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Amazon EC2 Graviton3 Benchmark Comparison

Amazon AWS Graviton3 benchmarks by Michael Larabel.

Automated Executive Summary

c7g.4xlarge Graviton3 had the most wins, coming in first place for 45% of the tests.

Based on the geometric mean of all complete results, the fastest (c7g.4xlarge Graviton3) was 3.188x the speed of the slowest (a1.4xlarge Graviton). c6i.4xlarge Xeon was 0.985x the speed of c7g.4xlarge Graviton3, c6a.4xlarge EPYC was 0.907x the speed of c6i.4xlarge Xeon, c6g.4xlarge Graviton2 was 0.782x the speed of c6a.4xlarge EPYC, a1.4xlarge Graviton was 0.449x the speed of c6g.4xlarge Graviton2.

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

NAS Parallel Benchmarks (Test / Class: LU.C) at 14.908x
LeelaChessZero (Backend: Eigen) at 11.453x
LeelaChessZero (Backend: BLAS) at 10.348x
Stress-NG (Test: Memory Copying) at 8.385x
NAS Parallel Benchmarks (Test / Class: MG.C) at 8.051x
NAS Parallel Benchmarks (Test / Class: CG.C) at 7.85x
NAS Parallel Benchmarks (Test / Class: SP.C) at 7.392x
Zstd Compression (Compression Level: 3 - Compression Speed) at 7.318x

NAS Parallel Benchmarks (Test / Class: FT.C) at 6.977x
High Performance Conjugate Gradient at 6.962x.

Test Systems:

a1.4xlarge Graviton

Processor: ARMv8 Cortex-A72 (16 Cores), Motherboard: Amazon EC2 a1.4xlarge (1.0 BIOS), Chipset: Amazon Device 0200, Memory: 32GB, Disk: 193GB Amazon Elastic Block Store, Network: Amazon Elastic

OS: Ubuntu 22.04, Kernel: 5.15.0-1004-aws (aarch64), Compiler: GCC 11.2.0, File-System: ext4, System Layer: amazon

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=aarch64-linux-gnu --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-nls --enable-objc-gc=auto --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-target-system-zlib=auto -v
Java Notes: OpenJDK Runtime Environment (build 11.0.15+10-Ubuntu-0ubuntu0.22.04.1)
Python Notes: Python 3.10.4
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Not affected + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Mitigation of Branch predictor hardening BHB + srbds: Not affected + tsx_async_abort: Not affected

c6g.4xlarge Graviton2

Processor: ARMv8 Neoverse-N1 (16 Cores), Motherboard: Amazon EC2 c6g.4xlarge (1.0 BIOS), Chipset: Amazon Device 0200, Memory: 32GB, Disk: 193GB Amazon Elastic Block Store, Network: Amazon Elastic

OS: Ubuntu 22.04, Kernel: 5.15.0-1004-aws (aarch64), Compiler: GCC 11.2.0, File-System: ext4, System Layer: amazon

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=aarch64-linux-gnu --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-nls --enable-objc-gc=auto --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-target-system-zlib=auto -v
Java Notes: OpenJDK Runtime Environment (build 11.0.15+10-Ubuntu-0ubuntu0.22.04.1)
Python Notes: Python 3.10.4
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Mitigation of CSV2 BHB + srbds: Not affected + tsx_async_abort: Not affected

c7g.4xlarge Graviton3

Processor: ARMv8 Neoverse-V1 (16 Cores), Motherboard: Amazon EC2 c7g.4xlarge (1.0 BIOS), Chipset: Amazon Device 0200, Memory: 32GB, Disk: 193GB Amazon Elastic Block Store, Network: Amazon Elastic

OS: Ubuntu 22.04, Kernel: 5.15.0-1004-aws (aarch64), Compiler: GCC 11.2.0, File-System: ext4, System Layer: amazon

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=aarch64-linux-gnu --disable-libquadmath --disable-libquadmath-support --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-fix-cortex-a53-843419 --enable-gnu-unique-object --enable-languages=c,ada,c++,go,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-nls

--enable-objc-gc=auto --enable-plugin --enable-shared --enable-threads=posix --host=aarch64-linux-gnu --program-prefix=aarch64-linux-gnu- --target=aarch64-linux-gnu --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-target-system-zlib=auto -v
Java Notes: OpenJDK Runtime Environment (build 11.0.15+10-Ubuntu-0ubuntu0.22.04.1)
Python Notes: Python 3.10.4
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl + spectre_v1: Mitigation of __user pointer sanitization + spectre_v2: Mitigation of CSV2 BHB + srbds: Not affected + tsx_async_abort: Not affected

c6a.4xlarge EPYC

Processor: AMD EPYC 7R13 (8 Cores / 16 Threads), Motherboard: Amazon EC2 c6a.4xlarge (1.0 BIOS), Chipset: Intel 440FX 82441FX PMC, Memory: 32GB, Disk: 193GB Amazon Elastic Block Store, Network: Amazon Elastic

OS: Ubuntu 22.04, Kernel: 5.15.0-1004-aws (x86_64), Compiler: GCC 11.2.0, File-System: ext4, System Layer: amazon

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-cet --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-11-gBFGDP/gcc-11-11.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-11-gBFGDP/gcc-11-11.2.0/debian/tmp-gcn/usr --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: CPU Microcode: 0xa001144
Java Notes: OpenJDK Runtime Environment (build 11.0.15+10-Ubuntu-0ubuntu0.22.04.1)
Python Notes: Python 3.10.4
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Retpolines IBPB: conditional IBRS_FW STIBP: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

c6i.4xlarge Xeon

Processor: Intel Xeon Platinum 8375C (8 Cores / 16 Threads), Motherboard: Amazon EC2 c6i.4xlarge (1.0 BIOS), Chipset: Intel 440FX 82441FX PMC, Memory: 32GB, Disk: 193GB Amazon Elastic Block Store, Network: Amazon Elastic

OS: Ubuntu 22.04, Kernel: 5.15.0-1004-aws (x86_64), Compiler: GCC 11.2.0, File-System: ext4, System Layer: amazon

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-cet --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-serialization=2 --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-11-gBFGDP/gcc-11-11.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-11-gBFGDP/gcc-11-11.2.0/debian/tmp-gcn/usr --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: CPU Microcode: 0xd000331
Java Notes: OpenJDK Runtime Environment (build 11.0.15+10-Ubuntu-0ubuntu0.22.04.1)
Python Notes: Python 3.10.4
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Enhanced IBRS IBPB: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

	a1.4xlarge Graviton	c6g.4xlarge Graviton2	c7g.4xlarge Graviton3	c6a.4xlarge EPYC	c6i.4xlarge Xeon
High Performance Conjugate Gradient (GFLOP/s)	**3.77834**	19.7218	**26.3058**	5.06042	8.66031
Normalized	14.36%	74.97%	100%	19.24%	32.92%
Standard Deviation	0%	0.1%	0.2%	0.1%	0.8%

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NAS Parallel Benchmarks - BT.C (Mop/s)	3148	6449	10340	13134	13888
Normalized	22.67%	46.44%	74.45%	94.57%	100%
Standard Deviation	0.2%	0.1%	0.1%	1.3%	0.3%
NAS Parallel Benchmarks - CG.C (Mop/s)	1213	3521	6572	6169	9523
Normalized	12.74%	36.97%	69.01%	64.78%	100%
Standard Deviation	2.4%	0.5%	0.5%	2.3%	1.2%
NAS Parallel Benchmarks - EP.D (Mop/s)	339.20	558.88	934.72	466.21	1103
Normalized	30.75%	50.66%	84.73%	42.26%	100%
Standard Deviation	0.1%	0.1%	0.1%	0%	5.4%
NAS Parallel Benchmarks - FT.C (Mop/s)	2927	6244	11792	18300	20424
Normalized	14.33%	30.57%	57.74%	89.6%	100%
Standard Deviation	0.1%	0%	0%	0.4%	0.3%
NAS Parallel Benchmarks - IS.D (Mop/s)	197.57	372.76	1042	541.35	861.57
Normalized	18.96%	35.78%	100%	51.96%	82.69%
Standard Deviation	0.3%	0.1%	0.4%	0.1%	0.4%
NAS Parallel Benchmarks - LU.C (Mop/s)	2558	5134	7730	25141	38137
Normalized	6.71%	13.46%	20.27%	65.92%	100%
Standard Deviation	0%	0%	0%	0.1%	0.7%
NAS Parallel Benchmarks - MG.C (Mop/s)	3266	6721	13482	16826	26299
Normalized	12.42%	25.56%	51.26%	63.98%	100%
Standard Deviation	0.1%	0%	0.1%	0.3%	1.2%
NAS Parallel Benchmarks - SP.C (Mop/s)	1294	2356	4467	8095	9563
Normalized	13.53%	24.64%	46.71%	84.65%	100%
Standard Deviation	0.3%	0%	0.4%	0.5%	1.3%
LeelaChessZero - BLAS	135	864	1103	1091	1397
Normalized	9.66%	61.85%	78.95%	78.1%	100%
Standard Deviation	1.1%	2.4%	1%	3.5%	2.7%
LeelaChessZero - Eigen	128	834	1189	1001	1466
Normalized	8.73%	56.89%	81.11%	68.28%	100%
Standard Deviation	0.9%	2.5%	1.4%	3.5%	1.6%
Rodinia - OpenMP LavaMD (sec)	360.304	215.666	143.334	224.331	281.389
Normalized	39.78%	66.46%	100%	63.89%	50.94%
Standard Deviation	0%	0%	0.2%	0%	0.1%
Rodinia - OpenMP CFD Solver (sec)	41.450	17.035	10.478	21.789	20.446
Normalized	25.28%	61.51%	100%	48.09%	51.25%
Standard Deviation	0.3%	0.5%	0.4%	0.7%	0.2%
Rodinia - O.S (sec)	47.430	15.484	13.296	18.383	23.512
Normalized	28.03%	85.87%	100%	72.33%	56.55%
Standard Deviation	0.1%	6.6%	8.6%	0.5%	0.5%
Algebraic Multi-Grid Benchmark (Figure Of Merit)	186716933	932652900	1258807333	267670700	661364767
Normalized	14.83%	74.09%	100%	21.26%	52.54%
Standard Deviation	0.2%	0.6%	0.1%	0.1%	1.3%

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Timed MrBayes Analysis - P.P.A (sec)	644.788	384.753	251.397	120.636	134.924
Normalized	18.71%	31.35%	47.99%	100%	89.41%
Standard Deviation	0.1%	0.1%	0.2%	0.5%	1.8%
Xcompact3d Incompact3d - i.i.1.C.P.D (sec)	53.7706274	11.5733547	8.01671425	28.2797661	17.8682772
Normalized	14.91%	69.27%	100%	28.35%	44.87%
Standard Deviation	0.1%	0.2%	0.3%	0.2%	0.9%
Xcompact3d Incompact3d - i.i.1.C.P.D (sec)	182.583939	41.0240835	29.1258570	110.770027	69.2169978
Normalized	15.95%	71%	100%	26.29%	42.08%
Standard Deviation	0.1%	0.1%	0.2%	0.2%	0.3%
LAMMPS Molecular Dynamics Simulator - Rhodopsin Protein (ns/day)	3.245	7.935	11.291	5.067	6.220
Normalized	28.74%	70.28%	100%	44.88%	55.09%
Standard Deviation	2.1%	0.3%	0.9%	2.7%	0.2%
LULESH (z/s)	2328	6016	10941	5452	8112
Normalized	21.28%	54.99%	100%	49.83%	74.15%
Standard Deviation	0.5%	0.1%	1.2%	0.2%	0.3%
WebP Image Encode - Q.1.L (Encode Time - sec)	61.801	31.082	22.769	26.708	21.122
Normalized	34.18%	67.96%	92.77%	79.08%	100%
Standard Deviation	0.2%	0.1%	0.7%	2.5%	0.3%
WebP Image Encode - Q.1.L.H.C (Encode Time - sec)	124.708	66.147	48.208	48.677	41.805
Normalized	33.52%	63.2%	86.72%	85.88%	100%
Standard Deviation	0.1%	0%	0%	0.2%	1.4%
simdjson - Kostya (GB/s)	0.63	1.19	1.94	2.80	2.46
Normalized	22.5%	42.5%	69.29%	100%	87.86%
Standard Deviation	0%	0%	0%	0.2%	0.2%
simdjson - LargeRand (GB/s)	0.3	0.49	0.7	0.95	0.86
Normalized	31.58%	51.58%	73.68%	100%	90.53%
Standard Deviation	0%	1.2%	0%	0%	0%
simdjson - PartialTweets (GB/s)	0.78	1.51	2.62	3.64	3.71
Normalized	21.02%	40.7%	70.62%	98.11%	100%
Standard Deviation	0%	0%	0%	0.2%	0.2%
simdjson - DistinctUserID (GB/s)	0.8	1.53	2.69	4.30	4.30
Normalized	18.6%	35.58%	62.56%	100%	100%
Standard Deviation	0%	0%	0%	0.3%	0.1%
DaCapo Benchmark - H2 (msec)	6740	3964	2951	3019	2921
Normalized	43.34%	73.69%	98.98%	96.75%	100%
Standard Deviation	1.9%	2.3%	2.5%	1.8%	2.3%
DaCapo Benchmark - Jython (msec)	12997	5626	3940	4616	4013
Normalized	30.31%	70.03%	100%	85.36%	98.18%
Standard Deviation	0.7%	0.8%	0.4%	1%	1.2%
DaCapo Benchmark - Tradesoap (msec)	11182	4506	3524	4052	3815
Normalized	31.51%	78.21%	100%	86.97%	92.37%
Standard Deviation	1.3%	1.2%	0.8%	0.8%	1.3%

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DaCapo Benchmark - Tradebeans (msec)	9045	4344	3203	3167	2928
Normalized	32.37%	67.4%	91.41%	92.45%	100%
Standard Deviation	1%	1.8%	1.7%	2.5%	2.9%
Zstd Compression - 3 - Compression Speed (MB/s)	633.9	2888	4639	2784	3441
Normalized	13.66%	62.26%	100%	60.01%	74.17%
Standard Deviation	1.2%	0.4%	0.4%	0.2%	1.5%
Zstd Compression - 19 - Compression Speed (MB/s)	16.9	34.6	41.2	30.0	38.1
Normalized	41.02%	83.98%	100%	72.82%	92.48%
Standard Deviation	0.3%	0.3%	0%	1.2%	1.8%
Zstd Compression - 19 - D.S (MB/s)	1122	2052	3050	2908	2582
Normalized	36.77%	67.26%	100%	95.32%	84.65%
Standard Deviation	0.7%	1%	0.4%	0.2%	1.6%
Zstd Compression - 19, Long Mode - Compression Speed	16	31.0	39.5	25.9	33.8
Normalized	40.51%	78.48%	100%	65.57%	85.57%
Standard Deviation	0%	0.2%	1%	1.8%	0.5%
Zstd Compression - 19, Long Mode - D.S (MB/s)	1214	2196	3241	2826	2666
Normalized	37.46%	67.77%	100%	87.21%	82.27%
Standard Deviation	2.2%	0.2%	0.4%	0.4%	0.5%
TSCP - A.C.P (Nodes/s)	538500	872313	1370094	1442631	1272596
Normalized	37.33%	60.47%	94.97%	100%	88.21%
Standard Deviation	0.1%	0.1%	0%	0.6%	0.2%
ACES DGEMM - S.F.P.R (GFLOP/s)	0.891391	4.785123	5.853864	2.432432	2.230545
Normalized	15.23%	81.74%	100%	41.55%	38.1%
Standard Deviation	0.5%	0.3%	0.5%	2.3%	0.3%
Coremark - CoreMark Size 666 - I.P.S (Iterations/Sec)	203869	315464	405414	345133	285379
Normalized	50.29%	77.81%	100%	85.13%	70.39%
Standard Deviation	0.1%	0%	1.4%	1.1%	0%
7-Zip Compression - Compression Rating (MIPS)	32498	71285	97824	62562	66631
Normalized	33.22%	72.87%	100%	63.95%	68.11%
Standard Deviation	0.5%	0.1%	0.3%	0%	0.5%
7-Zip Compression - D.R (MIPS)	40891	59445	73054	57318	45653
Normalized	55.97%	81.37%	100%	78.46%	62.49%
Standard Deviation	0.1%	0.7%	0%	0.4%	0.1%
Stockfish - Total Time (Nodes/s)	10980430	21679245	27608891	23857623	22081961
Normalized	39.77%	78.52%	100%	86.41%	79.98%
Standard Deviation	2%	2.3%	1%	1.1%	1.9%
asmFish - 1.H.M.2.D (Nodes/s)	15331550	26540482	32134123	26187688	23746200
Normalized	47.71%	82.59%	100%	81.49%	73.9%
Standard Deviation	1.2%	2.3%	0.6%	2%	2.4%
libavif avifenc - 0 (sec)	768.302	406.937	256.841	195.532	204.994
Normalized	25.45%	48.05%	76.13%	100%	95.38%
Standard Deviation	0.1%	0.1%	0.1%	0.5%	0.3%
libavif avifenc - 2 (sec)	449.022	238.205	141.698	93.946	97.735
Normalized	20.92%	39.44%	66.3%	100%	96.12%
Standard Deviation	0.1%	0.1%	0.1%	0.8%	0.5%

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libavif avifenc - 6, Lossless (sec)	**33.991**	16.518	**11.908**	16.394	17.529
Normalized	35.03%	72.09%	100%	72.64%	67.93%
Standard Deviation	1.6%	1.8%	0.2%	1.2%	0.3%
Timed Apache Compilation - Time To Compile (sec)	**74.742**	34.201	26.940	23.532	**22.527**
Normalized	30.14%	65.87%	83.62%	95.73%	100%
Standard Deviation	0%	0.1%	0.3%	0.5%	0.4%
Timed Gem5 Compilation - Time To Compile (sec)	**1156**	488.805	**391.171**	515.201	469.940
Normalized	33.85%	80.03%	100%	75.93%	83.24%
Standard Deviation	0.1%	0.2%	0.6%	0.3%	0.2%
Timed ImageMagick Compilation - Time To Compile (sec)	**93.632**	40.333	**27.904**	32.626	29.737
Normalized	29.8%	69.18%	100%	85.53%	93.84%
Standard Deviation	0.5%	0.9%	0.8%	0.3%	0.4%
Timed LLVM Compilation - Ninja (sec)	**1785**	682.981	**544.929**	760.344	685.704
Normalized	30.54%	79.79%	100%	71.67%	79.47%
Standard Deviation	0%	0.1%	1.7%	0%	0%
Timed Node.js Compilation - Time To Compile (sec)	**1766**	628.401	**497.579**	664.347	604.620
Normalized	28.18%	79.18%	100%	74.9%	82.3%
Standard Deviation	0.2%	0.1%	0.7%	0.1%	0.1%
Timed PHP Compilation - Time To Compile (sec)	**196.029**	88.897	69.483	67.084	**64.337**
Normalized	32.82%	72.37%	92.59%	95.91%	100%
Standard Deviation	0.1%	0.6%	0.3%	0.1%	0.2%
Build2 - Time To Compile (sec)	**353.912**	142.277	**115.020**	150.994	136.801
Normalized	32.5%	80.84%	100%	76.18%	84.08%
Standard Deviation	0.9%	0.9%	1%	1%	0.9%
C-Ray - Total Time - 4.1.R.P.P (sec)	**104.761**	62.323	**38.517**	69.349	92.545
Normalized	36.77%	61.8%	100%	55.54%	41.62%
Standard Deviation	7.4%	0.1%	0.1%	2.5%	0.1%
POV-Ray - Trace Time (sec)	**93.801**	51.047	**37.863**	49.435	52.784
Normalized	40.37%	74.17%	100%	76.59%	71.73%
Standard Deviation	3.9%	0%	0.1%	0.6%	0.4%
m-queens - Time To Solve (sec)	**110.368**	75.224	**66.822**	72.330	91.231
Normalized	60.54%	88.83%	100%	92.38%	73.24%
Standard Deviation	0%	0%	0%	0%	0.1%
N-Queens - Elapsed Time (sec)	**32.285**	23.136	21.536	**16.378**	18.839
Normalized	50.73%	70.79%	76.05%	100%	86.94%
Standard Deviation	0%	0%	0%	0%	0%
Ngspice - C2670 (sec)	**473.901**	263.724	198.224	245.886	**147.893**
Normalized	31.21%	56.08%	74.61%	60.15%	100%
Standard Deviation	1.3%	0.6%	0.8%	0.8%	2.4%
Ngspice - C7552 (sec)	**480.793**	255.205	191.286	180.356	**161.081**
Normalized	33.5%	63.12%	84.21%	89.31%	100%
Standard Deviation	0.4%	2.5%	1.8%	0.6%	0.4%
Google SynthMark - VoiceMark_100 (Voices)	**331.070**	470.389	**675.635**	663.073	565.690
Normalized	49%	69.62%	100%	98.14%	83.73%
Standard Deviation	0%	0.1%	0.1%	1.9%	0.6%

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SecureMark - SecureMark-TLS (marks)	74356	120301	183708	213288	230549
Normalized	32.25%	52.18%	79.68%	92.51%	100%
Standard Deviation	0.1%	0%	0.7%	4.7%	0.6%
OpenSSL - SHA256 (byte/s)	6785689517	10723184083	13722045973	11691403353	7096993937
Normalized	49.45%	78.15%	100%	85.2%	51.72%
Standard Deviation	0.3%	0.8%	0.1%	0.1%	0%
OpenSSL - RSA4096 (sign/s)	588.3	660.6	2546	2089	2161
Normalized	23.1%	25.94%	100%	82.03%	84.88%
Standard Deviation	0%	0%	0%	0.1%	0.4%
OpenSSL - RSA4096 (verify/s)	45329	53952	178460	136784	140964
Normalized	25.4%	30.23%	100%	76.65%	78.99%
Standard Deviation	0.2%	0%	0.1%	0.1%	0.1%
Liquid-DSP - 16 - 256 - 57 (samples/s)	165513333	262890000	383606667	509746667	373100000
Normalized	32.47%	51.57%	75.25%	100%	73.19%
Standard Deviation	0%	0%	0.2%	0.2%	0%
GROMACS - MPI CPU - water_GMX50_bare (Ns/Day)	0.316	0.781	1.128	1.004	1.452
Normalized	21.76%	53.79%	77.69%	69.15%	100%
Standard Deviation	0%	0.1%	0.3%	0.4%	0.1%
TensorFlow Lite - SqueezeNet	12015	3969	3258	3103	2984
Normalized	24.84%	75.17%	91.59%	96.16%	100%
Standard Deviation	0.7%	1.6%	1.2%	0.1%	0.2%
TensorFlow Lite - Inception V4	188910	46794	41855	44921	41186
Normalized	21.8%	88.02%	98.4%	91.69%	100%
Standard Deviation	1.6%	0.7%	0.9%	0.2%	0.3%
TensorFlow Lite - NASNet Mobile (us)	30987	14985	11592	9267	10901
Normalized	29.91%	61.84%	79.94%	100%	85.01%
Standard Deviation	0.3%	5.3%	4.1%	0.4%	5.7%
TensorFlow Lite - Mobilenet Float (us)	9990	2501	2157	2160	1965
Normalized	19.67%	78.58%	91.12%	90.99%	100%
Standard Deviation	2%	2%	1.6%	0.1%	0.2%
TensorFlow Lite - Mobilenet Quant (us)	5725	1980	1503	3848	3967
Normalized	26.25%	75.9%	100%	39.06%	37.88%
Standard Deviation	0.6%	1.3%	2%	5.4%	7%
TensorFlow Lite - I.R.V (us)	171169	45956	40051	41367	41180
Normalized	23.4%	87.15%	100%	96.82%	97.26%
Standard Deviation	0.8%	1.3%	1.3%	0.1%	0.5%
ASTC Encoder - Thorough (sec)	33.5198	16.5222	13.9248	7.9818	7.2625
Normalized	21.67%	43.96%	52.16%	90.99%	100%
Standard Deviation	0%	0.1%	0%	0.3%	0%
ASTC Encoder - Exhaustive	277.7669	159.2039	139.3797	72.3908	69.6387
Normalized	25.07%	43.74%	49.96%	96.2%	100%
Standard Deviation	0%	0%	0%	0.1%	0.1%
Stress-NG - Crypto (Bogo Ops/s)	11985	17924	23182	13556	10210
Normalized	51.7%	77.32%	100%	58.48%	44.04%
Standard Deviation	0.1%	0.9%	0.2%	0.1%	0.1%
Stress-NG - IO_uring (Bogo	918172	770522	843016	768723	1037943
Normalized	88.46%	74.24%	81.22%	74.06%	100%
Standard Deviation	0.7%	0.5%	0.1%	0.2%	0.1%

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Stress-NG - CPU Stress (Bogo Ops/s)	**2366**	3405	5030	**13305**	12527
Normalized	17.78%	25.59%	37.8%	100%	94.16%
Standard Deviation	0%	0%	0%	0.5%	2.2%
Stress-NG - Vector Math (Bogo Ops/s)	**27341**	37754	**55258**	53788	40140
Normalized	49.48%	68.32%	100%	97.34%	72.64%
Standard Deviation	0%	0.1%	0.1%	0%	0.1%
Stress-NG - Memory Copying (Bogo Ops/s)	**798.24**	2903	**6693**	3552	3150
Normalized	11.93%	43.37%	100%	53.06%	47.07%
Standard Deviation	0.2%	0.2%	0.1%	0.6%	0.1%
GPAW - Carbon Nanotube (sec)	**769.346**	215.528	**155.180**	302.956	202.106
Normalized	20.17%	72%	100%	51.22%	76.78%
Standard Deviation	1.2%	0.1%	0.1%	0.1%	0.2%
PyBench - T.F.A.T.T	**3452**	1741	1185	1961	**997**
Normalized	28.88%	57.27%	84.14%	50.84%	100%
Standard Deviation	0.9%	0.2%	0%	0.1%	0.7%
nginx - 100 (Reqs/sec)	**143155**	307349	345711	**388011**	356303
Normalized	36.89%	79.21%	89.1%	100%	91.83%
Standard Deviation	0%	2.2%	1%	0.2%	0.8%
nginx - 200 (Reqs/sec)	**141436**	308939	352381	**390933**	356830
Normalized	36.18%	79.03%	90.14%	100%	91.28%
Standard Deviation	0.2%	0.8%	2%	0.6%	0.8%
nginx - 500 (Reqs/sec)	**139415**	310597	346613	**389030**	351673
Normalized	35.84%	79.84%	89.1%	100%	90.4%
Standard Deviation	0.2%	2.1%	0.5%	0.3%	0.8%
nginx - 1000 (Reqs/sec)	**138205**	308213	346815	**388658**	347345
Normalized	35.56%	79.3%	89.23%	100%	89.37%
Standard Deviation	0.1%	0.9%	0.7%	0.3%	1.3%
ONNX Runtime - GPT-2 - CPU - Standard (Inferences/min)	**2312**	6948	**7990**	5617	7944
Normalized	28.94%	86.96%	100%	70.3%	99.42%
Standard Deviation	0.2%	0.1%	0.1%	4.6%	14.1%
ONNX Runtime - bertsquad-12 - CPU - Standard (Inferences/min)	**115**	322	407	488	**773**
Normalized	14.88%	41.66%	52.65%	63.13%	100%
Standard Deviation	1.3%	0.1%	0.1%	0.2%	22.8%
ONNX Runtime - fcn-resnet101-11 - CPU -	**10**	28	38	65	**139**
Normalized	7.19%	20.14%	27.34%	46.76%	100%
Standard Deviation	0%	0%	0%	29.6%	0.7%
ONNX Runtime - ArcFace ResNet-100 - CPU - Standard (Inferences/min)	**165**	334	609	1192	**1374**
Normalized	12.01%	24.31%	44.32%	86.75%	100%
Standard Deviation	0.5%	0.1%	0%	24%	23.1%
ONNX Runtime - super-resolution-10 - CPU - Standard (Inferences/min)	**757**	2072	2817	**3696**	3450
Normalized	20.48%	56.06%	76.22%	100%	93.34%
Standard Deviation	0.1%	0.1%	0.1%	22%	0.1%

