</b>						47473	<b>58016</b>	48060	46037	<b>42996</b>
Normalized						81.83%	100%	82.84%	79.35%	74.11%
Standard Deviation						1%	0.5%	0.3%	1%	1.3%
<b>Stress-NG - S.V.M.P (Bogo Ops/s)</b>						7121514	<b>7715222</b>	3771783	5634958	<b>3664267</b>
Normalized						92.3%	100%	48.89%	73.04%	47.49%
Standard Deviation						0.2%	3.3%	0.6%	12.6%	2.5%

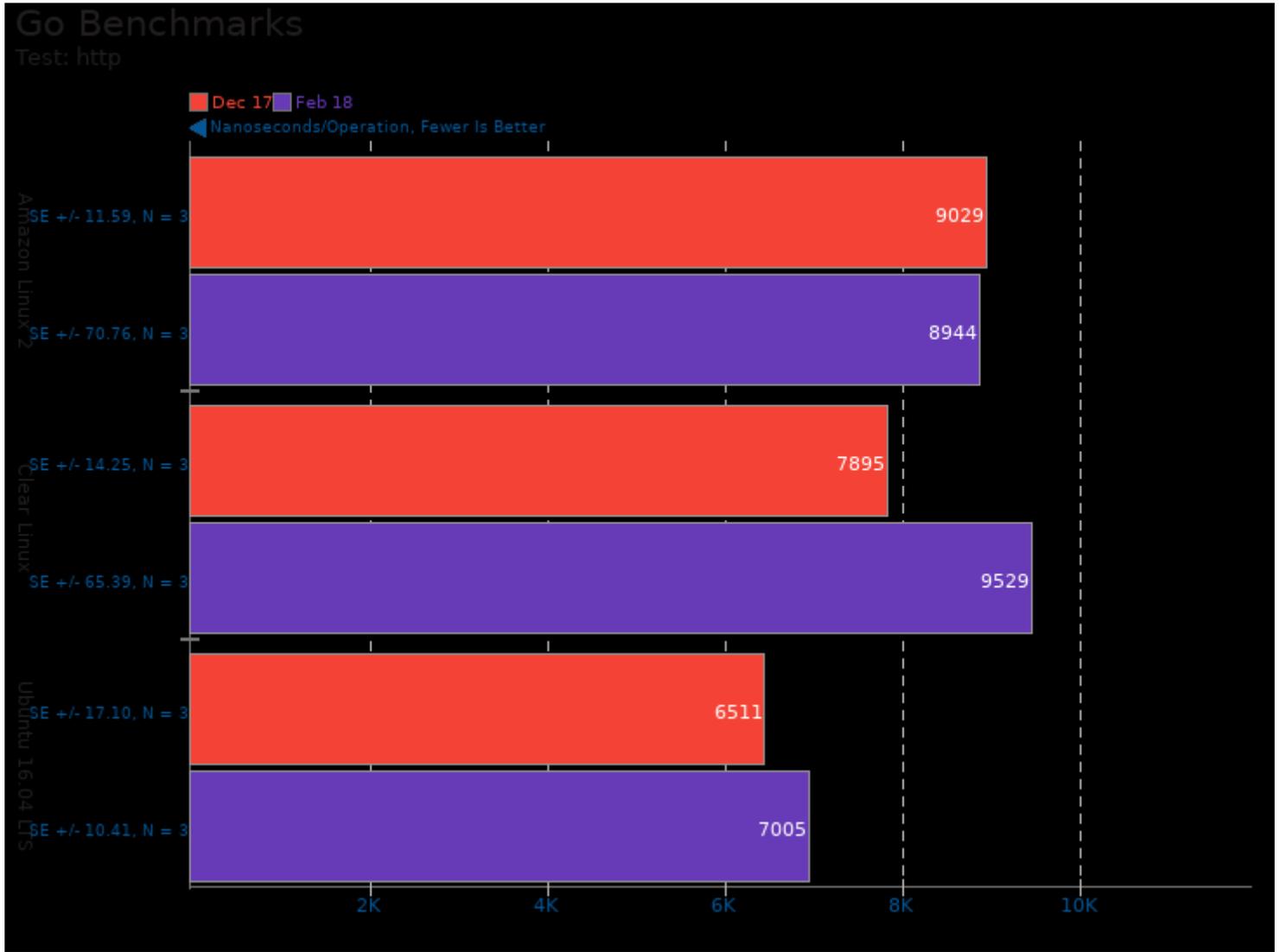
<b>Stress-NG - Semaphores (Bogo Ops/s)</b>	<b>2975130</b>	2965228	817497	2833823	<b>730365</b>
Normalized	100%	99.67%	27.48%	95.25%	24.55%
Standard Deviation	3.1%	3.2%	1%	2.8%	5.8%
<b>Stress-NG - Socket Activity (Bogo Ops/s)</b>	9291	<b>7813</b>	9169	<b>10077</b>	9690
Normalized	92.2%	77.53%	90.98%	100%	96.15%
Standard Deviation	1.8%	1.6%	1.5%	1.5%	1.5%
<b>Stress-NG - Context Switching (Bogo Ops/s)</b>	<b>1157545</b>	2058642	2126165	<b>2521015</b>	2050121
Normalized	45.92%	81.66%	84.34%	100%	81.32%
Standard Deviation	16.9%	0.3%	0.4%	0.2%	1.2%
<b>Hackbench - 16 - Process (sec)</b>	<b>73.34</b>	<b>45.86</b>	52.11	47.52	50.30
Normalized	62.53%	100%	88.01%	96.51%	91.17%
Standard Deviation	15.6%	0.5%	0.2%	0.4%	0.7%
<b>Hackbench - 16 - Thread (sec)</b>	<b>84.28</b>	<b>47.27</b>	51.95	49.26	49.92
Normalized	56.09%	100%	90.99%	95.96%	94.69%
Standard Deviation	1.3%	0.8%	0.3%	0.5%	0.4%
<b>Hackbench - 32 - Process (sec)</b>	<b>129.30</b>	<b>81.55</b>	102.14	94.10	101.87
Normalized	63.07%	100%	79.84%	86.66%	80.05%
Standard Deviation	2.1%	0.1%	0.6%	0.7%	0.4%
<b>Schbench - 8 - 8 (usec, 99.9th Latency Percentile)</b>	<b>55936</b>	75853	79147	<b>83584</b>	64256
Normalized	100%	73.74%	70.67%	66.92%	87.05%
Standard Deviation	3.9%	3.3%	2.1%	2.3%	1.9%
<b>Schbench - 8 - 16 (usec, 99.9th Latency Percentile)</b>	<b>117888</b>	<b>183040</b>	168533	175019	121216
Normalized	100%	64.41%	69.95%	67.36%	97.25%
Standard Deviation	1.8%	2.4%	0.9%	3.3%	0.6%
<b>Schbench - 16 - 8 (usec, 99.9th Latency Percentile)</b>	<b>112427</b>	<b>178773</b>	160000	169728	117717
Normalized	100%	62.89%	70.27%	66.24%	95.51%
Standard Deviation	1.3%	2.6%	1.1%	1.1%	1.9%
<b>Schbench - 16 - 16 (usec, 99.9th Latency Percentile)</b>	<b>179968</b>	<b>383829</b>	326827	346624	195669
Normalized	100%	46.89%	55.07%	51.92%	91.98%
Standard Deviation	1.5%	1.5%	0.7%	2.8%	1.7%
<b>Schbench - 32 - 8 (usec, 99.9th Latency Percentile)</b>	<b>187989</b>	<b>394069</b>	324864	348160	195499
Normalized	100%	47.7%	57.87%	54%	96.16%
Standard Deviation	0.2%	3.3%	3.4%	3.3%	1.1%

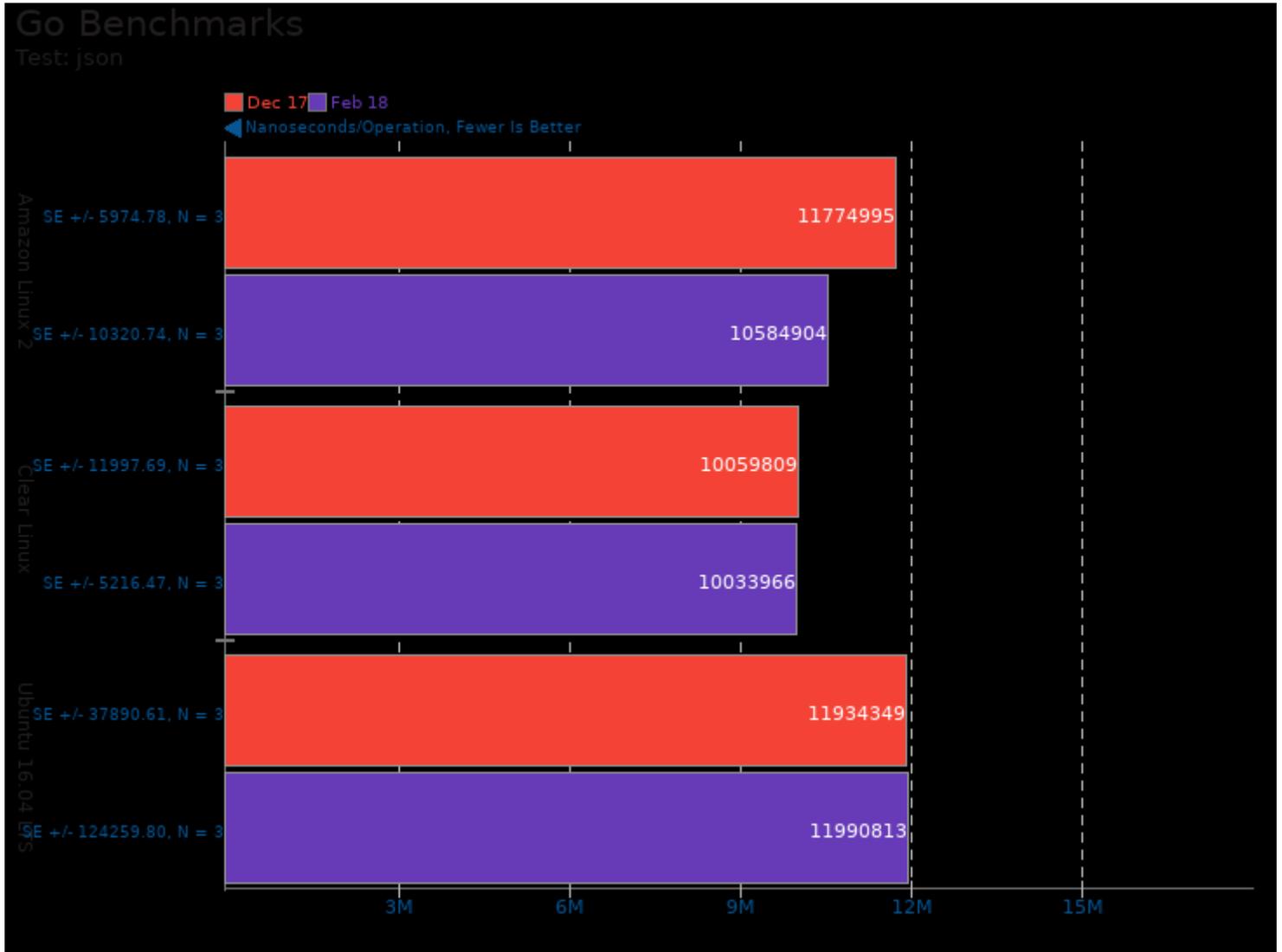
Schbench - 32 - 16	294741	753323	675499	715093	333312
(usec, 99.9th Latency Percentile)					
Normalized	100%	39.13%	43.63%	41.22%	88.43%
Standard Deviation	2.1%	2.6%	1.5%	2.2%	
Crafty - Elapsed Time (Nodes/s)	5397216	5399095	5315611	5286783	5268520
Normalized	99.97%	100%	98.45%	97.92%	97.58%
Standard Deviation	0.4%	0.3%	0.1%	0.2%	0.3%
Botan - AES-256 - Encrypt (MiB/s)	1251	1388	1261		1314
Normalized	90.17%	100%	90.85%		94.7%
Standard Deviation	0.1%	0%	1.5%		0.2%
Botan - AES-256 - Decrypt (MiB/s)	1250				
Standard Deviation	0.1%				
Botan - Blowfish - Encrypt (MiB/s)	163.83	166.22	176.47		168.75
Normalized	92.84%	94.19%	100%		95.63%
Standard Deviation	0%	0%	0%		0%
Botan - Blowfish - Decrypt (MiB/s)	163.18				
Standard Deviation	0%				
Botan - CAST-256 - Encrypt (MiB/s)	85.91	86.53	82.56		83.12
Normalized	99.28%	100%	95.41%		96.06%
Standard Deviation	0%	0%	0.1%		0.5%
Botan - CAST-256 - Decrypt (MiB/s)	85.91				
Standard Deviation	0%				
Botan - KASUMI - Encrypt (MiB/s)	58.02	58.72	53.26		57.98
Normalized	98.81%	100%	90.7%		98.74%
Standard Deviation	0.1%	0.1%	0%		0%
Botan - KASUMI - Decrypt (MiB/s)	56.29				
Standard Deviation	0.1%				
Botan - Twofish - Encrypt (MiB/s)	212.55	219.25	202.27		209.51
Normalized	96.94%	100%	92.26%		95.56%
Standard Deviation	0.1%	0%	0.1%		0.1%
Botan - Twofish - Decrypt (MiB/s)	210.60				
Standard Deviation	0.2%				
BLAKE2 (Cycles/Byte)	5.37	5.37	4.85	4.85	4.84
Normalized	90.13%	90.13%	99.79%	99.79%	100%
Standard Deviation	0.1%	0%	0%	0.1%	0.1%

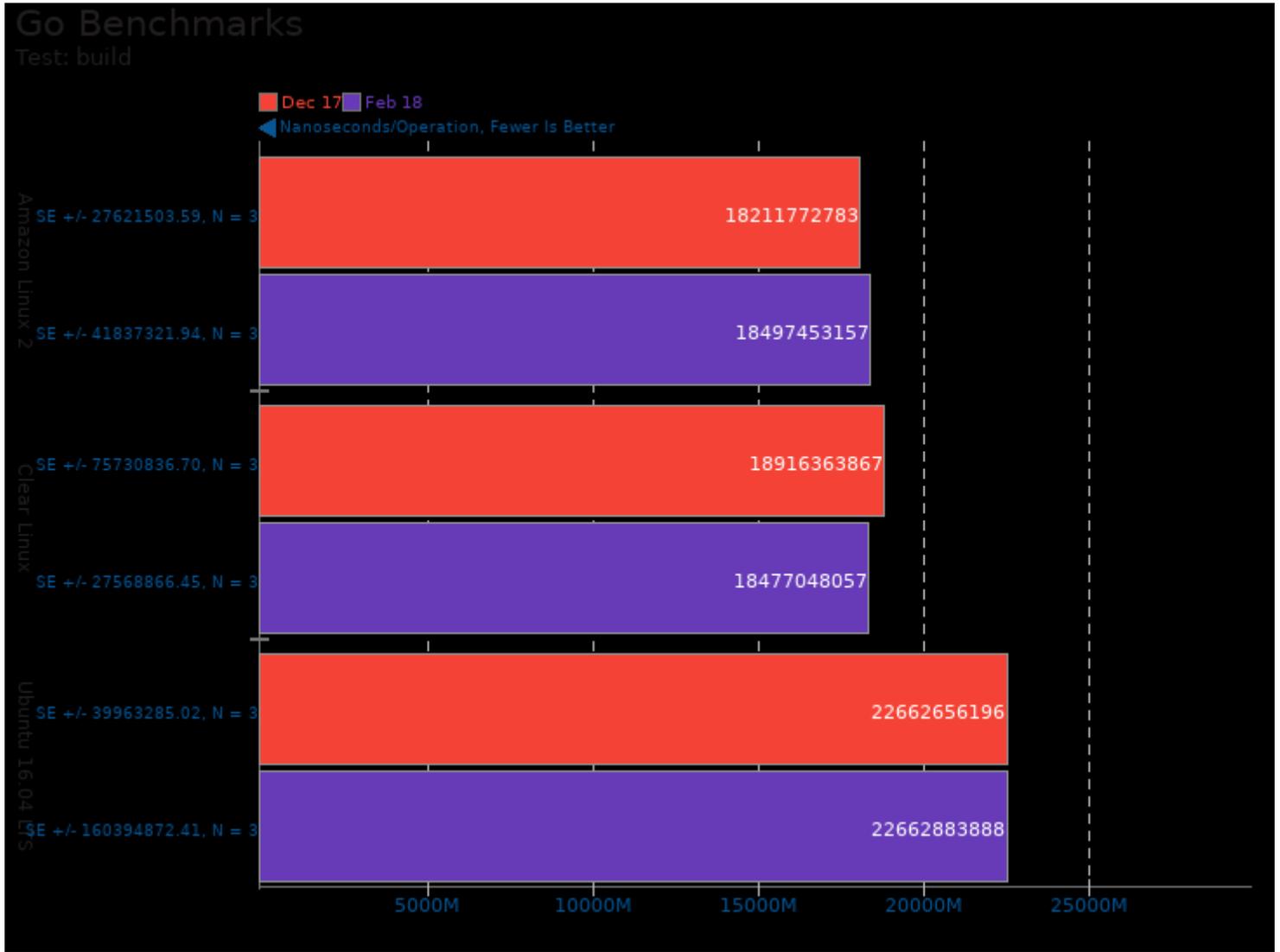
<b>Timed MAFFT</b>	4.76	4.62	<b>4.32</b>	<b>4.86</b>
<b>Alignment - M.S.A</b>				
<b>(sec)</b>				
Normalized	90.76%	93.51%	100%	88.89%
Standard Deviation	1.7%	2%	3.3%	4.2%
<b>NGINX Benchmark</b>	<b>23257</b>			<b>26900</b>
<b>- S.W.P.S</b>				
Normalized	86.46%			100%
Standard Deviation	1.9%			1.1%
<b>POV-Ray - Trace</b>	<b>81.42</b>		<b>88.16</b>	84.71
<b>Time (sec)</b>				
Normalized	100%		92.35%	96.12%
Standard Deviation	0.1%		0.7%	0.6%
<b>OpenSSL - R.4.b.P</b>	<b>1021</b>	1020	<b>1003</b>	1020
<b>(Signs/sec)</b>				
Normalized	100%	99.93%	98.24%	99.9%
Standard Deviation	0%	0.1%	0.1%	0%
<b>Botan - AES-256 -</b>		<b>1394</b>	<b>1267</b>	1317
<b>Encrypt - Decrypt</b>				
<b>(MiB/s)</b>				
Normalized		100%	90.85%	94.49%
Standard Deviation		0%	1.4%	0.3%
<b>Botan - Blowfish -</b>		<b>165.76</b>	<b>175.97</b>	166.92
<b>Encrypt - Decrypt</b>				
<b>(MiB/s)</b>				
Normalized		94.2%	100%	94.86%
Standard Deviation		0.1%	0%	0.3%
<b>Botan - CAST-256 -</b>		<b>86.34</b>	<b>82.58</b>	83.11
<b>Encrypt - Decrypt</b>				
<b>(MiB/s)</b>				
Normalized		100%	95.65%	96.26%
Standard Deviation		0.4%	0.1%	0.5%
<b>Botan - KASUMI -</b>		<b>56.97</b>	<b>50.40</b>	56.30
<b>Encrypt - Decrypt</b>				
<b>(MiB/s)</b>				
Normalized		100%	88.47%	98.82%
Standard Deviation		0.1%	0%	0%
<b>Botan - Twofish -</b>		<b>216.99</b>	<b>204.74</b>	205.82
<b>Encrypt - Decrypt</b>				
<b>(MiB/s)</b>				
Normalized		100%	94.35%	94.85%
Standard Deviation		0%	0.2%	0.1%