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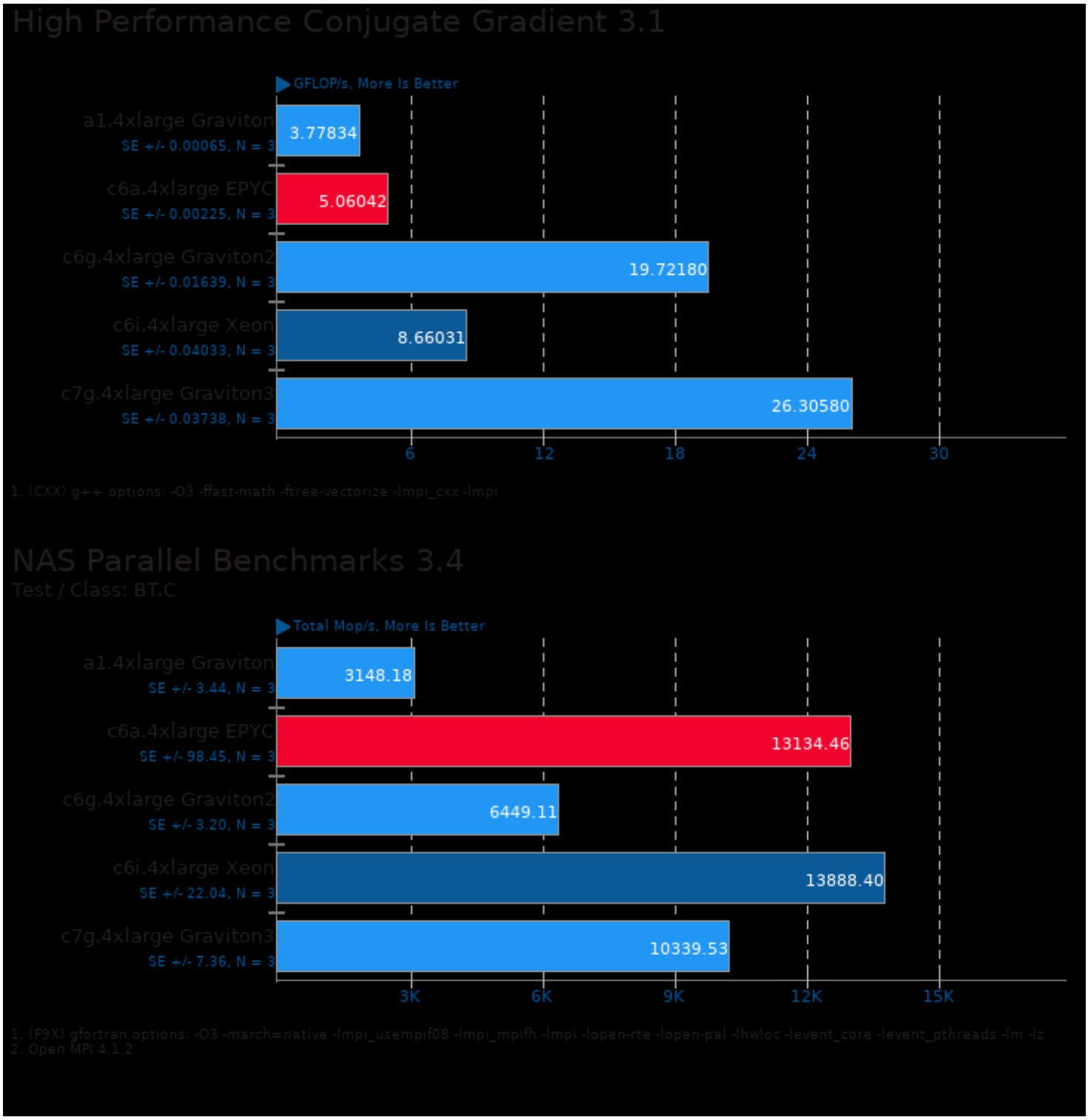
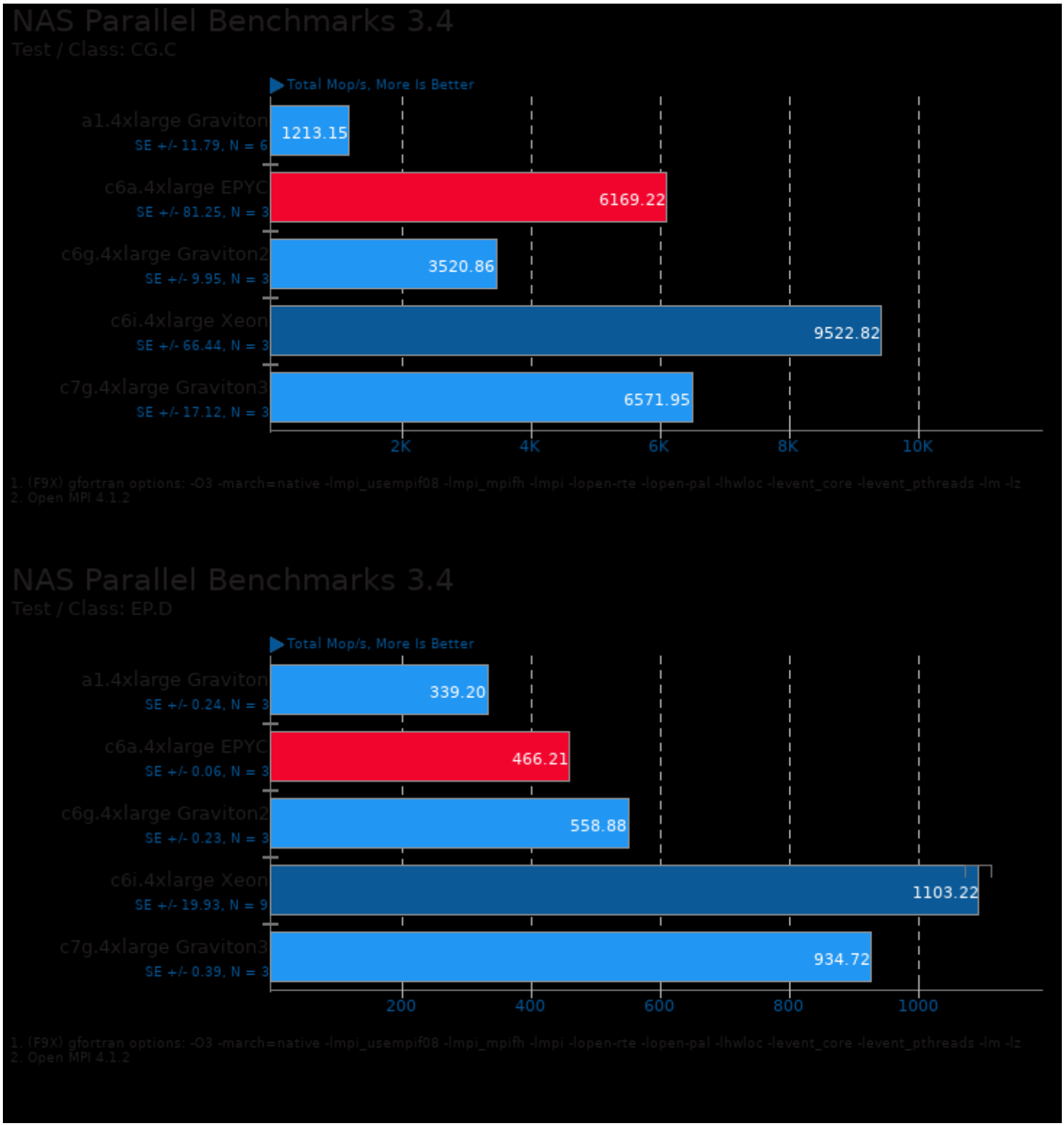
Apache HTTP Server - 100 (Reqs/sec)	**18636**	46995	67232	77568	**86546**
Normalized	21.53%	54.3%	77.68%	89.63%	100%
Standard Deviation	0.3%	0.3%	0.1%	0.5%	0.8%
Apache HTTP Server - 200 (Reqs/sec)	**20888**	50060	73677	83070	**94458**
Normalized	22.11%	53%	78%	87.94%	100%
Standard Deviation	0.5%	0.4%	1.5%	1.3%	1.1%
Apache HTTP Server - 500 (Reqs/sec)	**20133**	50078	73546	81996	**91747**
Normalized	21.94%	54.58%	80.16%	89.37%	100%
Standard Deviation	0.8%	2%	0.2%	2.8%	2.4%
Apache HTTP Server - 1000 (Reqs/sec)	**19279**	46629	72719	71537	**79831**
Normalized	24.15%	58.41%	91.09%	89.61%	100%
Standard Deviation	0.9%	1%	0.2%	1%	0.7%
PHPBench - P.B.S (Score)	**241259**	449855	666484	480741	**828186**
Normalized	29.13%	54.32%	80.48%	58.05%	100%
Standard Deviation	0.6%	0.3%	0.1%	1%	0.2%

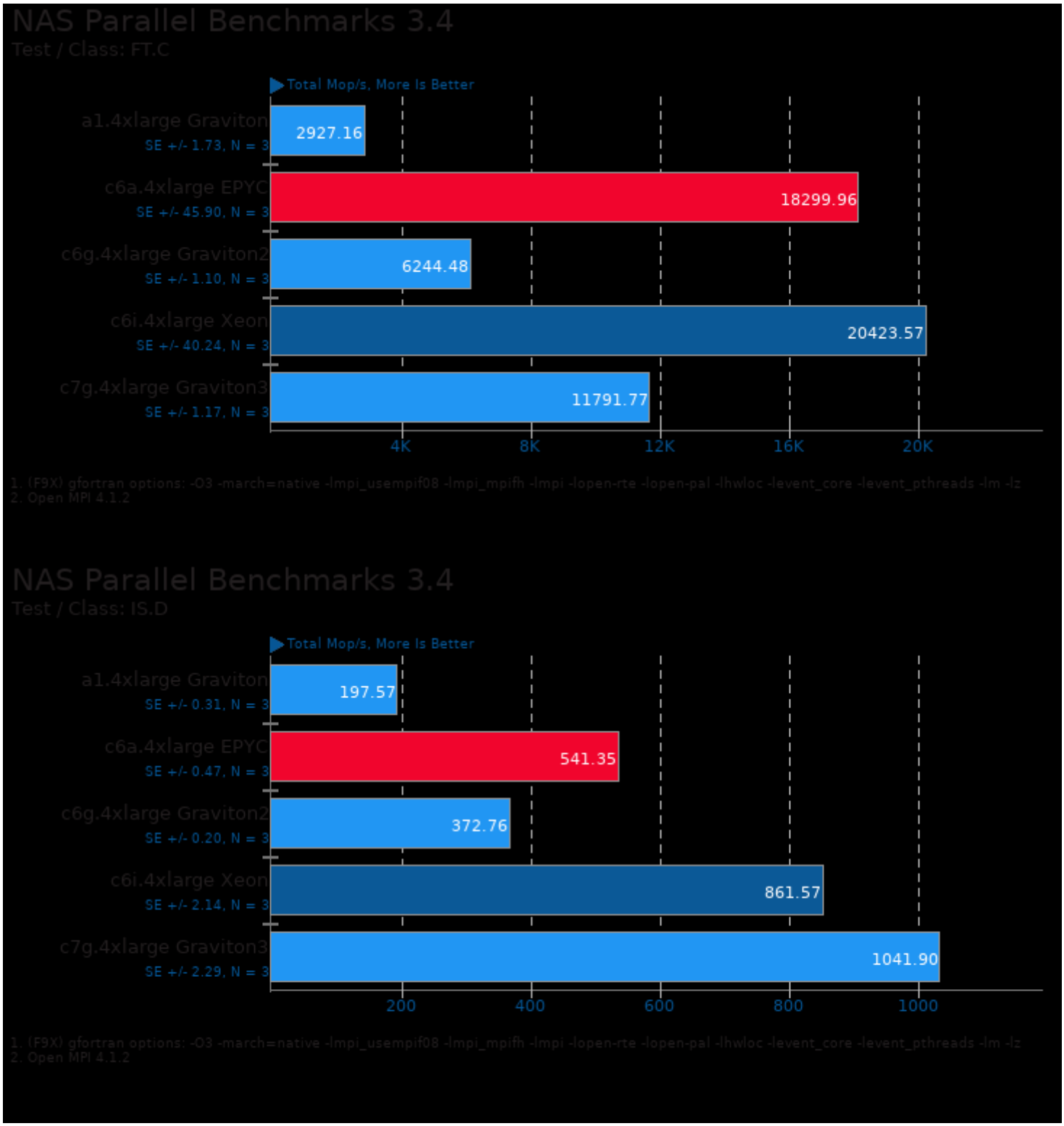
Amazon EC2 Graviton3 Benchmark Comparison



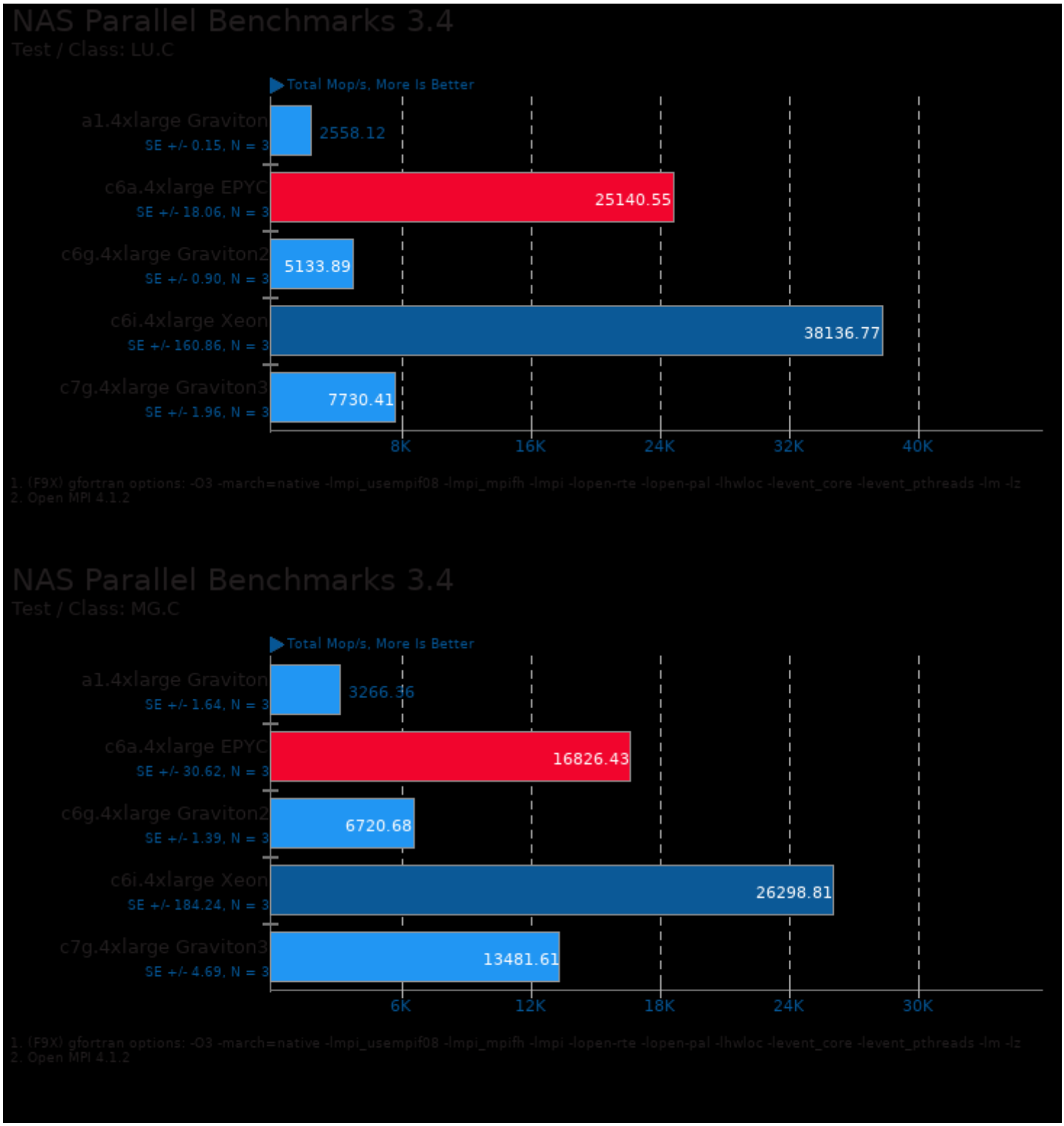
Amazon EC2 Graviton3 Benchmark Comparison



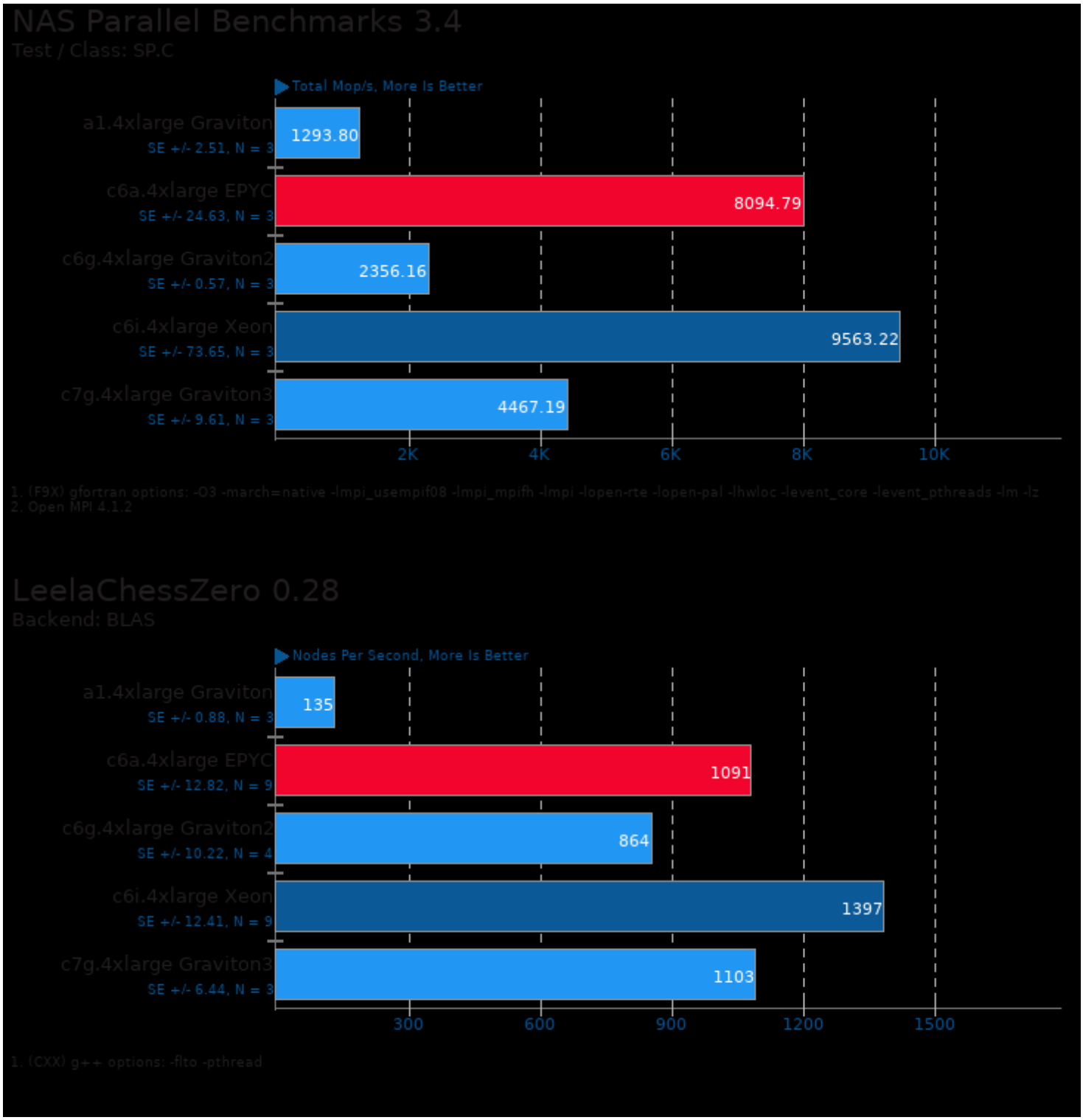
Amazon EC2 Graviton3 Benchmark Comparison



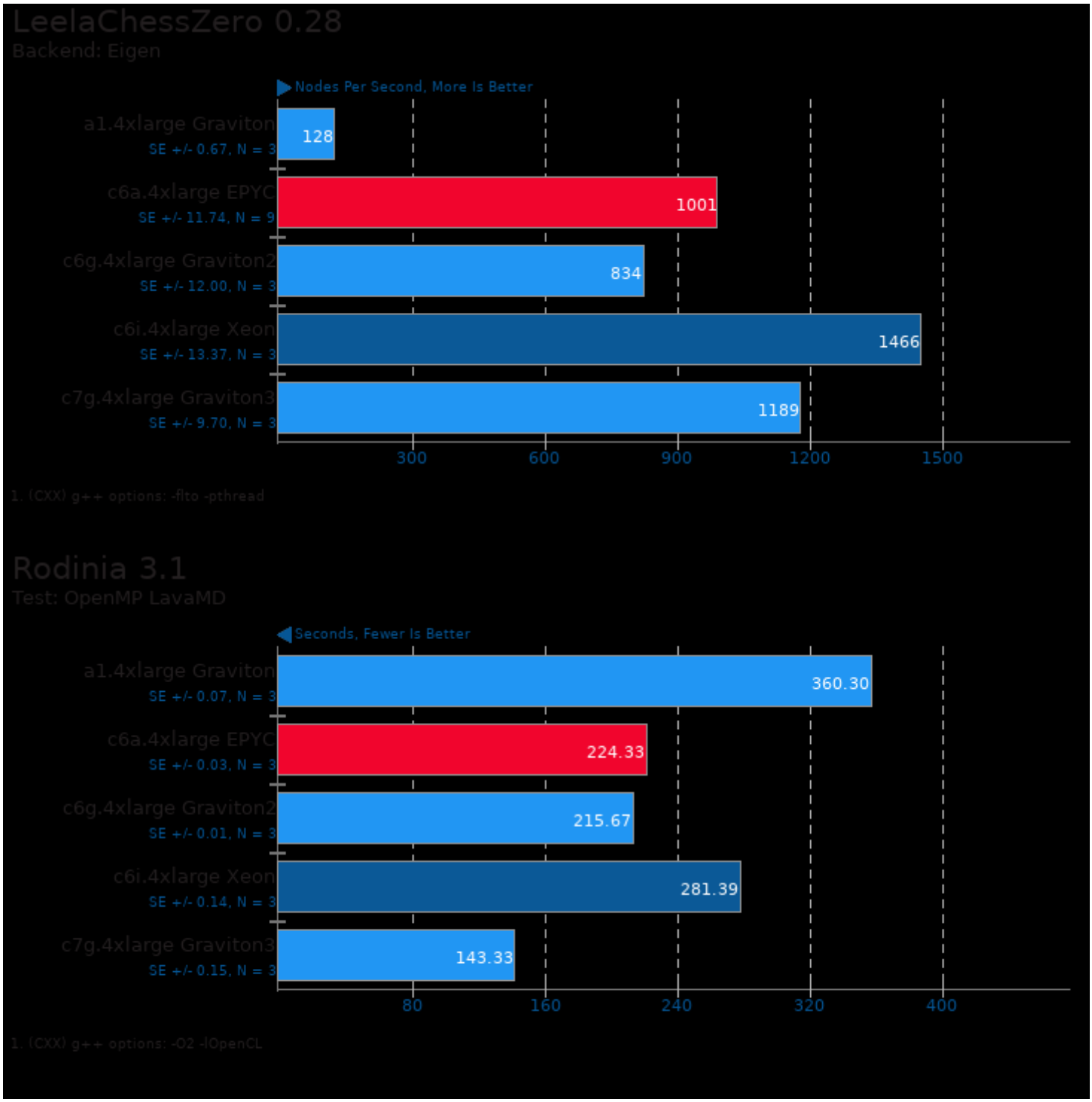
Amazon EC2 Graviton3 Benchmark Comparison



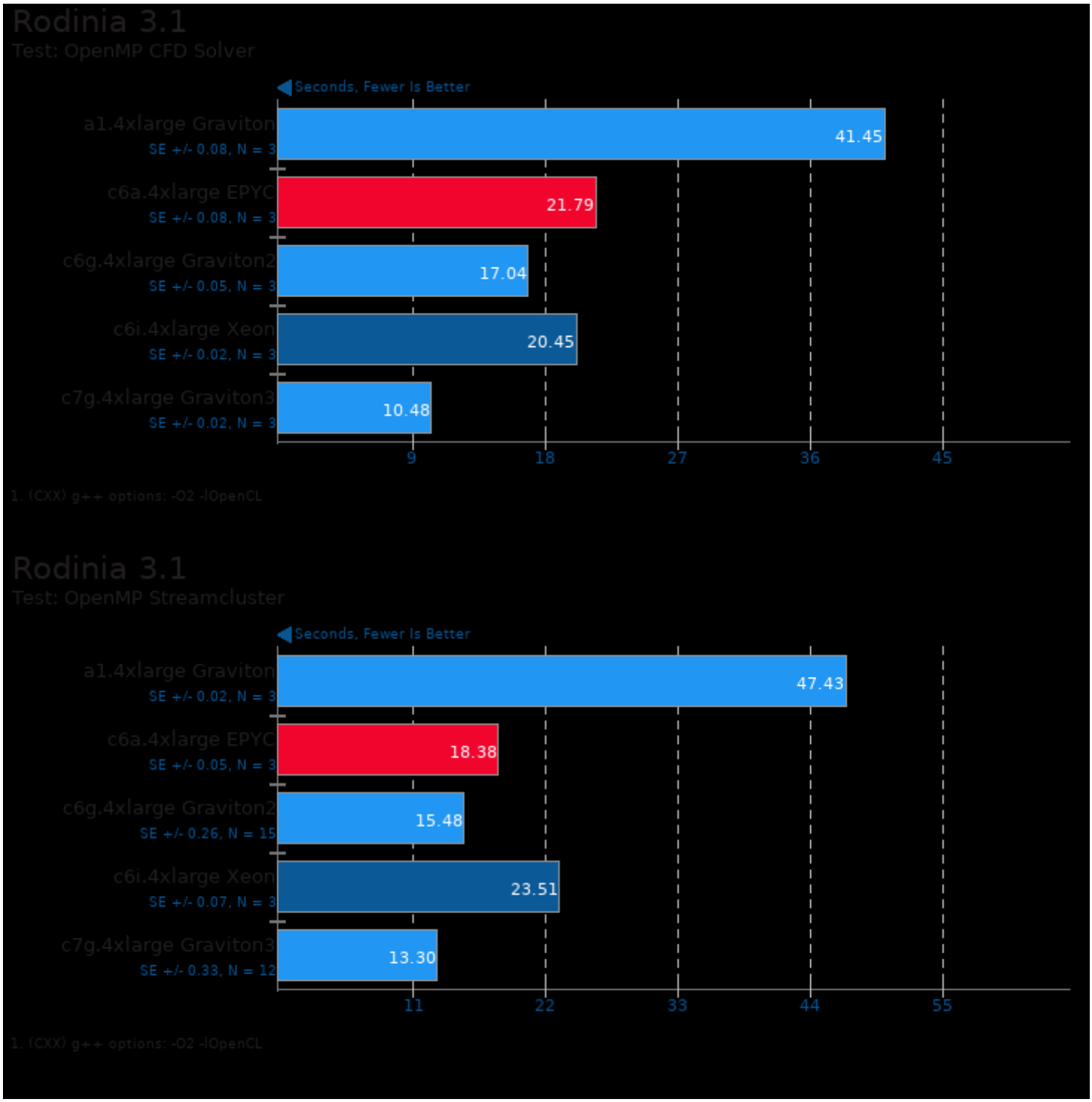
Amazon EC2 Graviton3 Benchmark Comparison



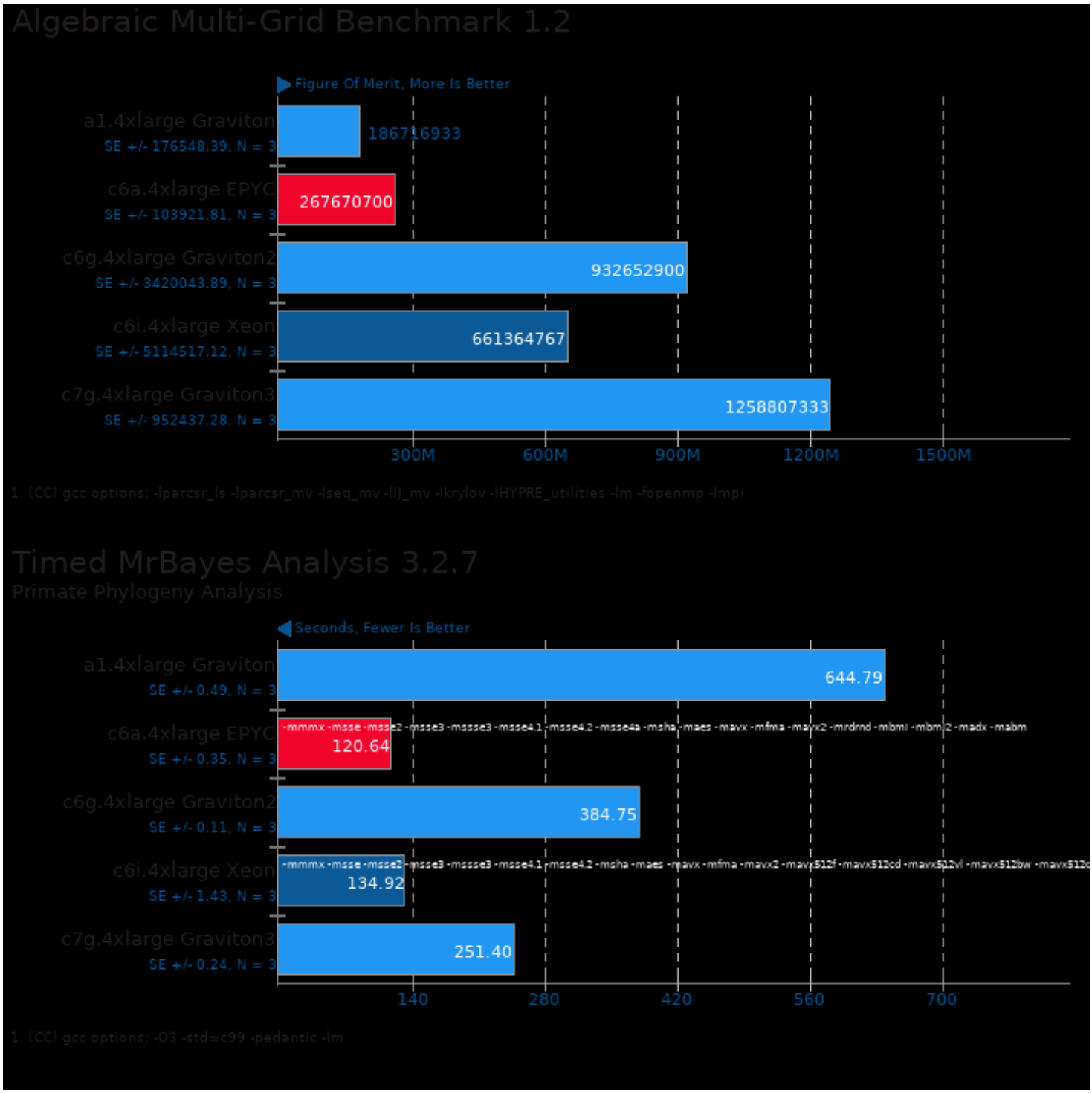
Amazon EC2 Graviton3 Benchmark Comparison



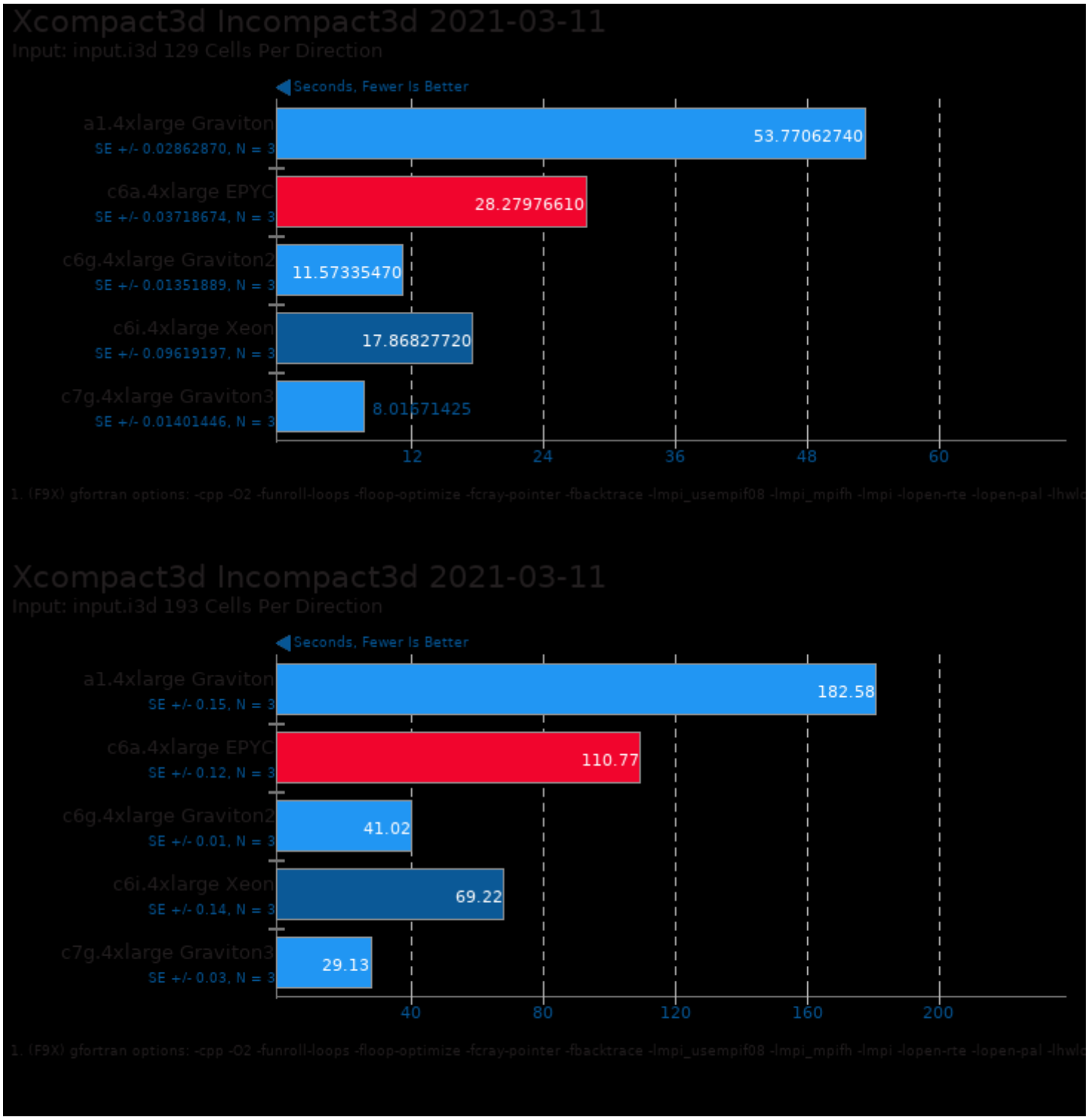
Amazon EC2 Graviton3 Benchmark Comparison



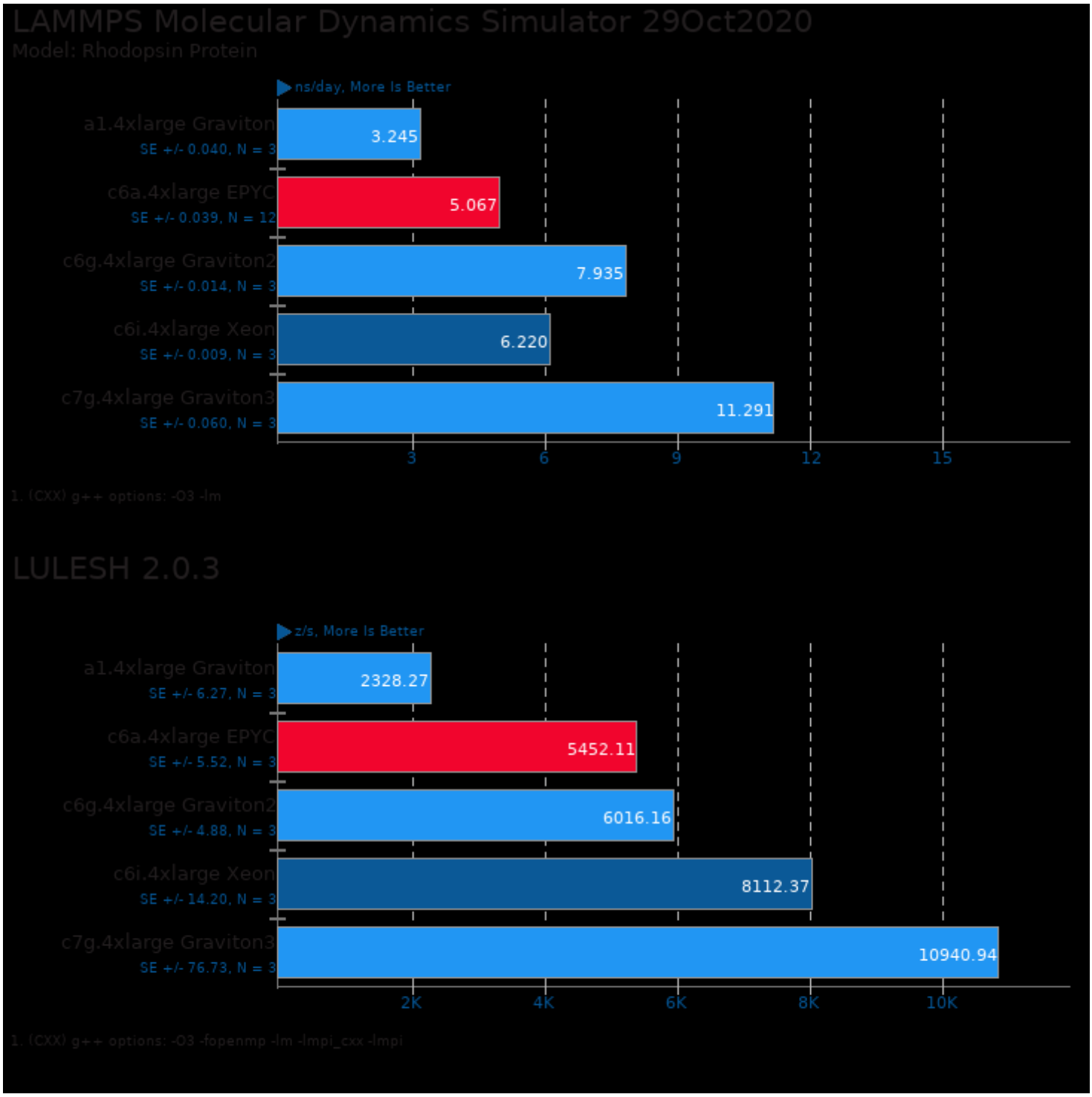
Amazon EC2 Graviton3 Benchmark Comparison



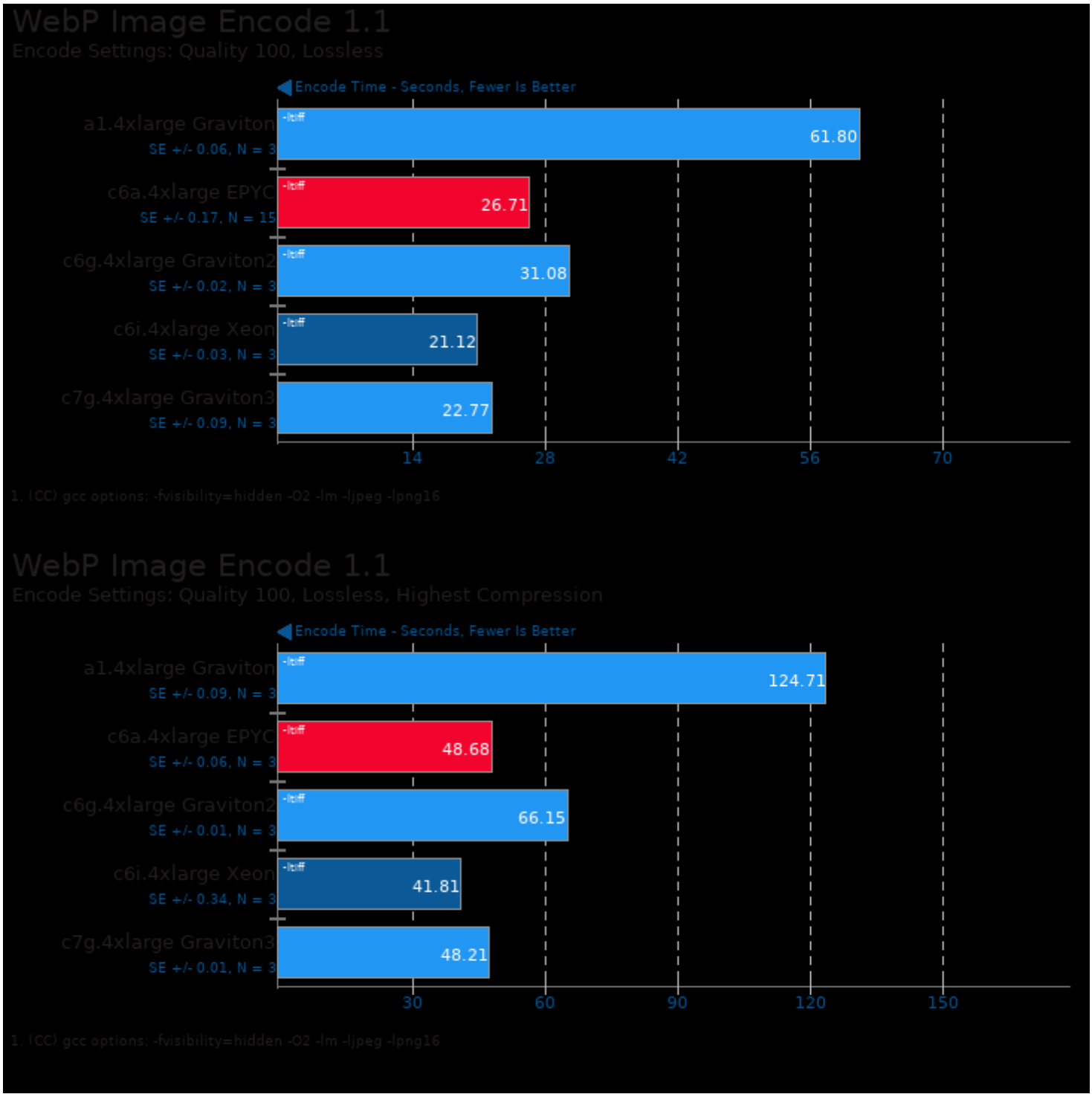
Amazon EC2 Graviton3 Benchmark Comparison



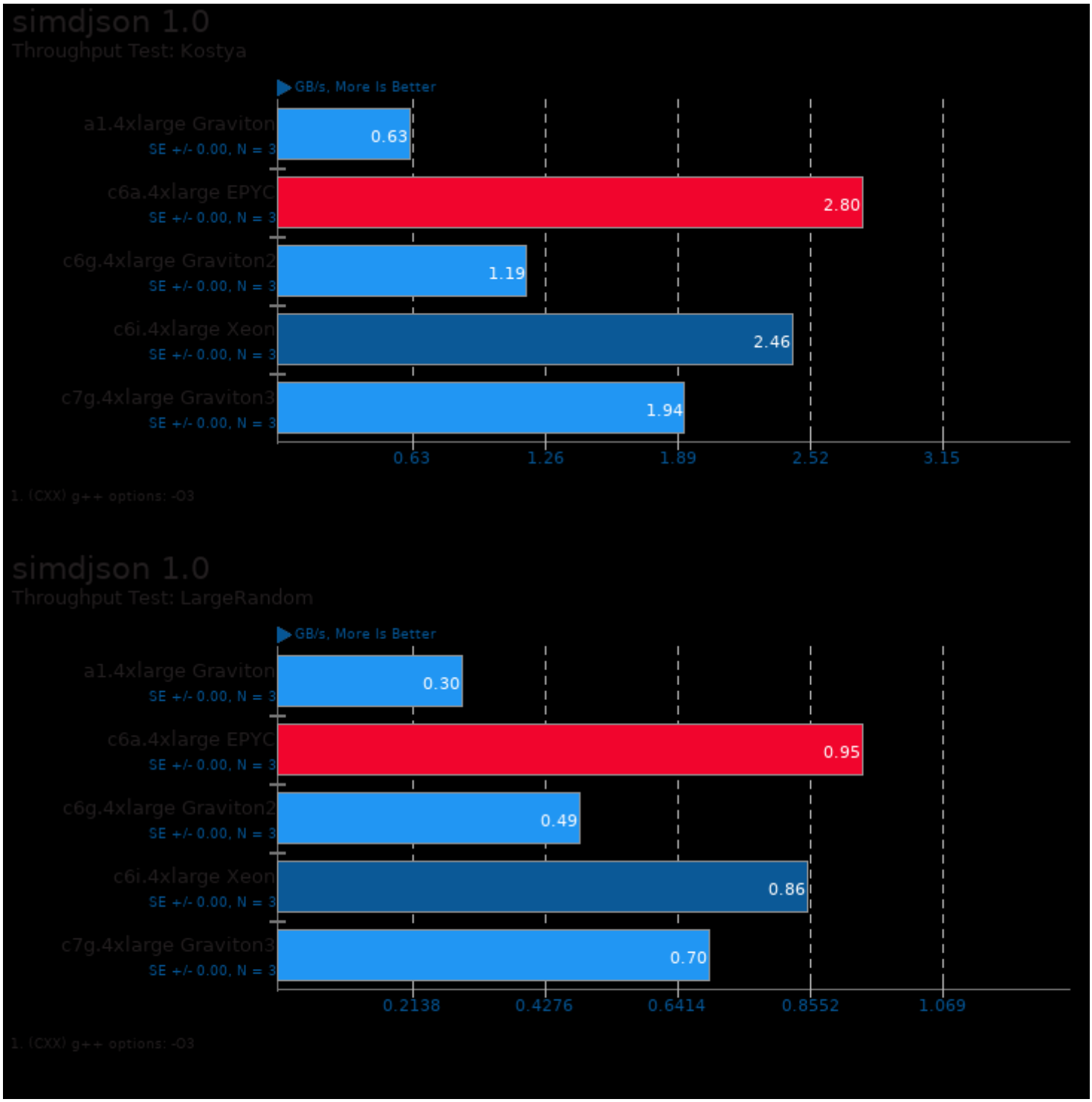
Amazon EC2 Graviton3 Benchmark Comparison



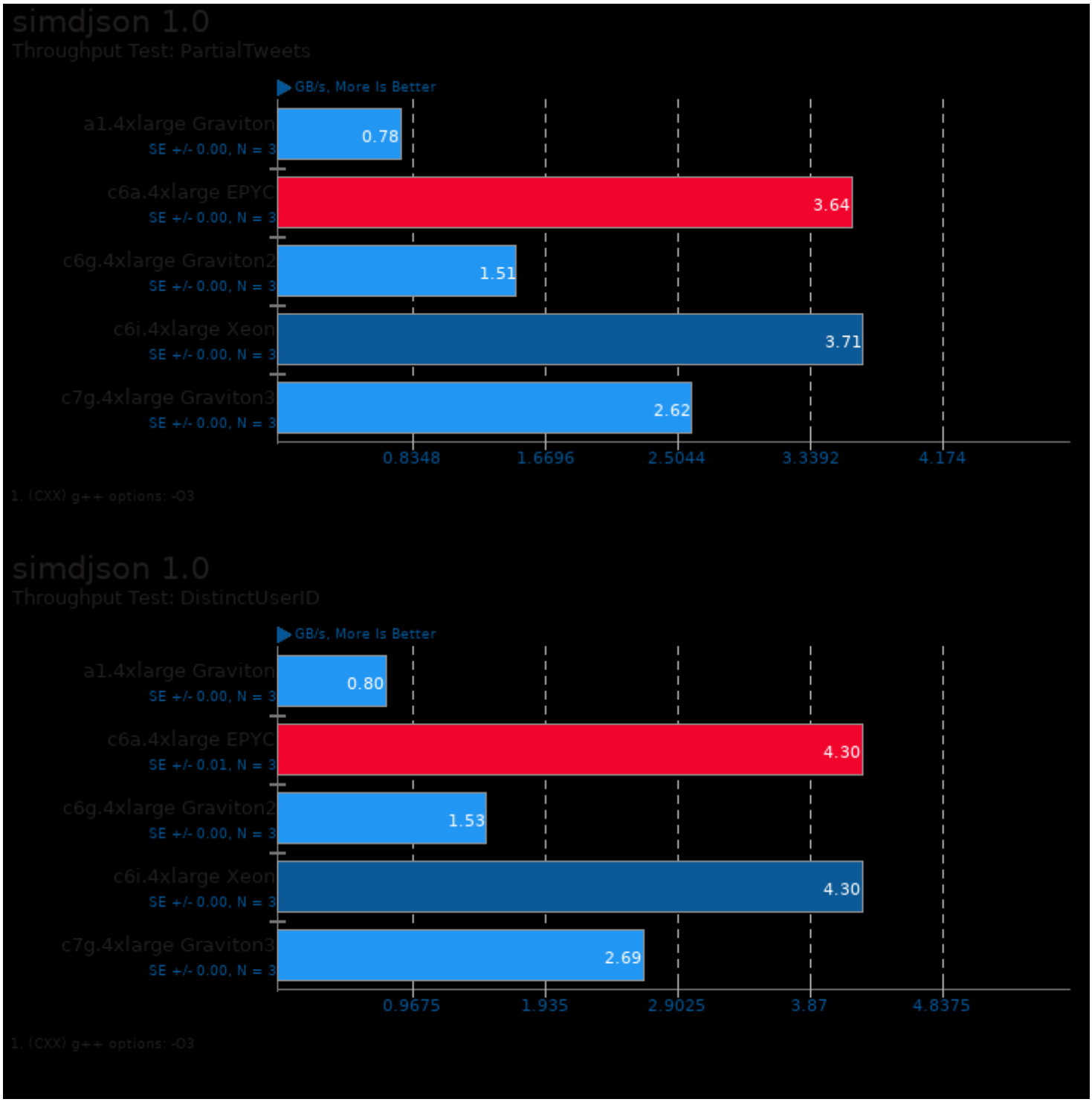
Amazon EC2 Graviton3 Benchmark Comparison



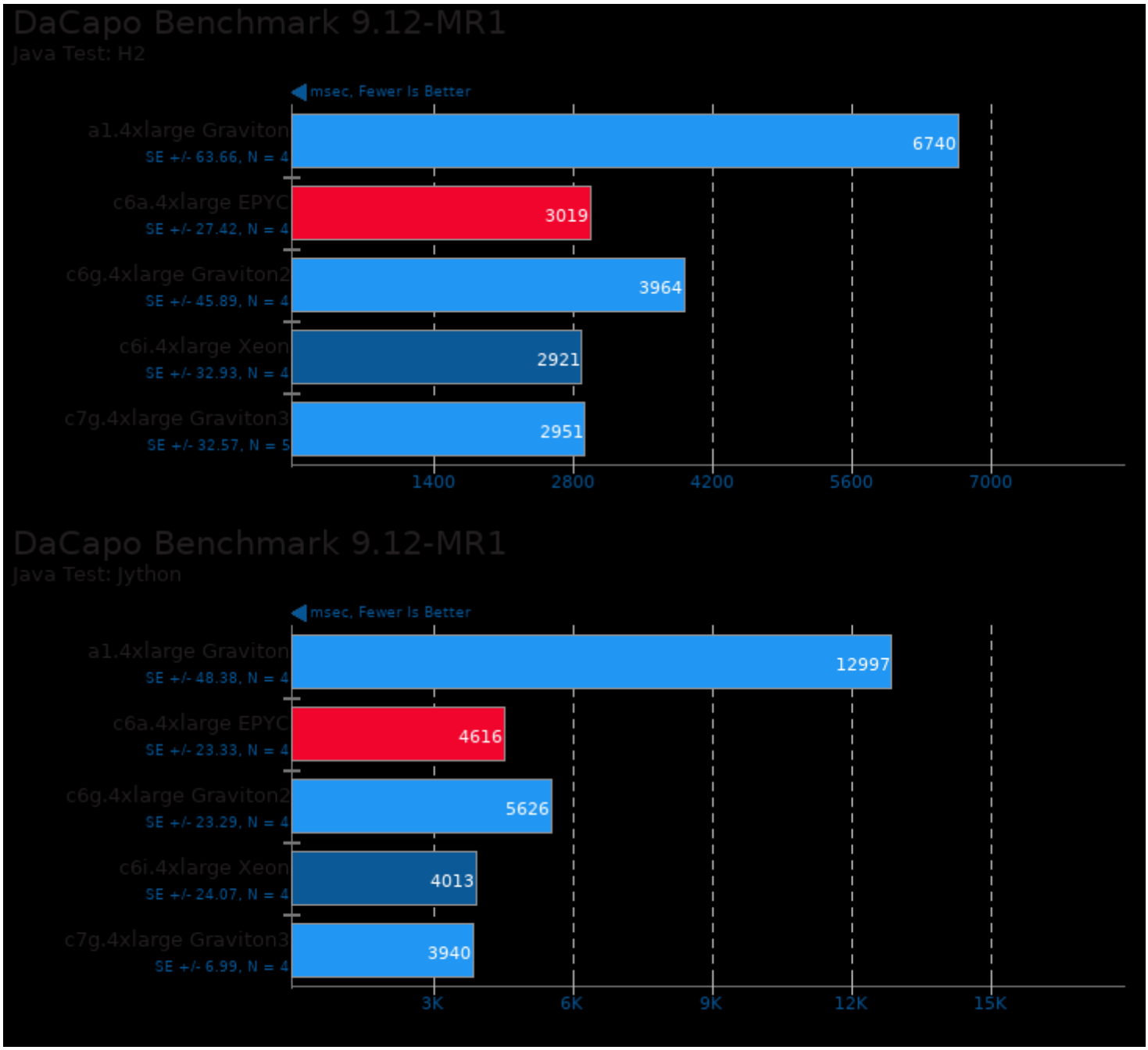
Amazon EC2 Graviton3 Benchmark Comparison



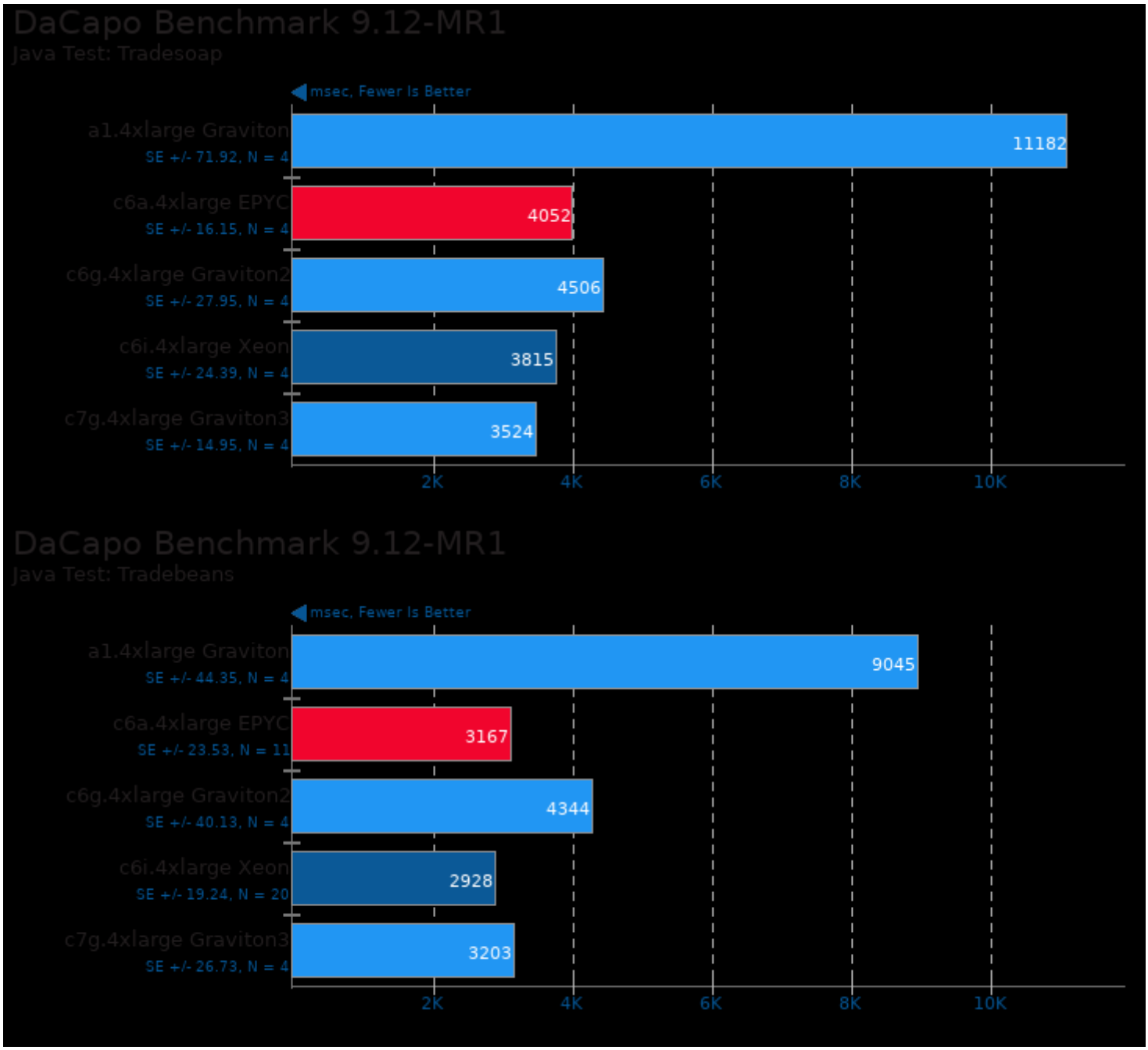
Amazon EC2 Graviton3 Benchmark Comparison



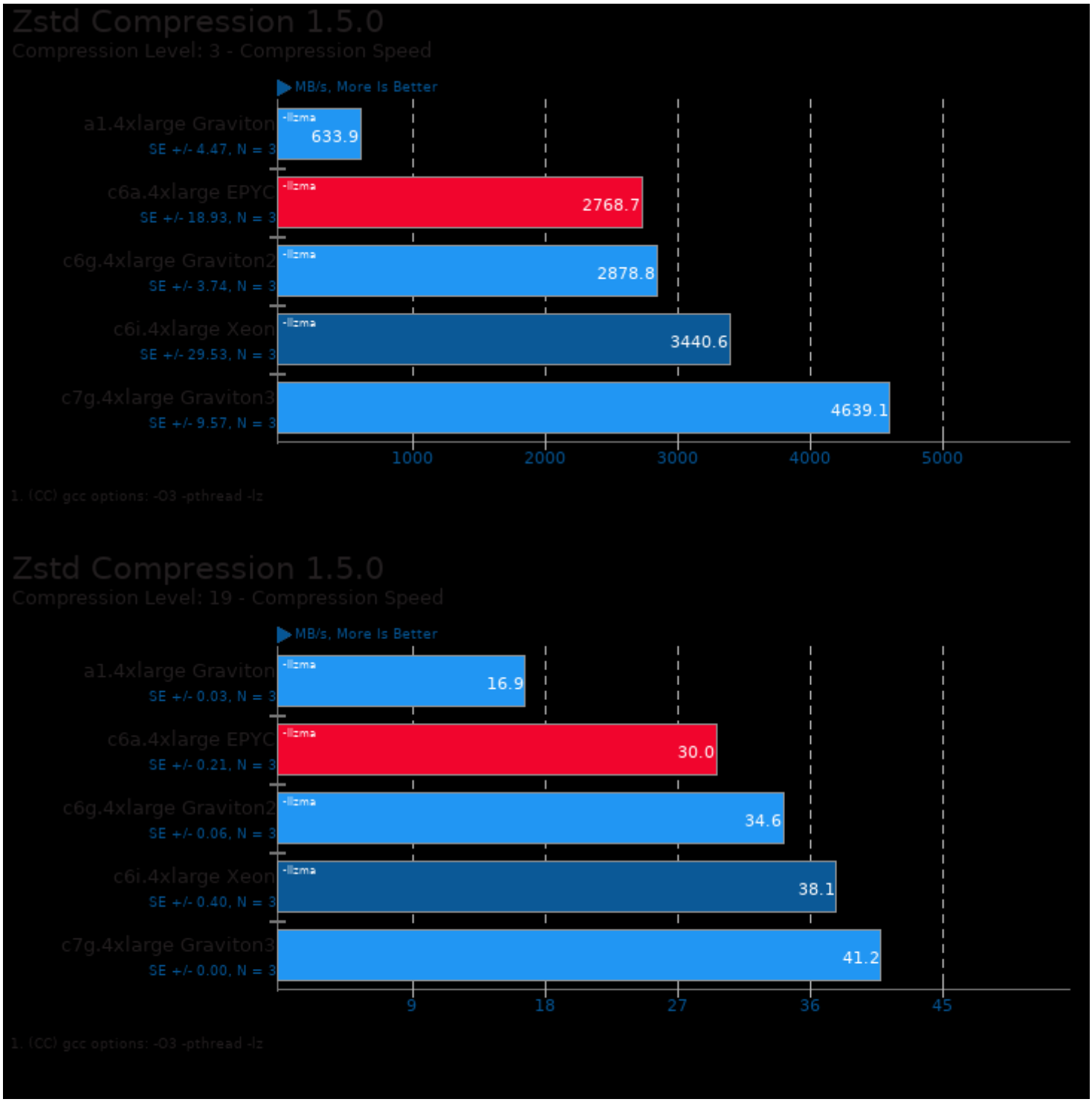
Amazon EC2 Graviton3 Benchmark Comparison