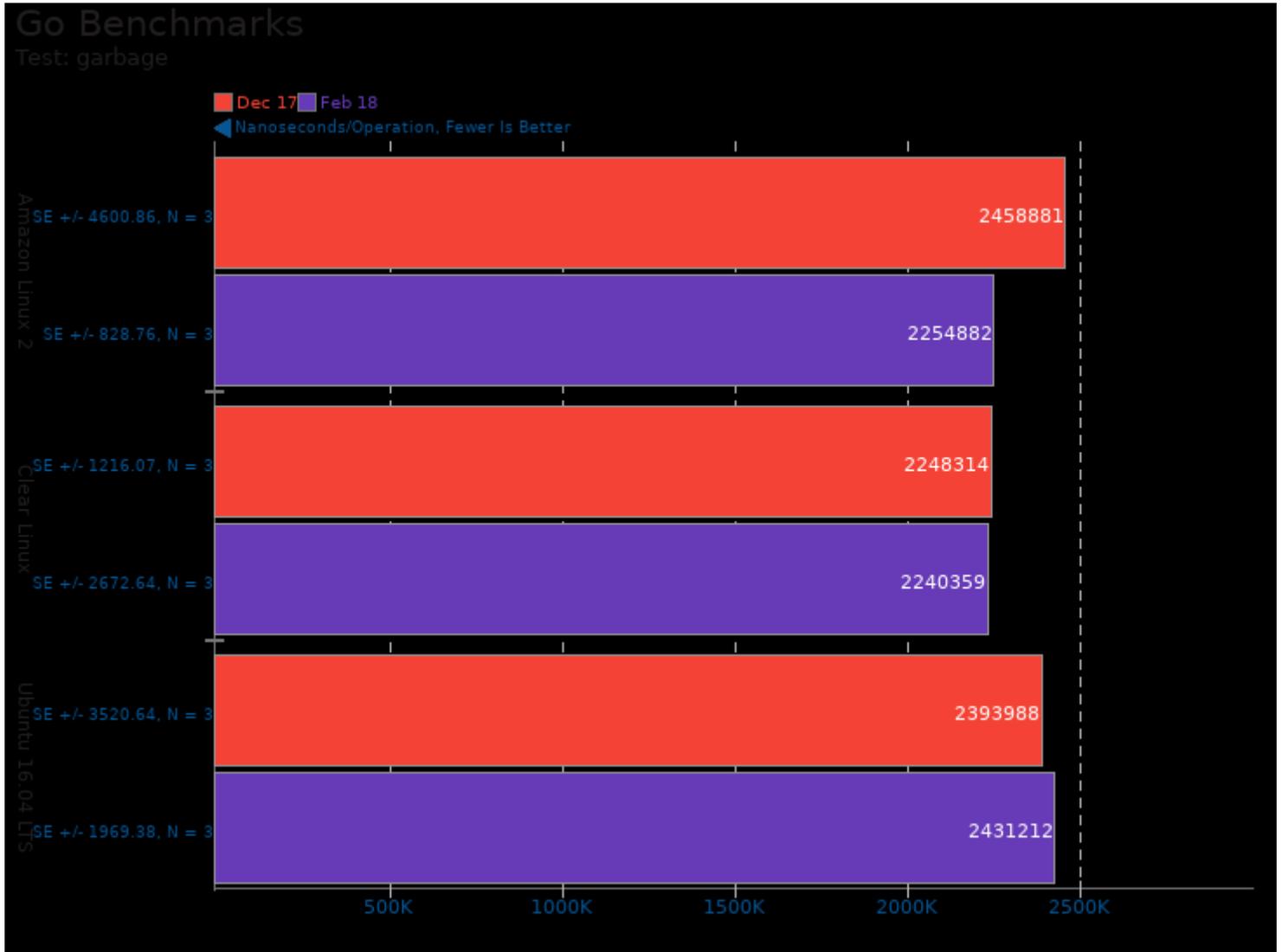


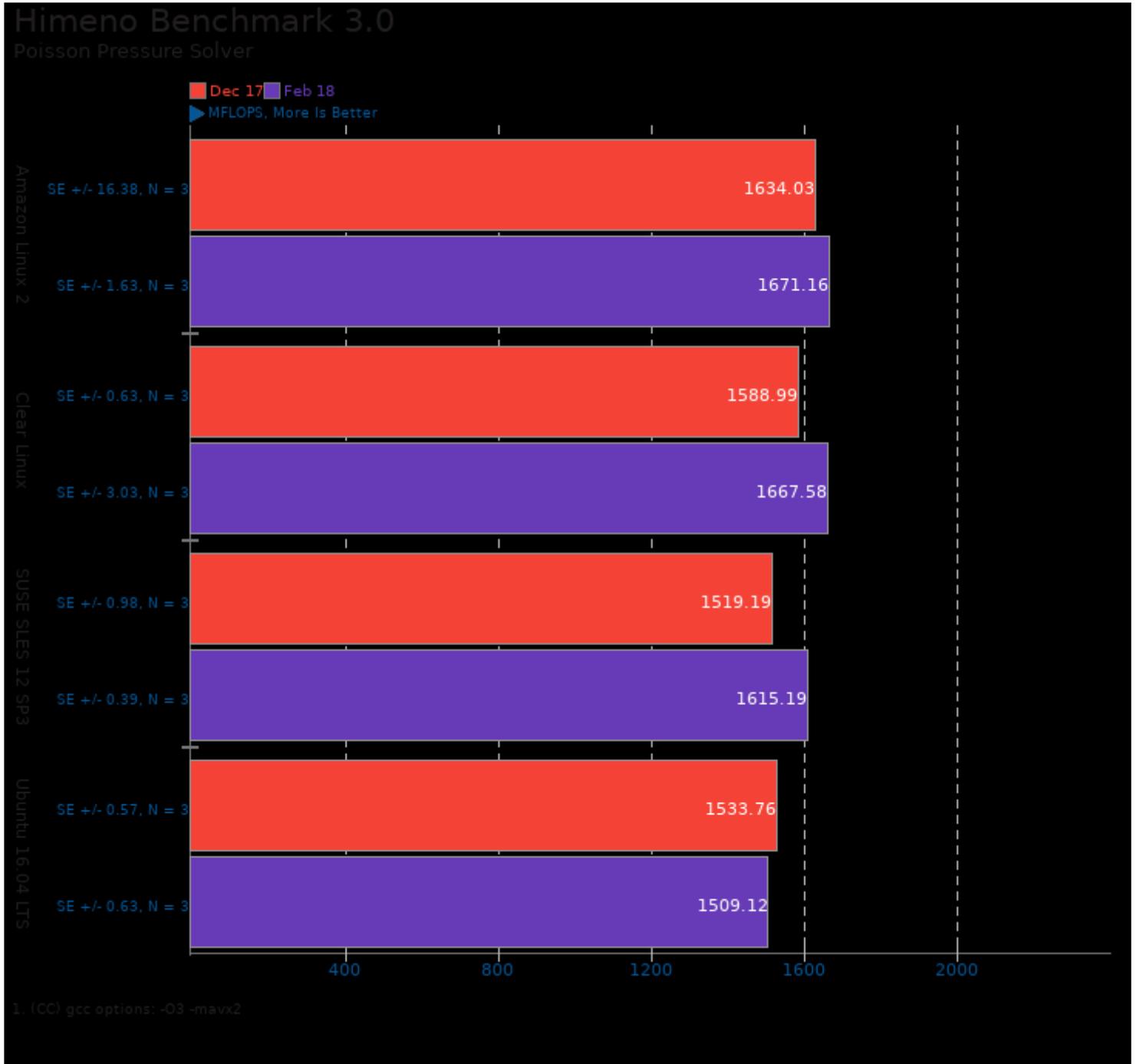


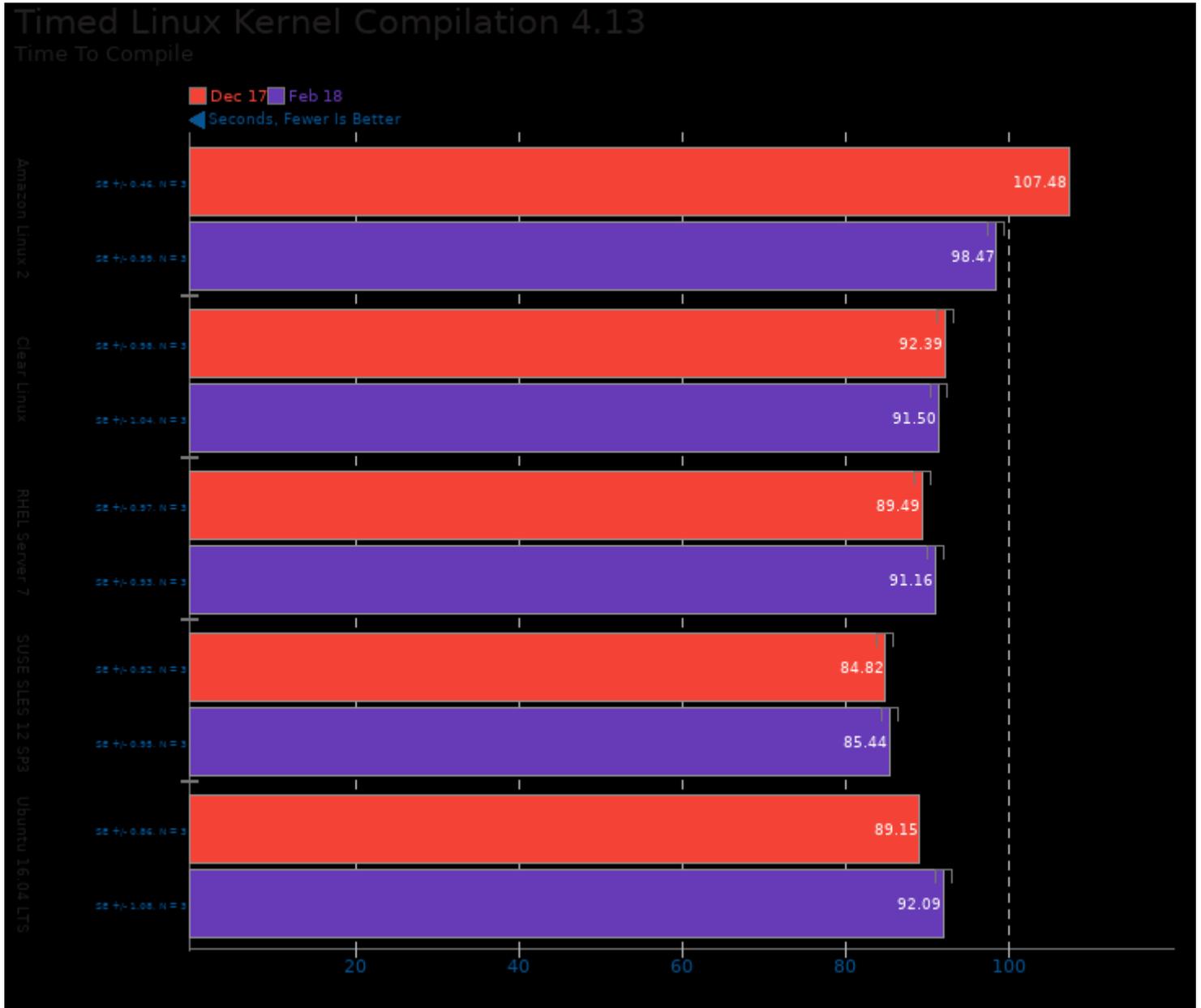


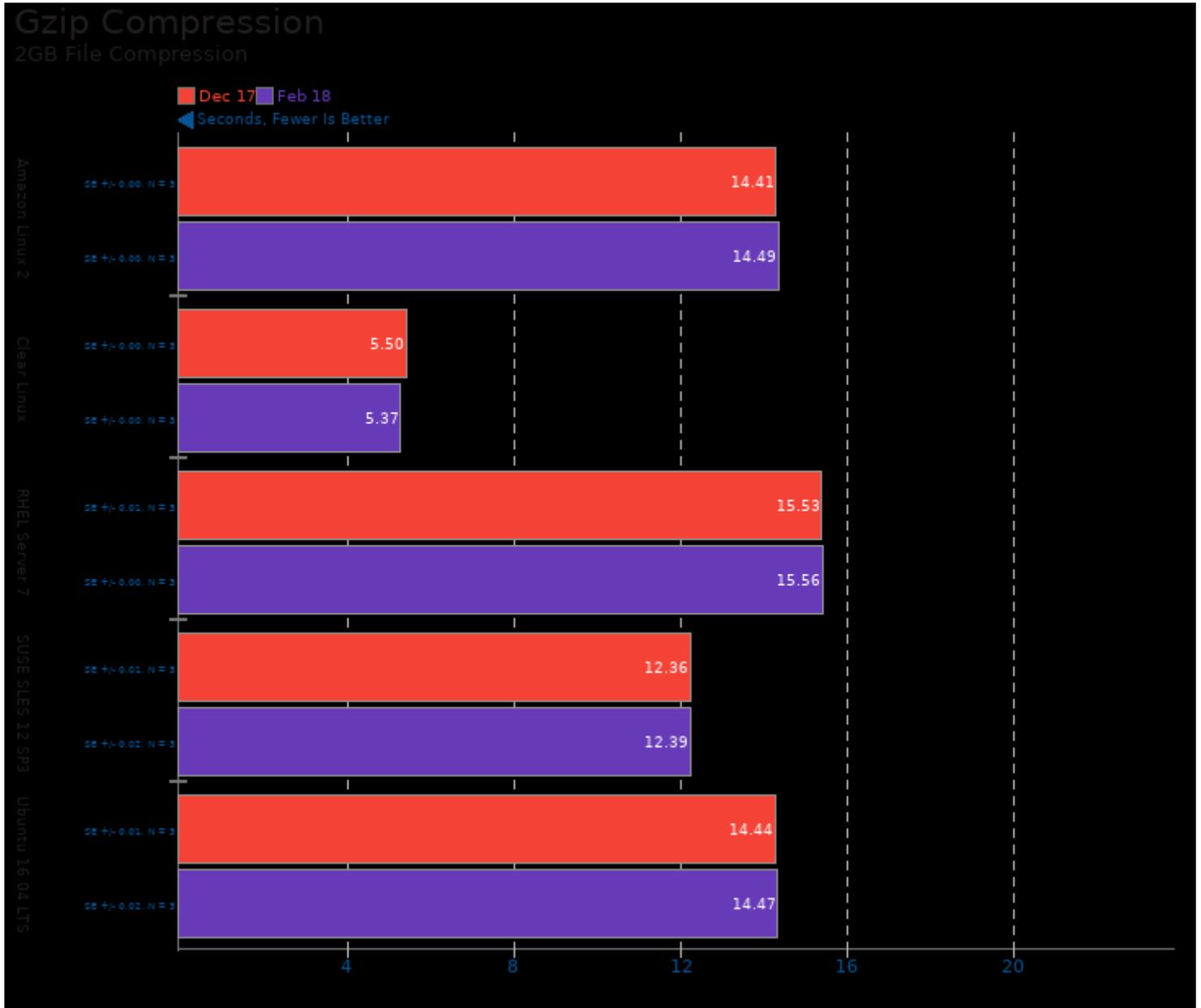


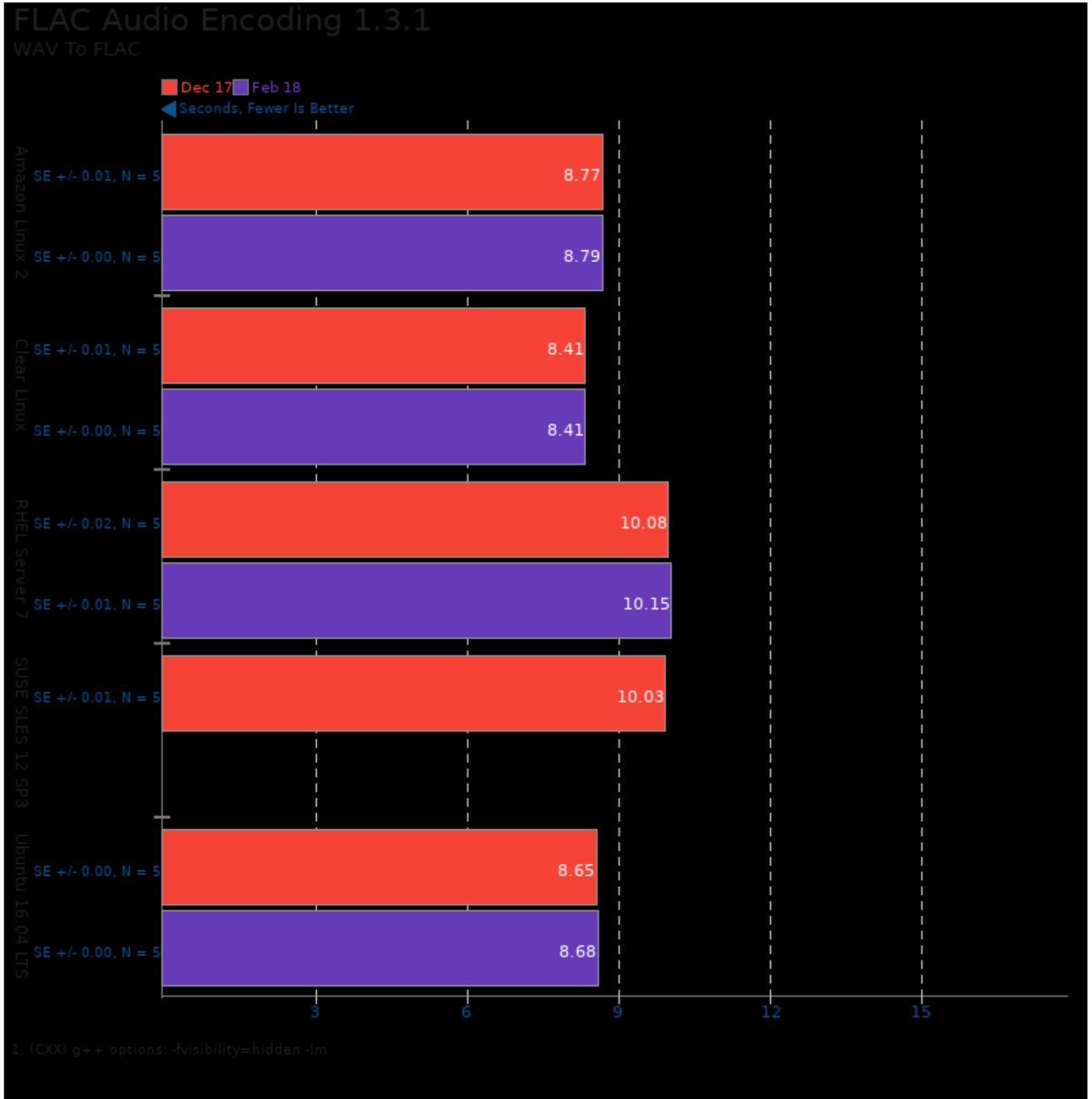


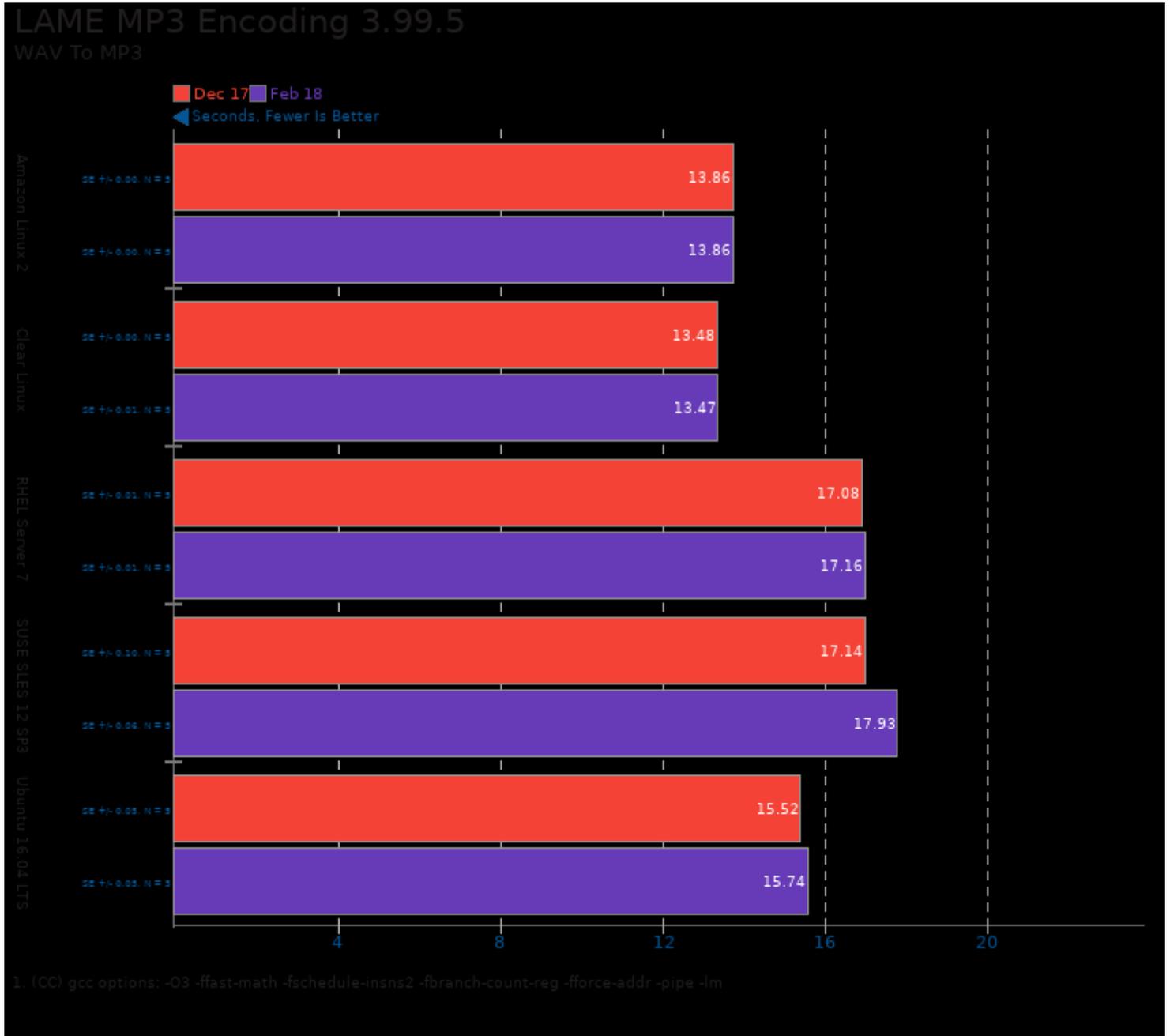


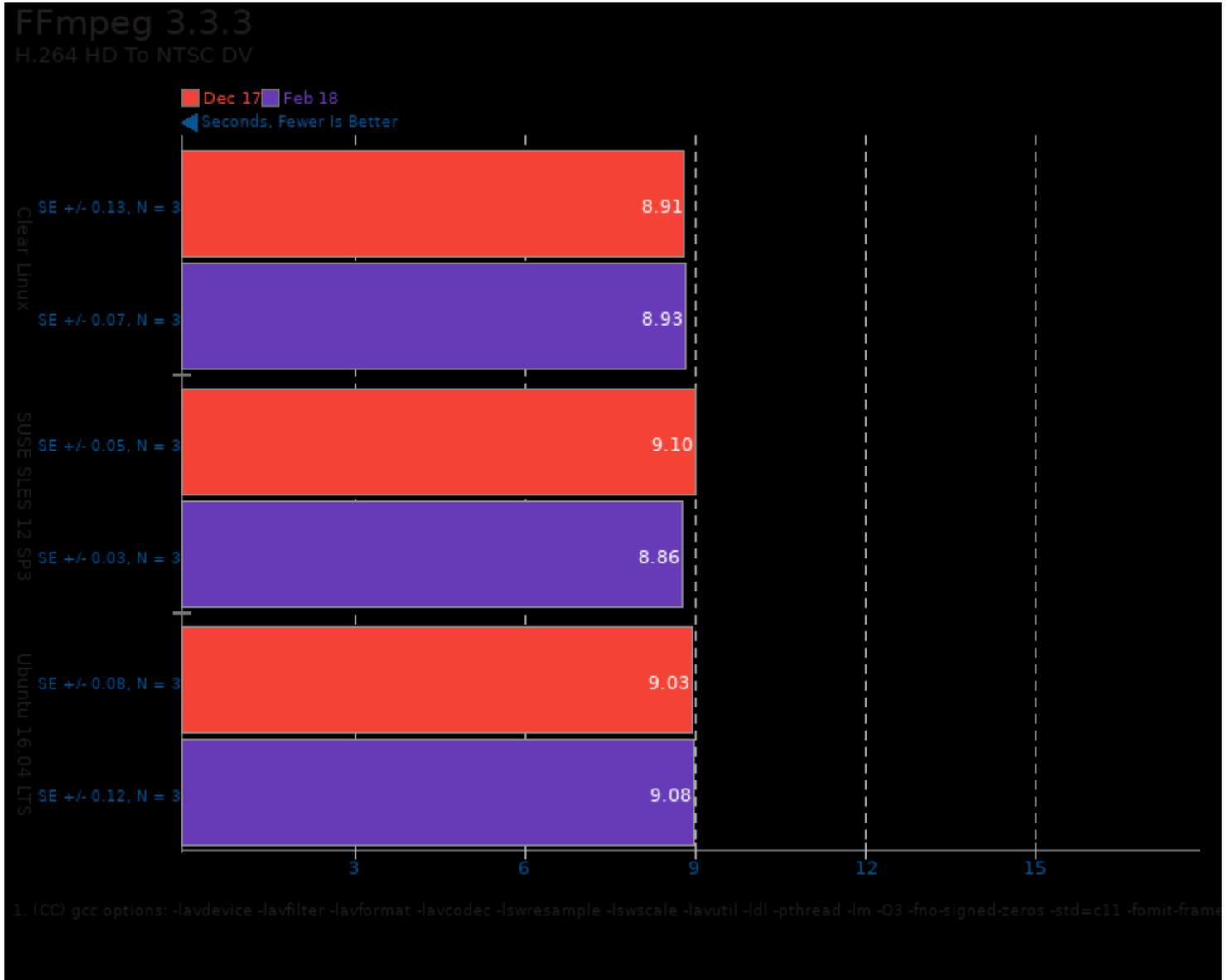


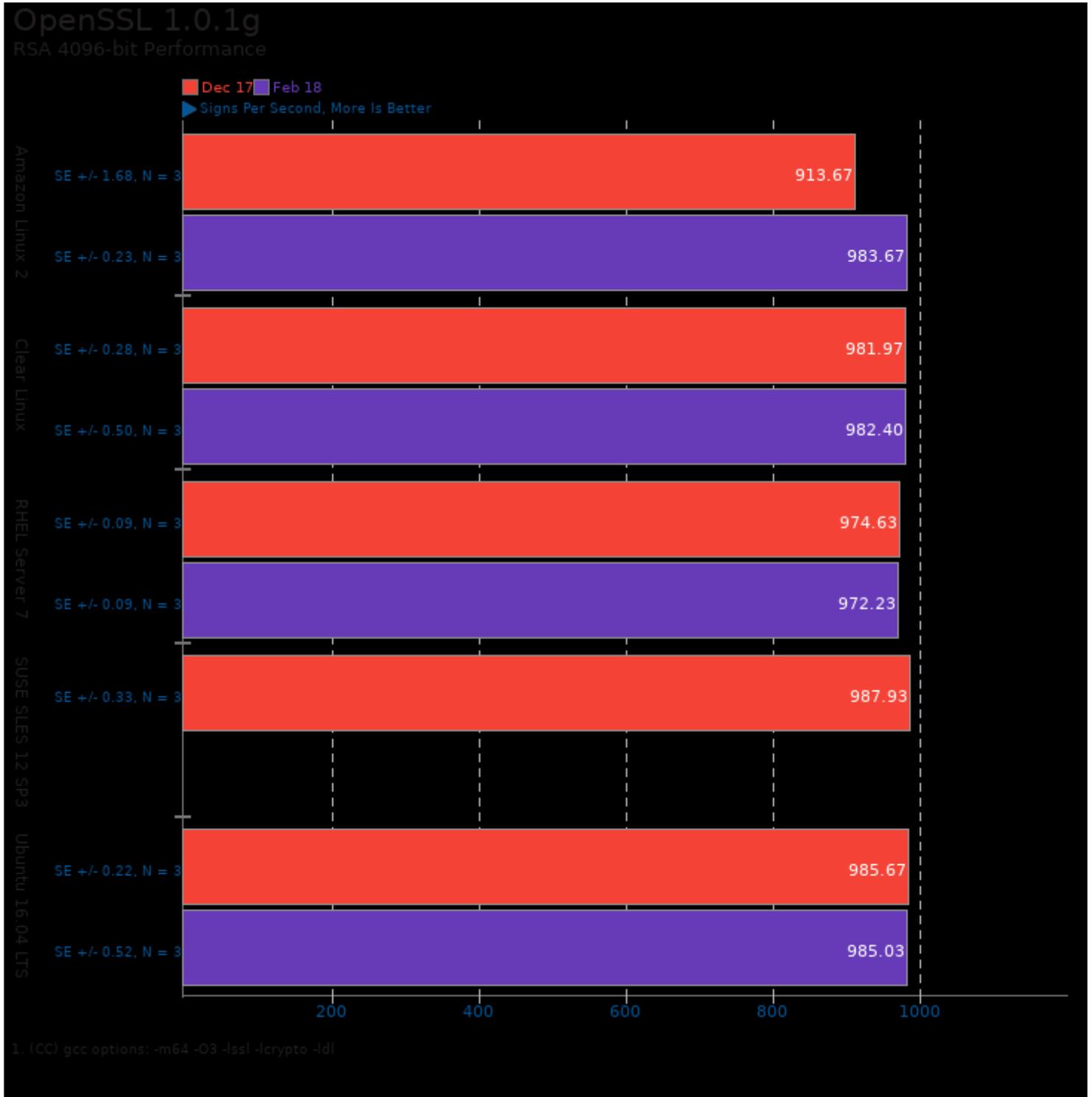




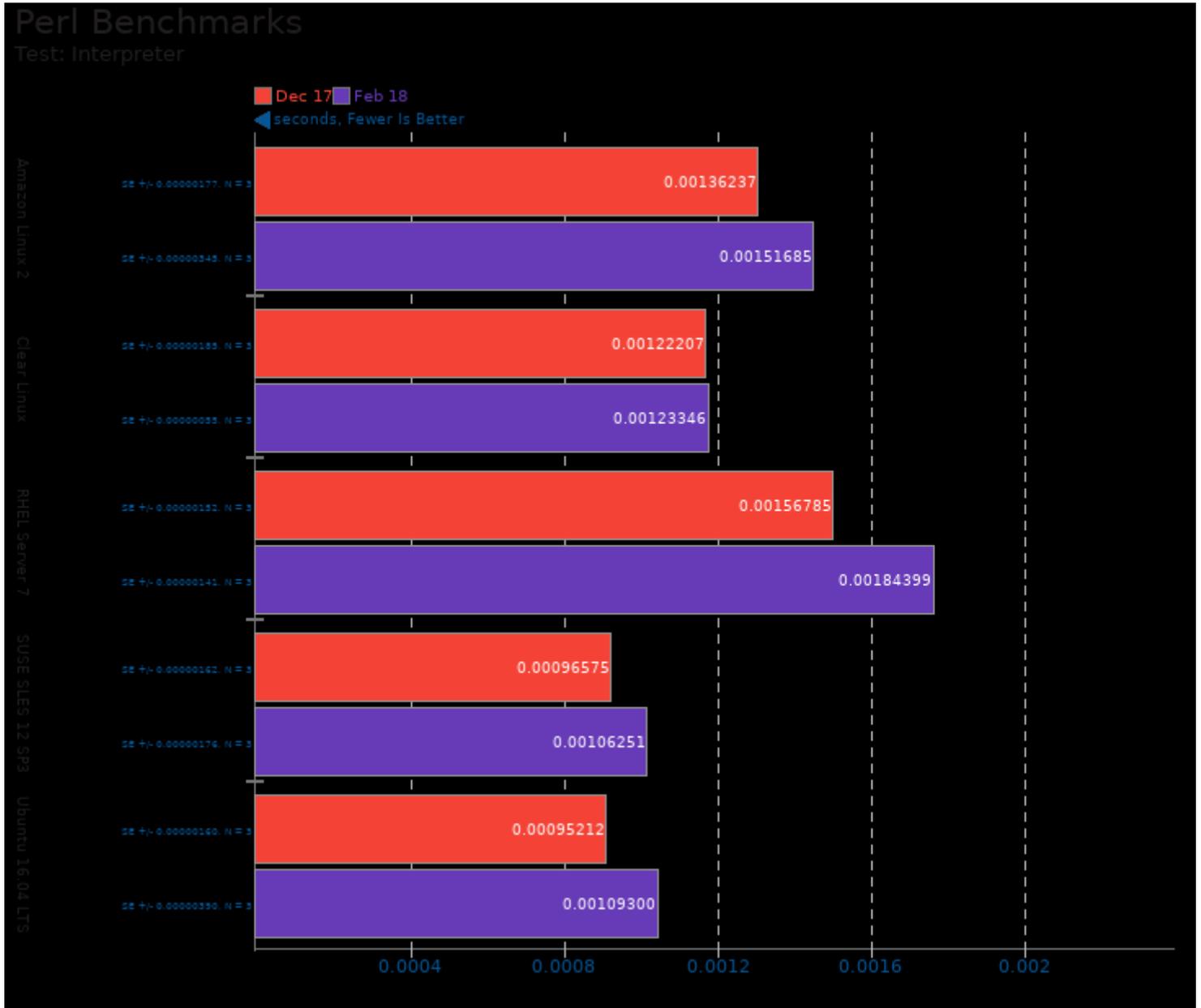


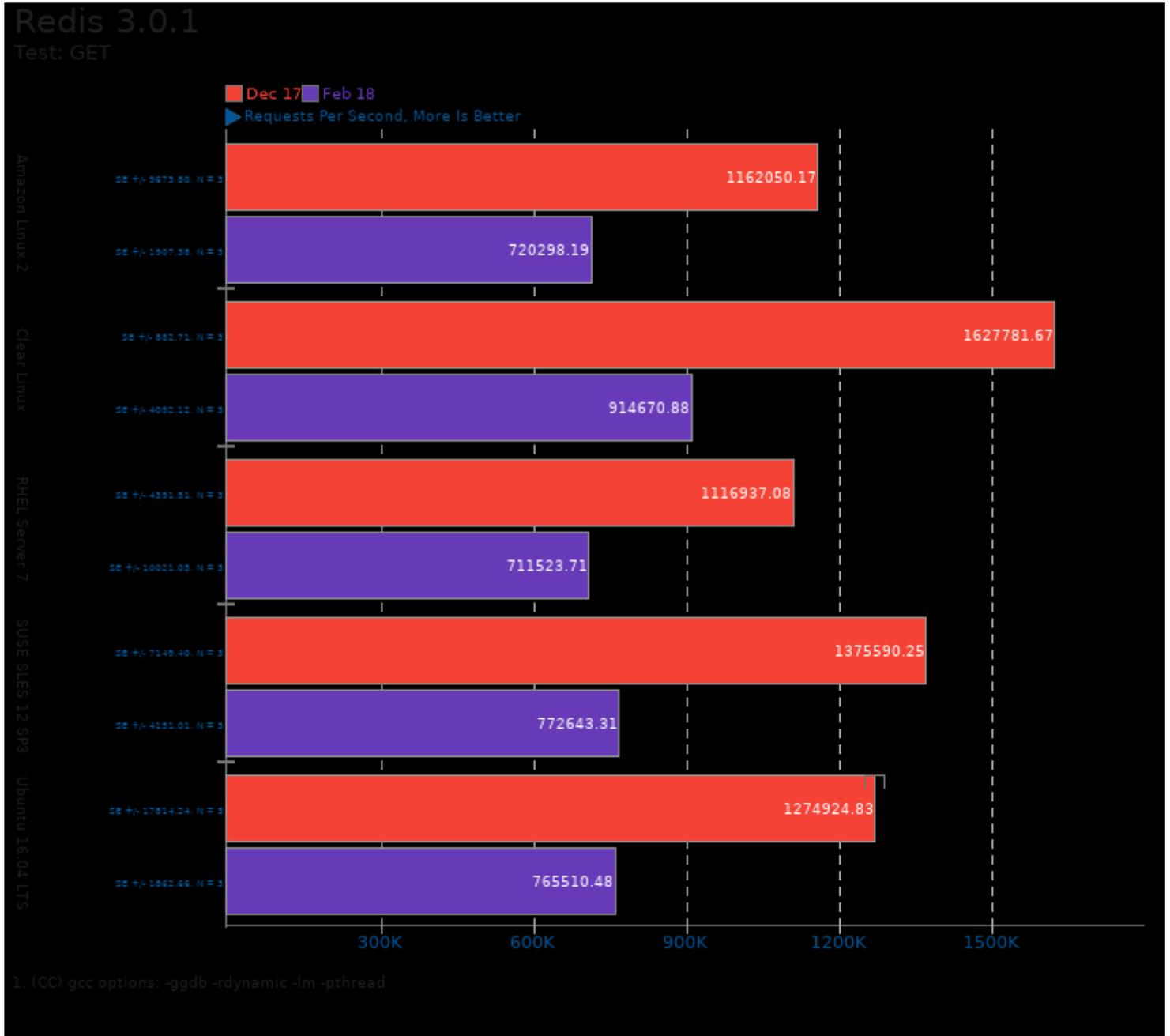


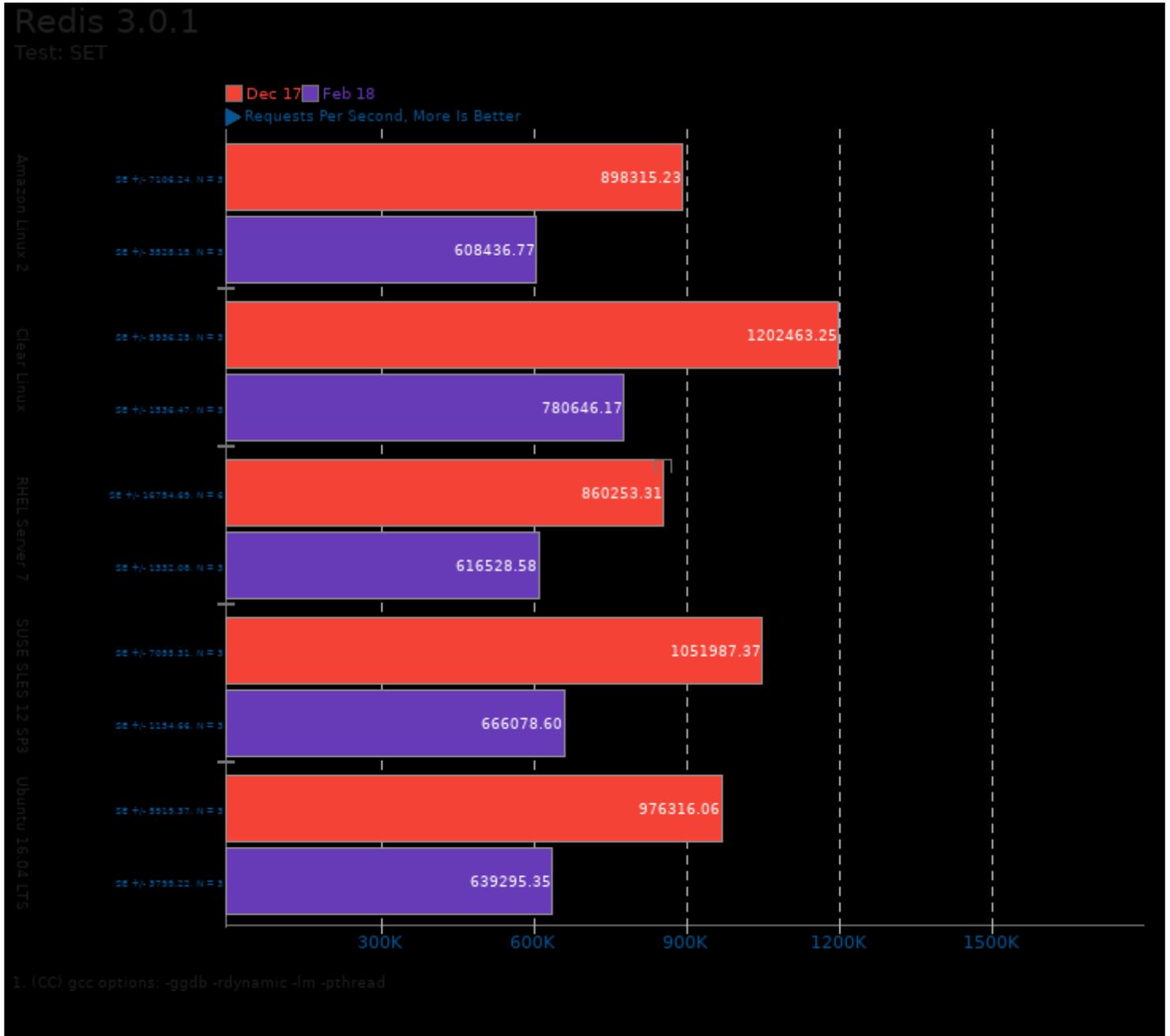


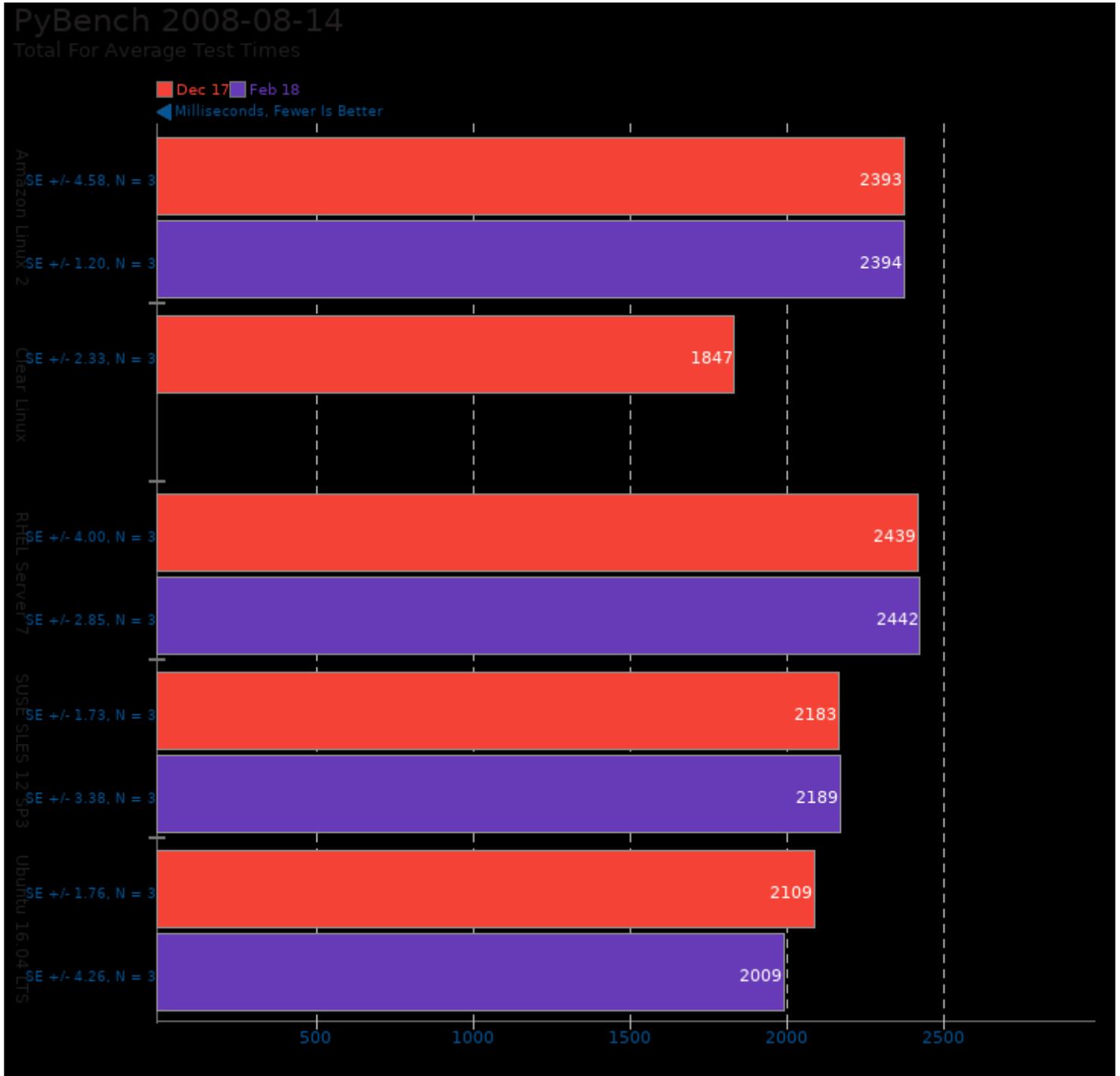


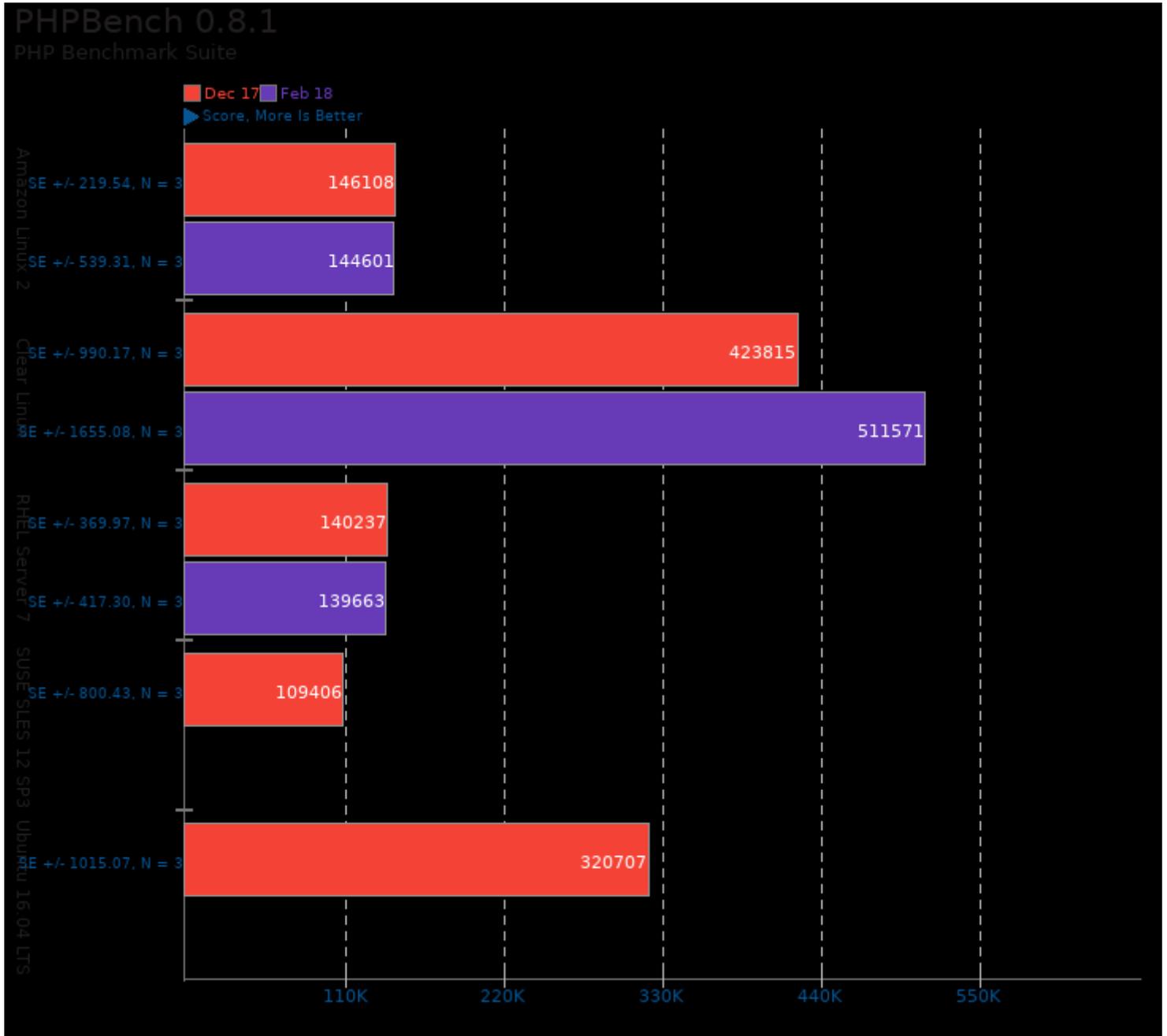


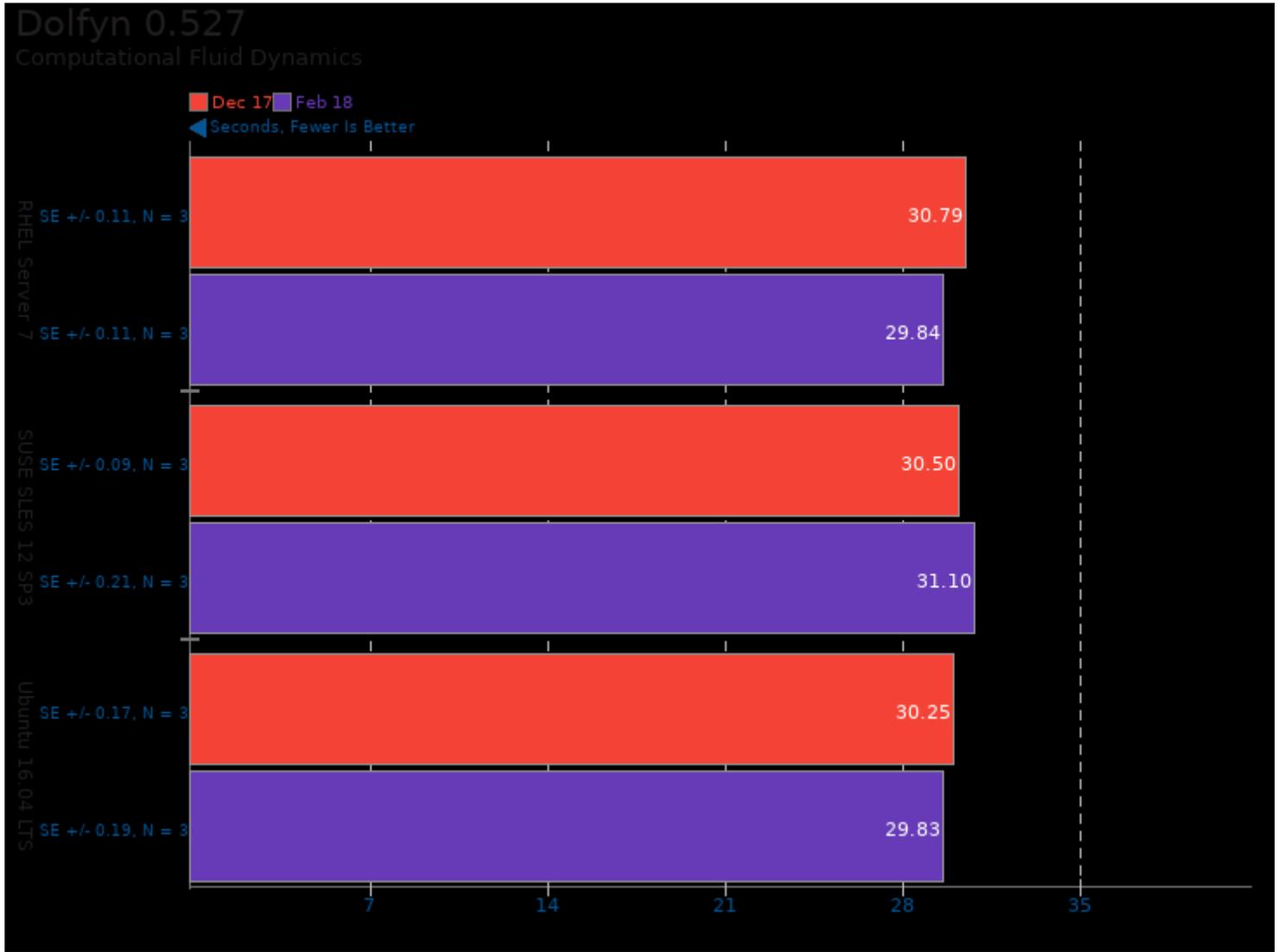