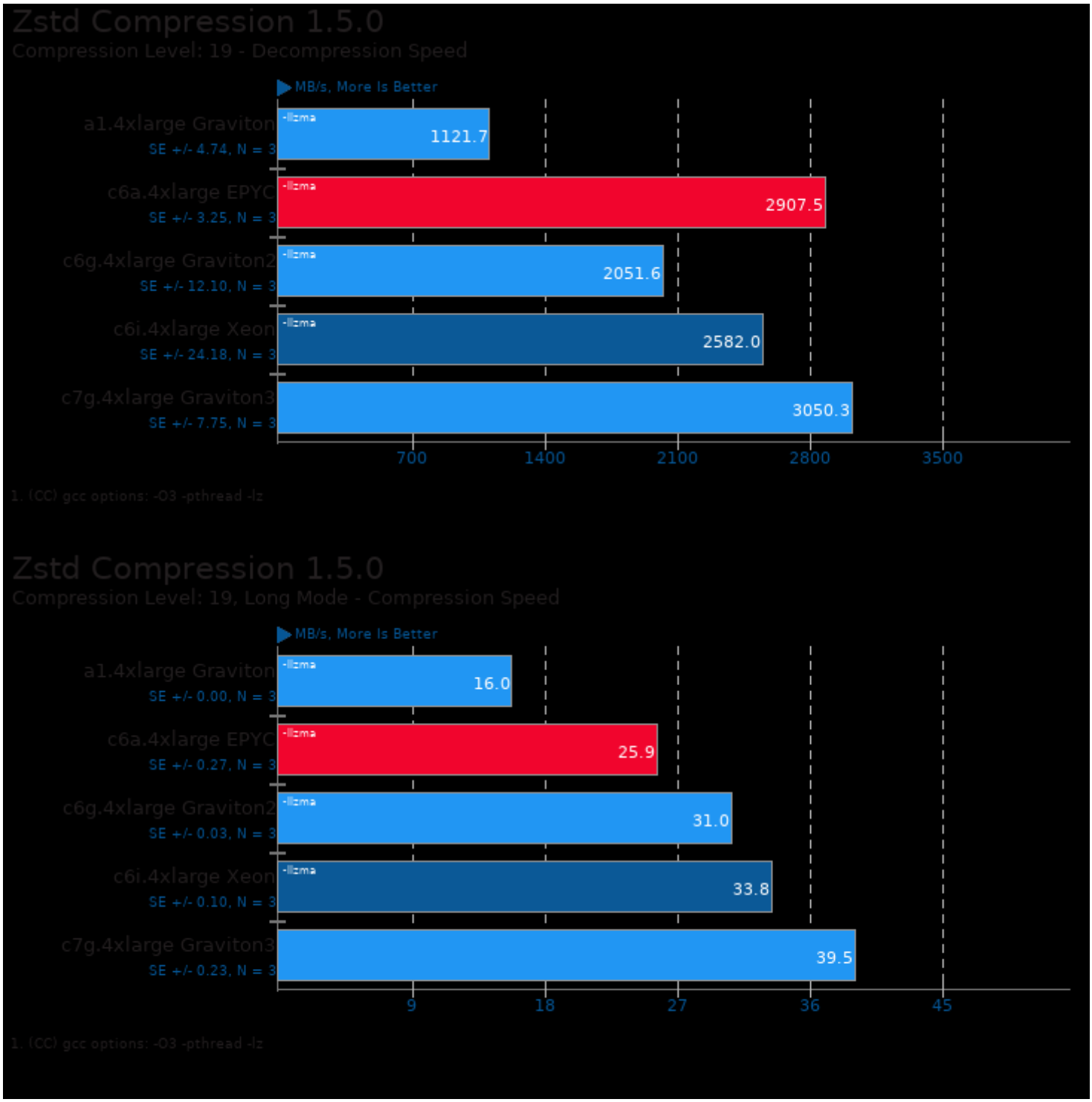
Amazon EC2 Graviton3 Benchmark Comparison



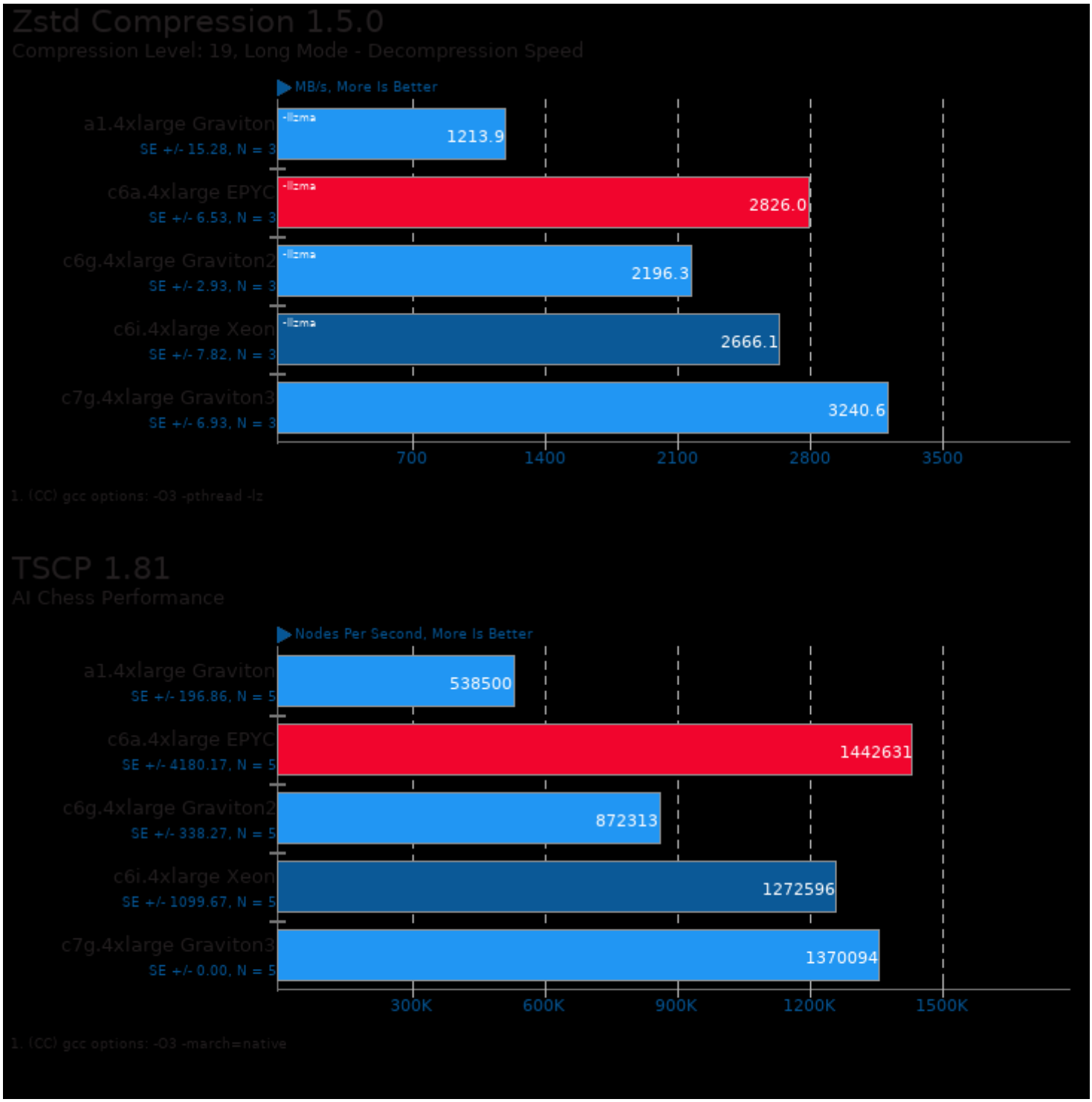
Amazon EC2 Graviton3 Benchmark Comparison



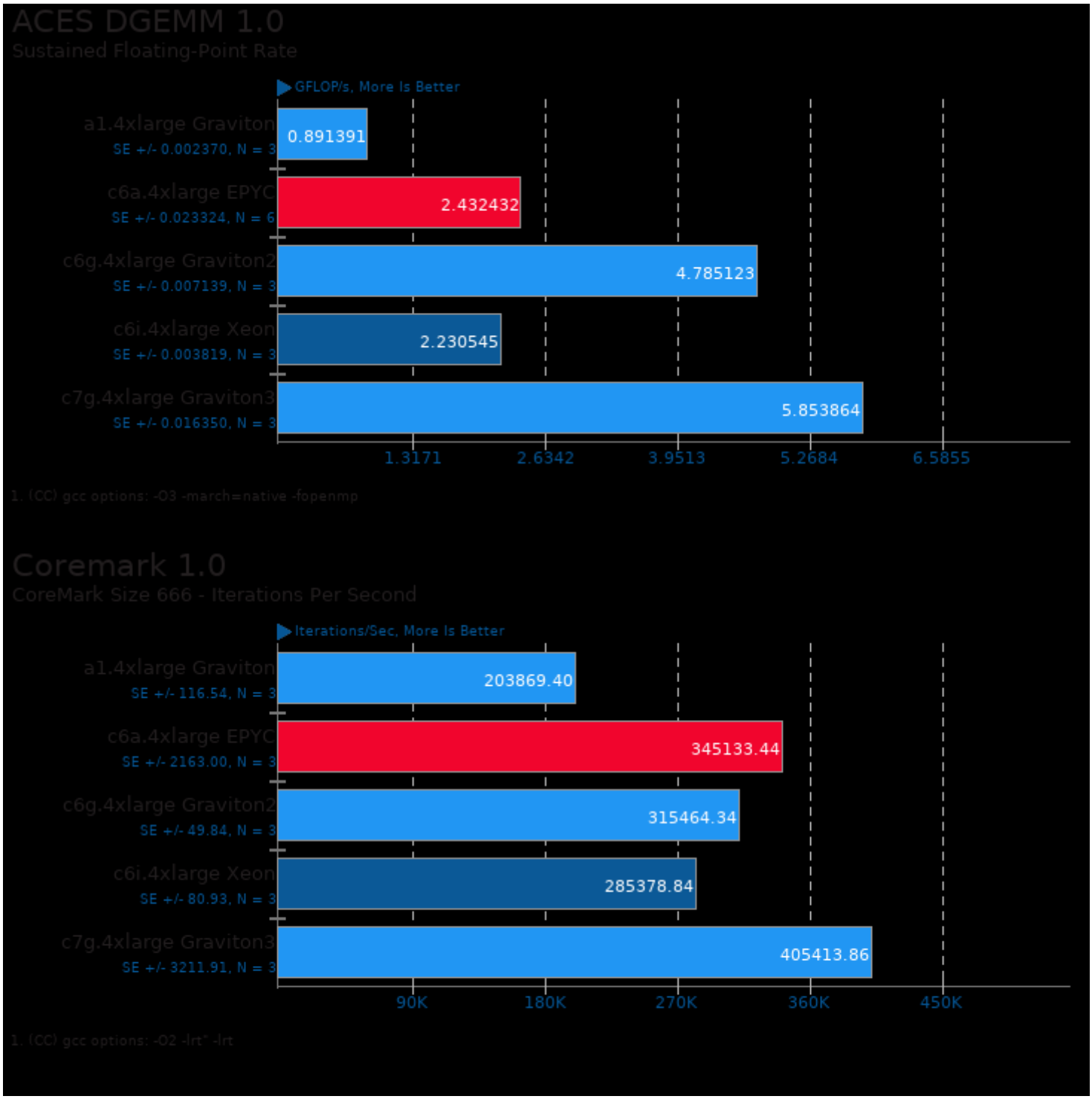
Amazon EC2 Graviton3 Benchmark Comparison



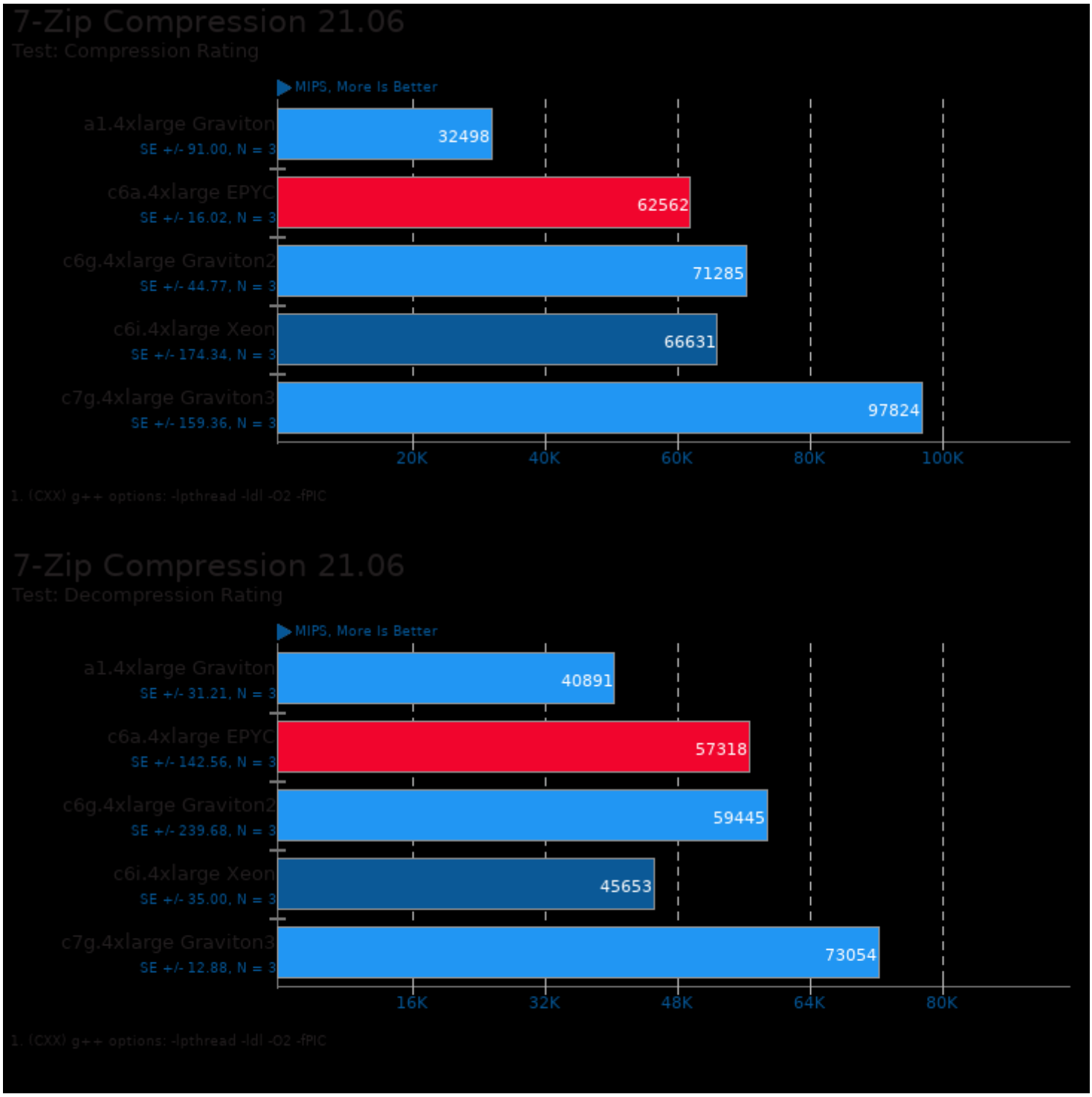
Amazon EC2 Graviton3 Benchmark Comparison



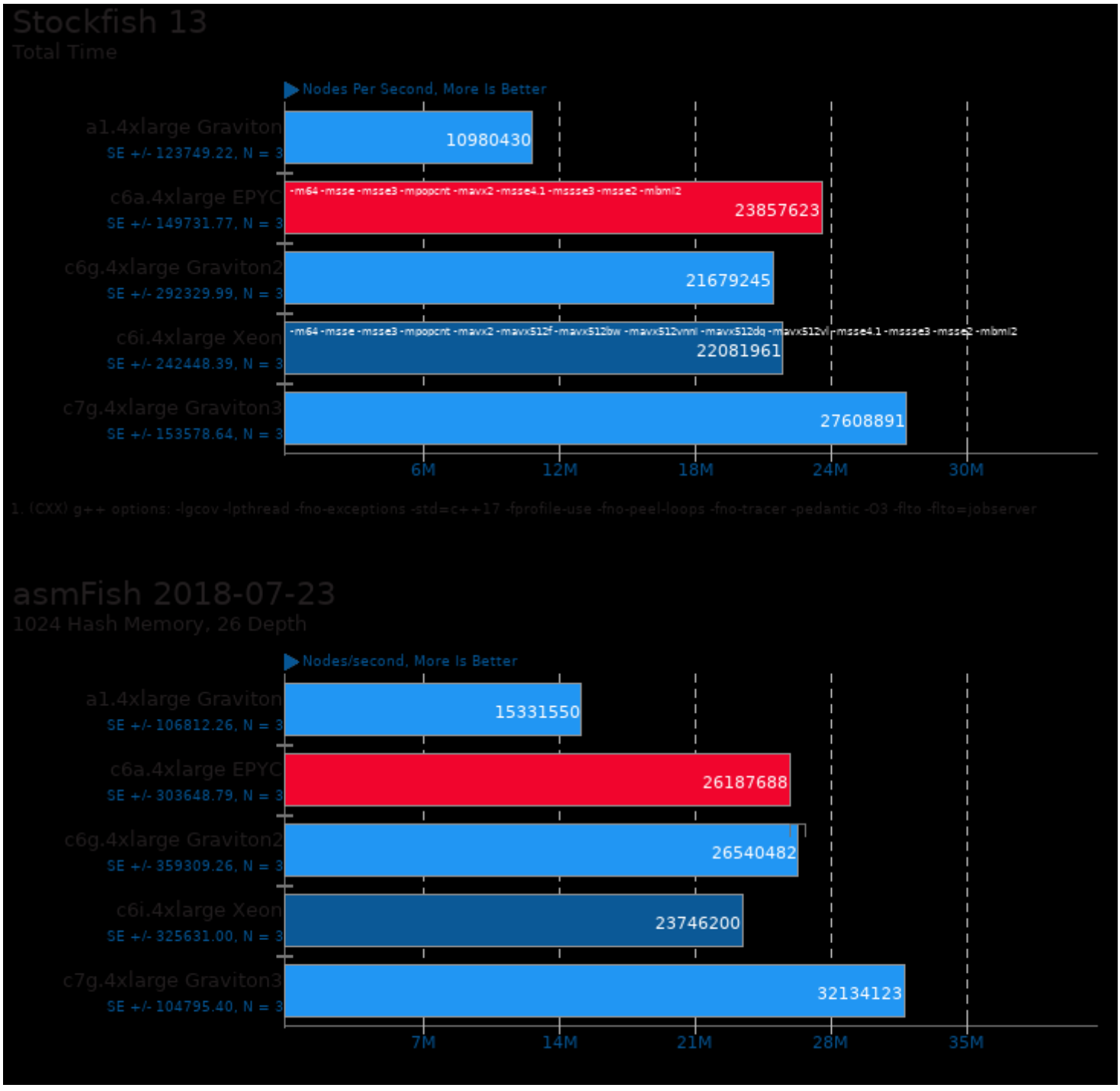
Amazon EC2 Graviton3 Benchmark Comparison



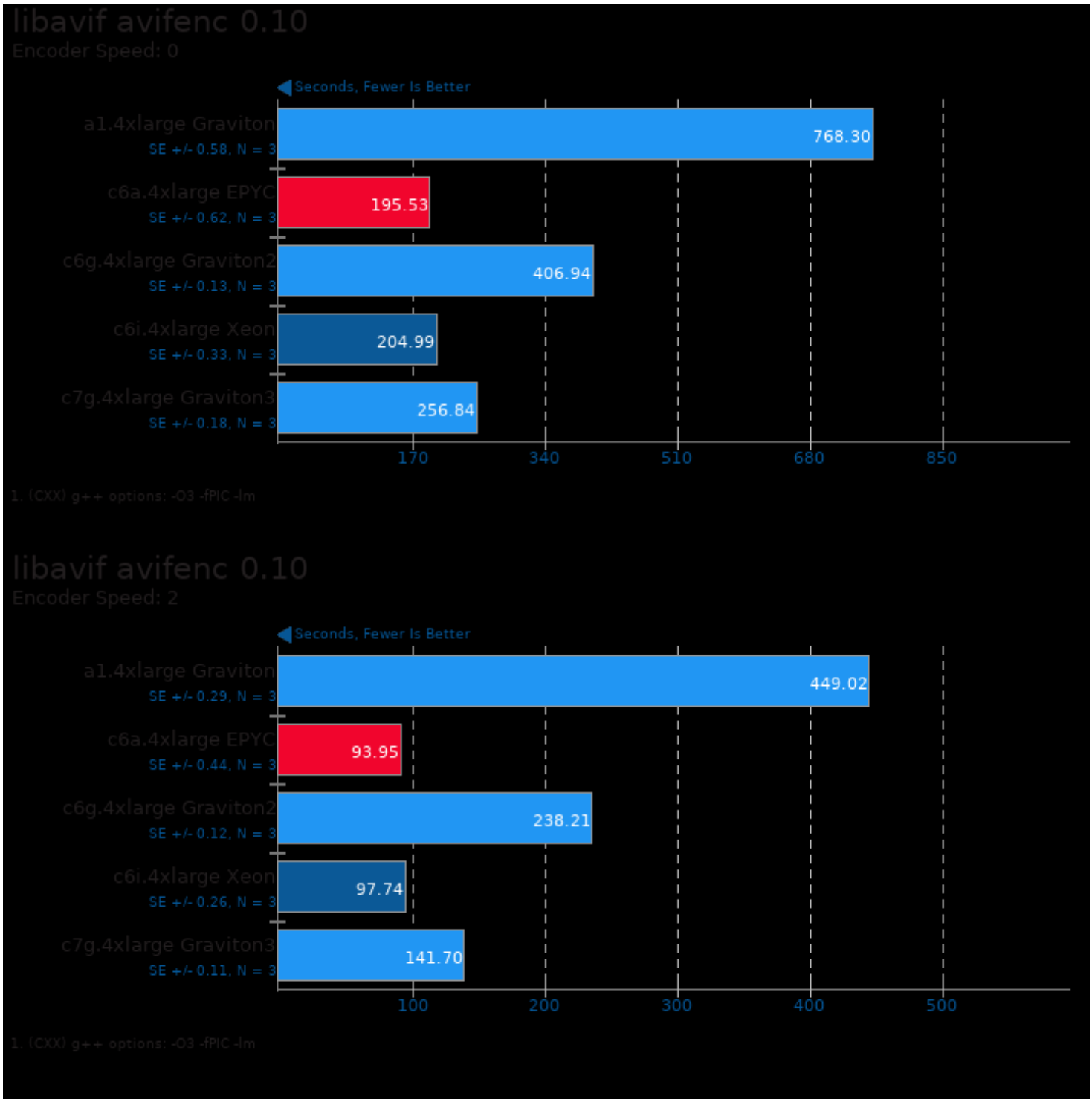
Amazon EC2 Graviton3 Benchmark Comparison



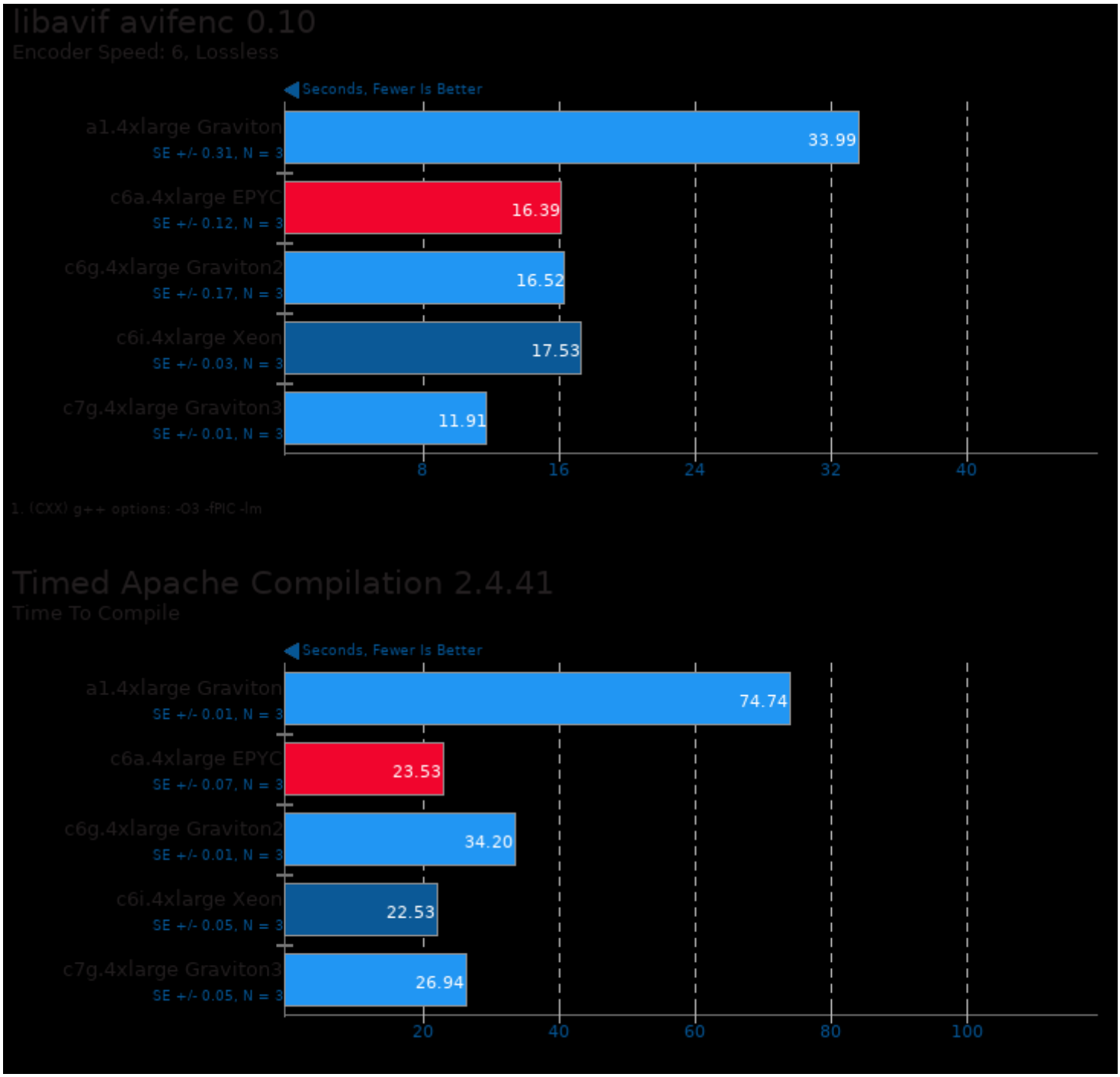
Amazon EC2 Graviton3 Benchmark Comparison



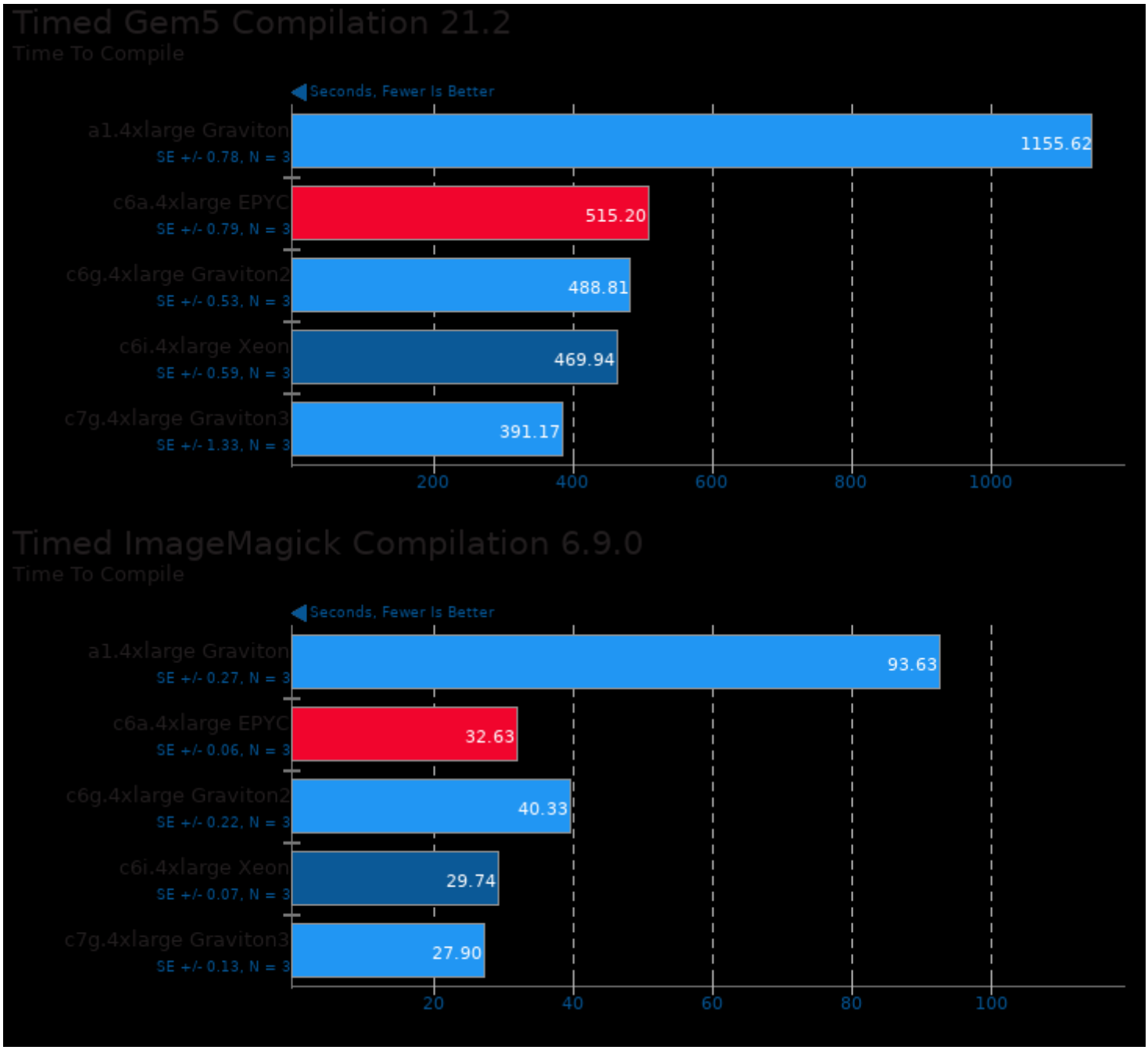
Amazon EC2 Graviton3 Benchmark Comparison