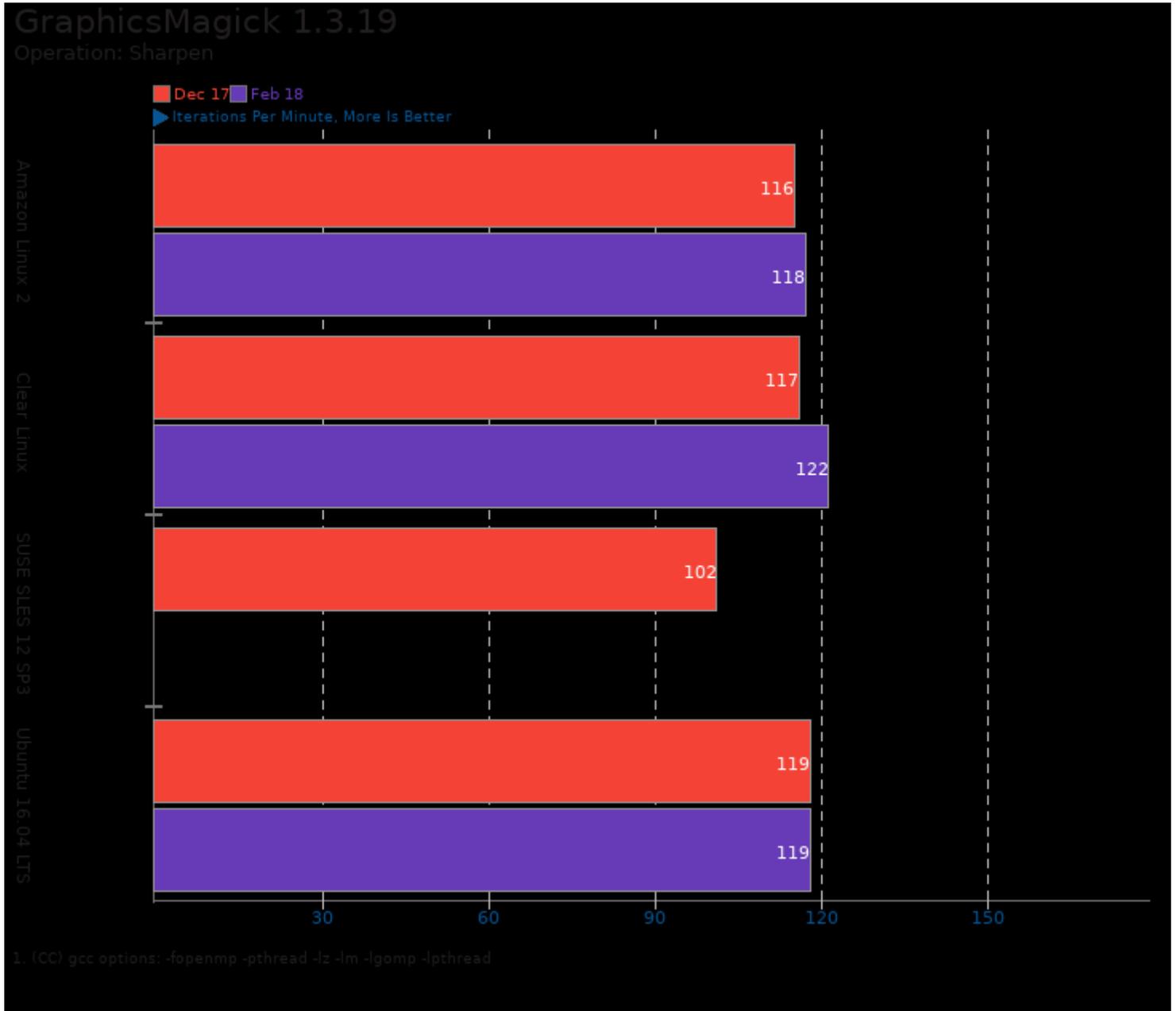


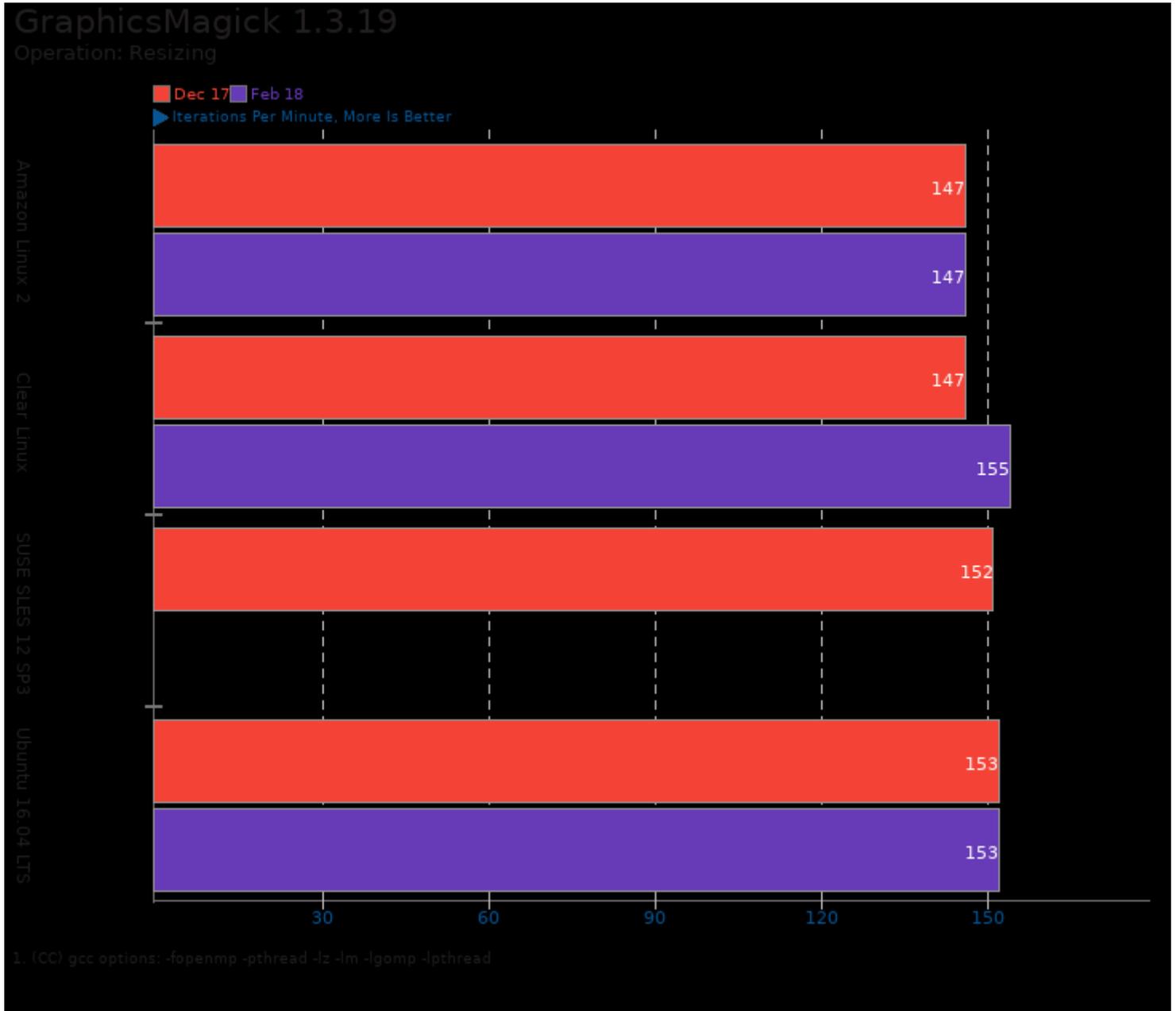


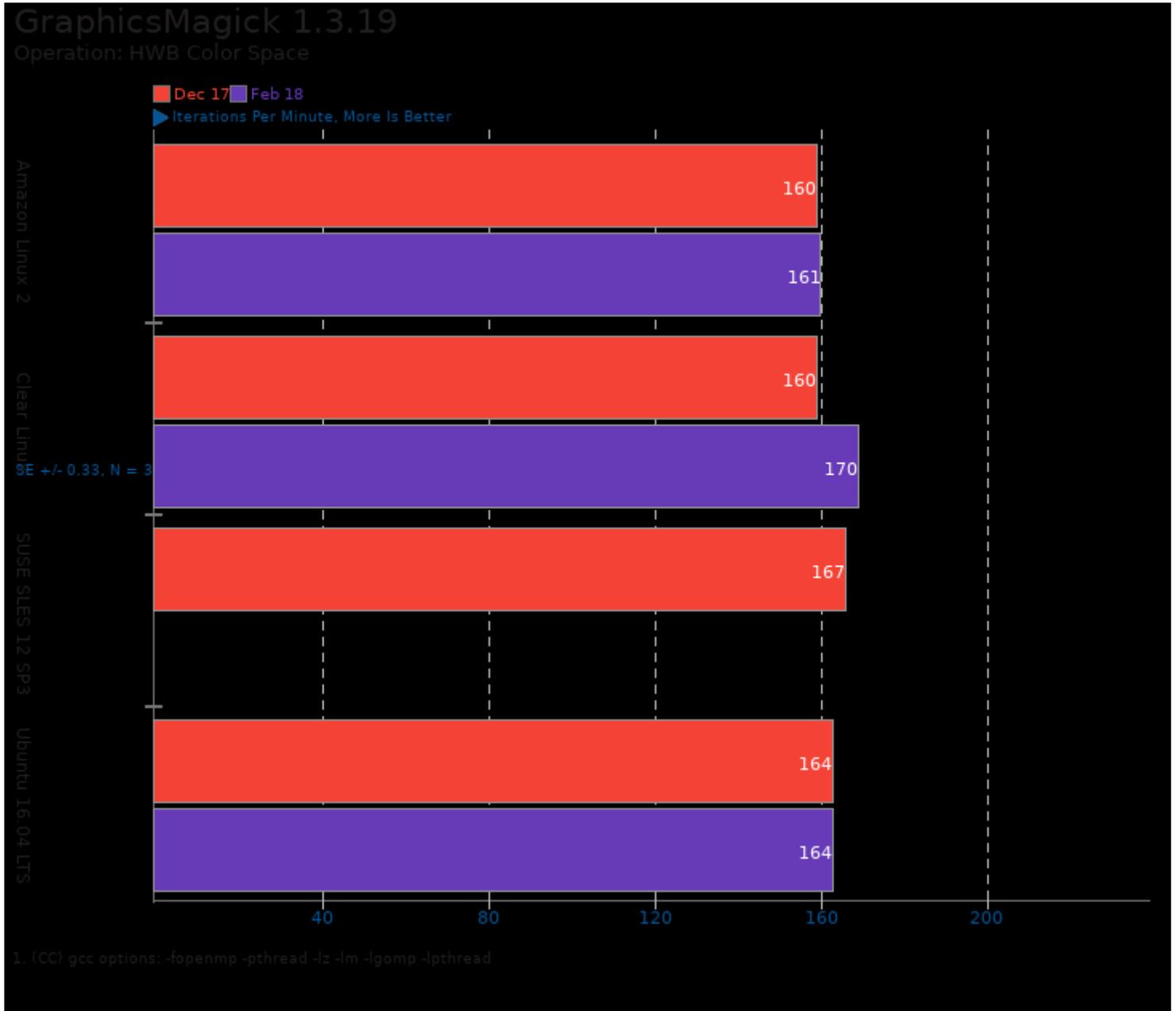


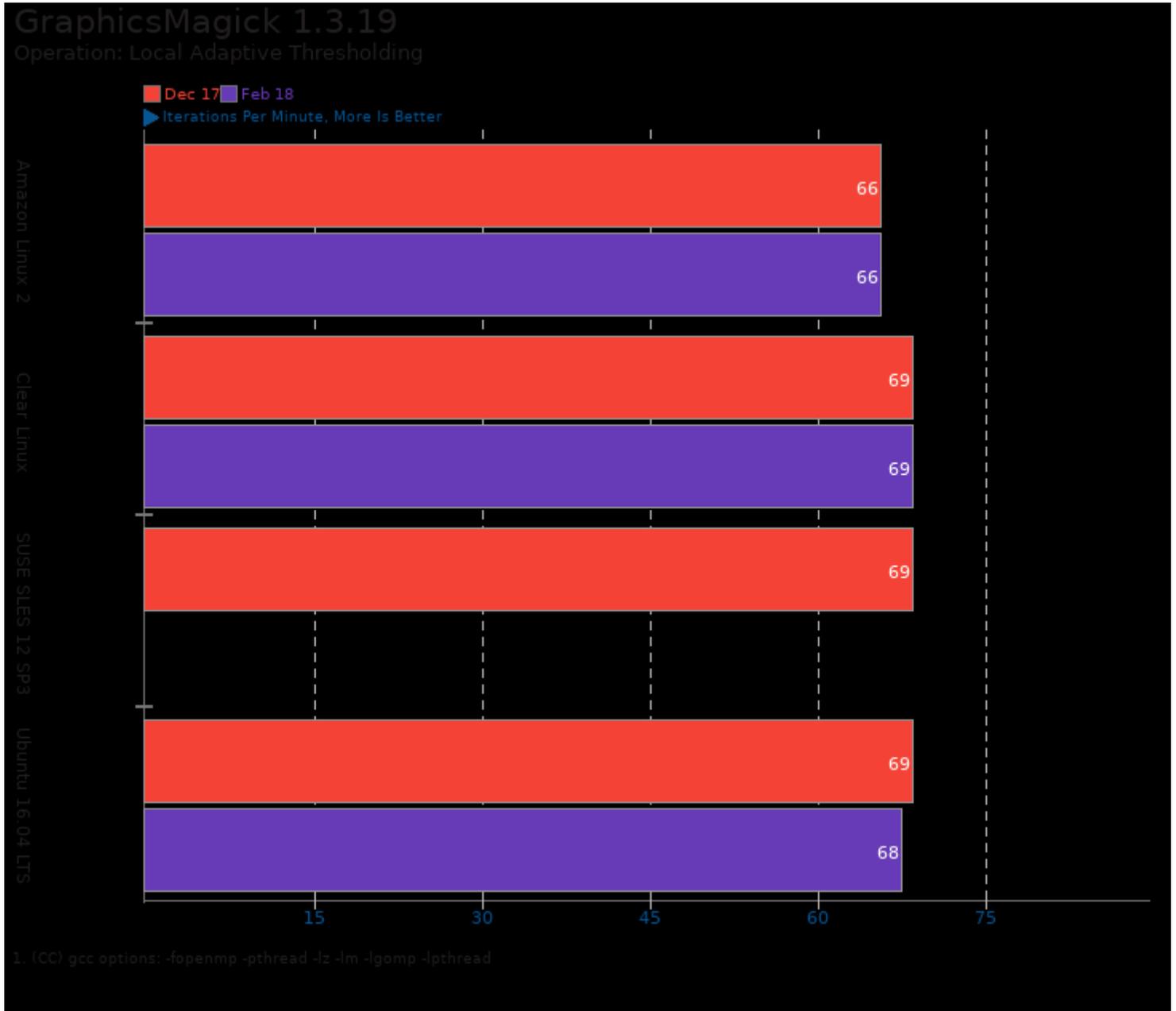


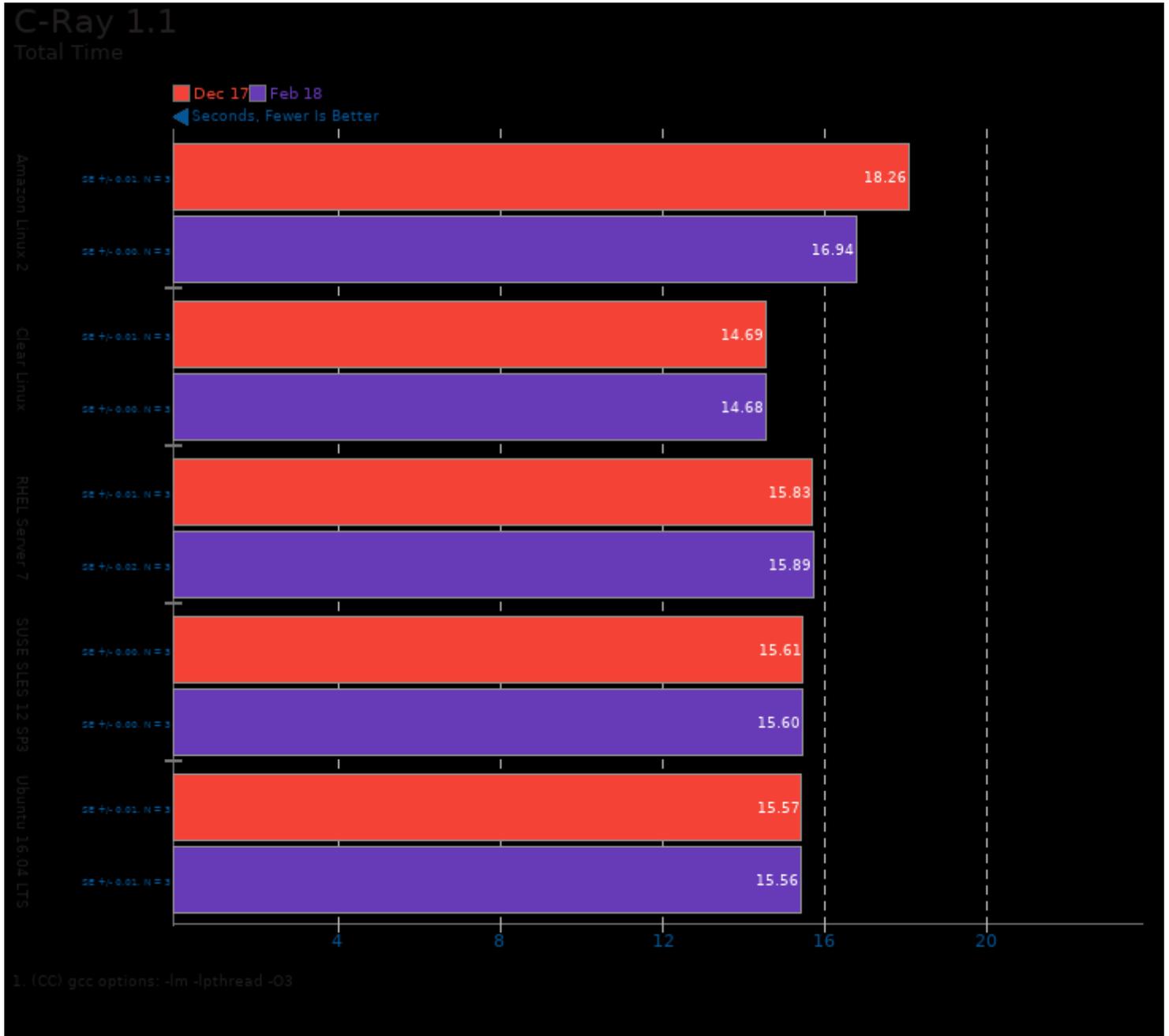


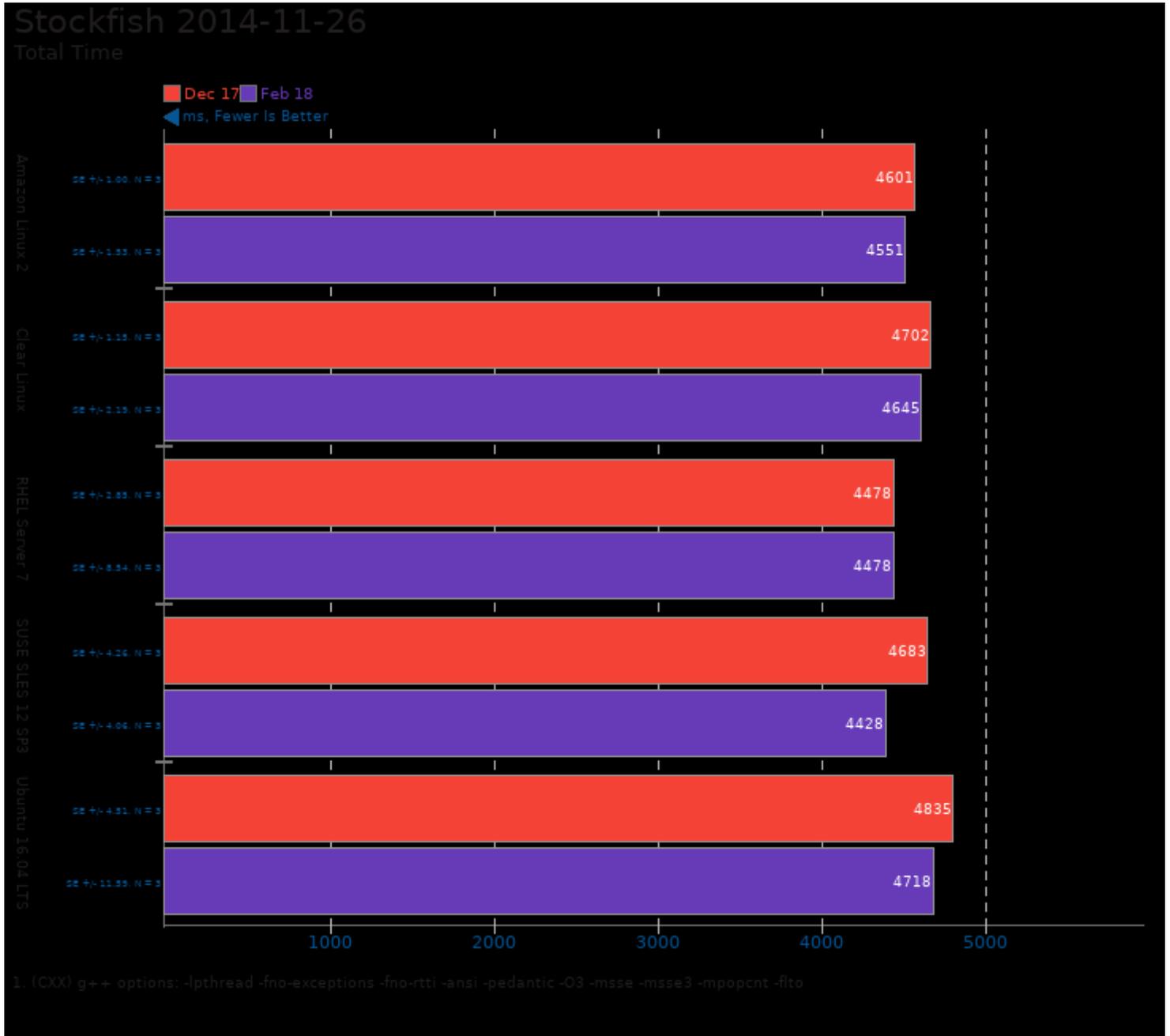


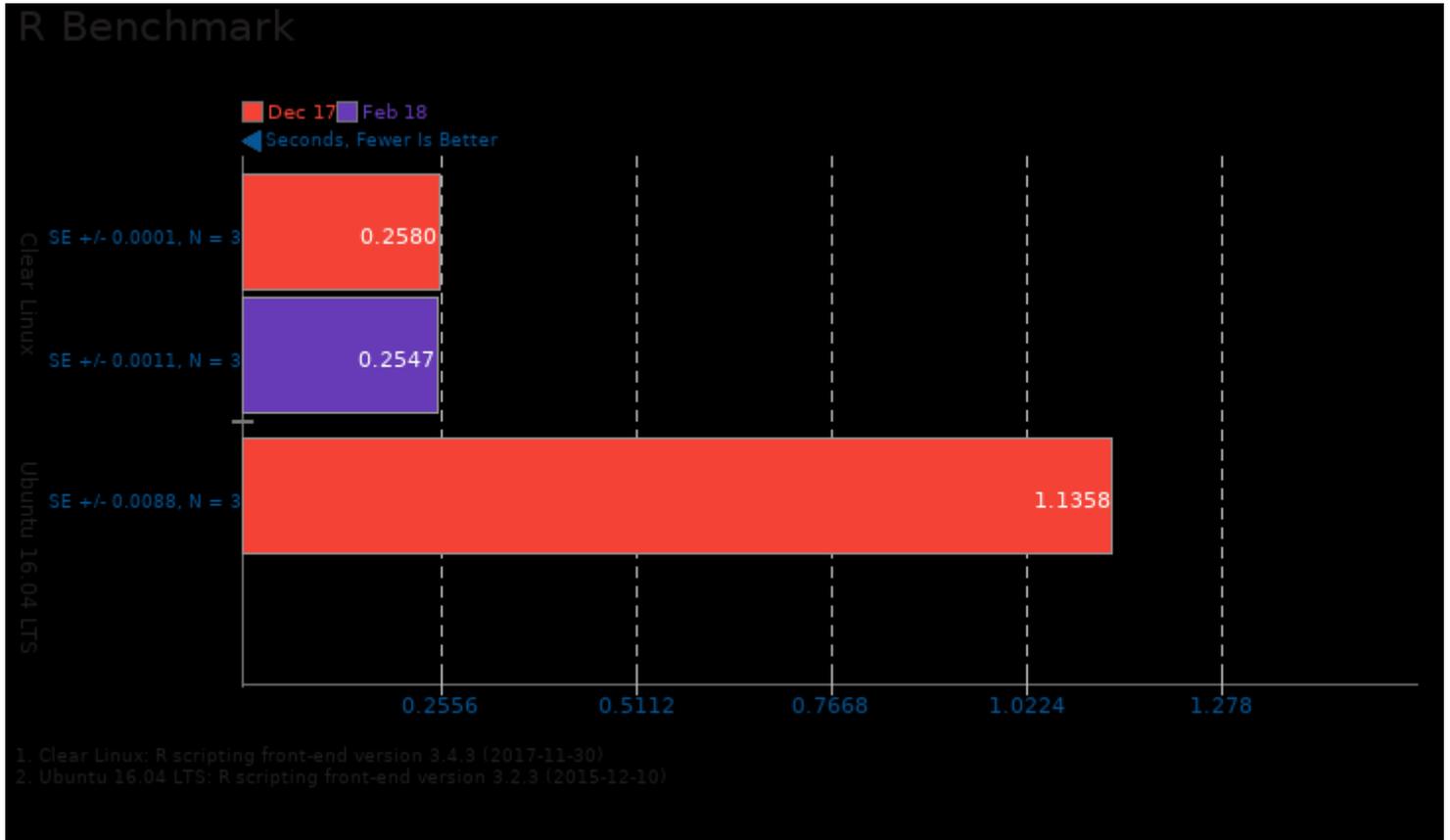


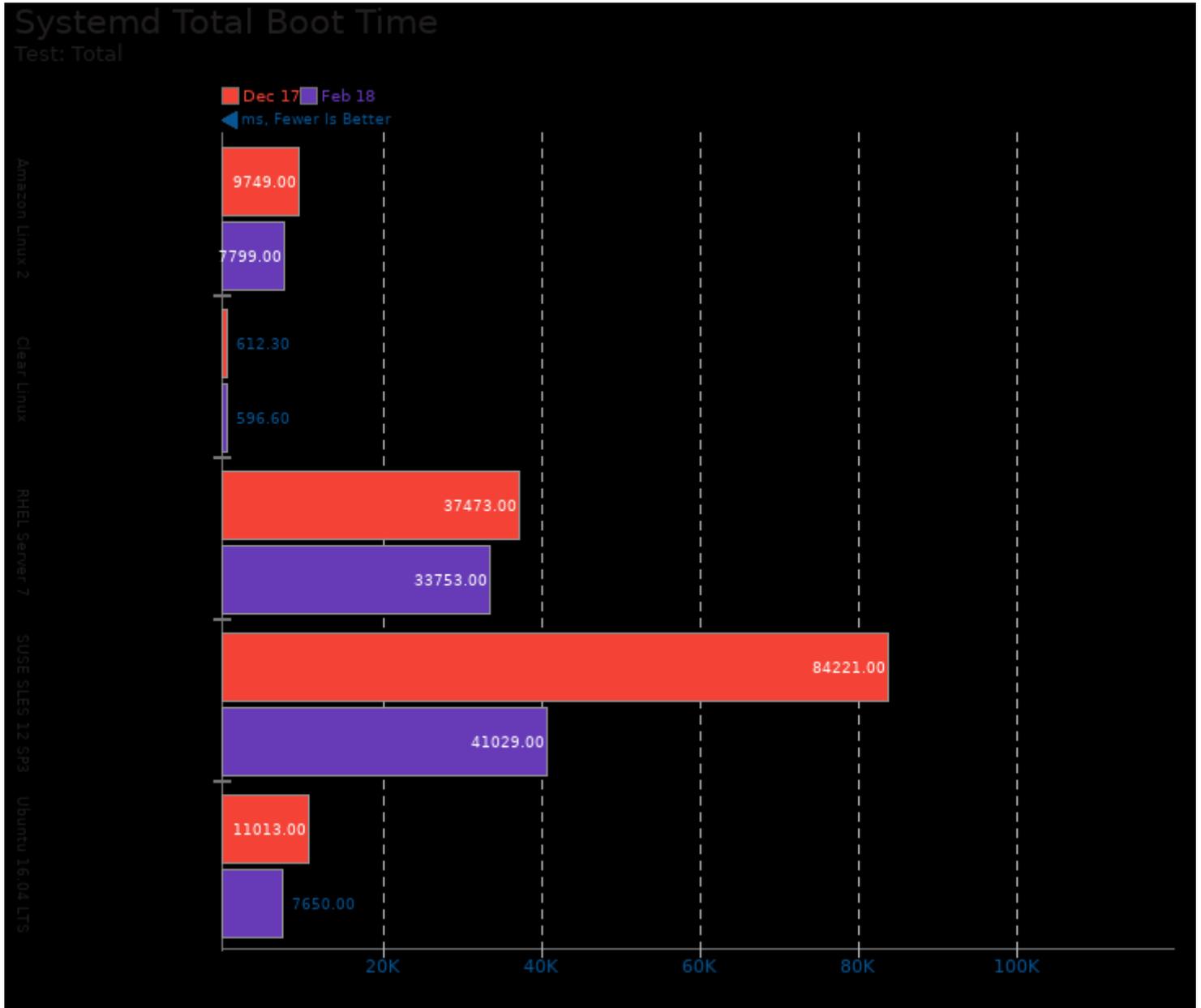


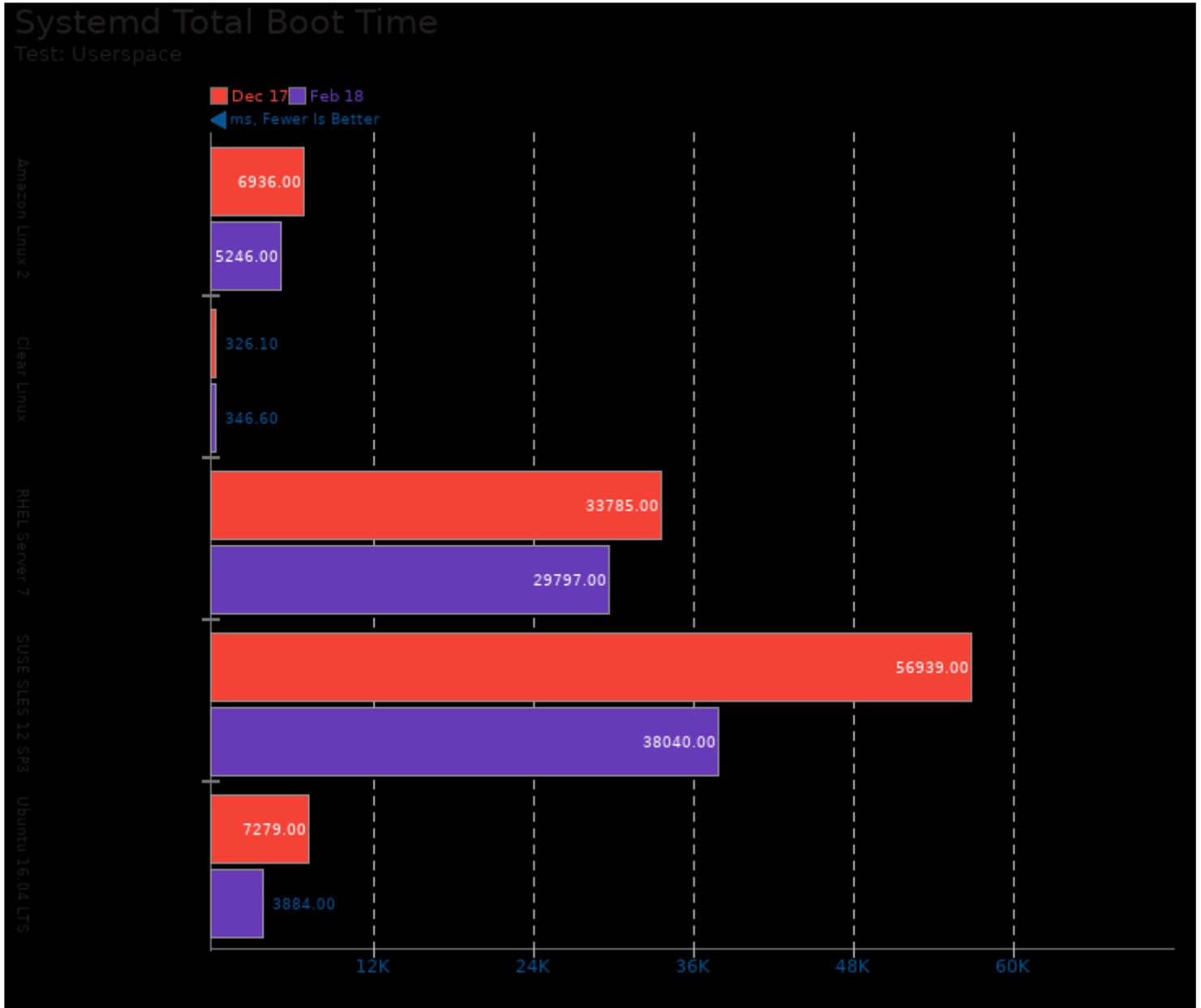


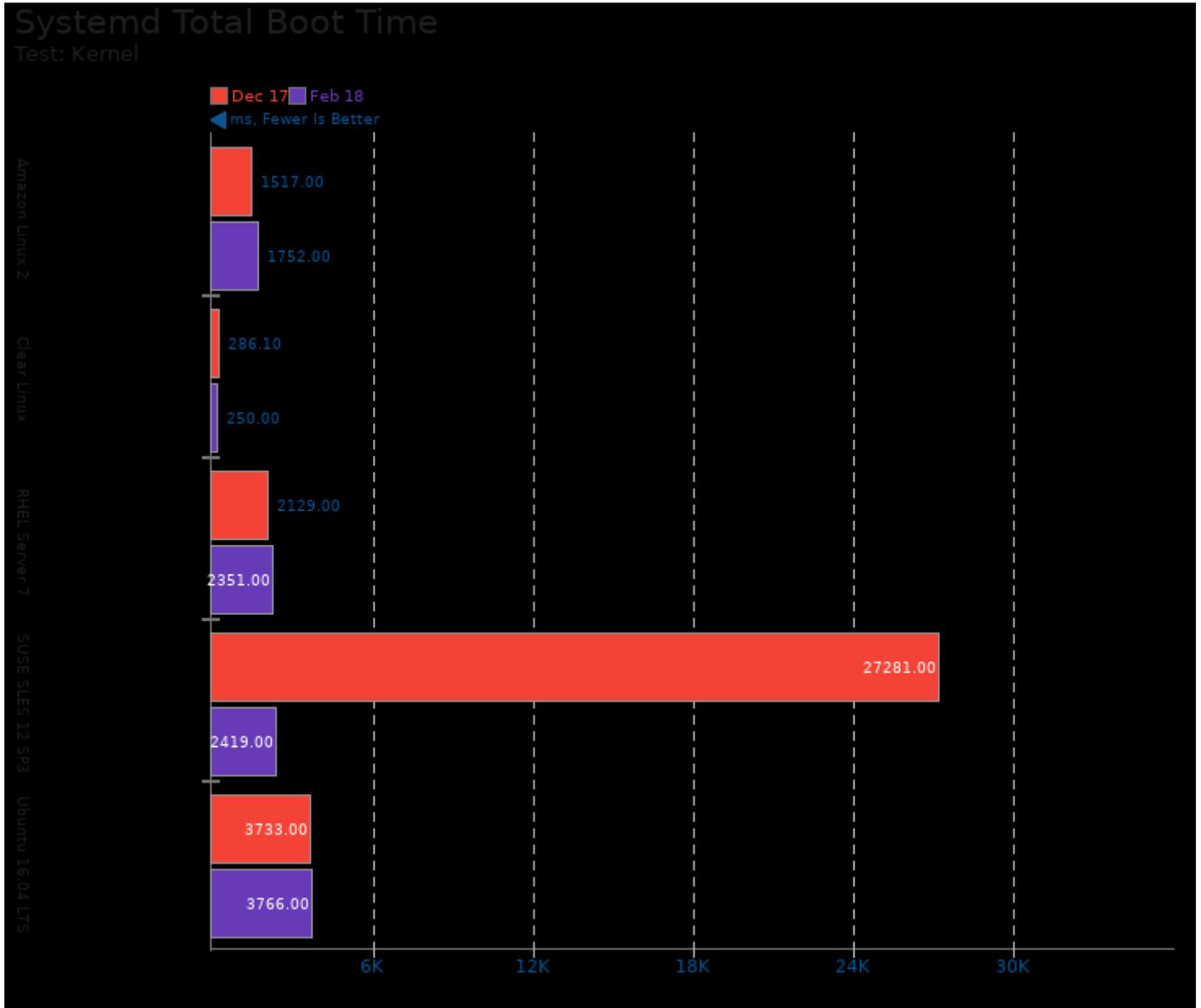








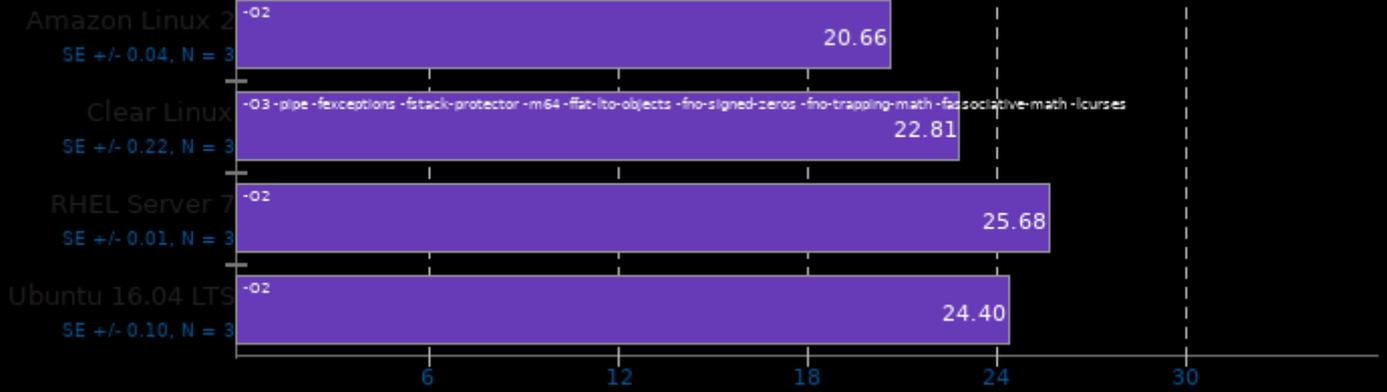




## SQLite 3.8.10.2

Test Target: Default Test Directory

← Seconds, Fewer Is Better