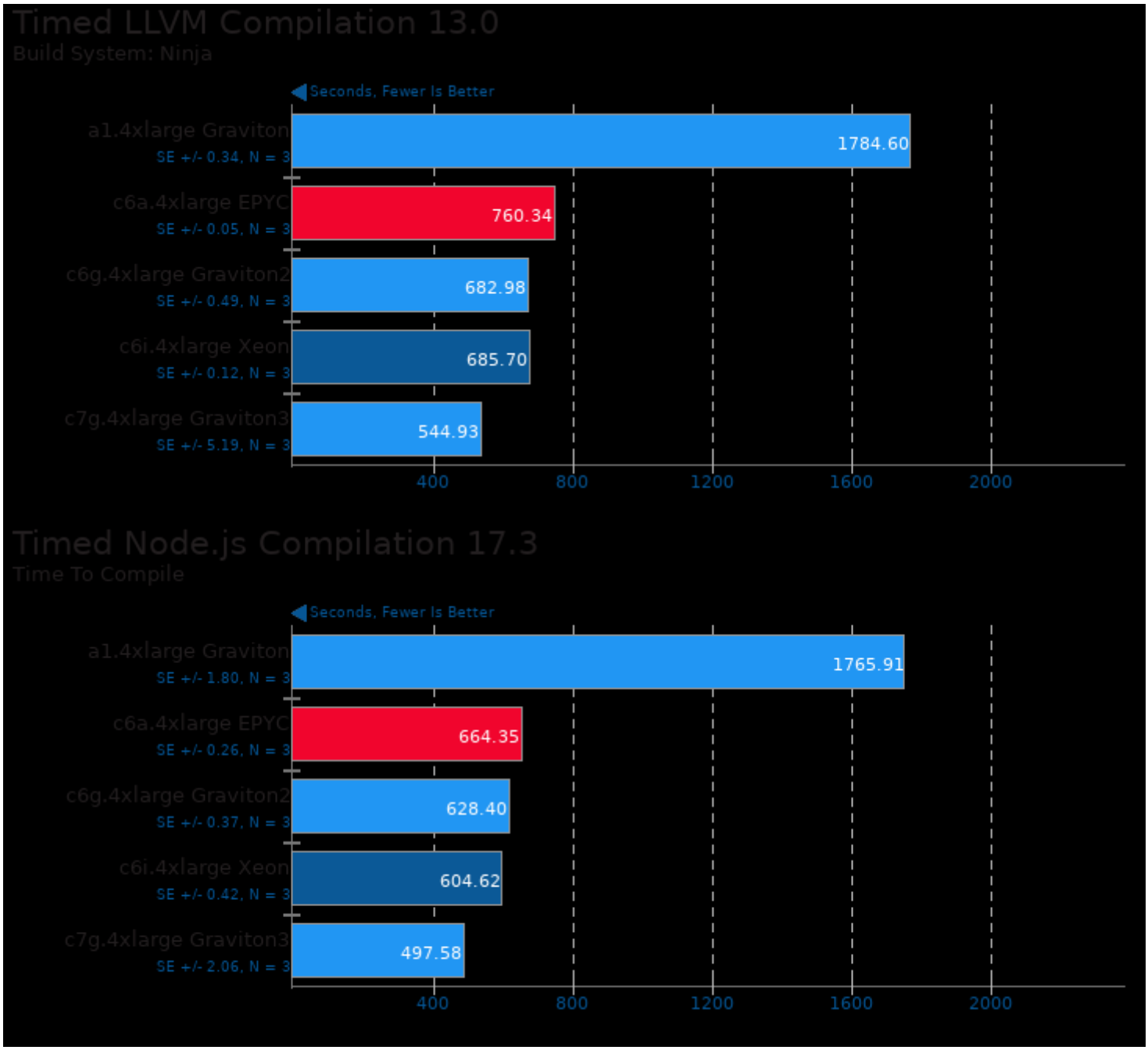
Amazon EC2 Graviton3 Benchmark Comparison



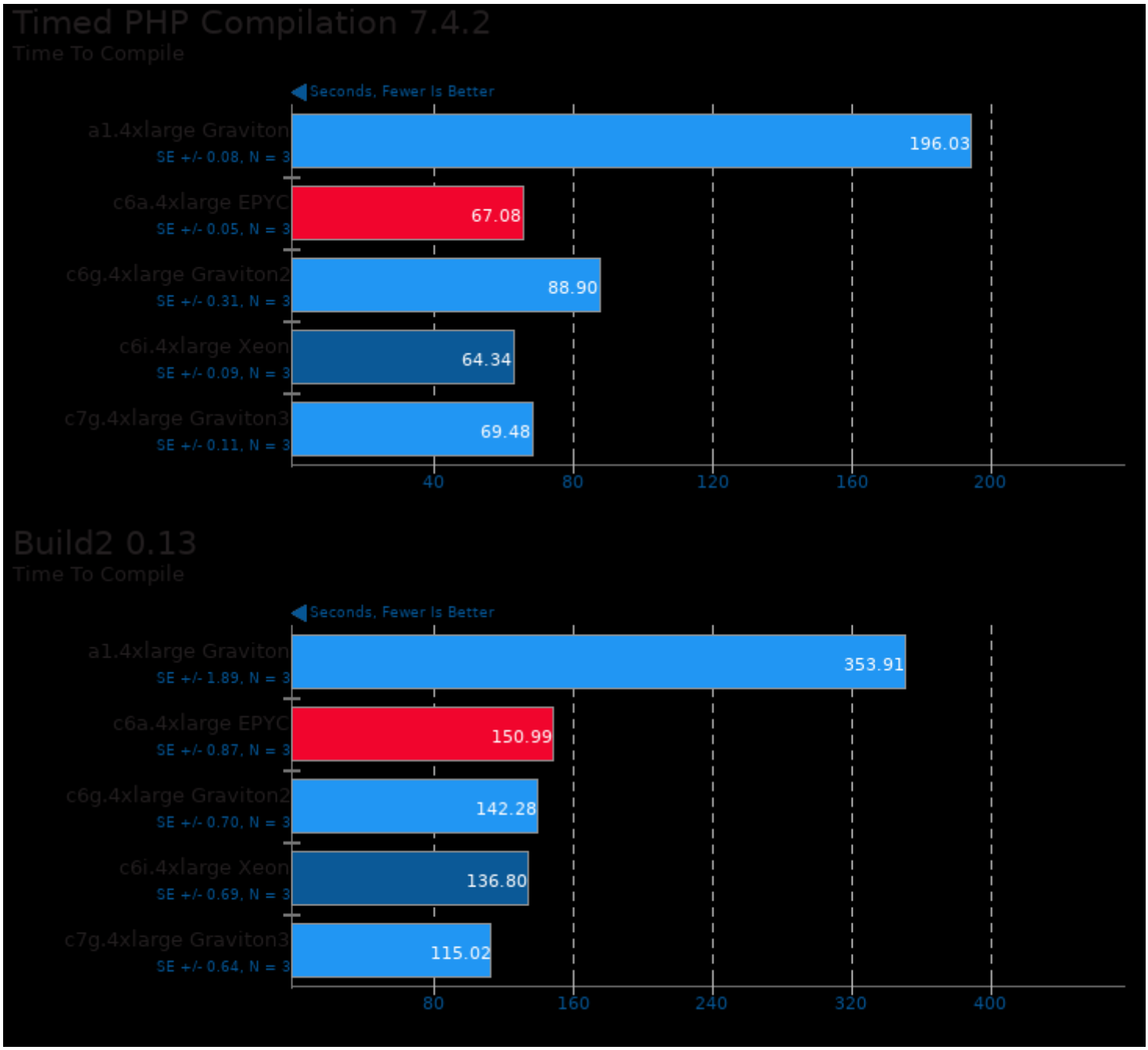
Amazon EC2 Graviton3 Benchmark Comparison



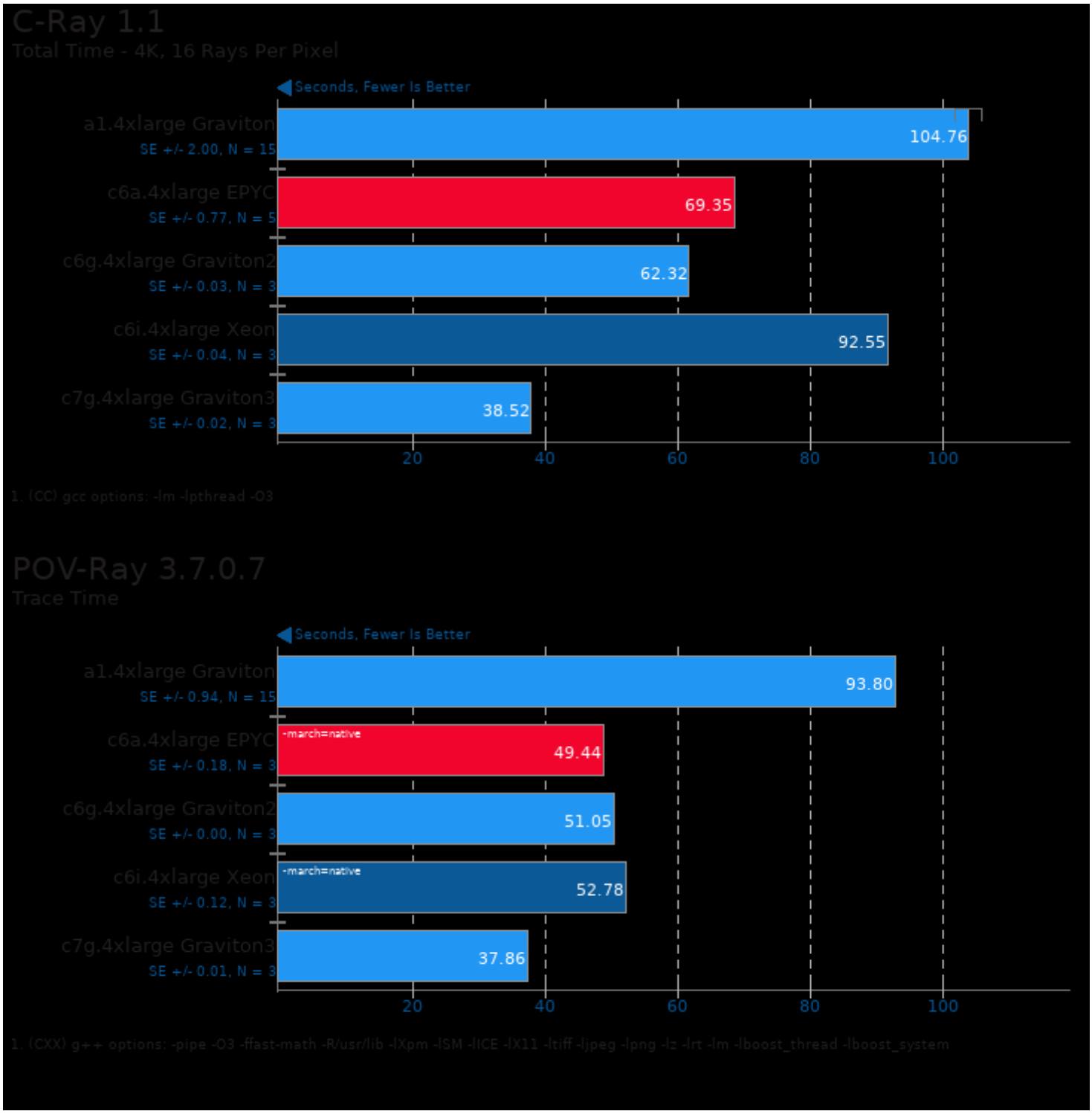
Amazon EC2 Graviton3 Benchmark Comparison



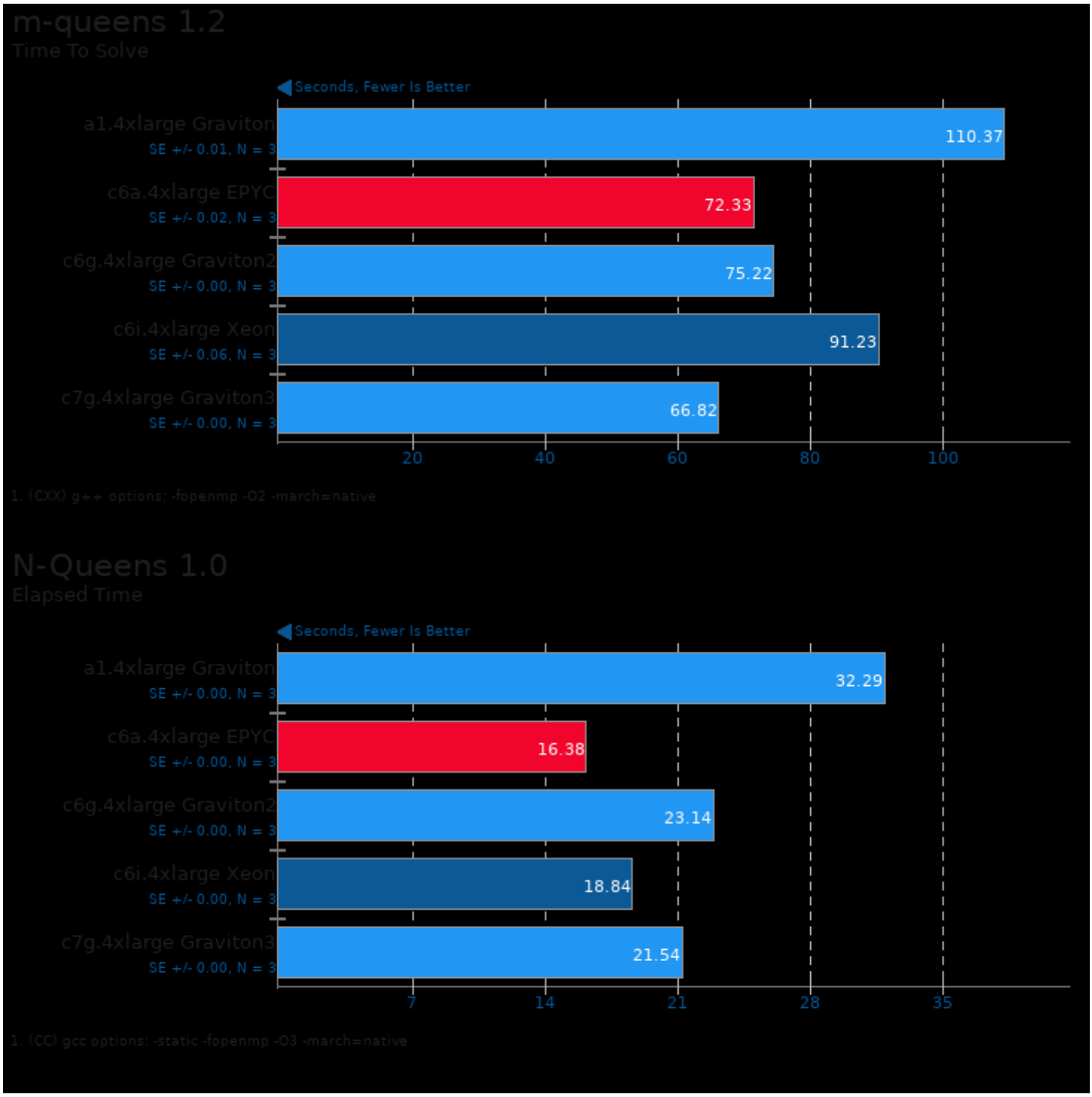
Amazon EC2 Graviton3 Benchmark Comparison



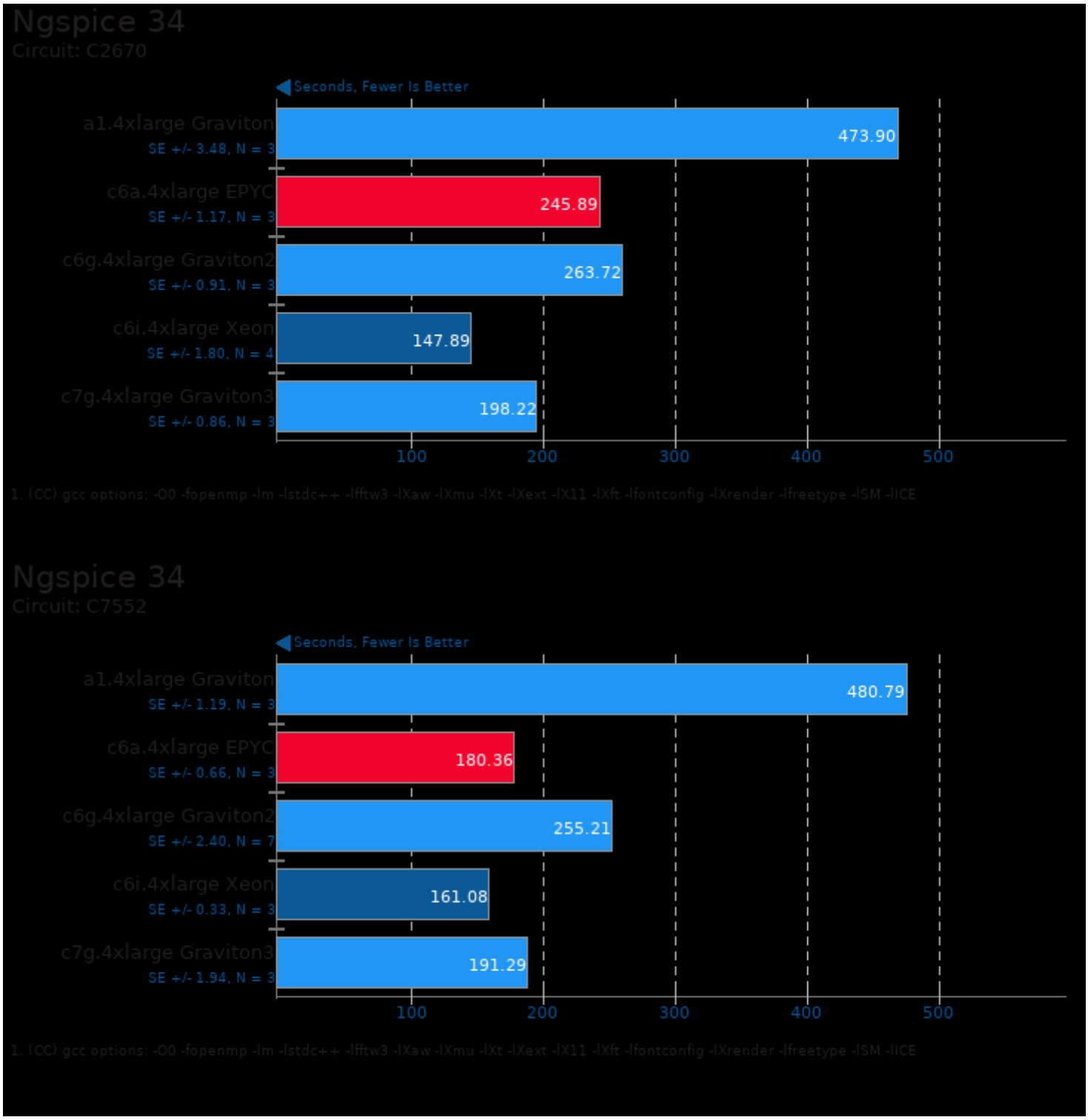
Amazon EC2 Graviton3 Benchmark Comparison



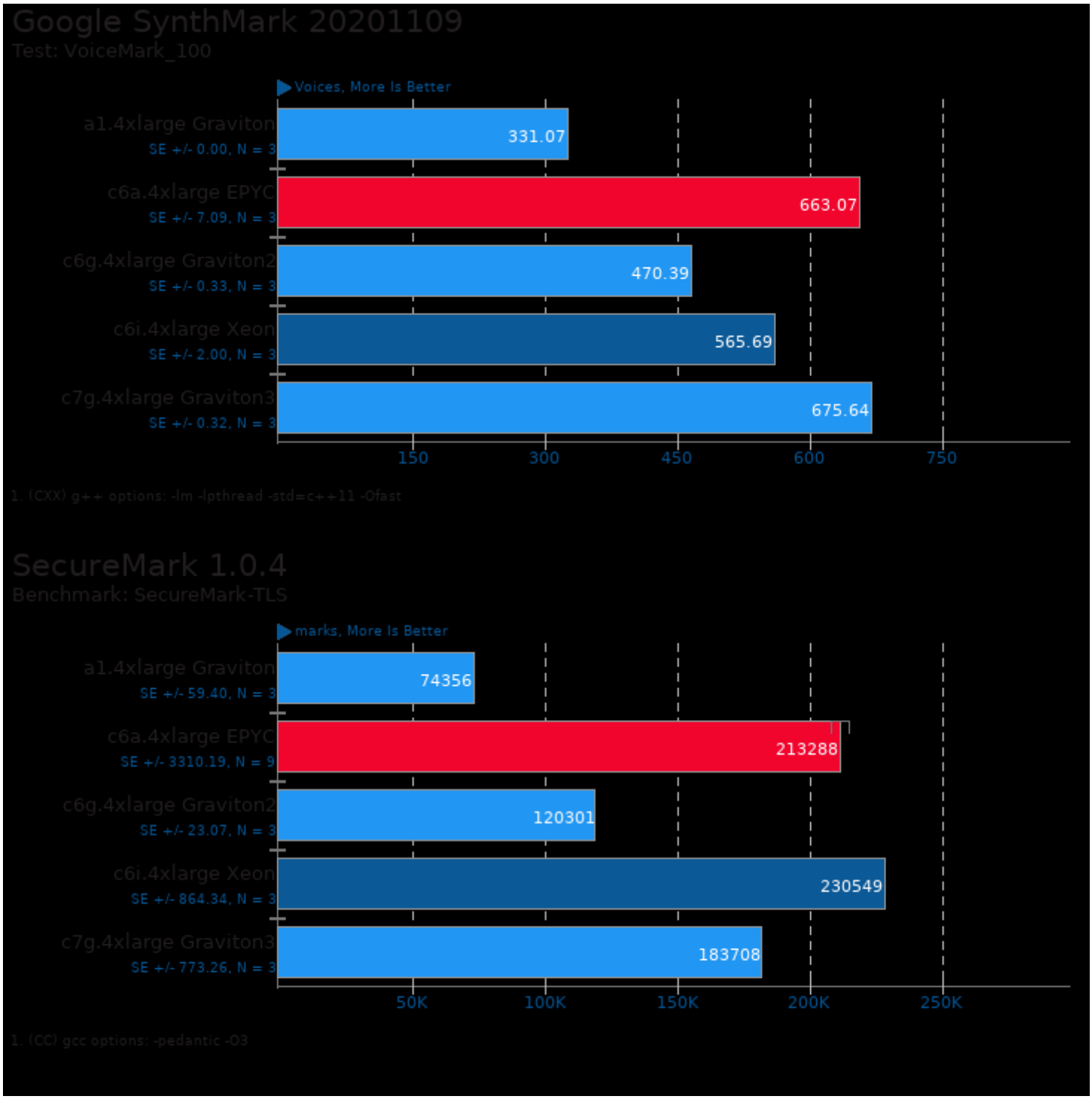
Amazon EC2 Graviton3 Benchmark Comparison



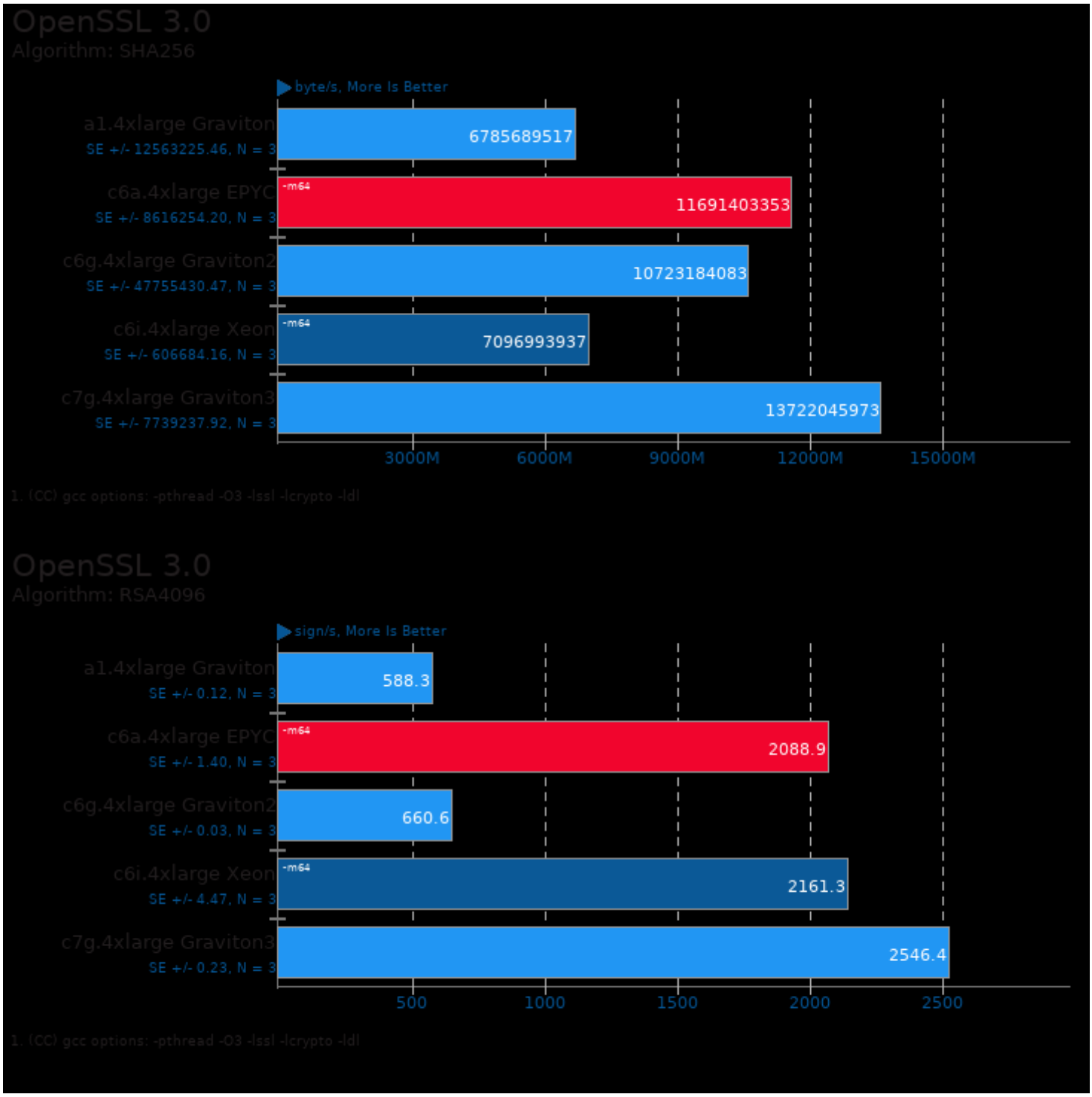
Amazon EC2 Graviton3 Benchmark Comparison



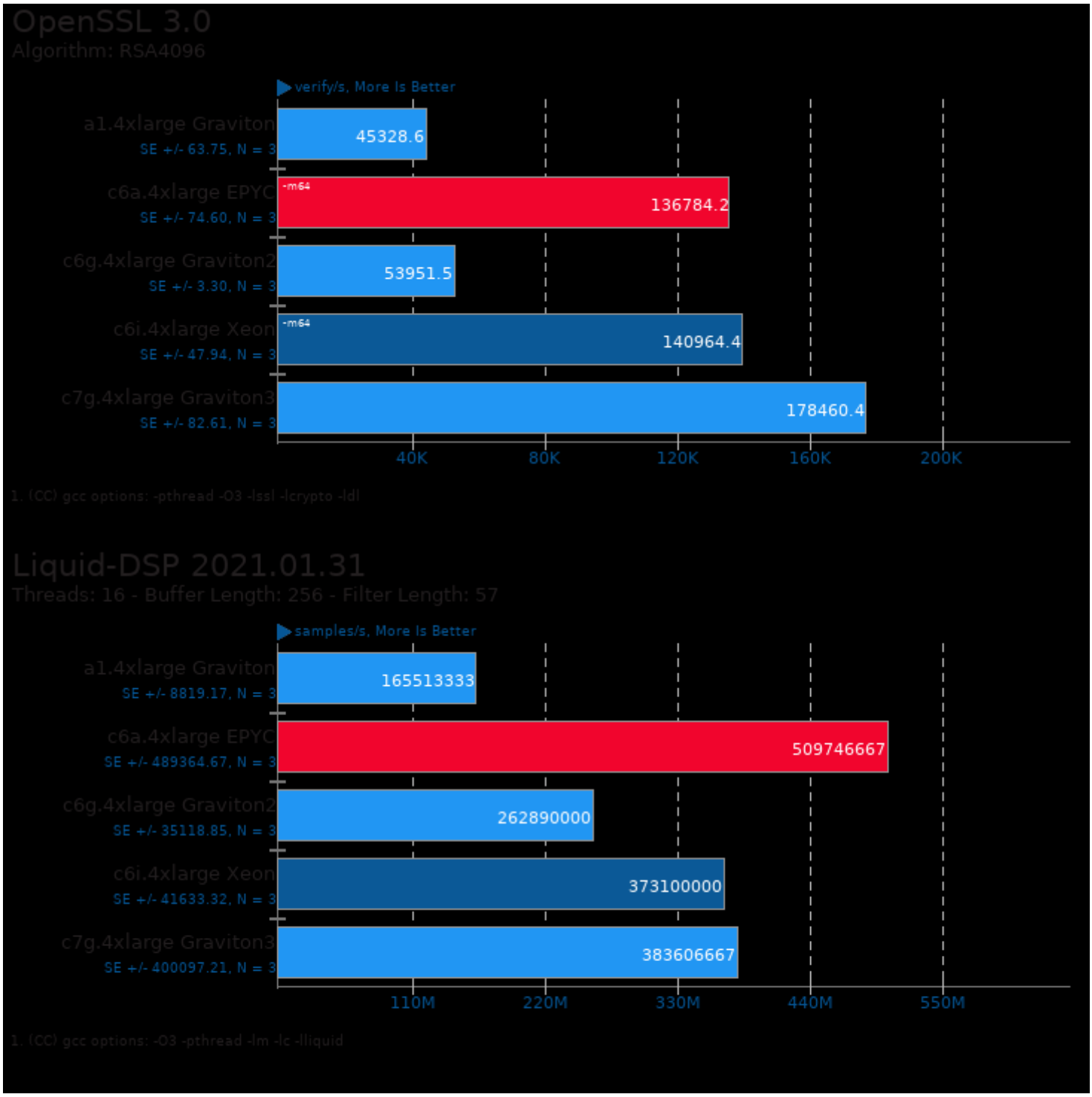
Amazon EC2 Graviton3 Benchmark Comparison