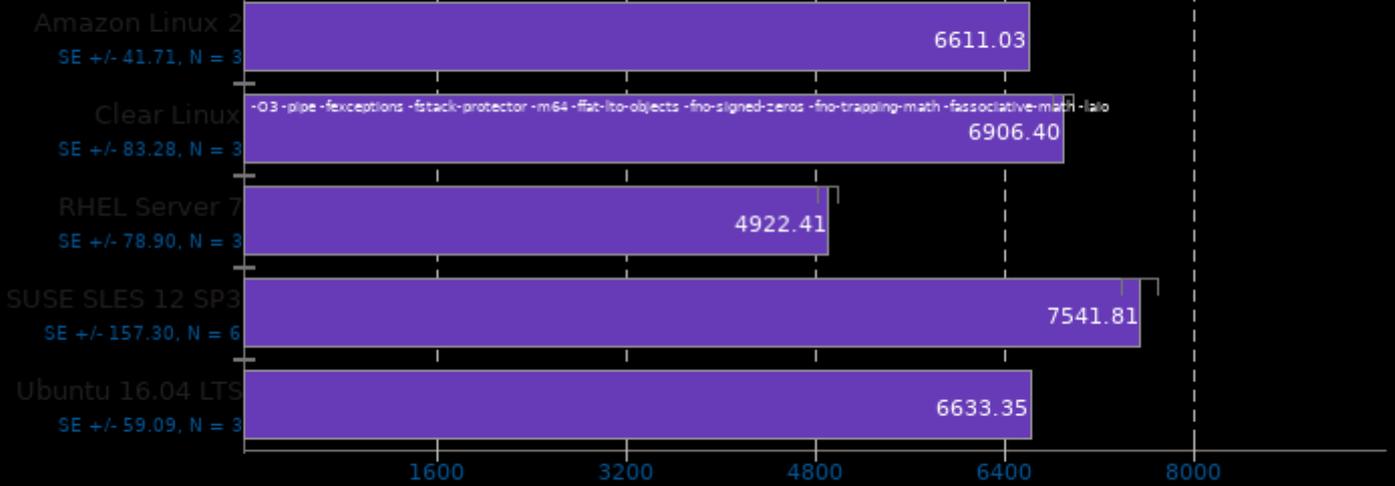


1. (CC) gcc options: -ldl -lpthread

## Stress-NG 0.07.26

Test: Memory Copying

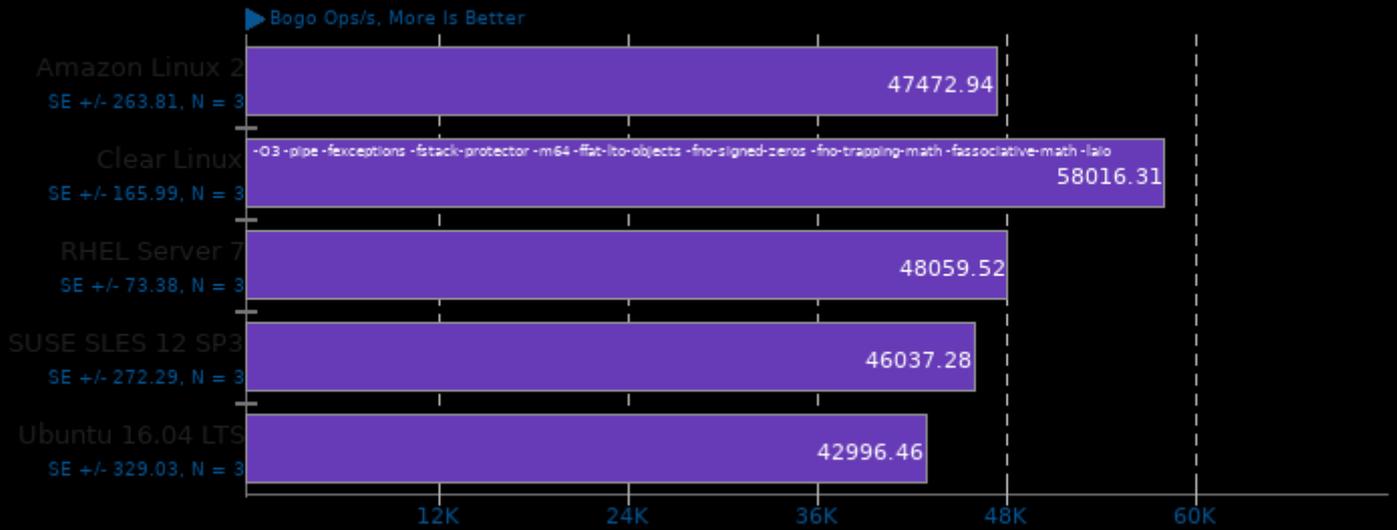
▶ Bogo Ops/s, More Is Better



1. (CC) gcc options: -O2 -std=gnu99 -lm -lz -lcrypt -lrt -lpthread -lc

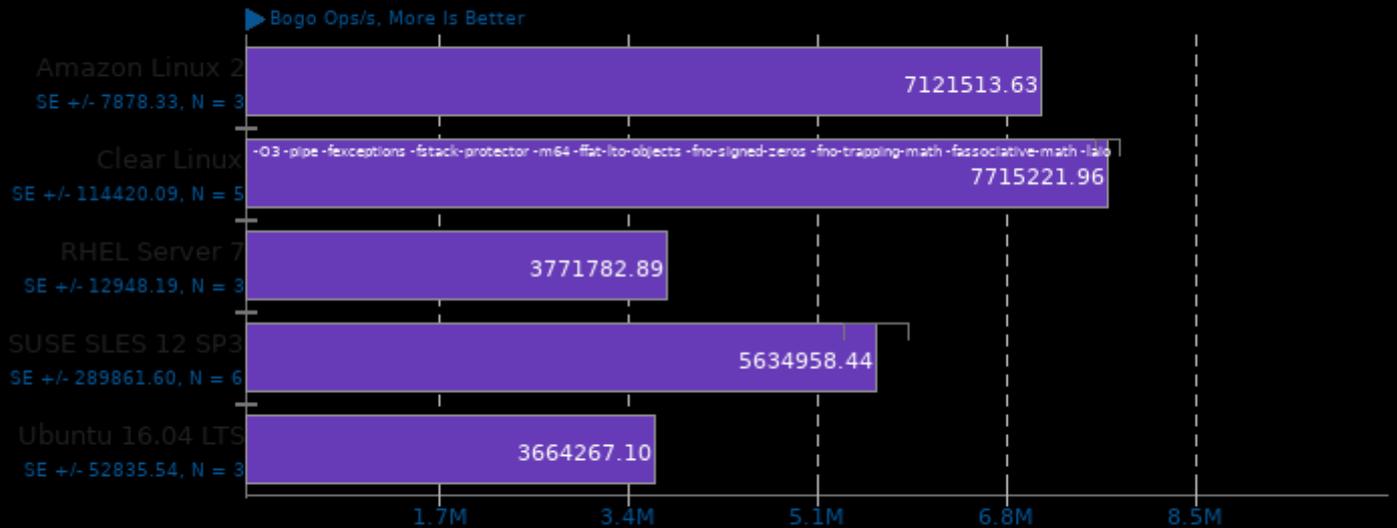
## Stress-NG 0.07.26

Test: Forking



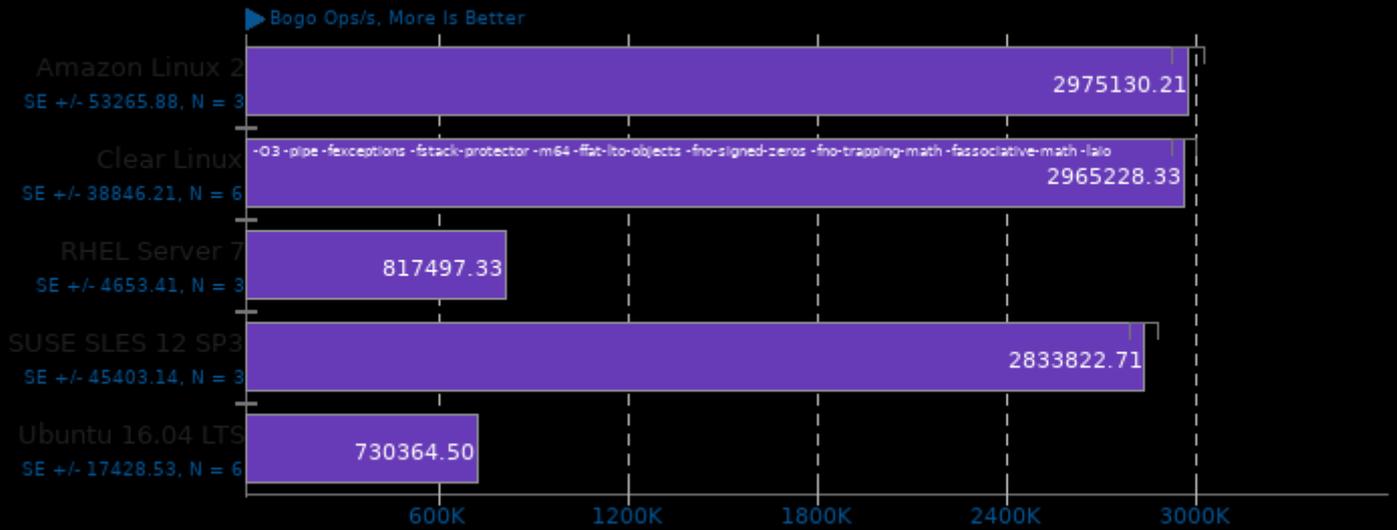
## Stress-NG 0.07.26

Test: System V Message Passing



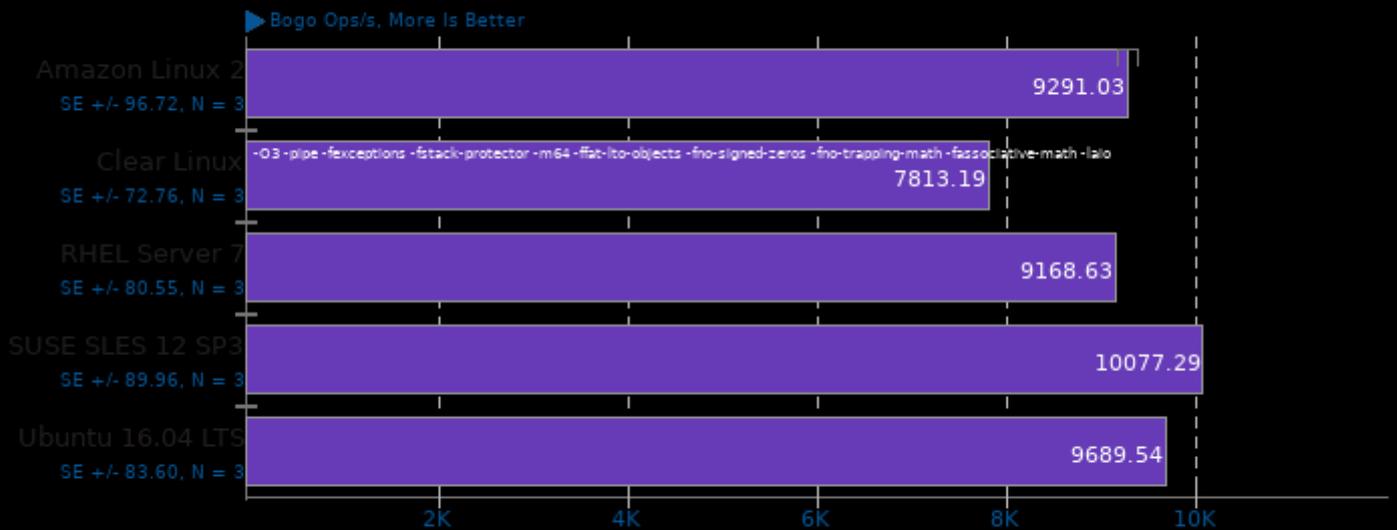
## Stress-NG 0.07.26

Test: Semaphores



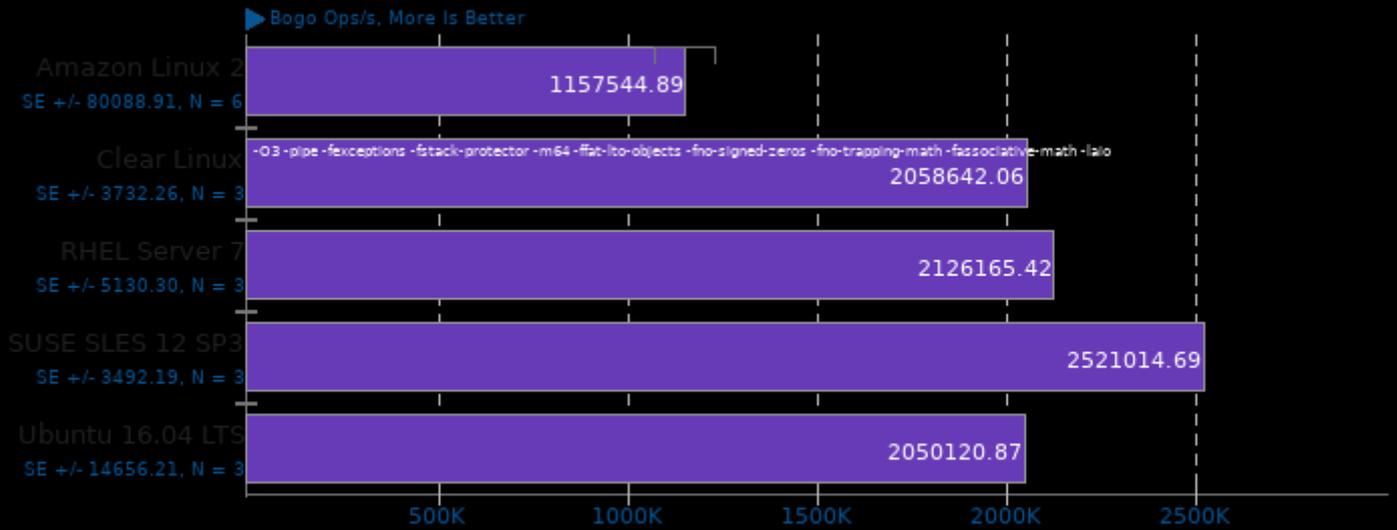