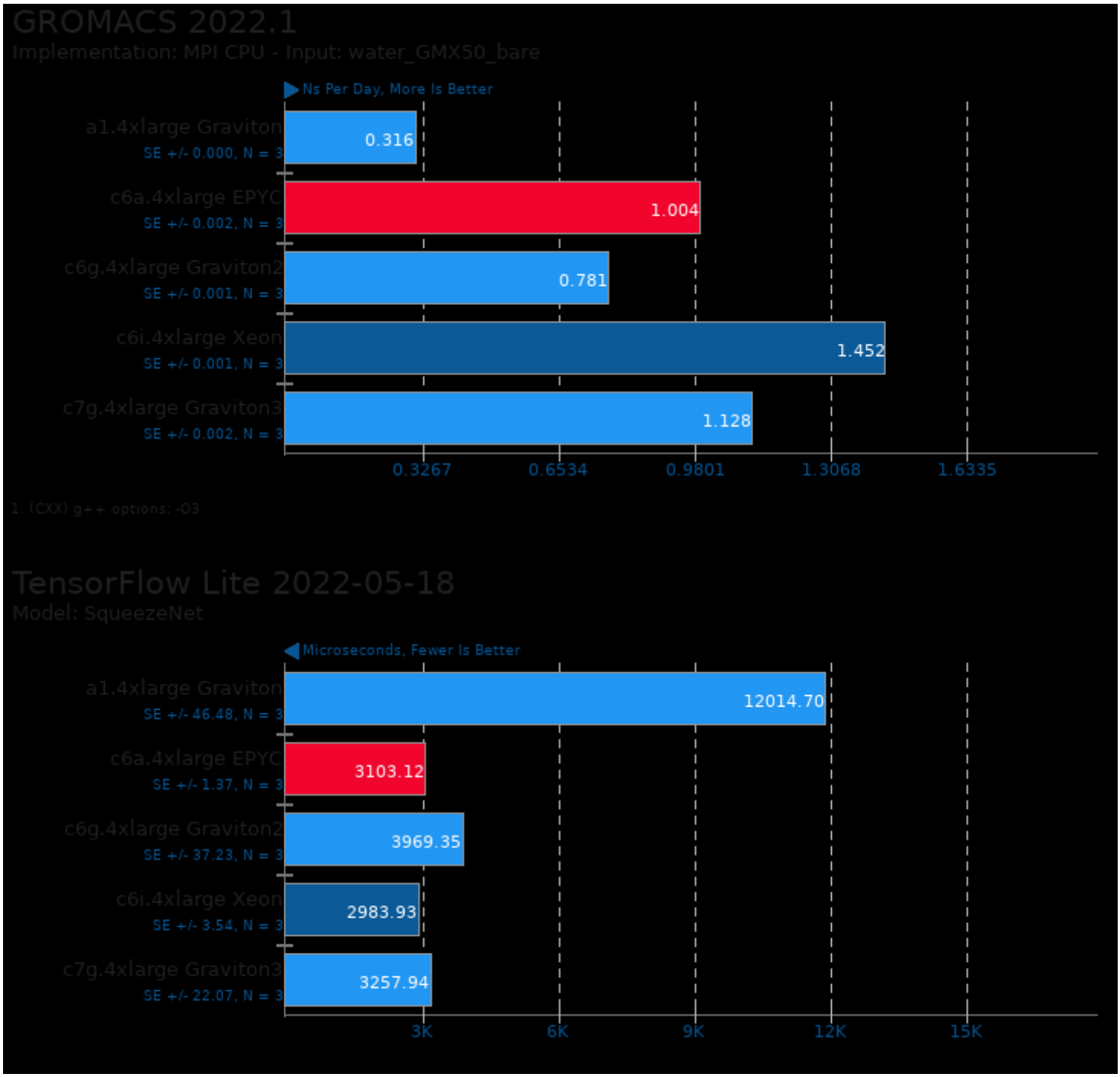
Amazon EC2 Graviton3 Benchmark Comparison



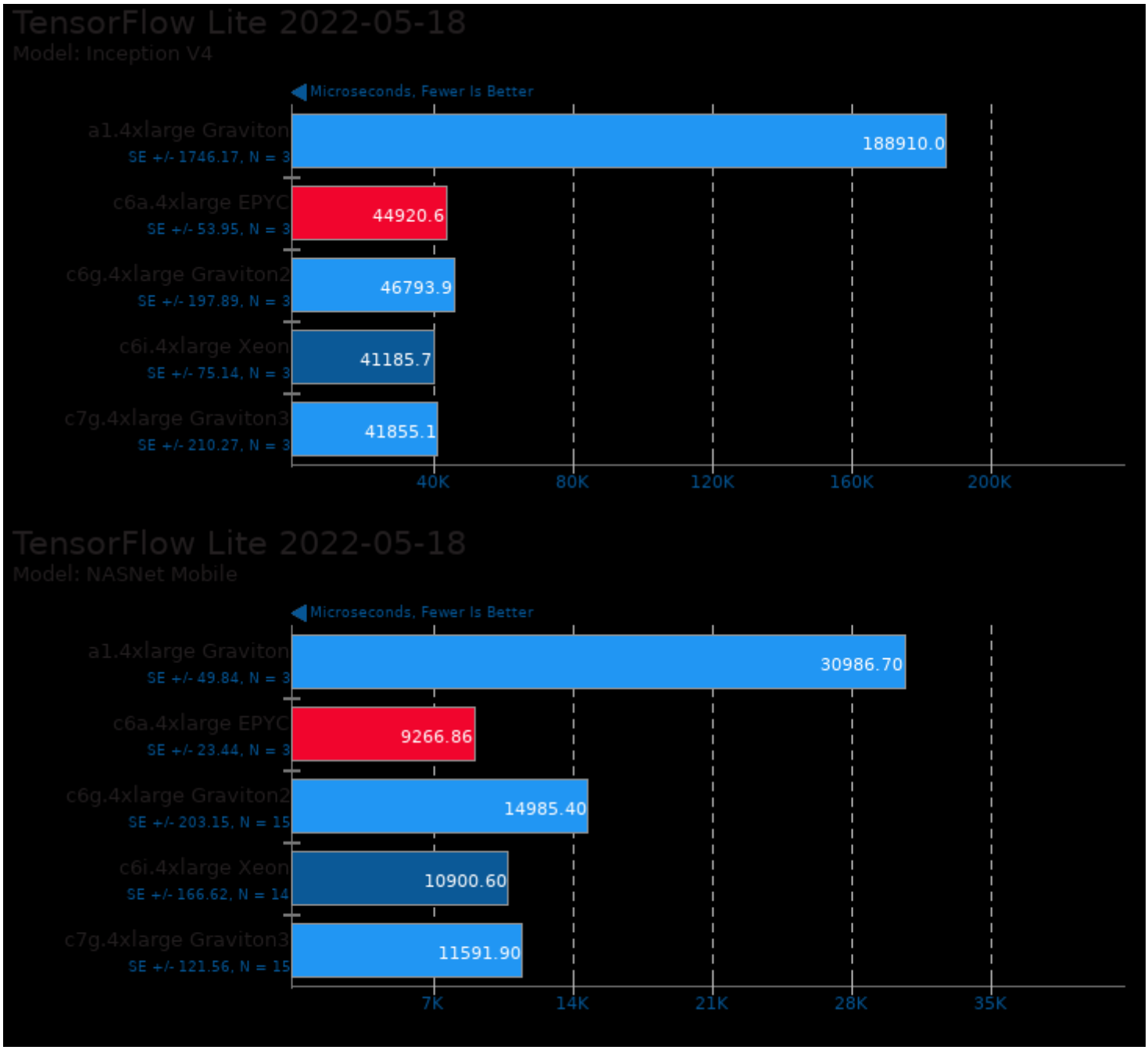
Amazon EC2 Graviton3 Benchmark Comparison



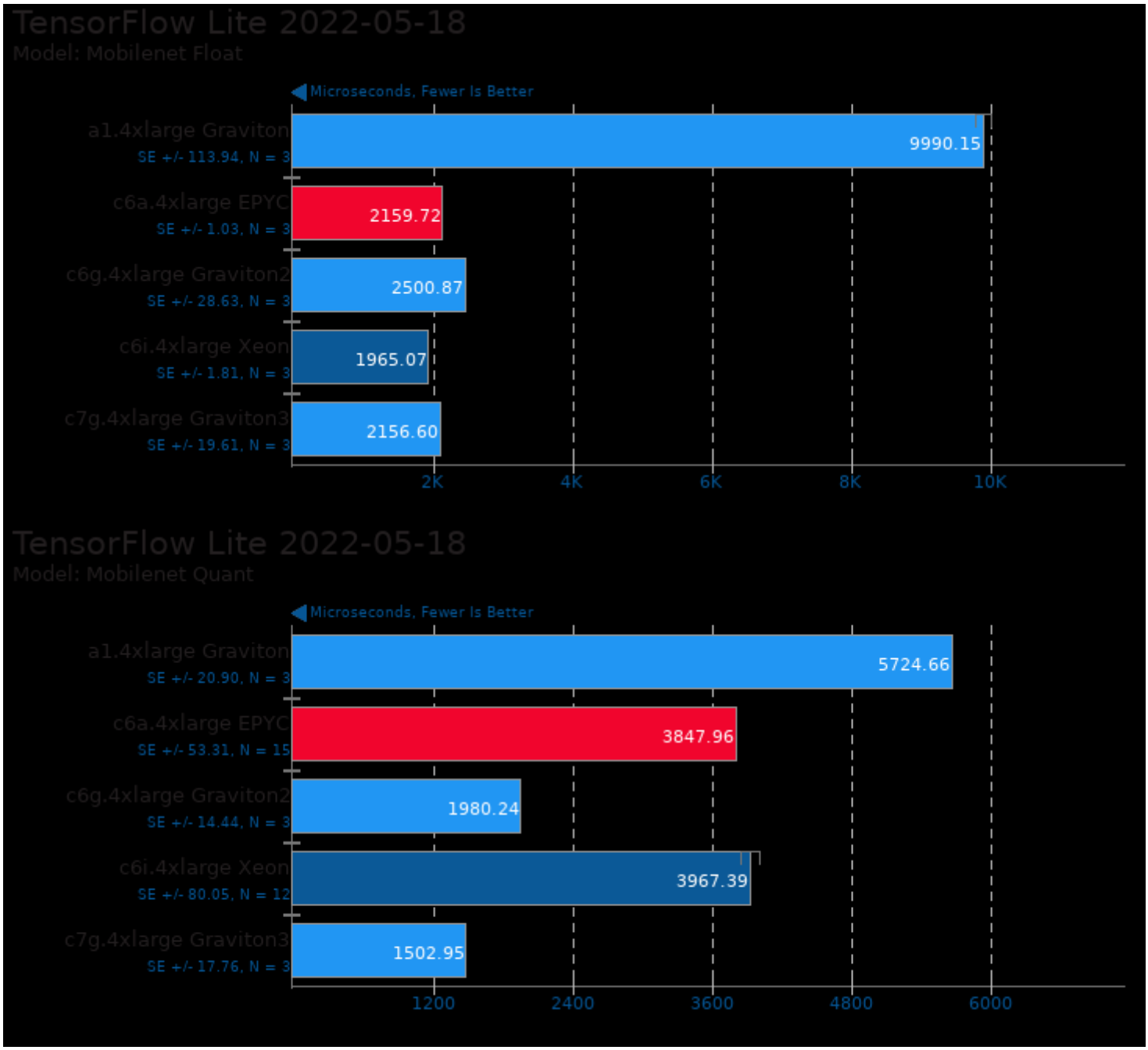
Amazon EC2 Graviton3 Benchmark Comparison



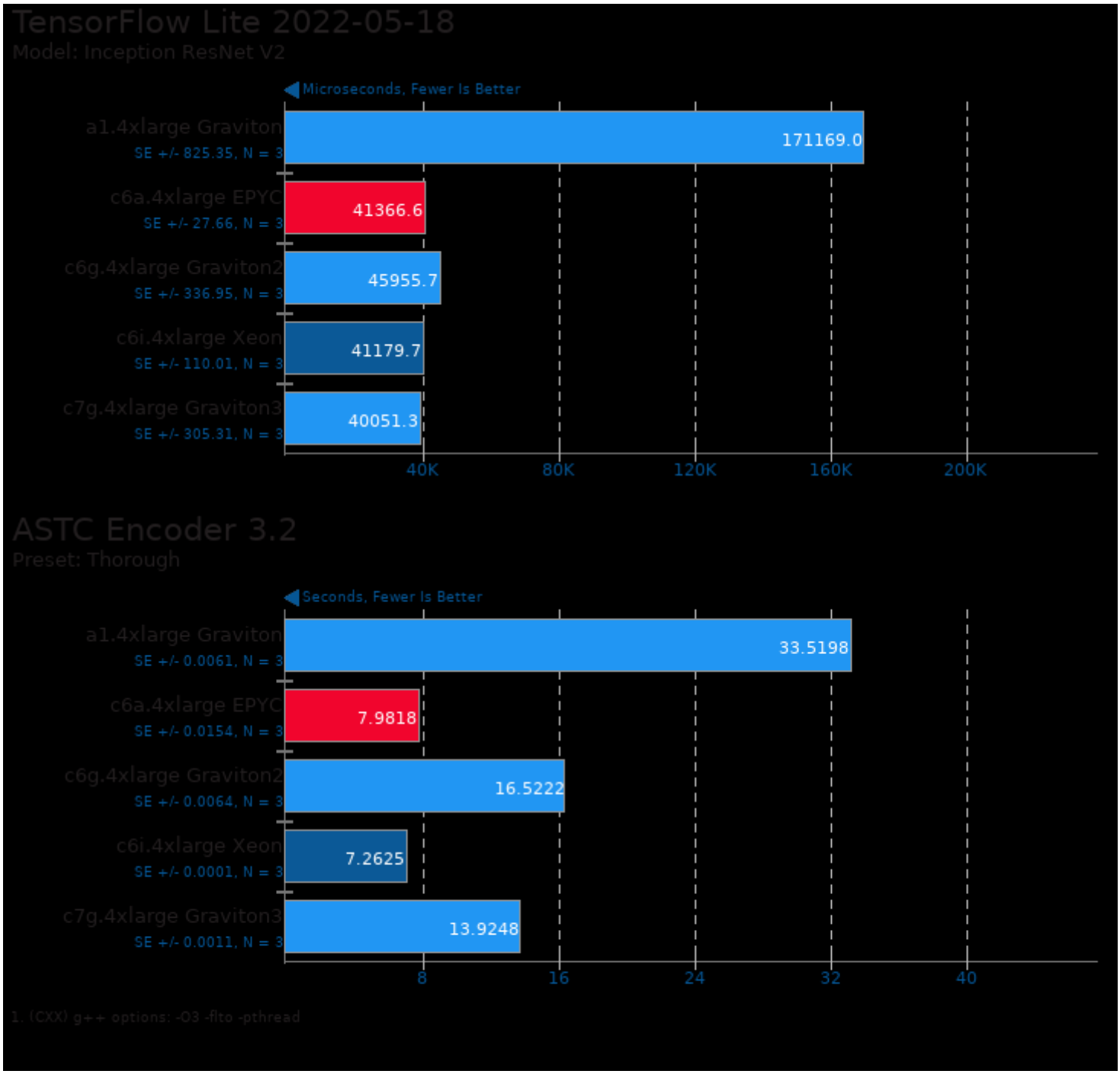
Amazon EC2 Graviton3 Benchmark Comparison



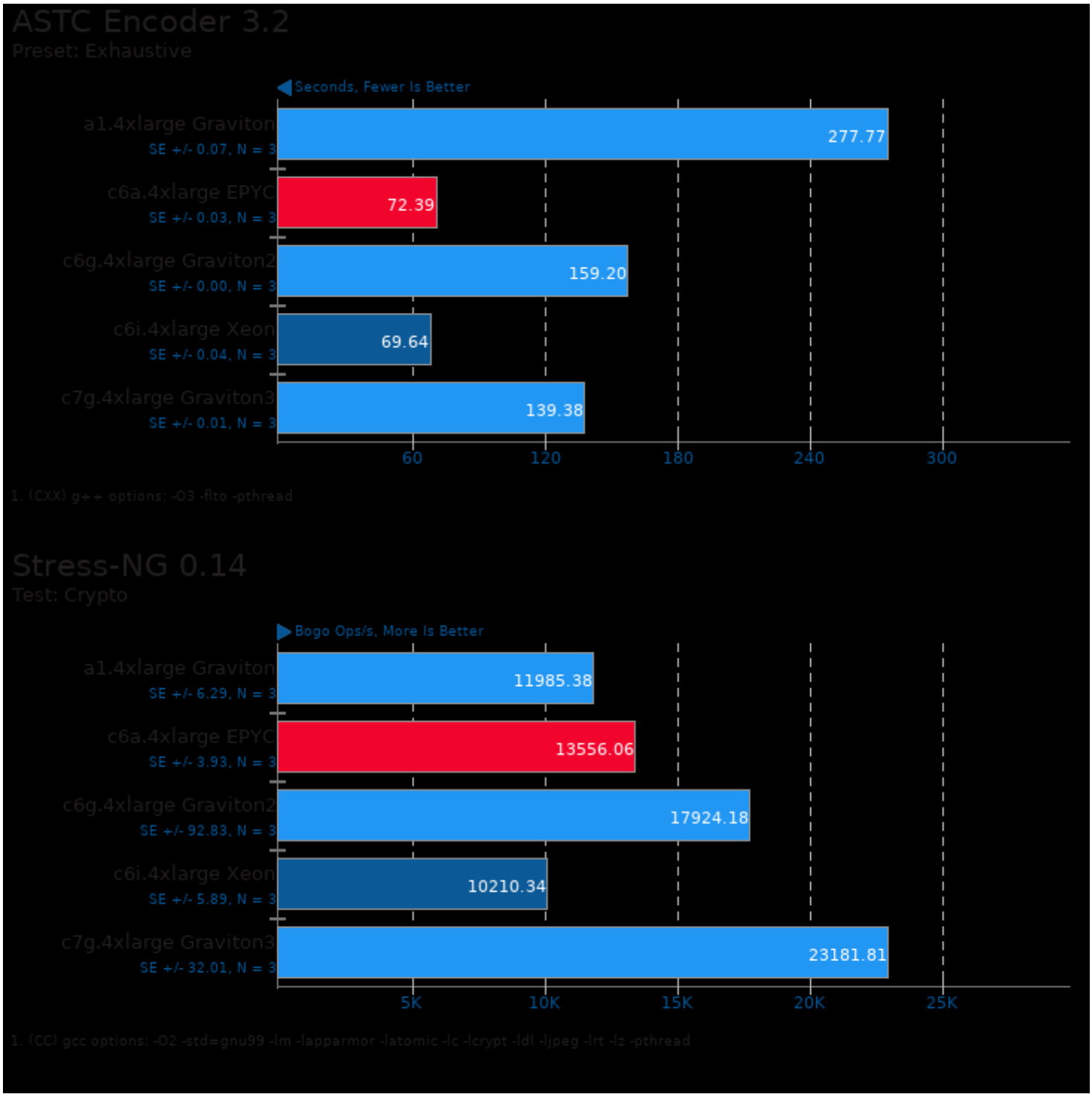
Amazon EC2 Graviton3 Benchmark Comparison



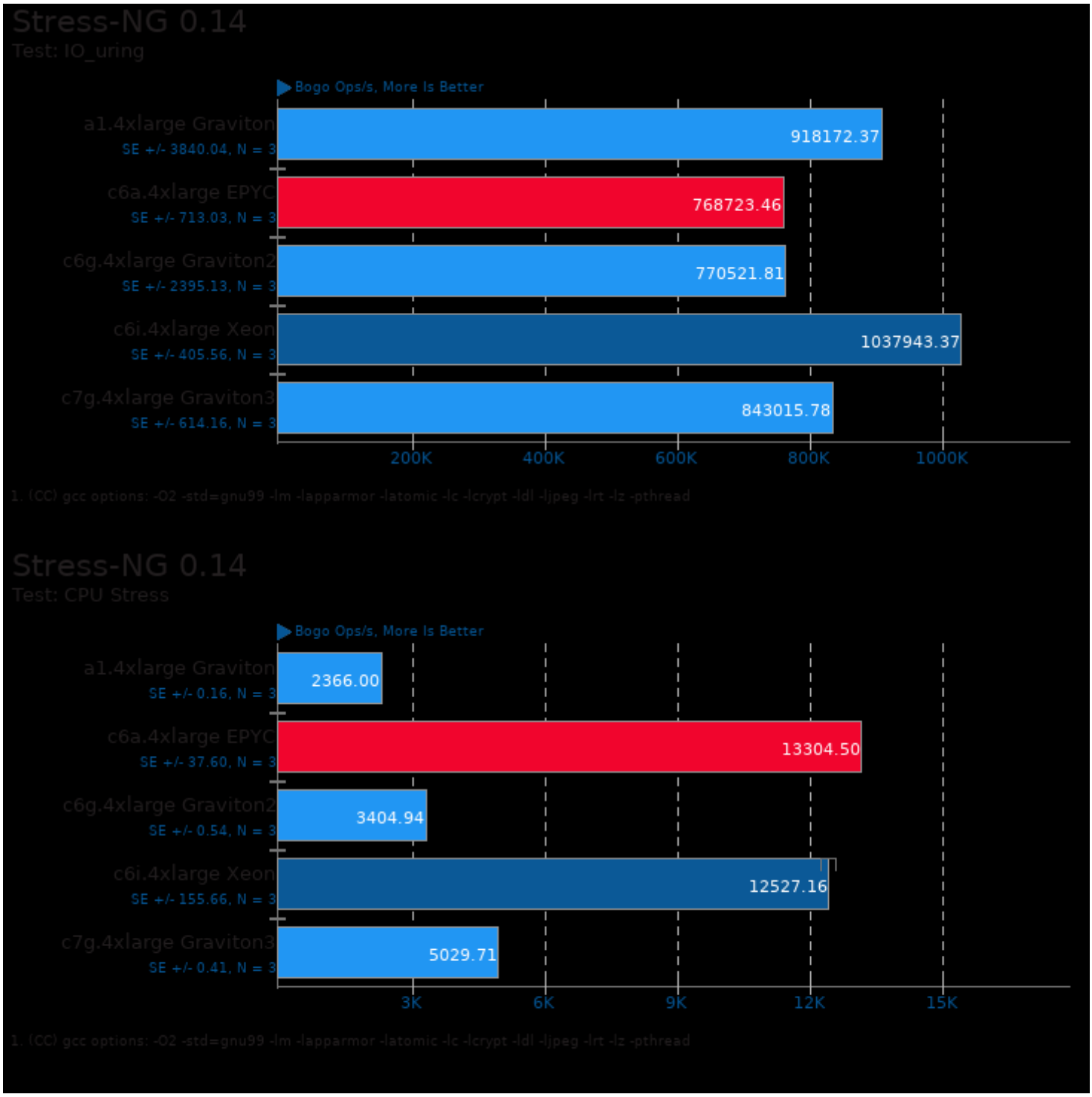
Amazon EC2 Graviton3 Benchmark Comparison



Amazon EC2 Graviton3 Benchmark Comparison



Amazon EC2 Graviton3 Benchmark Comparison



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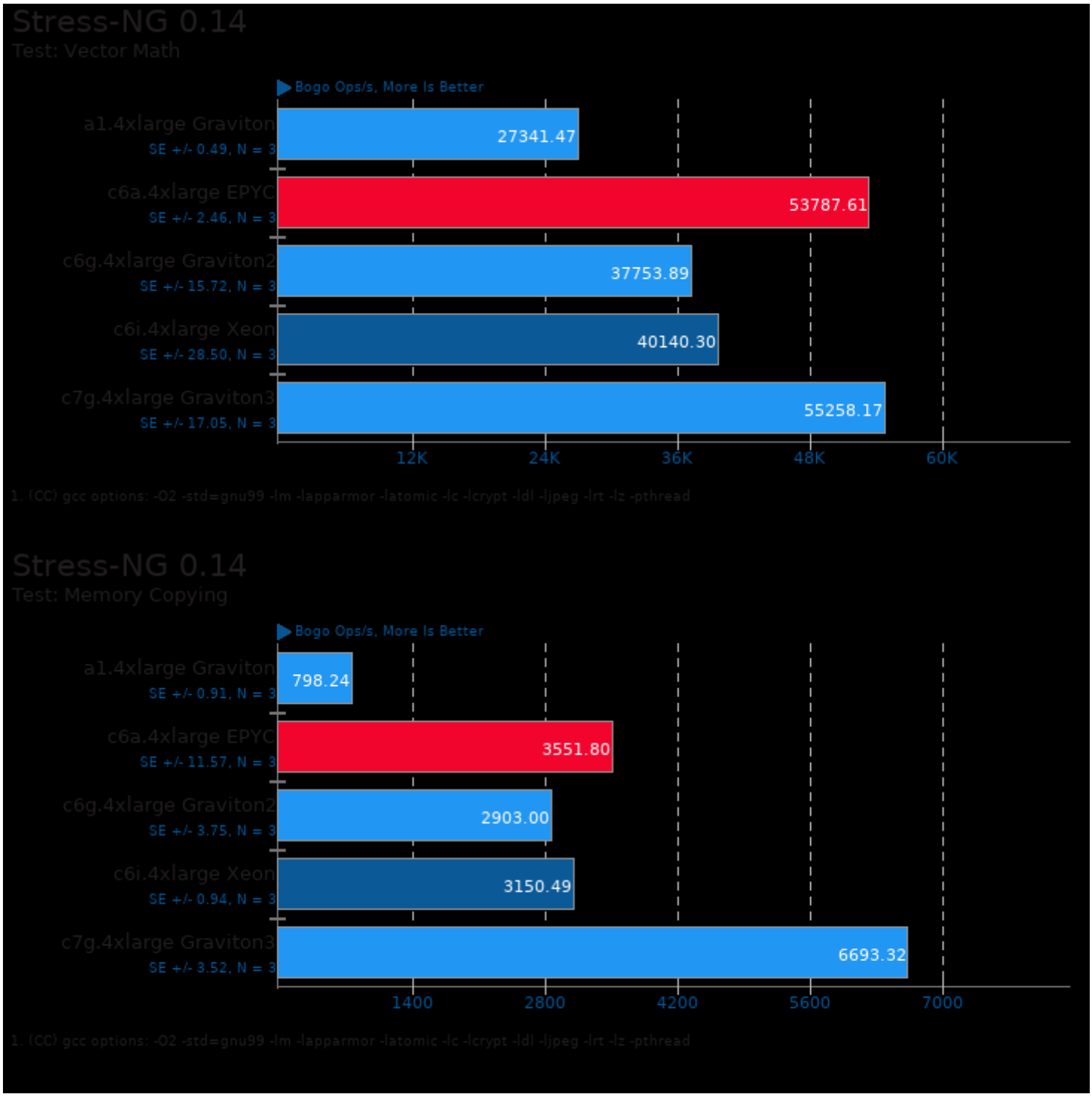
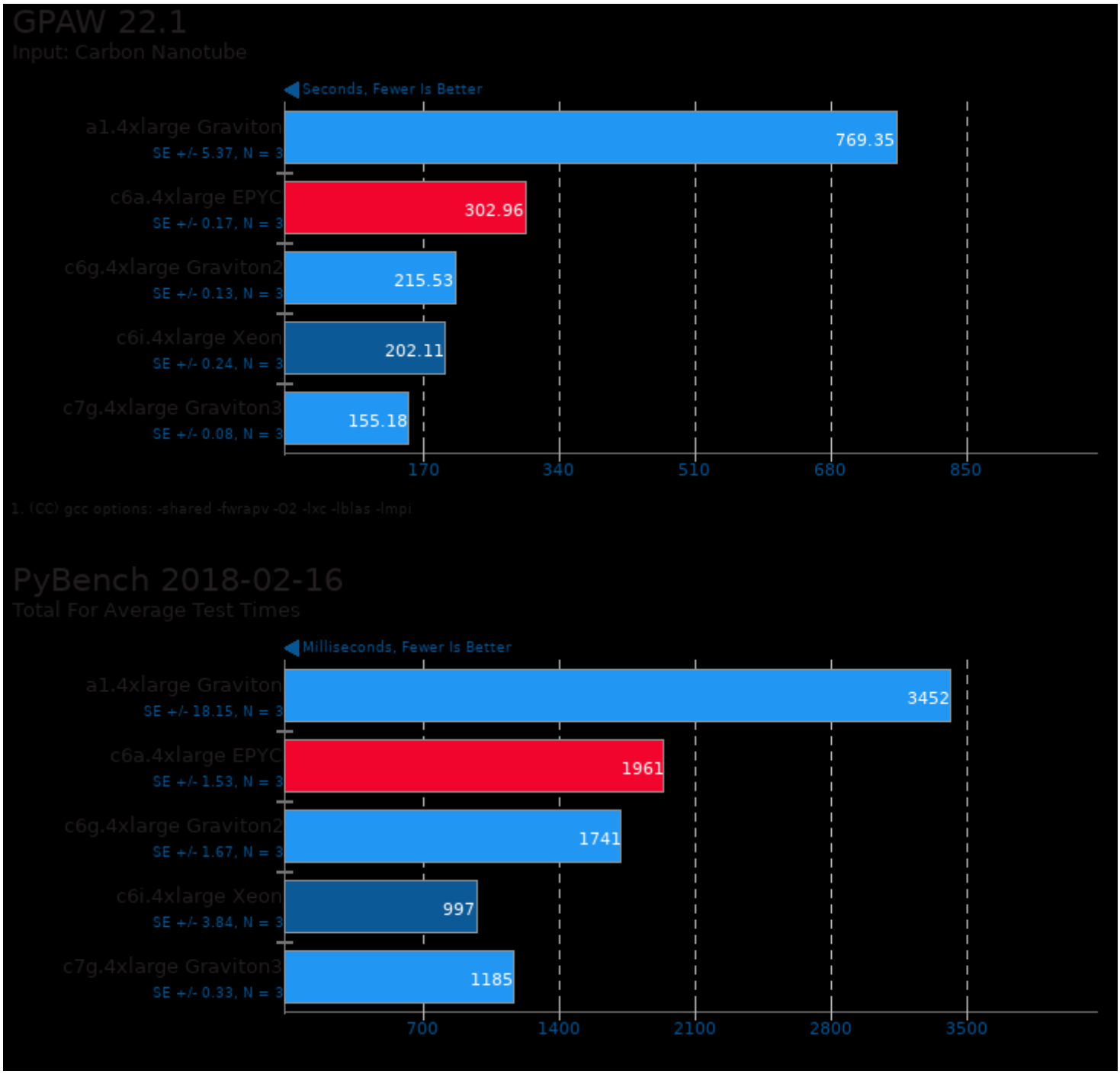