## Stress-NG 0.07.26

Test: Socket Activity



## Stress-NG 0.07.26

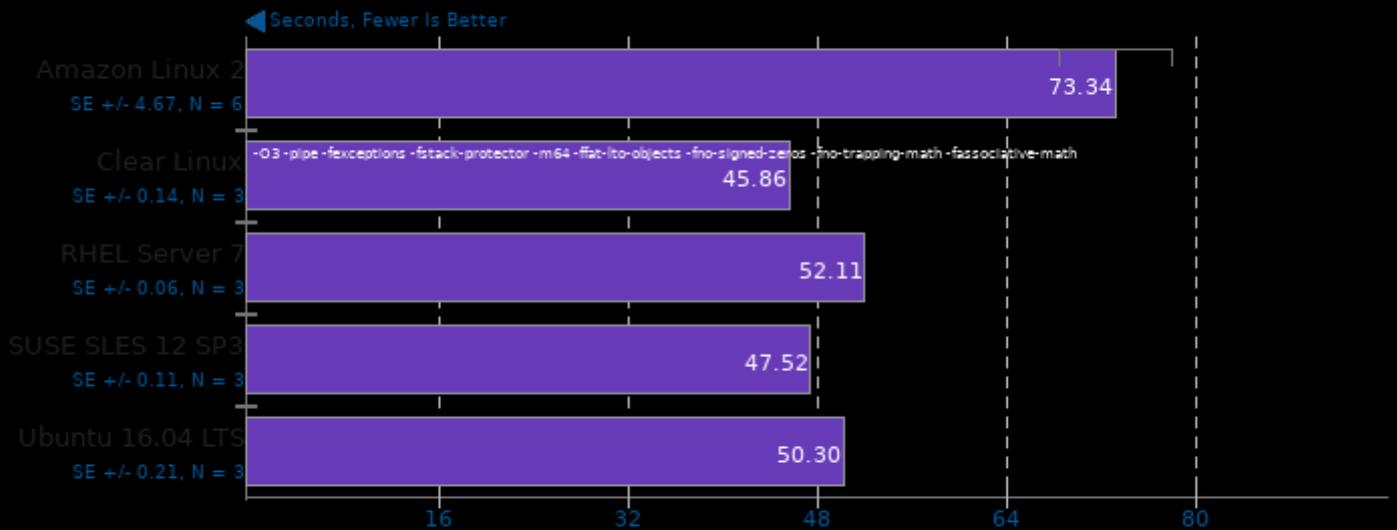
Test: Context Switching



1. (CC) gcc options: -O2 -std=gnu99 -lm -lz -lcrypt -lrt -lpthread -lc

## Hackbench

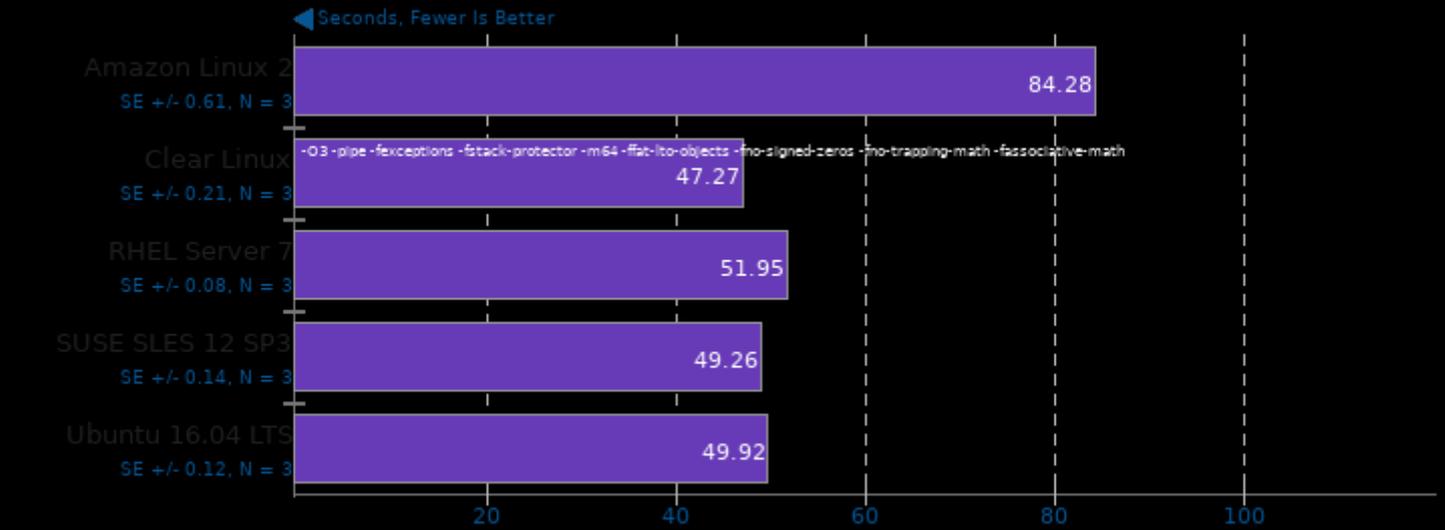
Count: 16 - Type: Process



1. (CC) gcc options: -lpthread

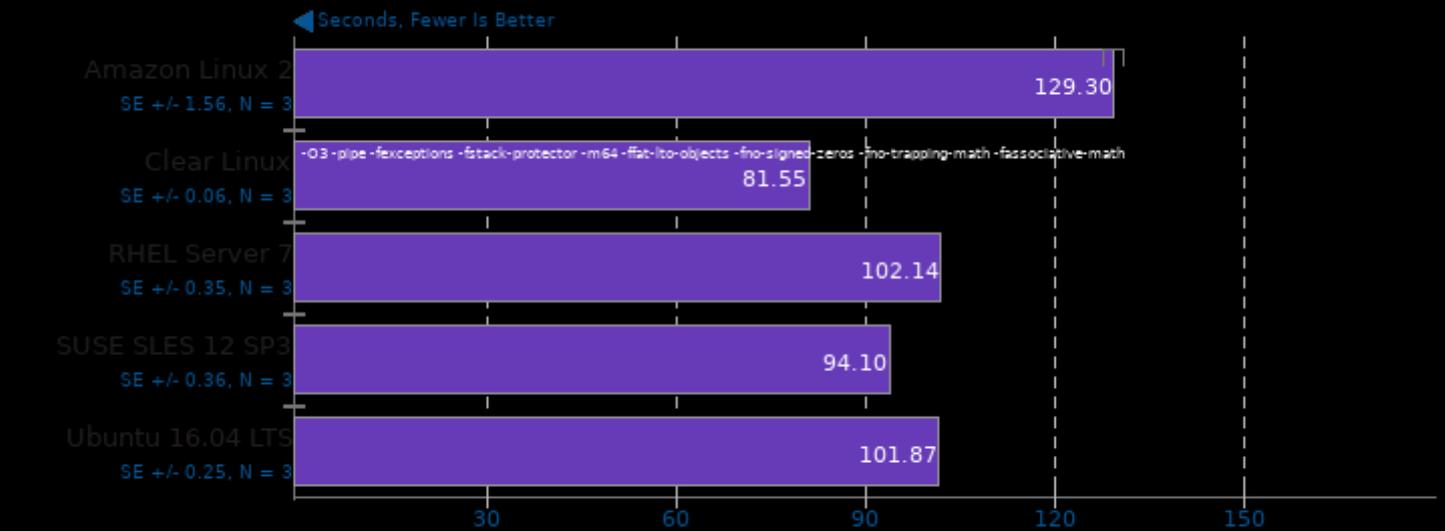
## Hackbench

Count: 16 - Type: Thread



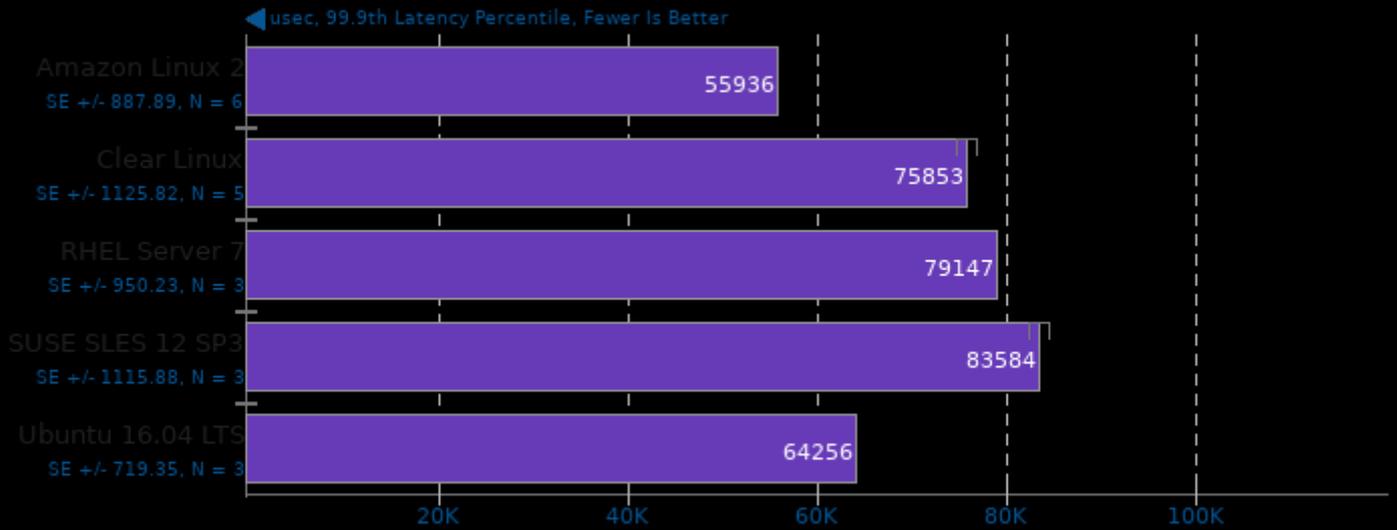
## Hackbench

Count: 32 - Type: Process



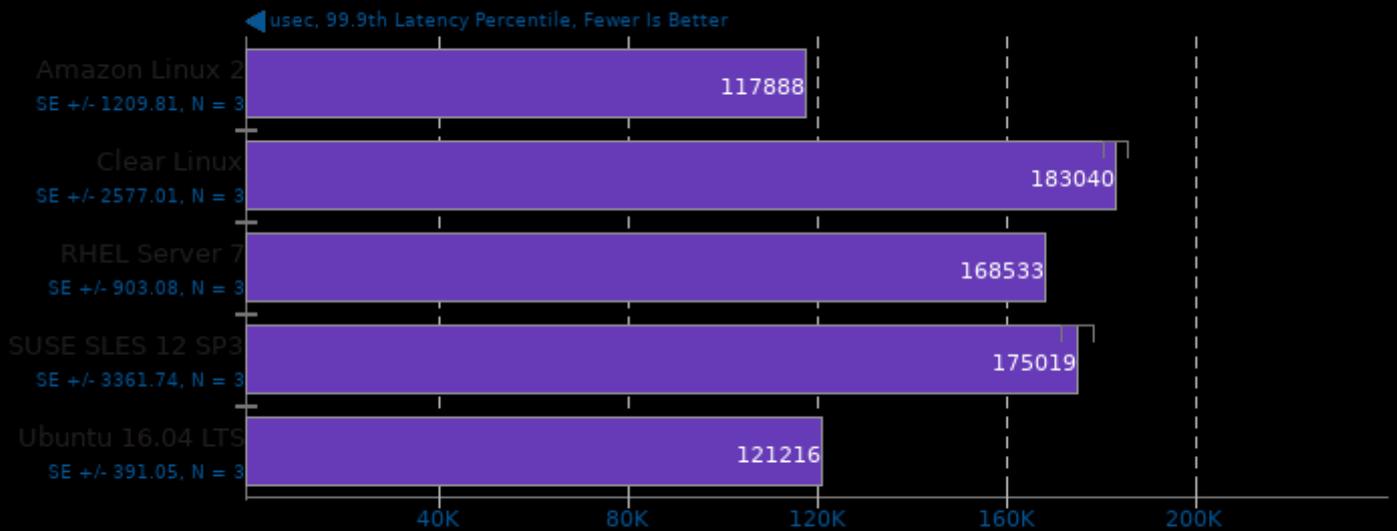
## Schbench

Message Threads: 8 - Workers Per Message Thread: 8



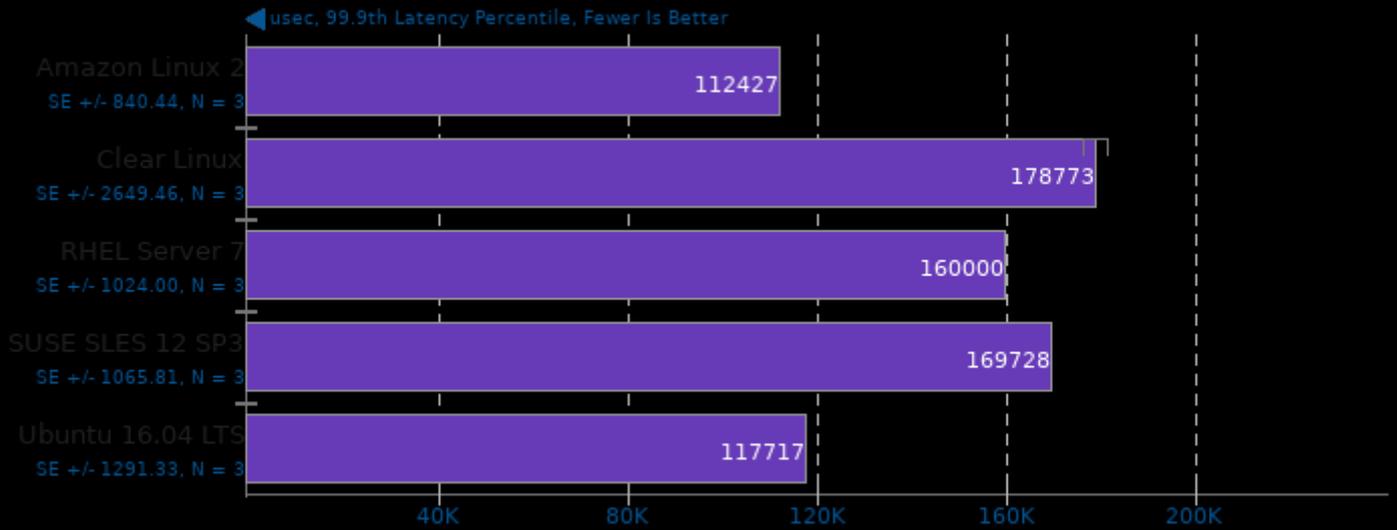
## Schbench

Message Threads: 8 - Workers Per Message Thread: 16



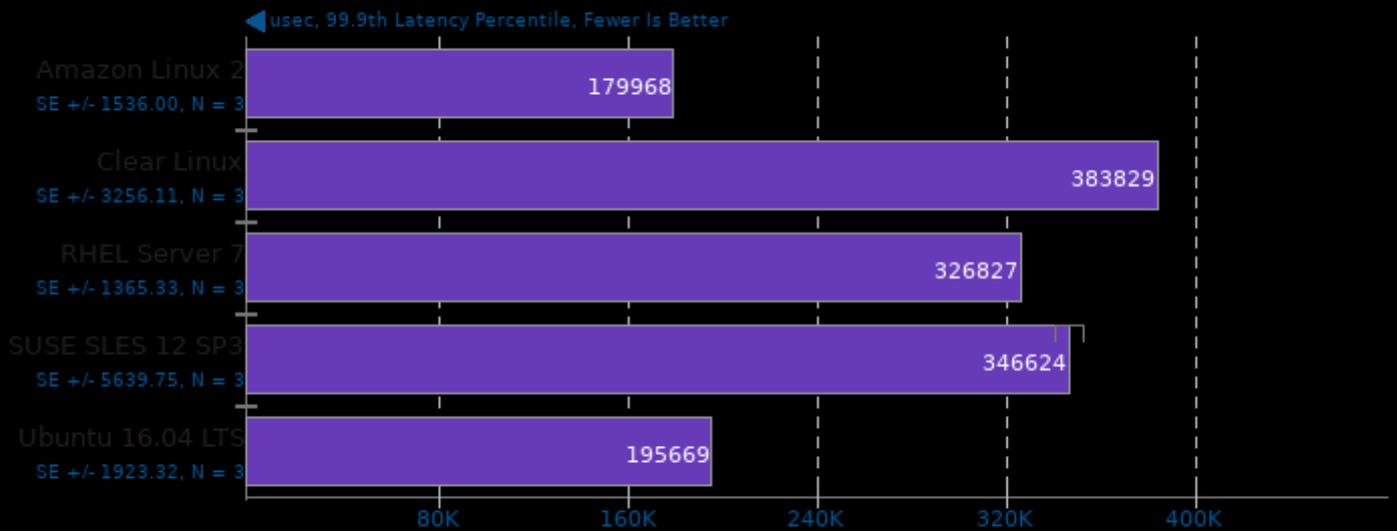
## Schbench

Message Threads: 16 - Workers Per Message Thread: 8



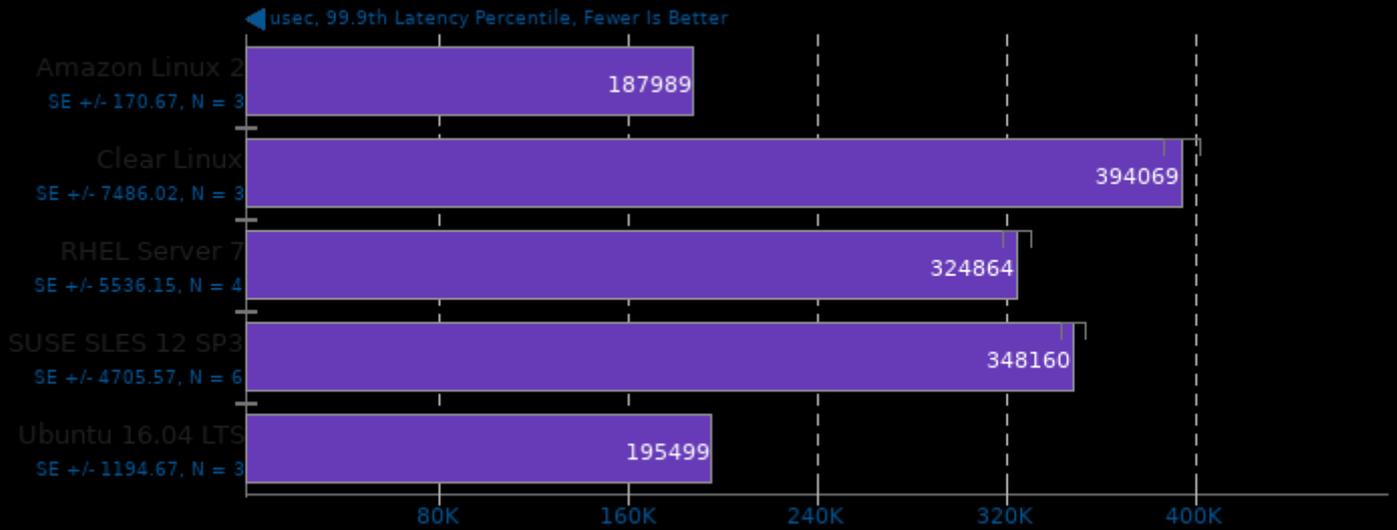
## Schbench

Message Threads: 16 - Workers Per Message Thread: 16



## Schbench

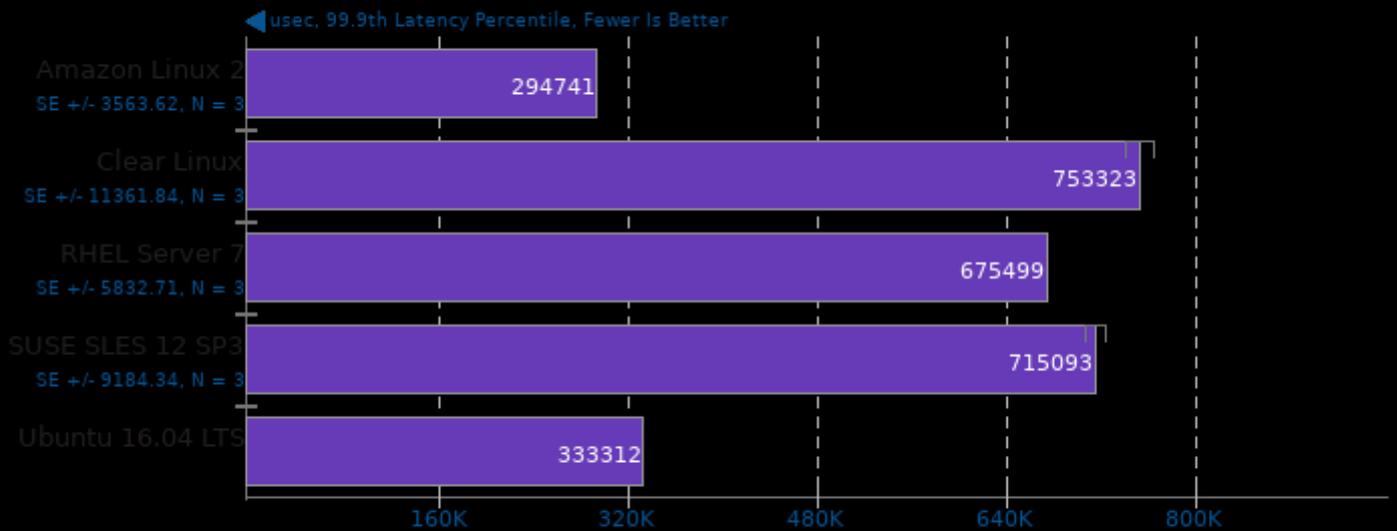
Message Threads: 32 - Workers Per Message Thread: 8



1, (C) gcc options: -O2 -lpthread

## Schbench

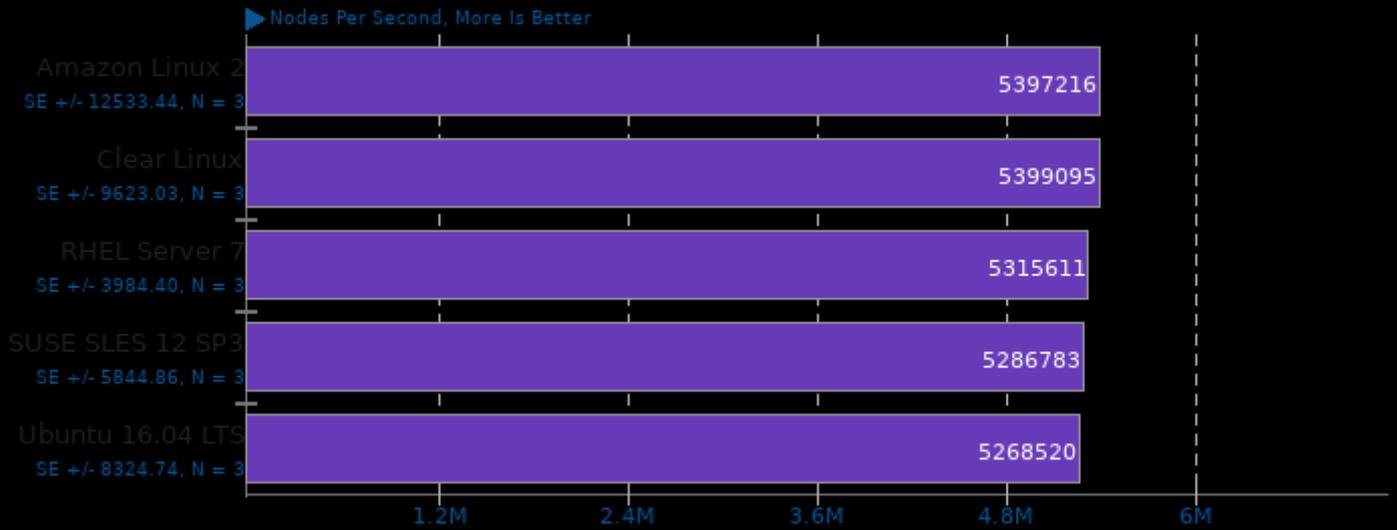
Message Threads: 32 - Workers Per Message Thread: 16