Amazon EC2 Graviton3 Benchmark Comparison



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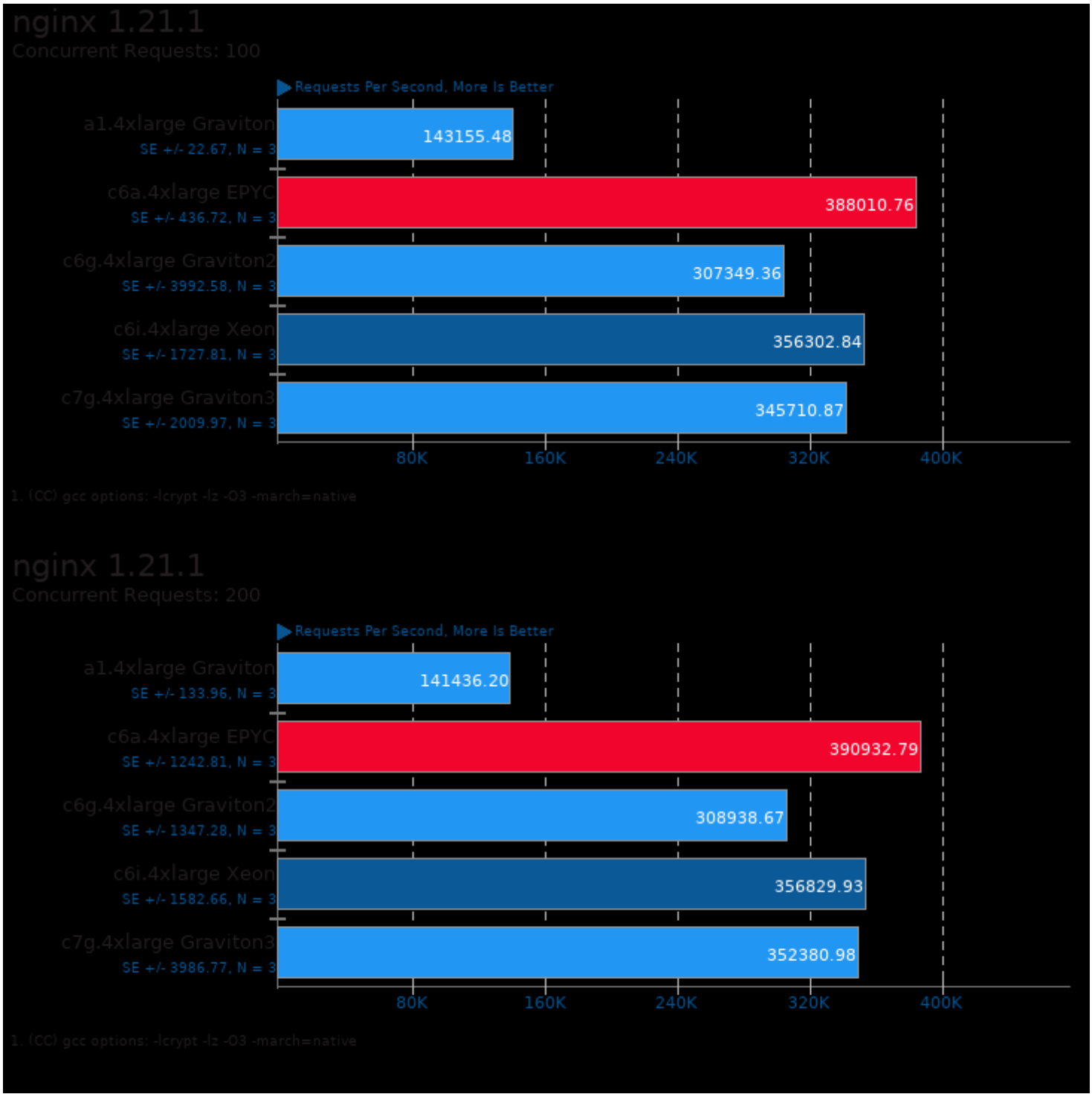
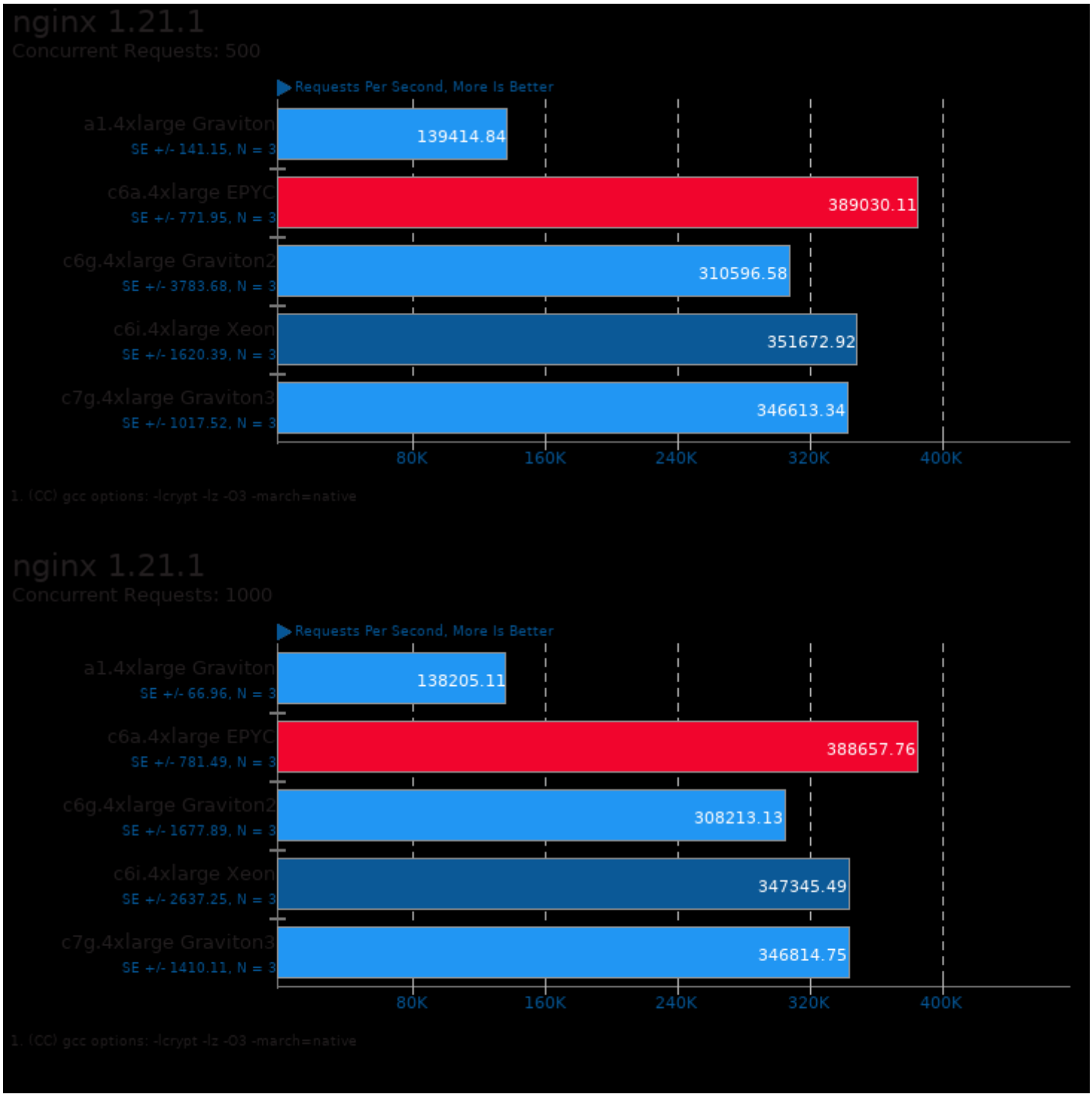
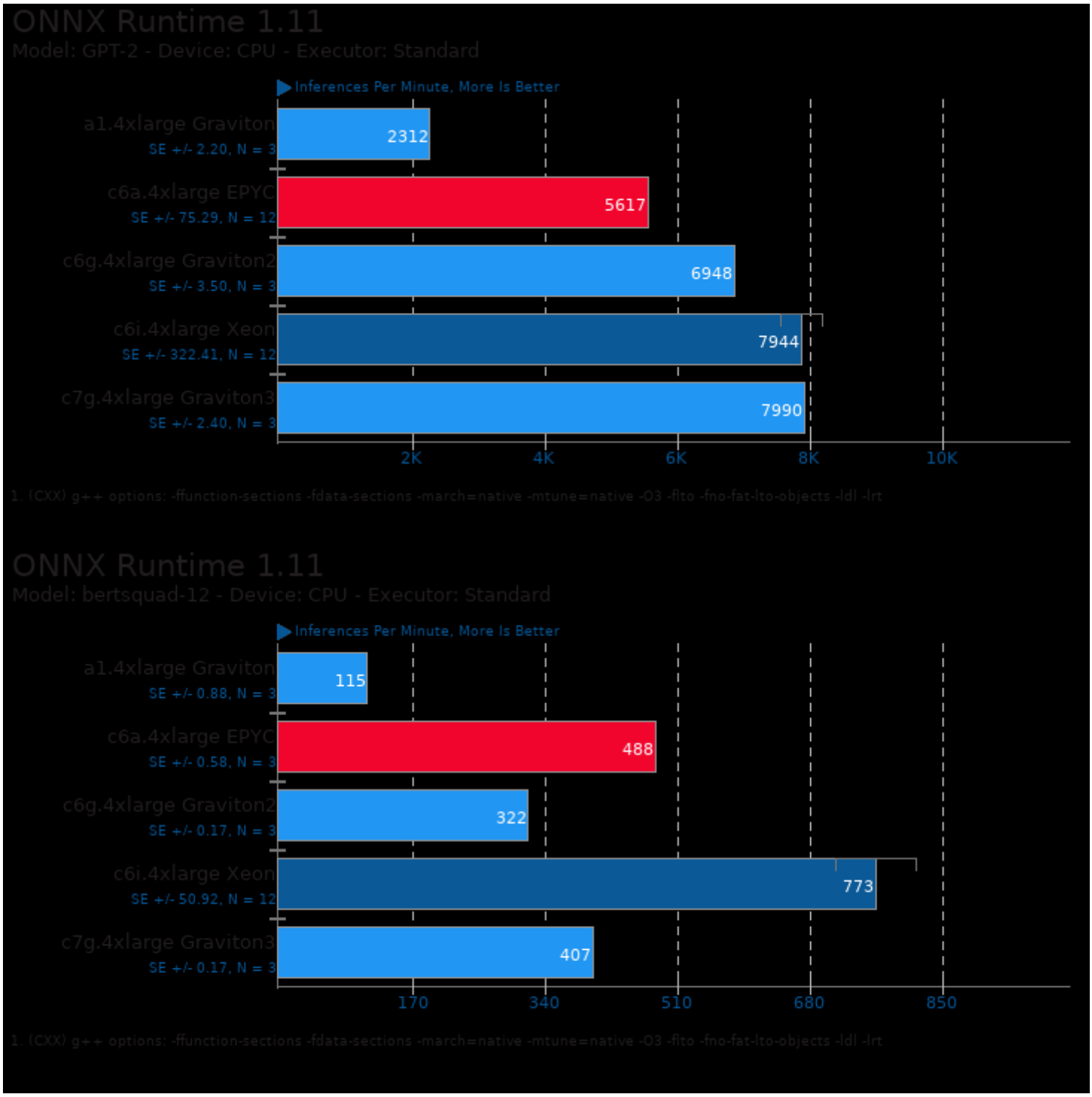


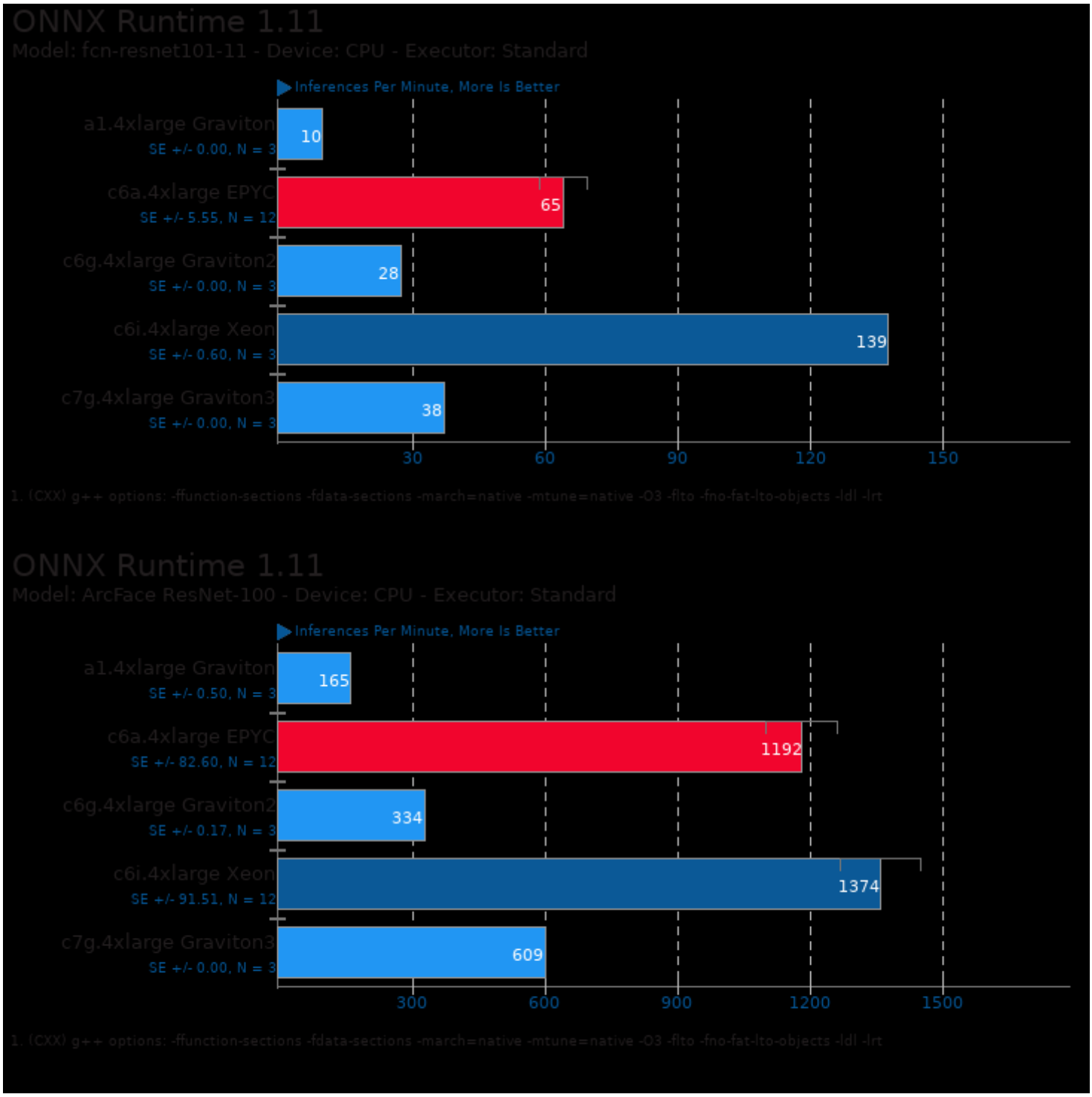
Amazon EC2 Graviton3 Benchmark Comparison



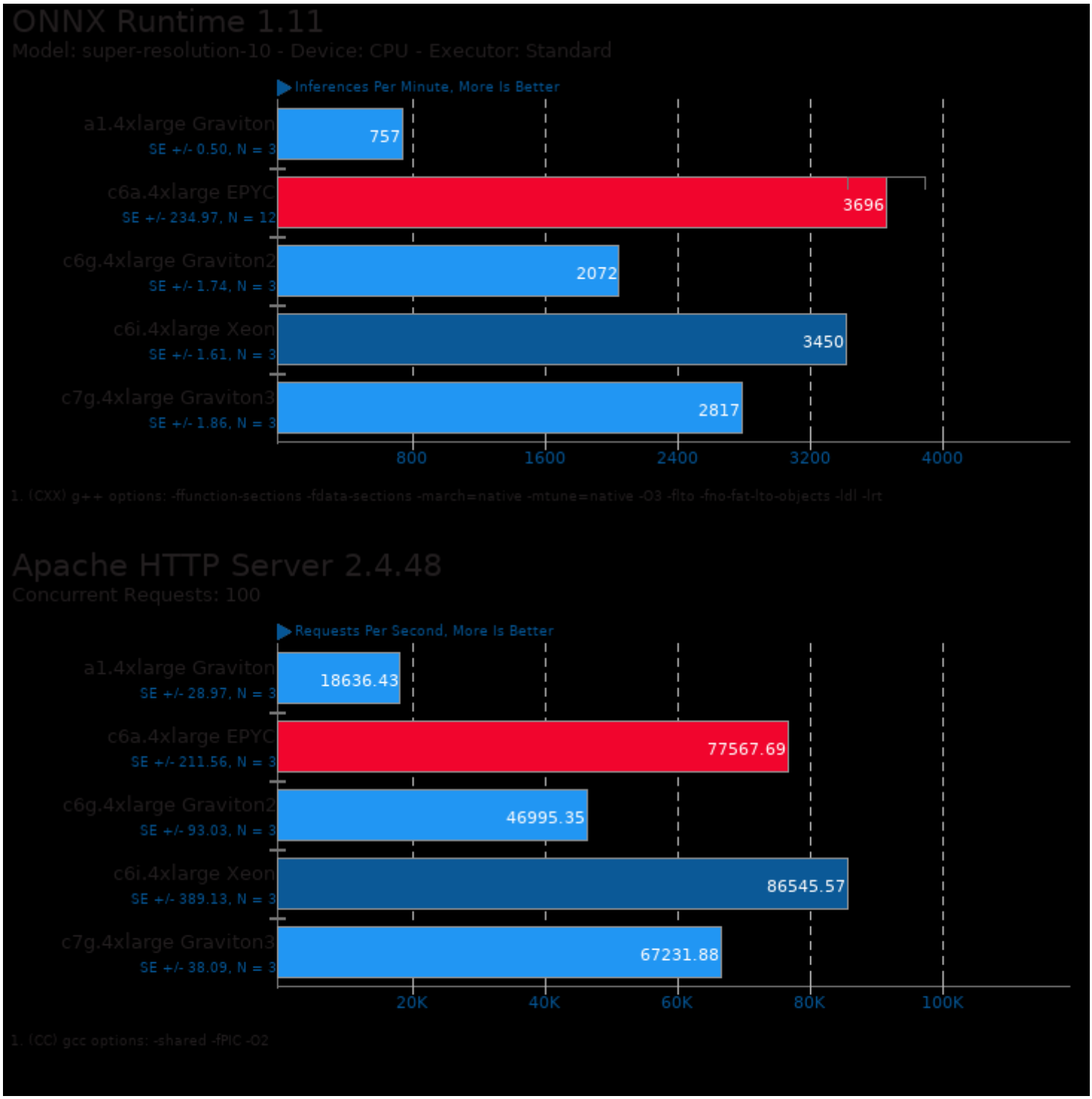
Amazon EC2 Graviton3 Benchmark Comparison



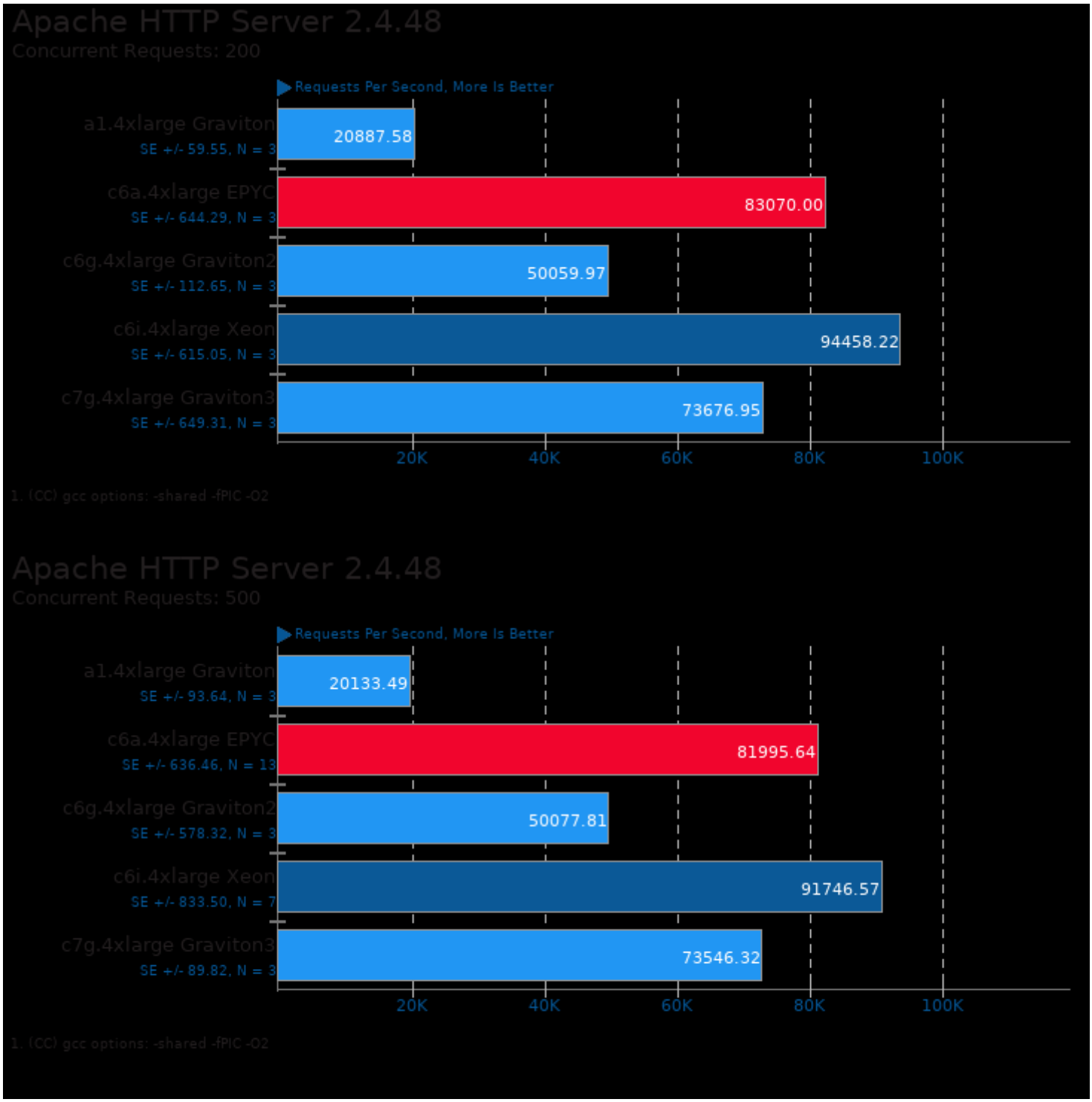
Amazon EC2 Graviton3 Benchmark Comparison



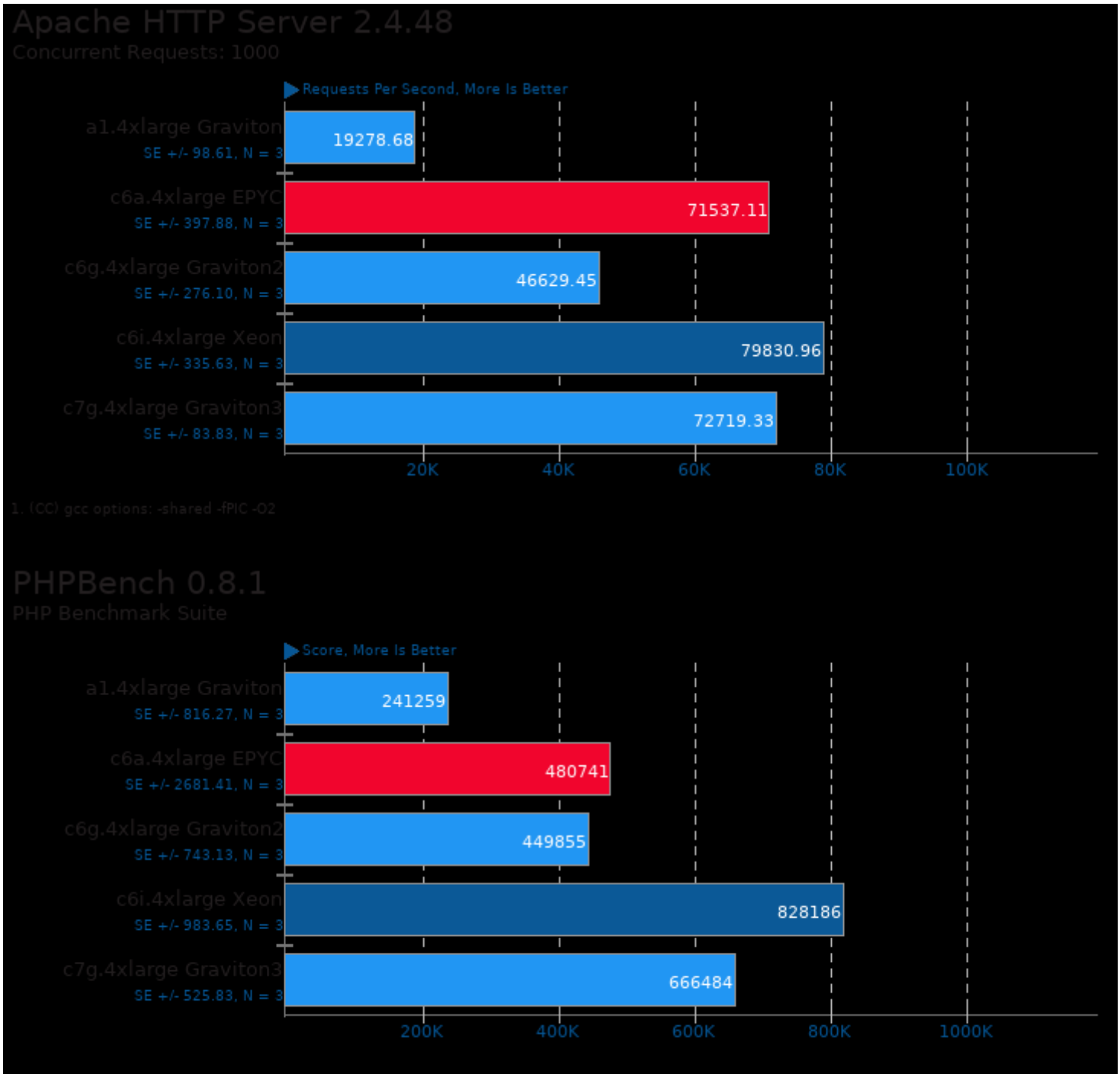
Amazon EC2 Graviton3 Benchmark Comparison