1, (C) gcc options: -O2 -lpthread

### Crafty 25.2

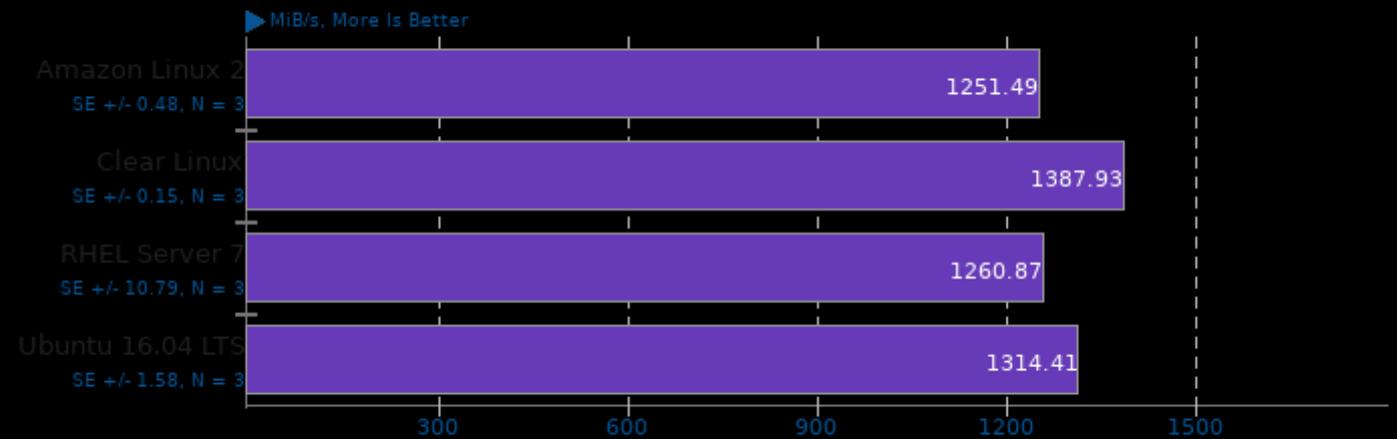
Elapsed Time



1. (CC) gcc options: -lstdc++ -fprofile-use -pthread -lm

### Botan 2.4.0

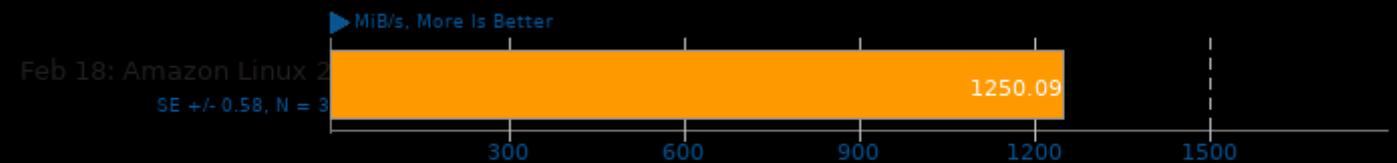
Test: AES-256 - Encrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

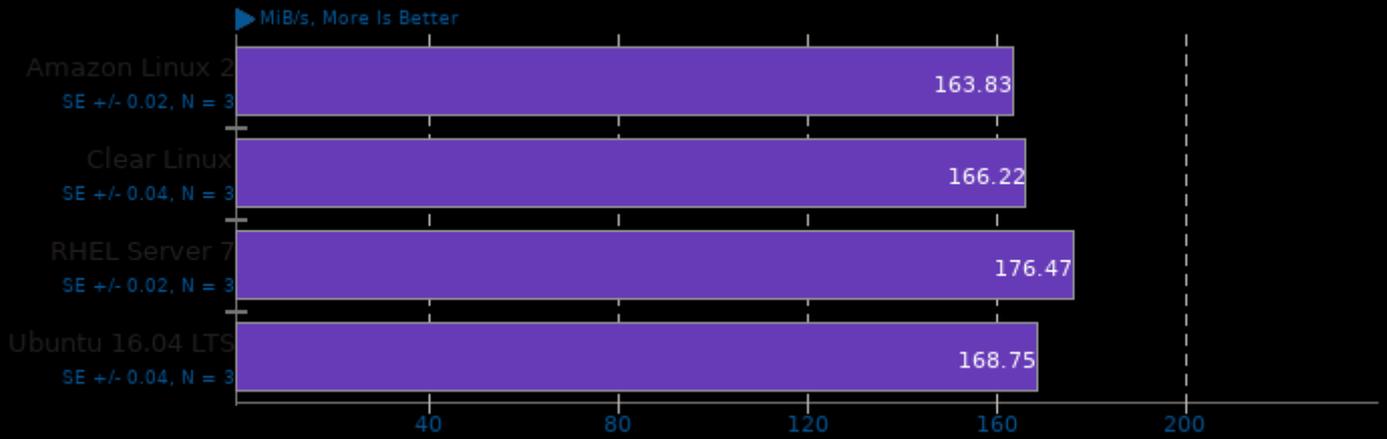
Test: AES-256 - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

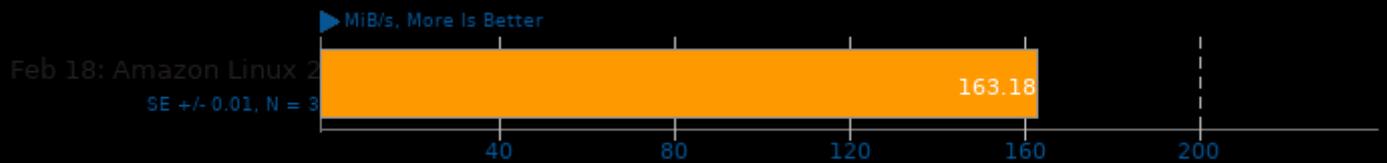
Test: Blowfish - Encrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

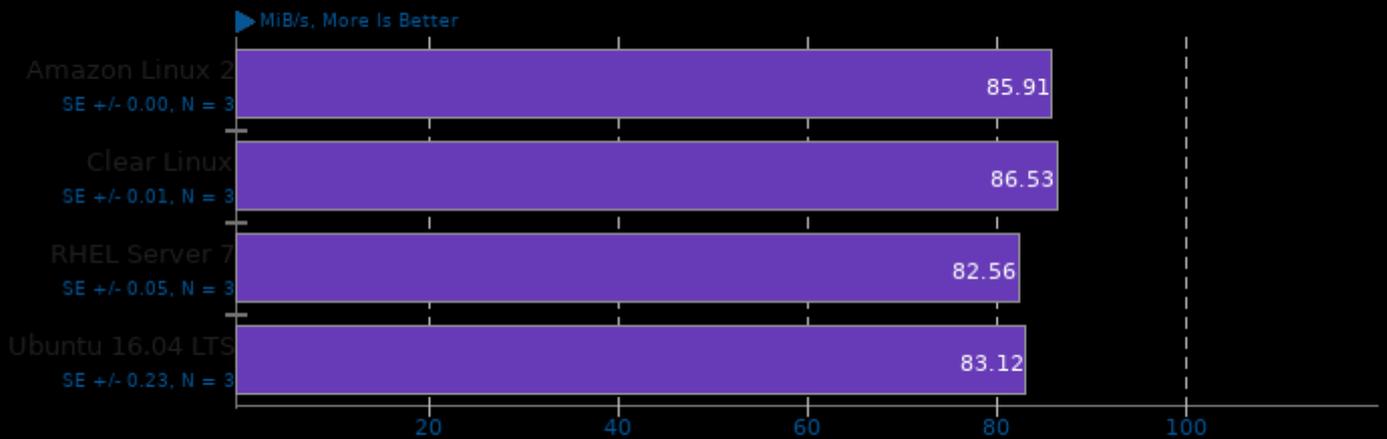
Test: Blowfish - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

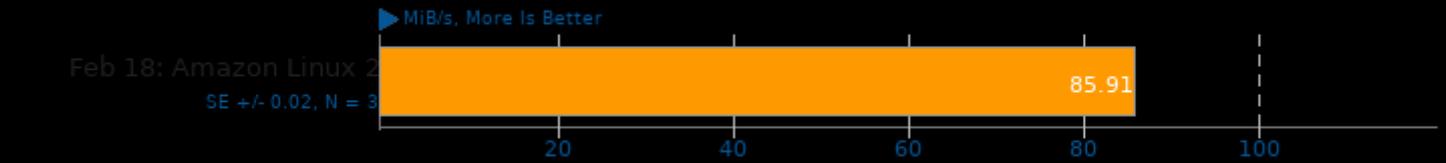
Test: CAST-256 - Encrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

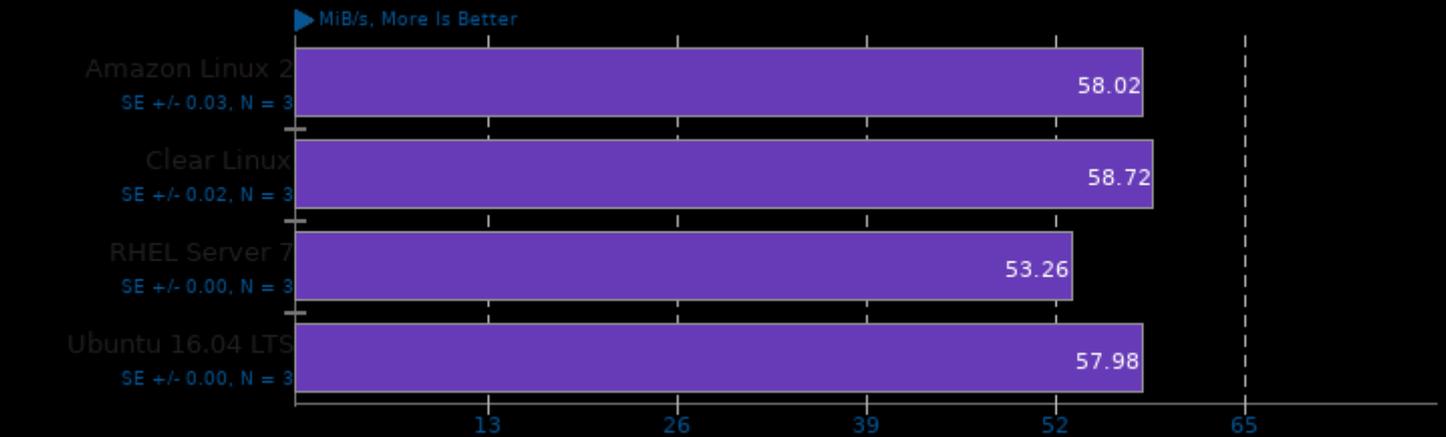
Test: CAST-256 - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

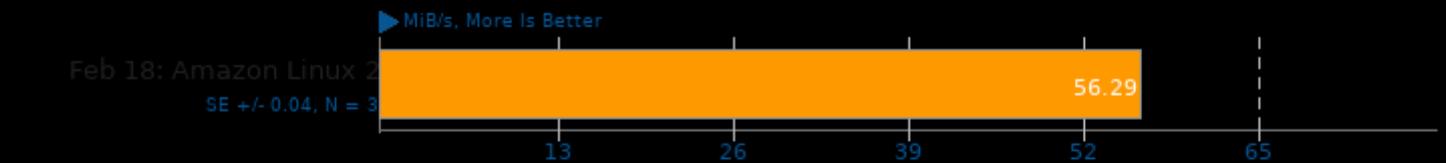
Test: KASUMI - Encrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

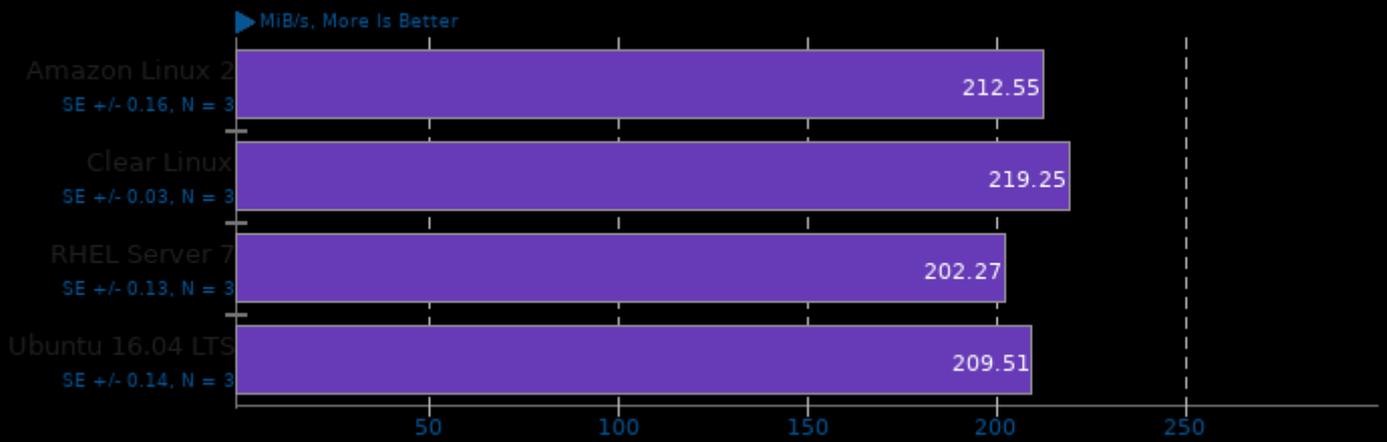
Test: KASUMI - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

## Botan 2.4.0

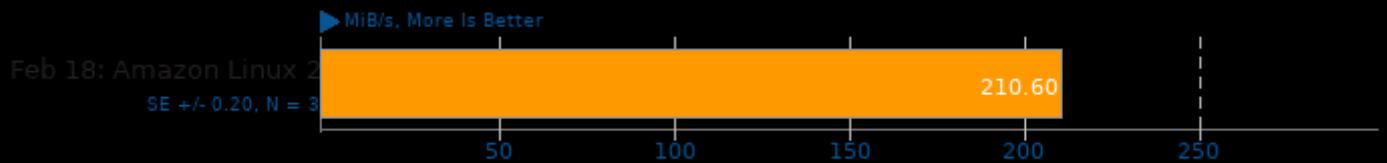
Test: Twofish - Encrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

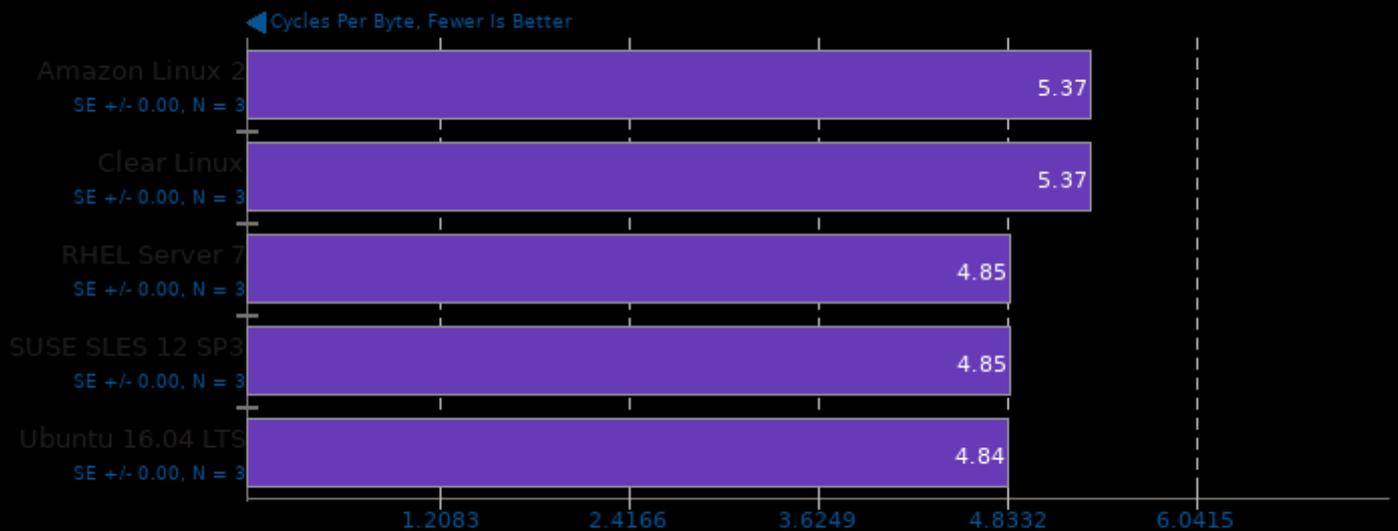
## Botan 2.4.0

Test: Twofish - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

## BLAKE2 20170307

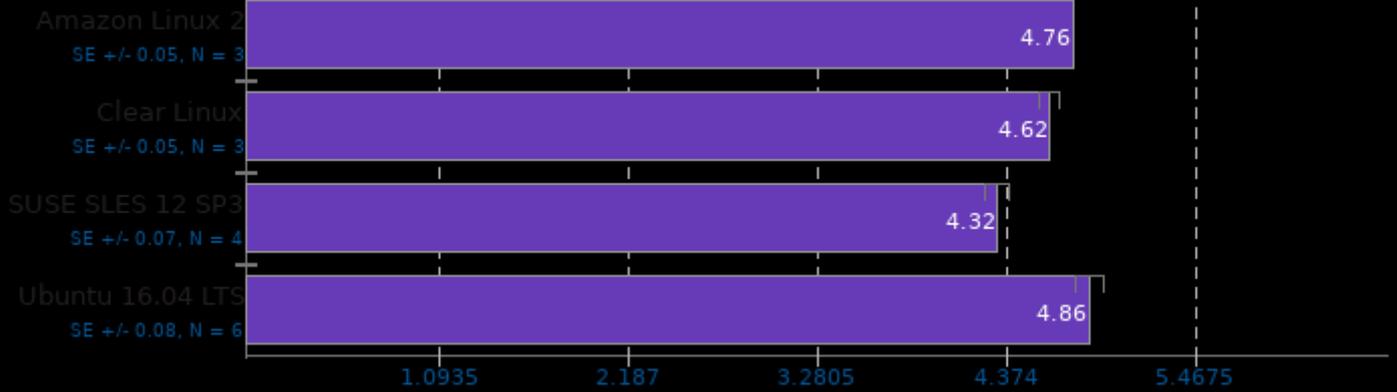


1. (C) gcc options: -O3 -march=native -lcrypto -lz

## Timed MAFFT Alignment 6.864

Multiple Sequence Alignment

◀ Seconds, Fewer Is Better

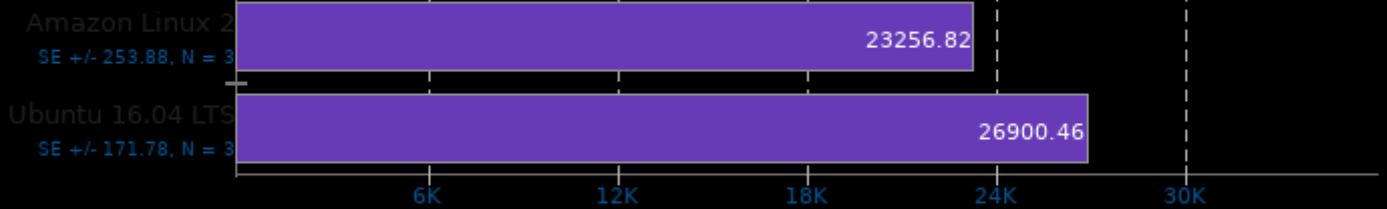


1. (GCC) gcc options: -O3 -lm -pthread

## NGINX Benchmark 1.9.9

Static Web Page Serving

▶ Requests Per Second, More Is Better

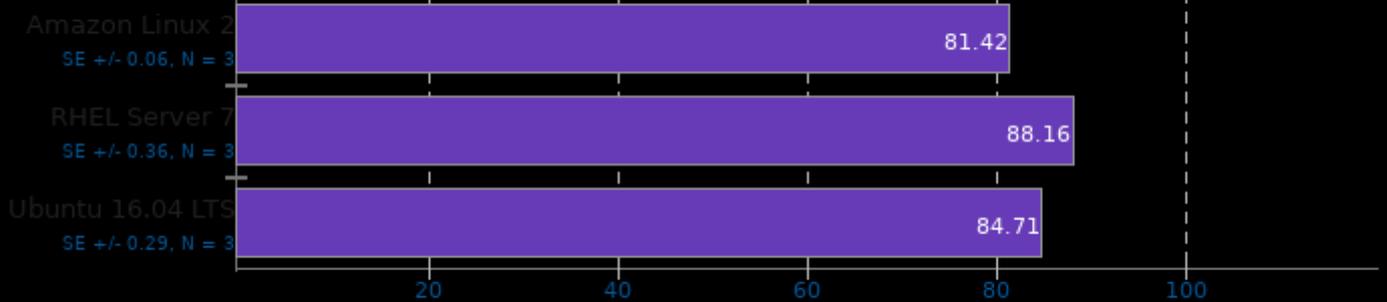


1. (GCC) gcc options: -pthread -lcrypt -lcrypto -lz -O3 -march=native

## POV-Ray 3.7.0.7

Trace Time

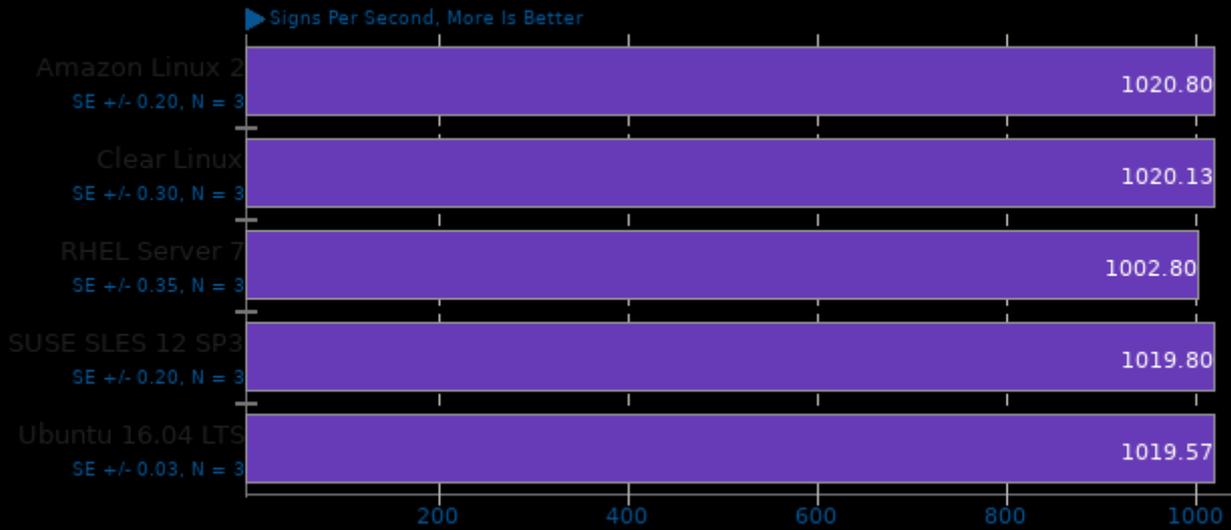
◀ Seconds, Fewer Is Better



1. (CXX) g++ options: -pipe -O3 -ffast-math -march=native -pthread -ltiff -ljpeg -lpng -lz -lrt -lm -lboost\_thread -lboost\_system

## OpenSSL 1.1.0f

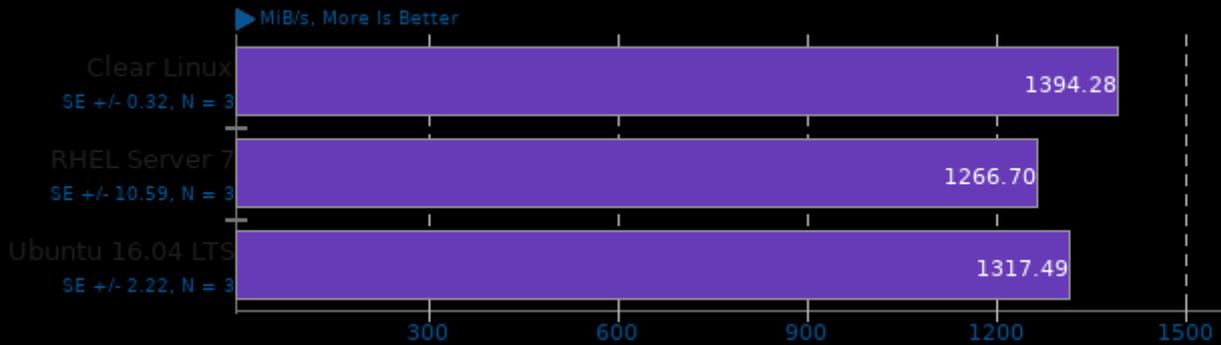
RSA 4096-bit Performance



1. (CC) gcc options: -O3 -pthread -m64 -lssl -lcrypto -ldl

## Botan 2.4.0

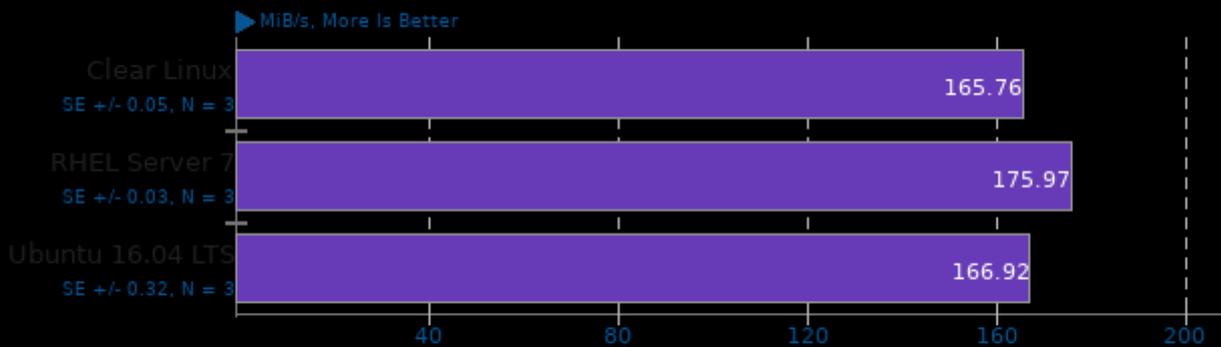
Test: AES-256 - Encrypt - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

## Botan 2.4.0

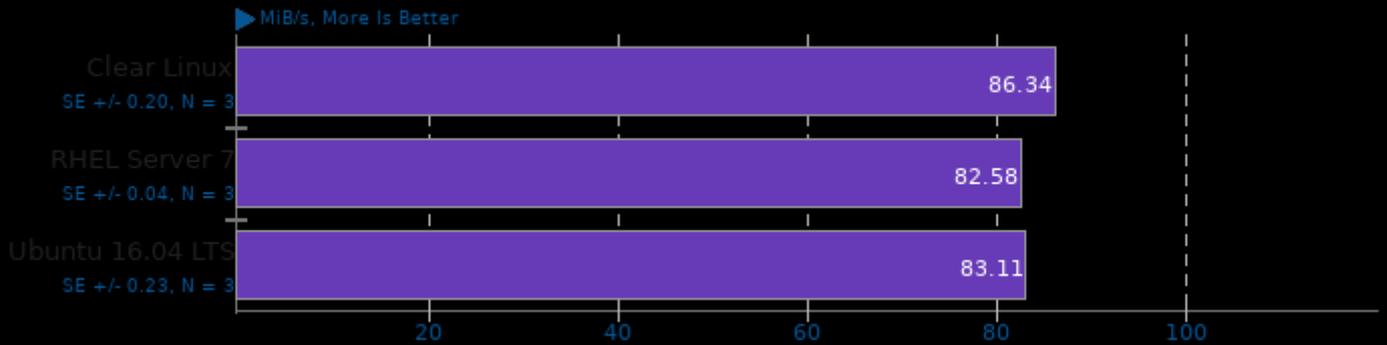
Test: Blowfish - Encrypt - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

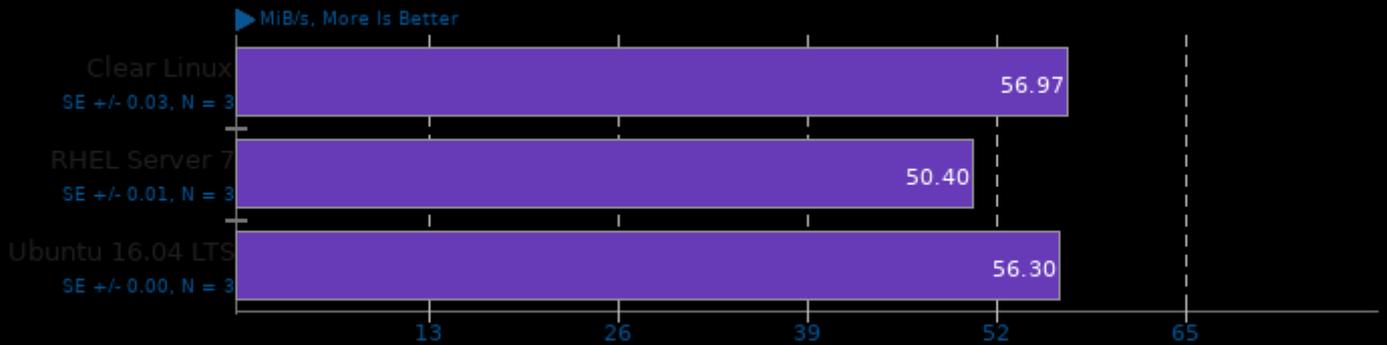
Test: CAST-256 - Encrypt - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

### Botan 2.4.0

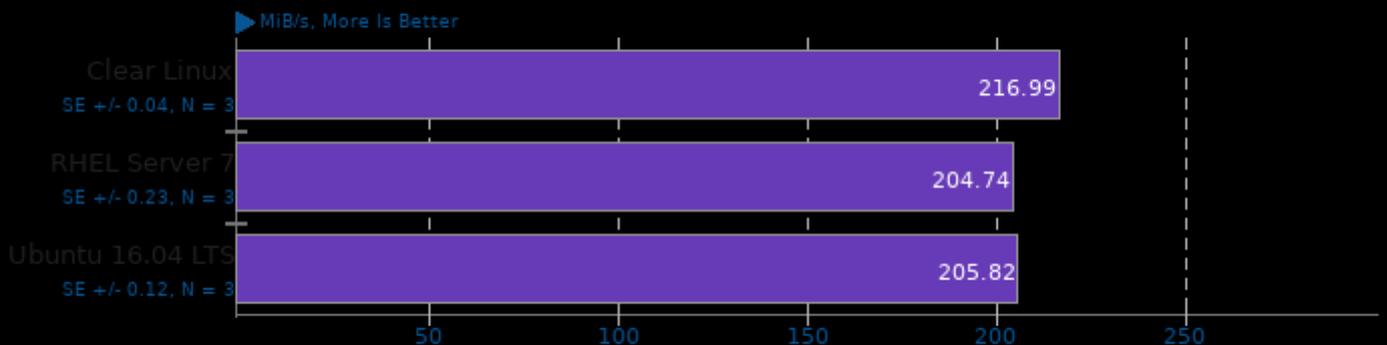
Test: KASUMI - Encrypt - Decrypt



1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

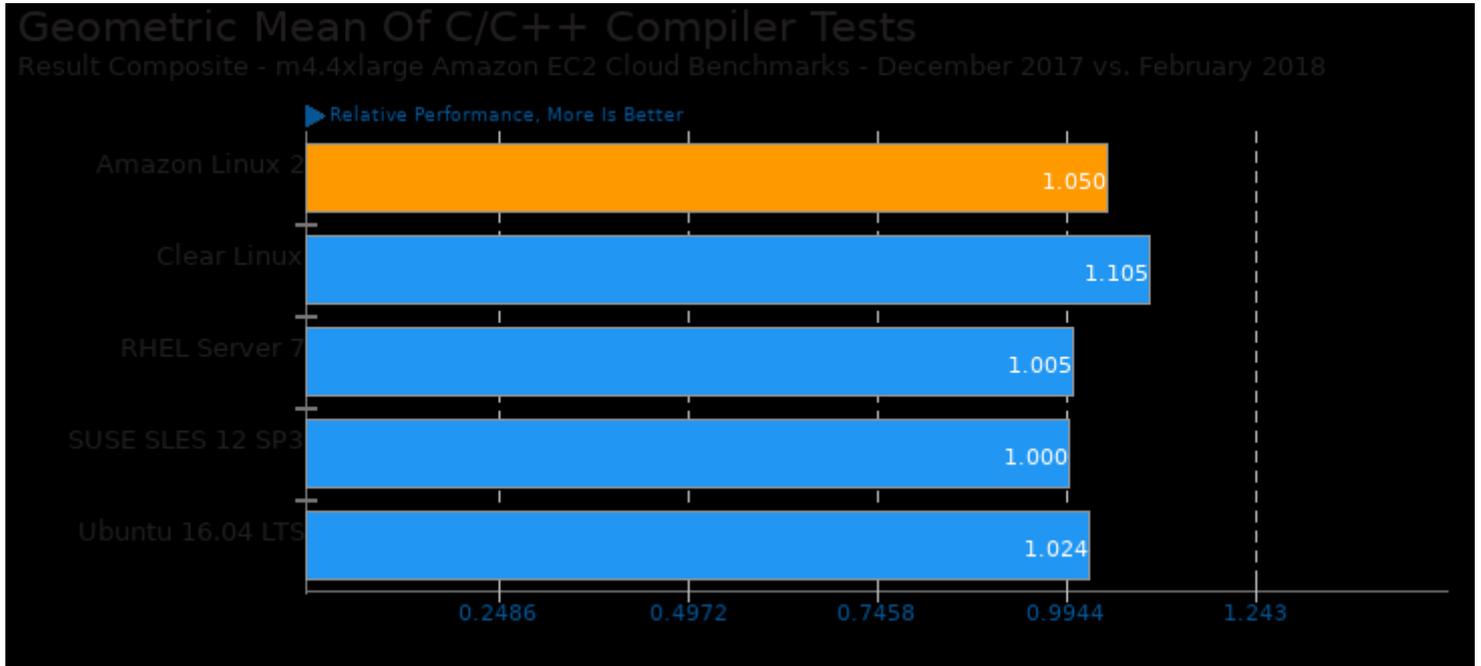
### Botan 2.4.0

Test: Twofish - Encrypt - Decrypt

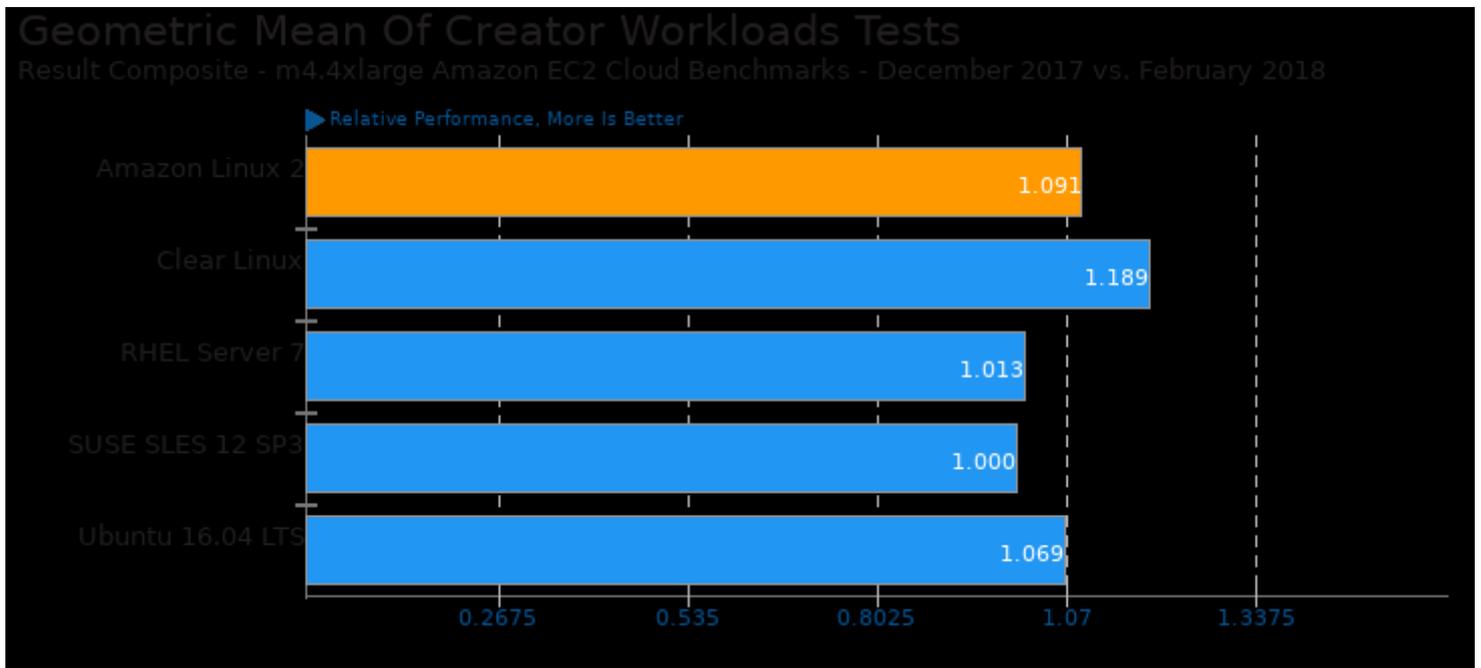


1. (CXX) g++ options: -fstack-protector -m64 -pthread -lbotan-2 -ldl -lrt

These geometric means are based upon test groupings / test suites for this result file.



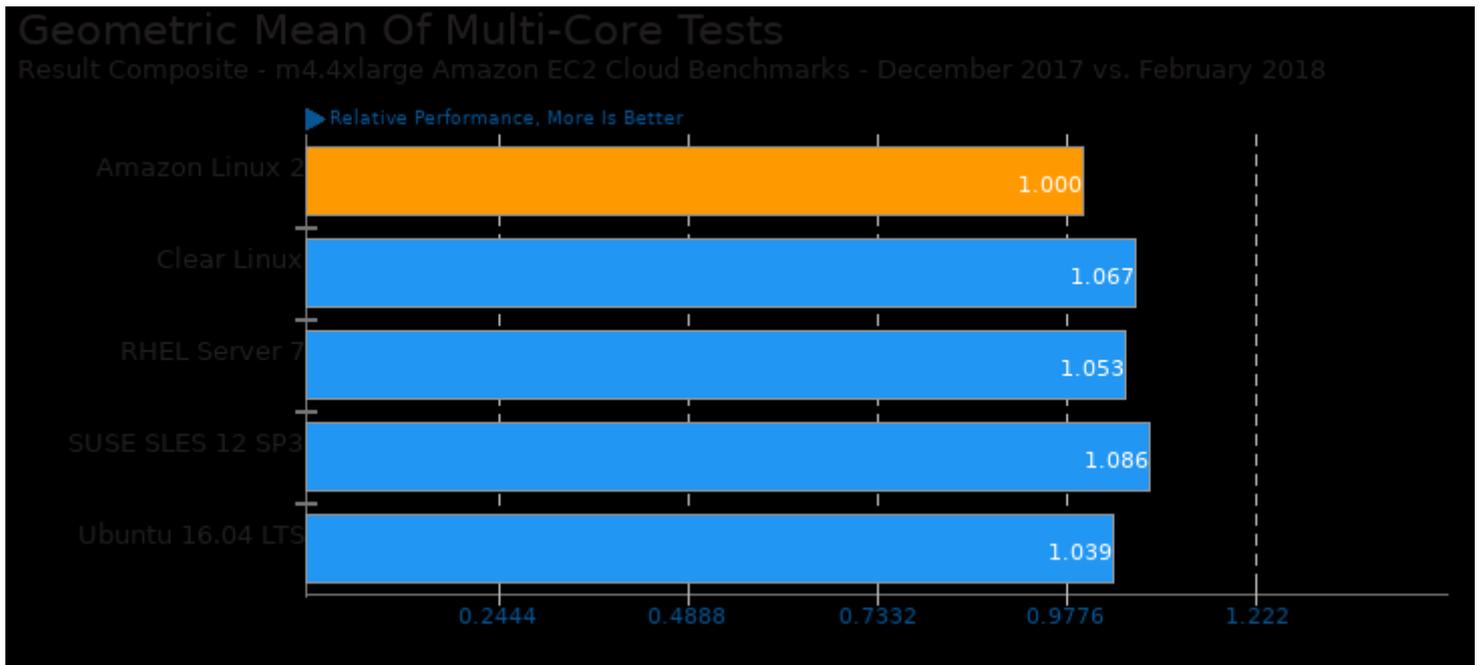
Geometric mean based upon tests: pts/mafft, pts/graphics-magick, pts/himeno, pts/stockfish, pts/c-ray, pts/encode-mp3, pts/encode-flac, pts/openssl and pts/nginx



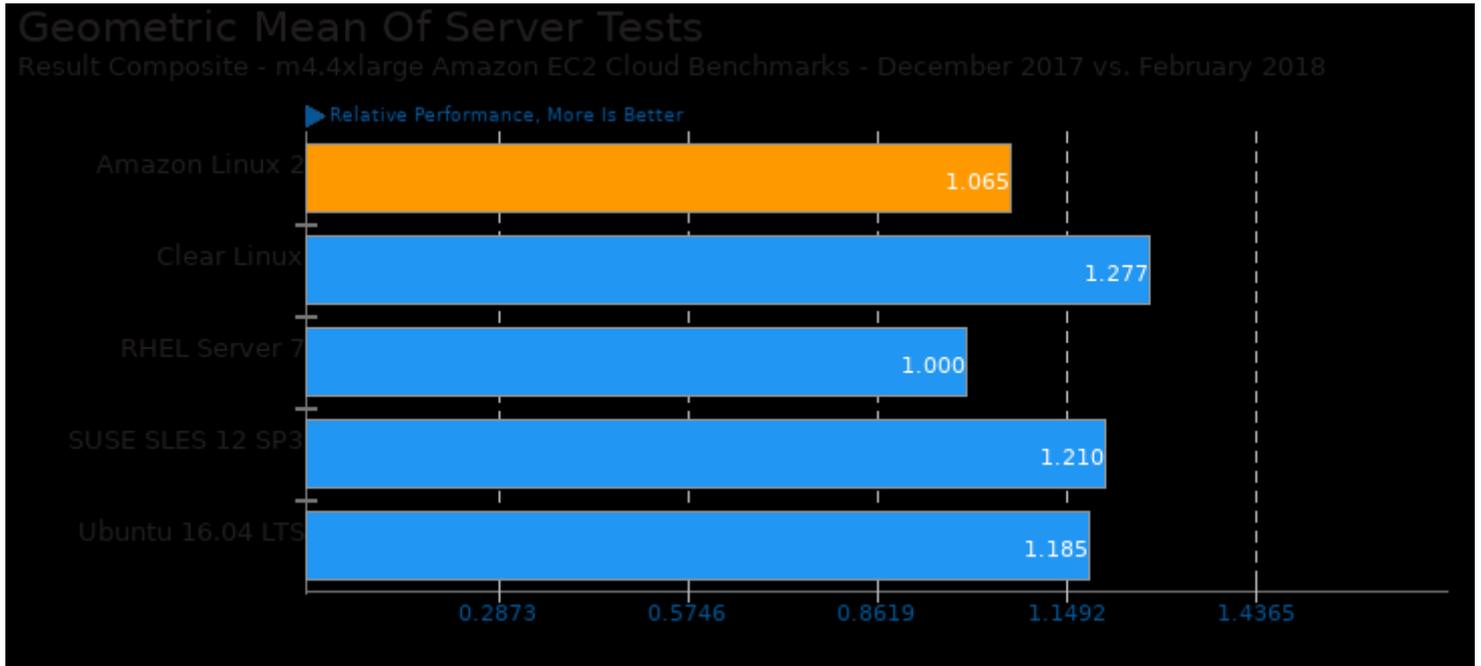
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/ffmpeg, pts/encode-mp3, pts/encode-flac and pts/graphics-magick



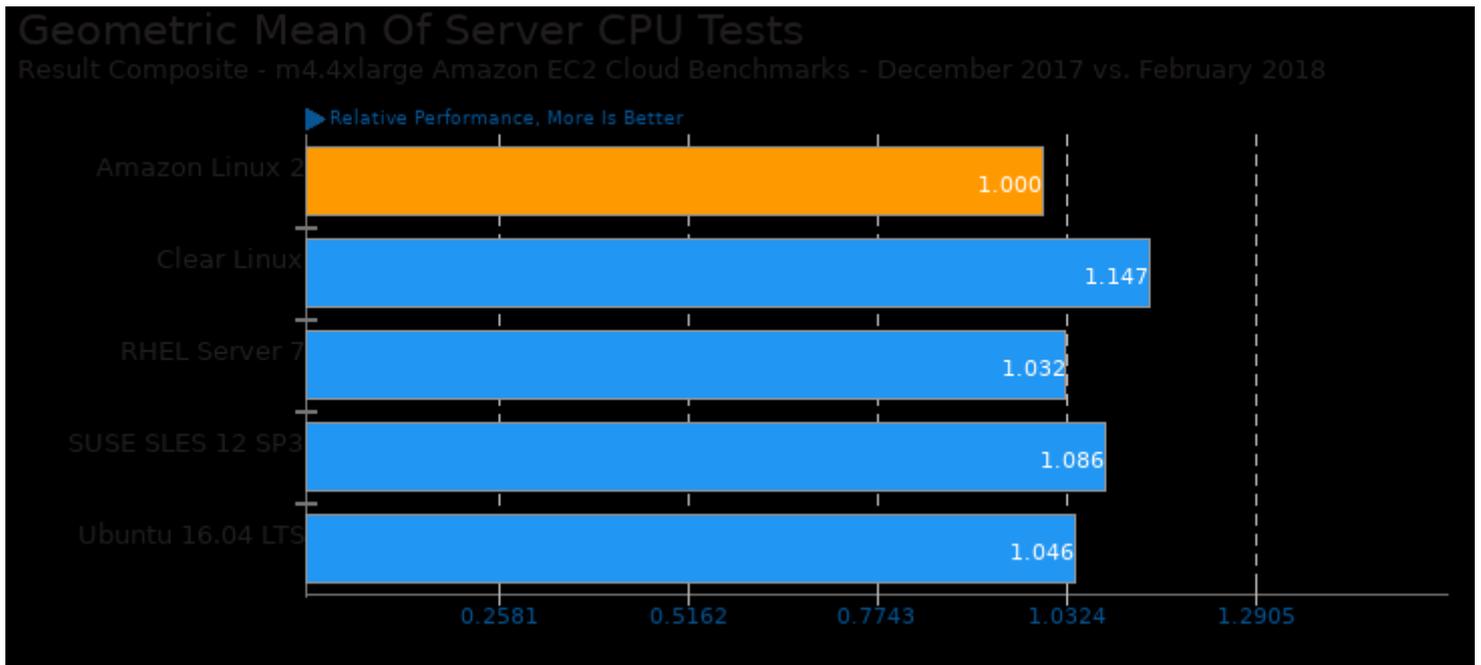
Geometric mean based upon tests: pts/sqlite and pts/redis



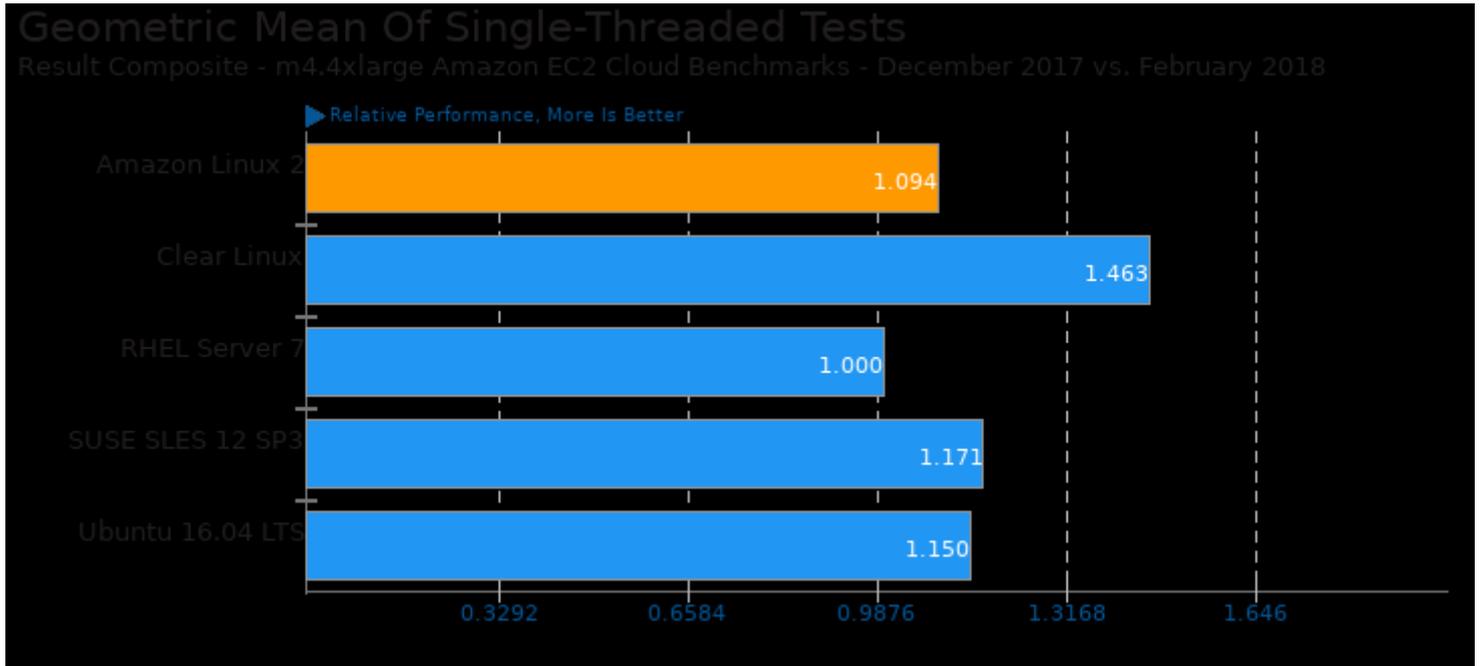
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/stockfish, pts/ffmpeg, pts/rodinia, pts/graphics-magick and pts/build-linux-kernel



Geometric mean based upon tests: pts/nginx, pts/redis, pts/phpbench, pts/openssl, pts/perl-benchmark and pts/sqlite



Geometric mean based upon tests: pts/rodinia, pts/himeno, pts/stockfish, pts/build-linux-kernel, pts/c-ray, pts/povray, pts/hackbench, pts/openssl, pts/redis, pts/stress-ng, pts/pybench and pts/phpbench



Geometric mean based upon tests: pts/blake2, pts/botan, pts/compress-gzip, pts/encode-flac, pts/encode-mp3, pts/perl-benchmark, pts/rbenchmark, pts/redis, pts/pybench, pts/phpbench and pts/nginx

*This file was automatically generated via the Phoronix Test Suite benchmarking software on Friday, 29 March 2024 08:25.*