Amazon EC2 Graviton3 Benchmark Comparison

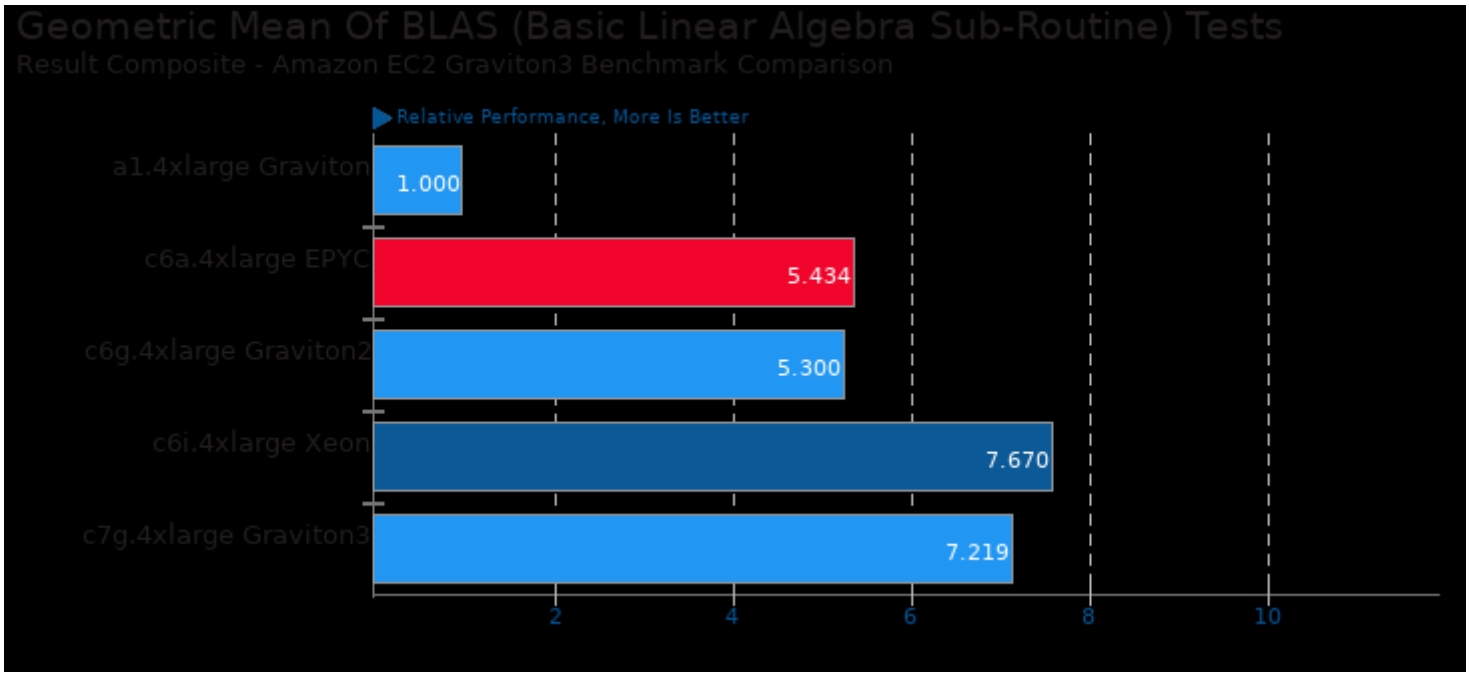


Amazon EC2 Graviton3 Benchmark Comparison

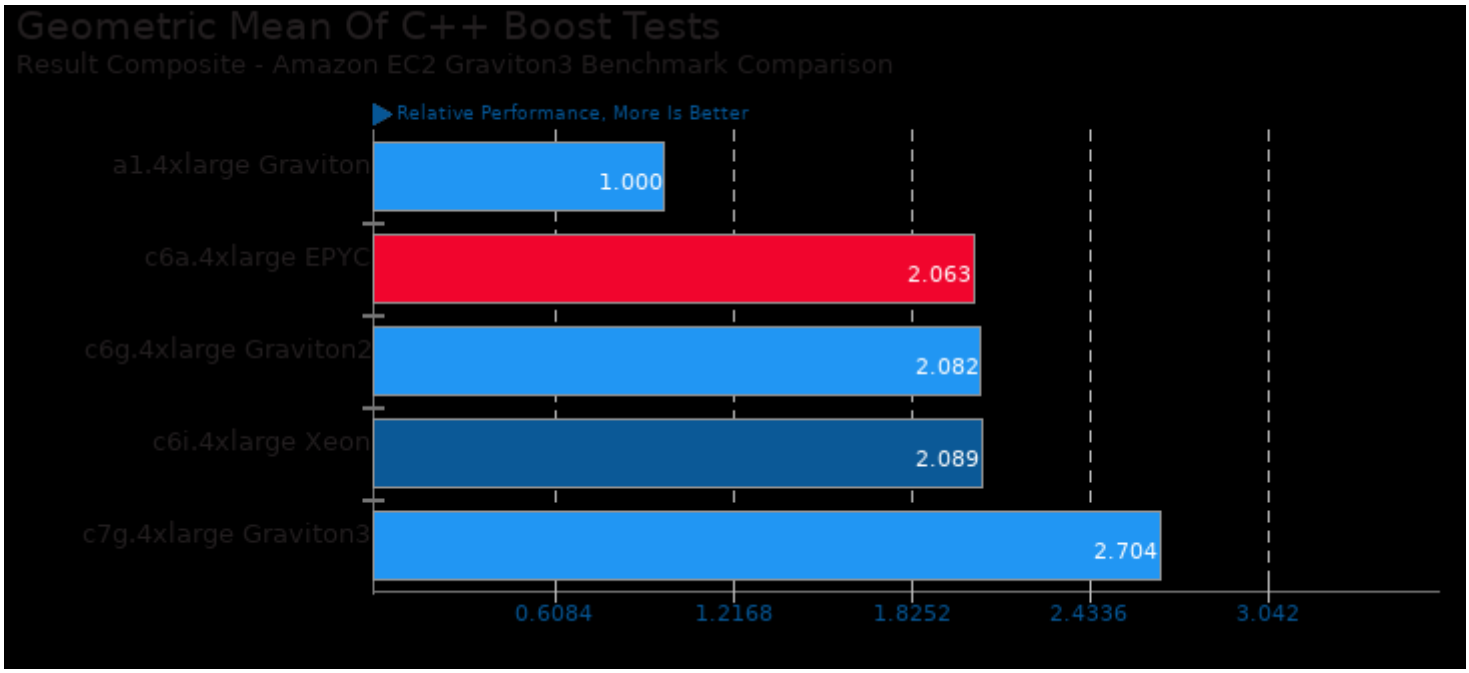


Amazon EC2 Graviton3 Benchmark Comparison

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

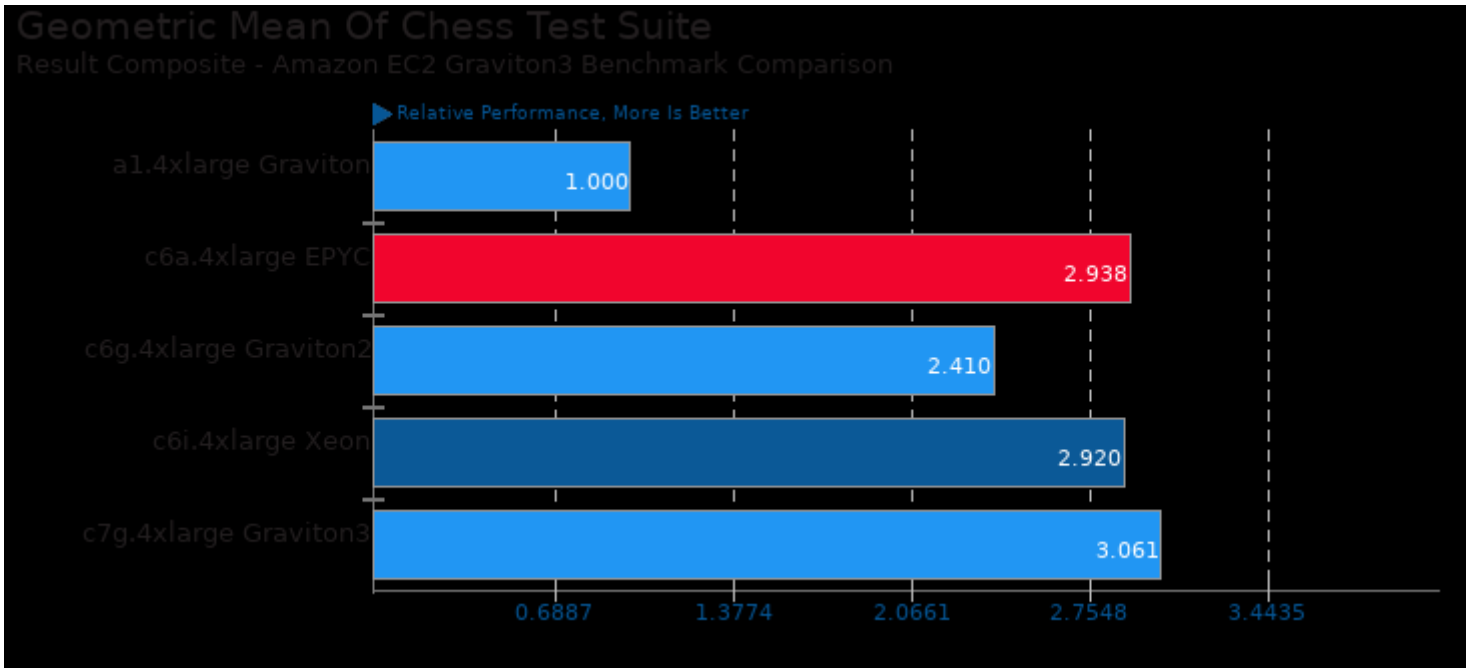


Geometric mean based upon tests: pts/lczero and pts/gpaw

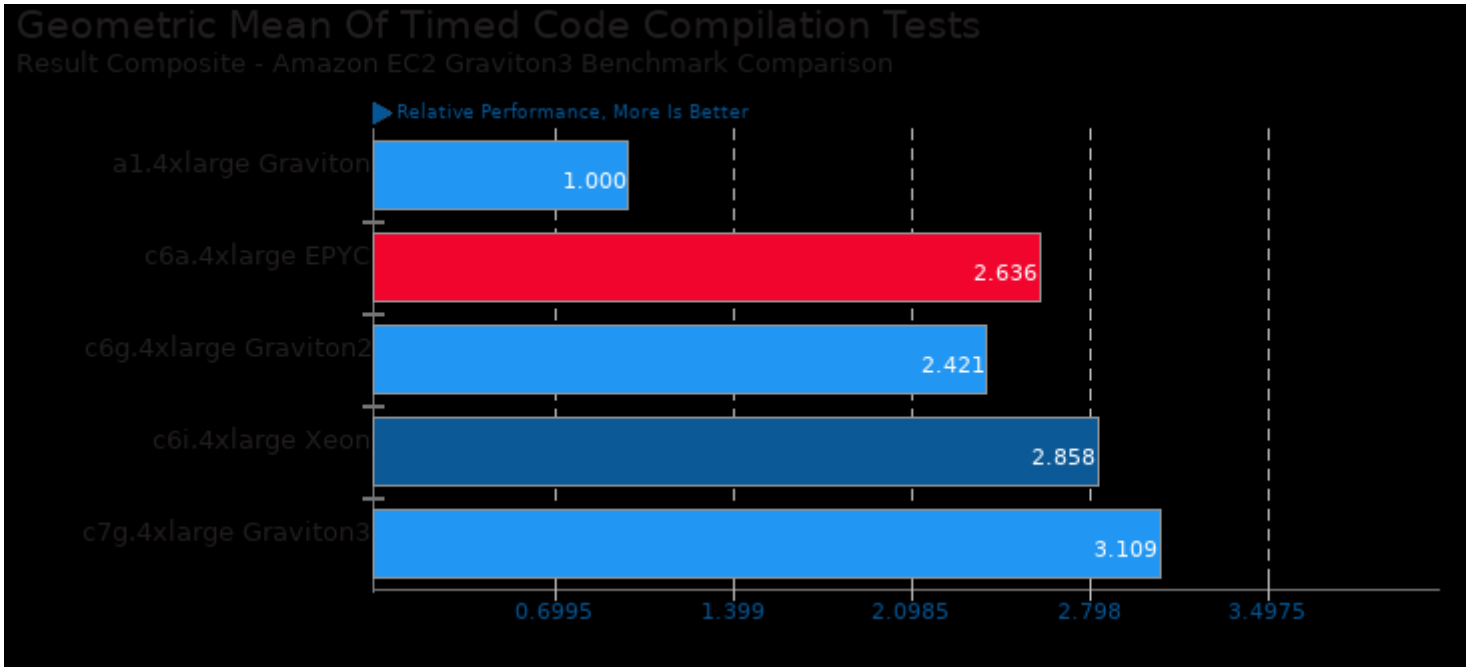


Geometric mean based upon tests: pts/build-gem5 and pts/povray

Amazon EC2 Graviton3 Benchmark Comparison

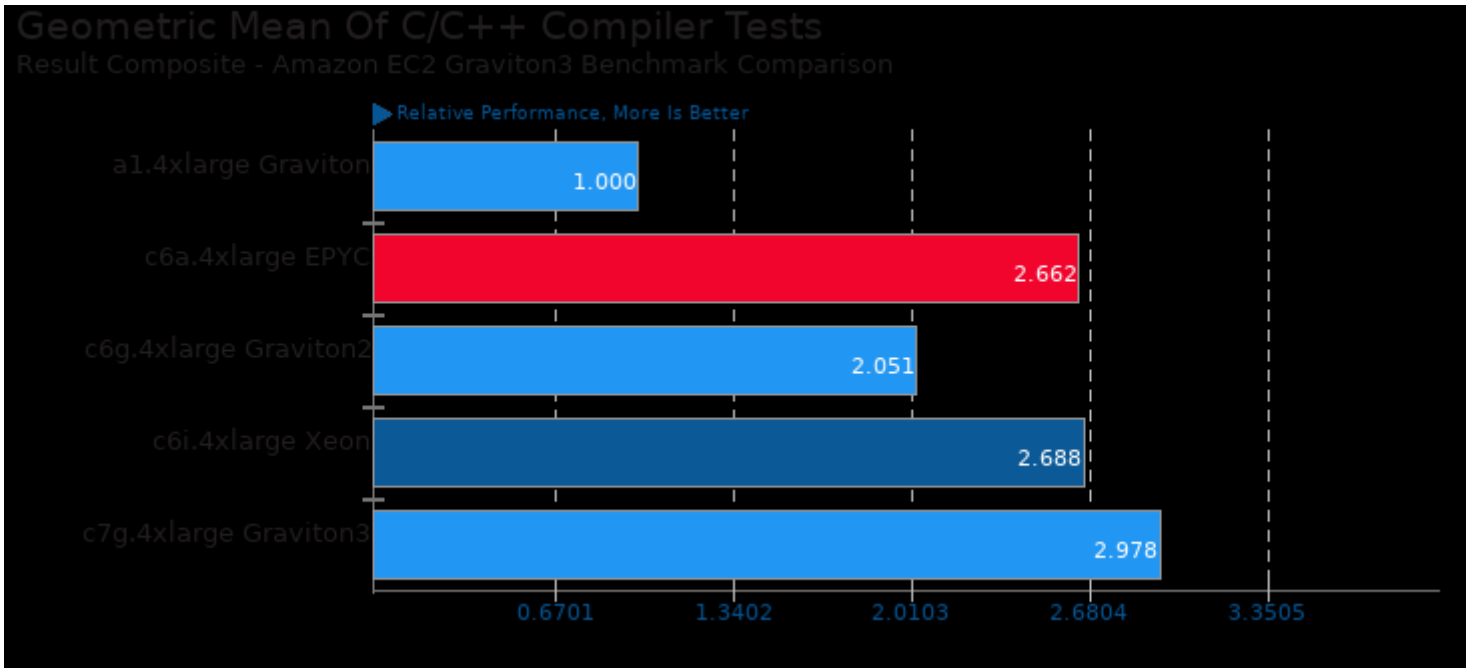


Geometric mean based upon tests: pts/tscp, pts/lczero, pts/stockfish, pts/asmfish, pts/n-queens and pts/m-queens

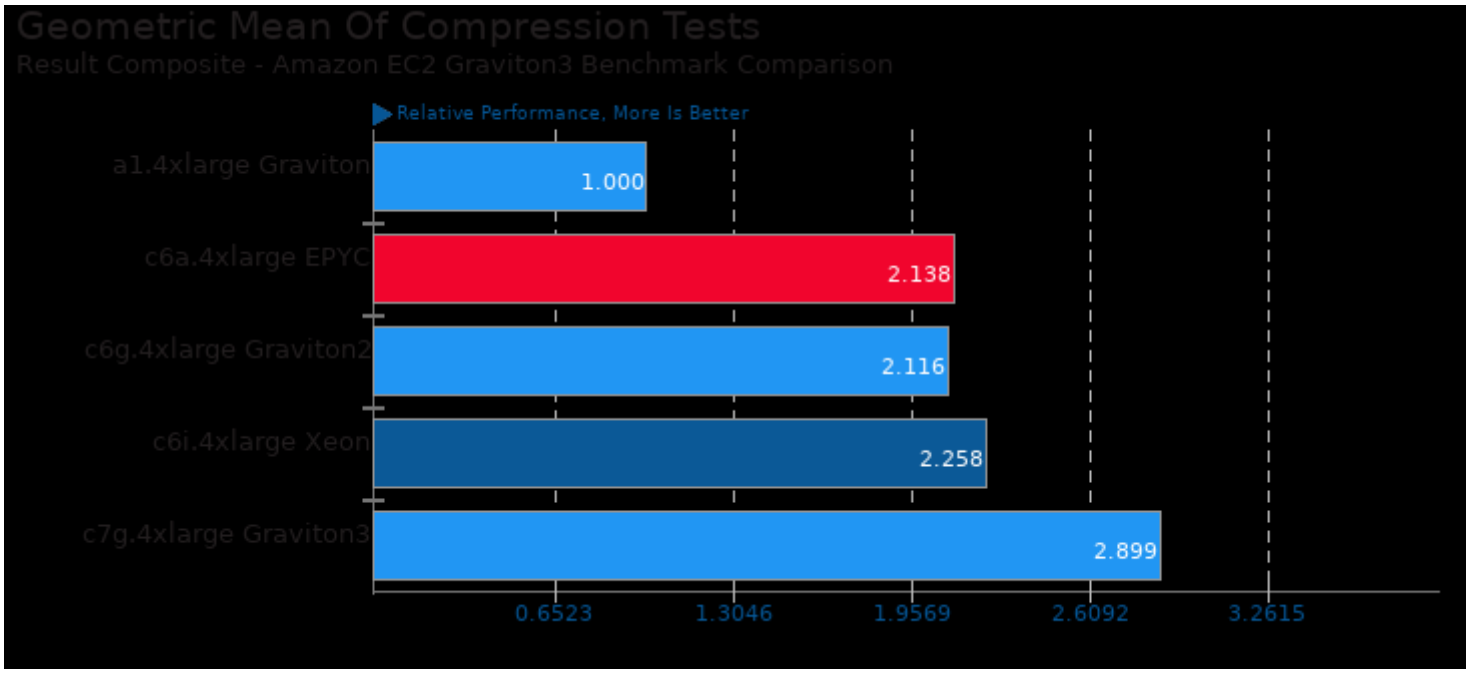


Geometric mean based upon tests: pts/build-apache, pts/build-php, pts/build-imagemagick, pts/build-llvm, pts/build2, pts/build-nodejs and pts/build-gem5

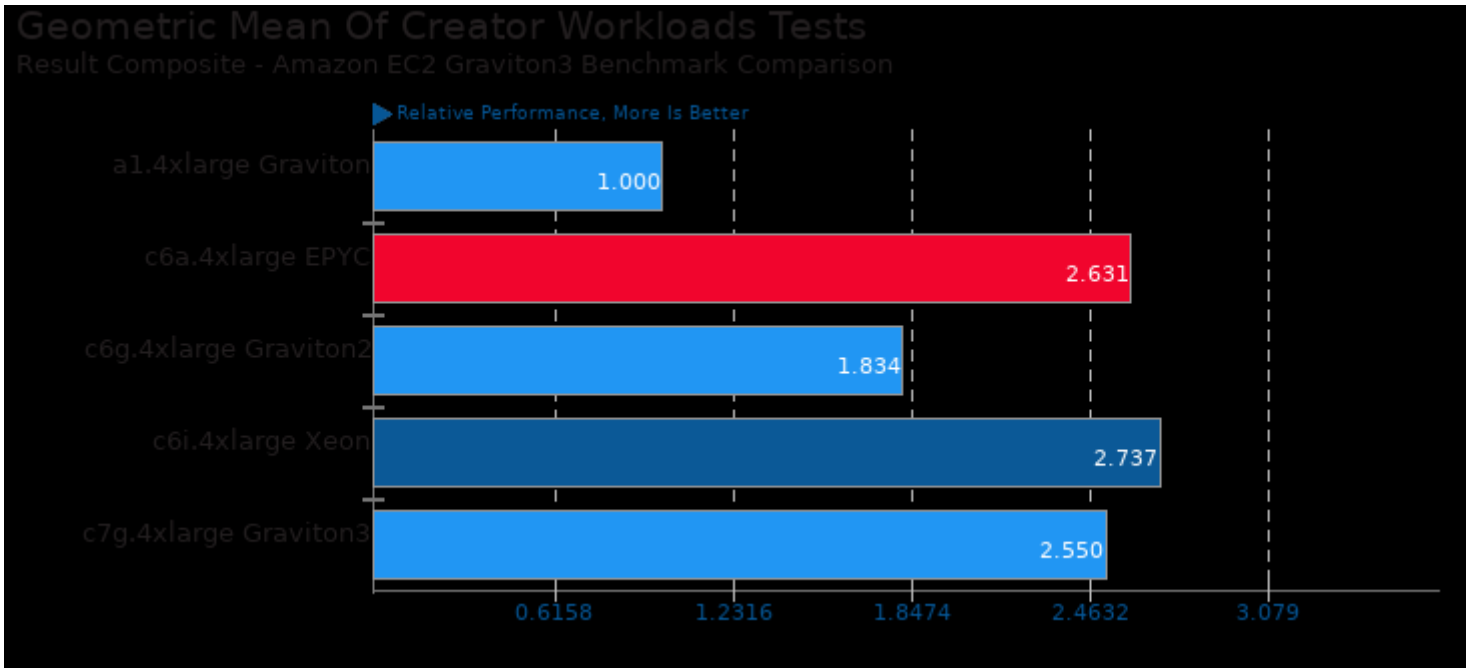
Amazon EC2 Graviton3 Benchmark Comparison



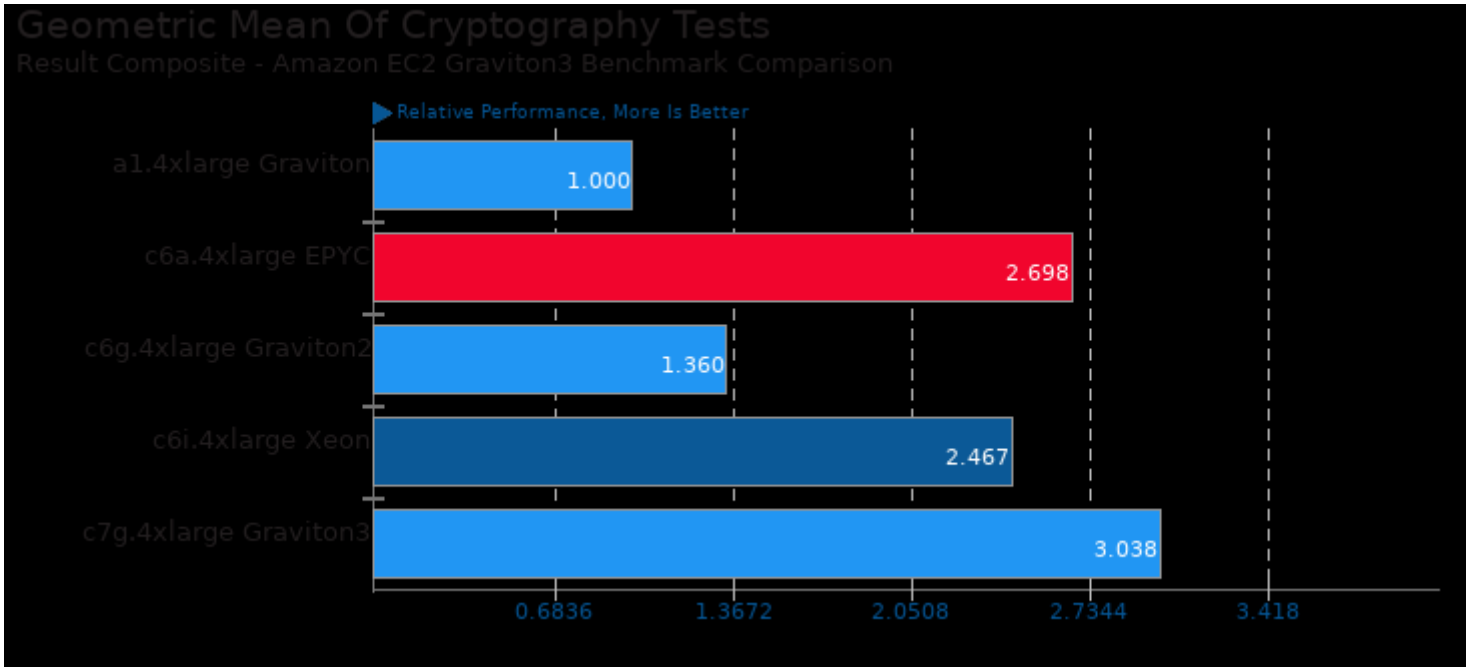
Geometric mean based upon tests: pts/tscp, pts/stockfish, pts/build-php, pts/build-imagemagick, pts/build-llvm, pts/c-ray, pts/compress-7zip, pts/apache, pts/mrbayes, pts/compress-zstd, pts/openssl, pts/nginx, pts/lammps, pts/gromacs and pts/build-apache



Geometric mean based upon tests: pts/compress-7zip and pts/compress-zstd

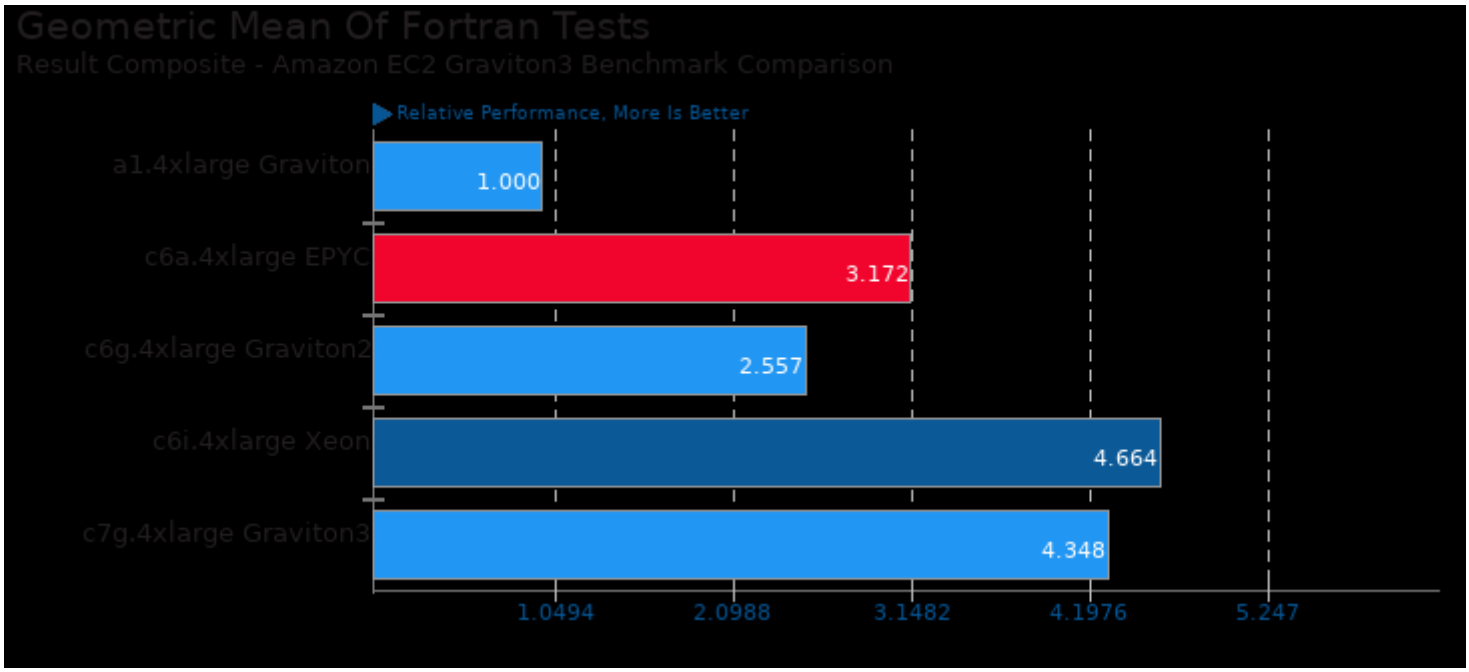


Geometric mean based upon tests: pts/c-ray, pts/povray, pts/avifenc, pts/webp, pts/astcenc, pts/synthmark and pts/ngspice

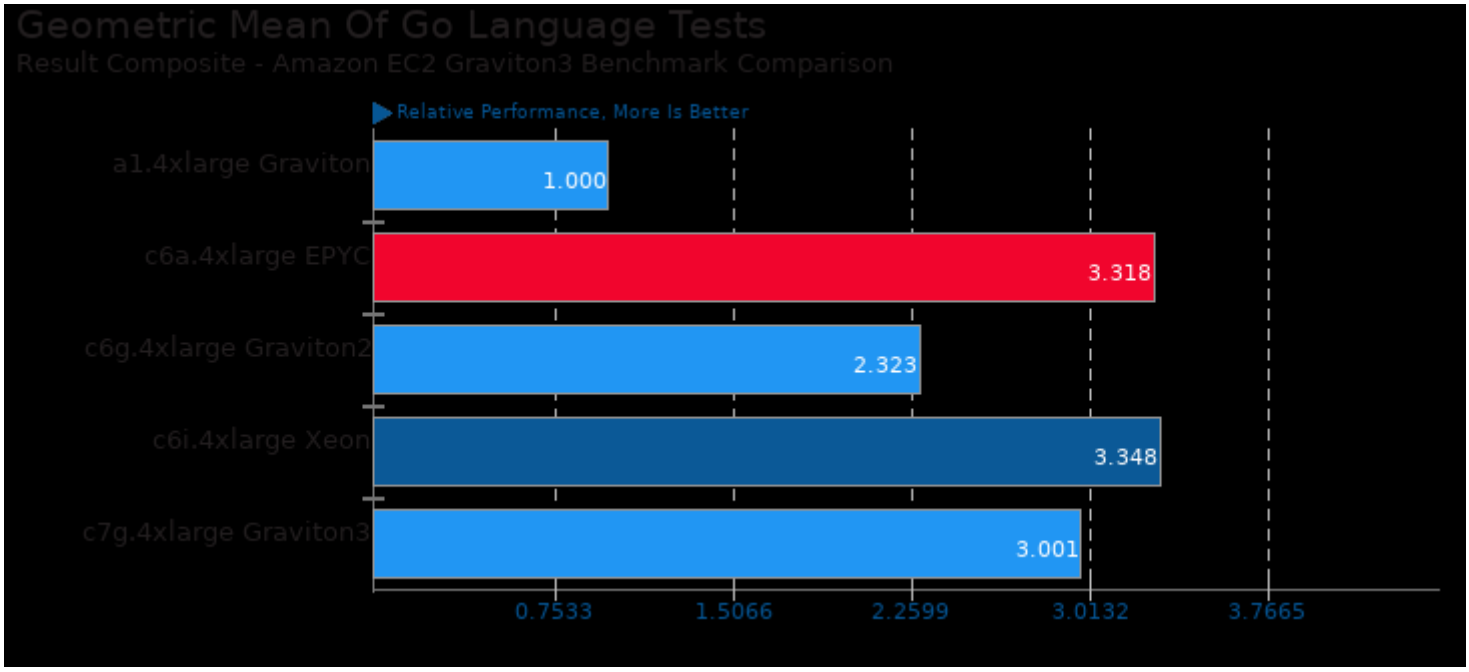


Geometric mean based upon tests: pts/openssl and pts/securemark

Amazon EC2 Graviton3 Benchmark Comparison

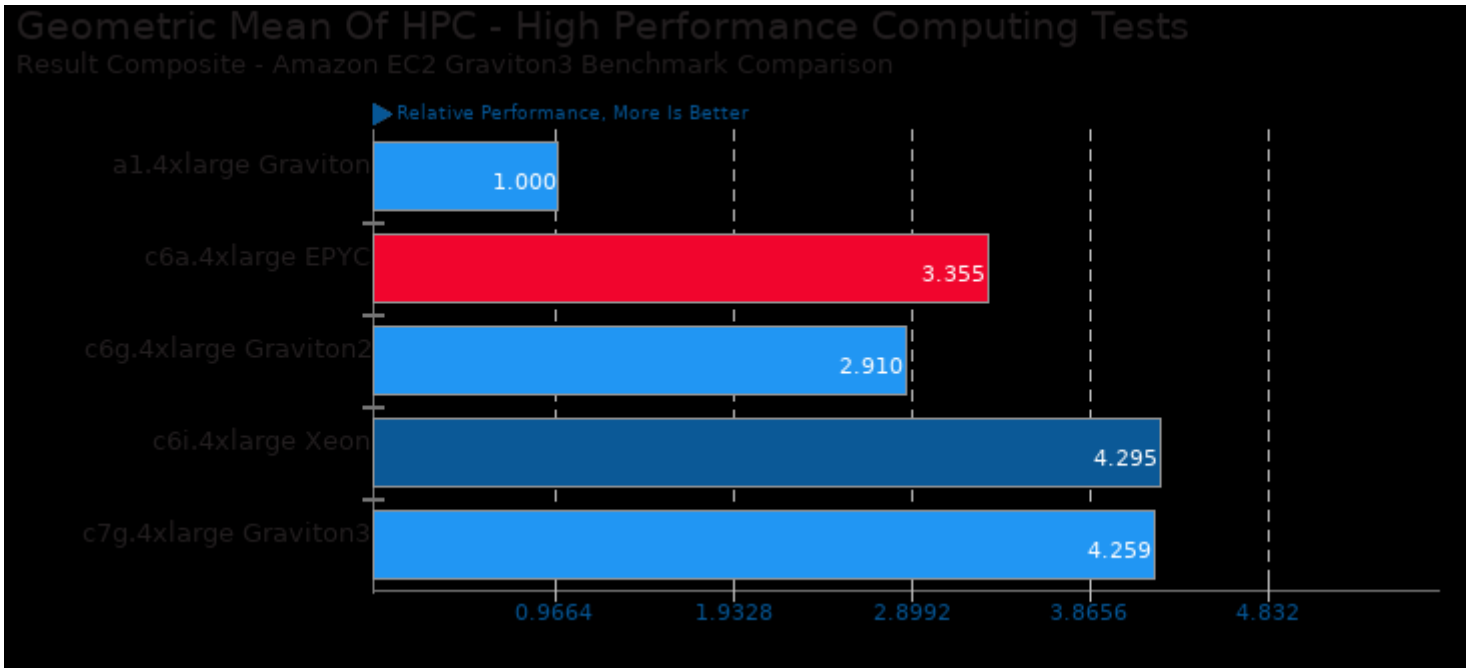


Geometric mean based upon tests: pts/hpcg, pts/npb, pts/incompact3d and pts/lammps

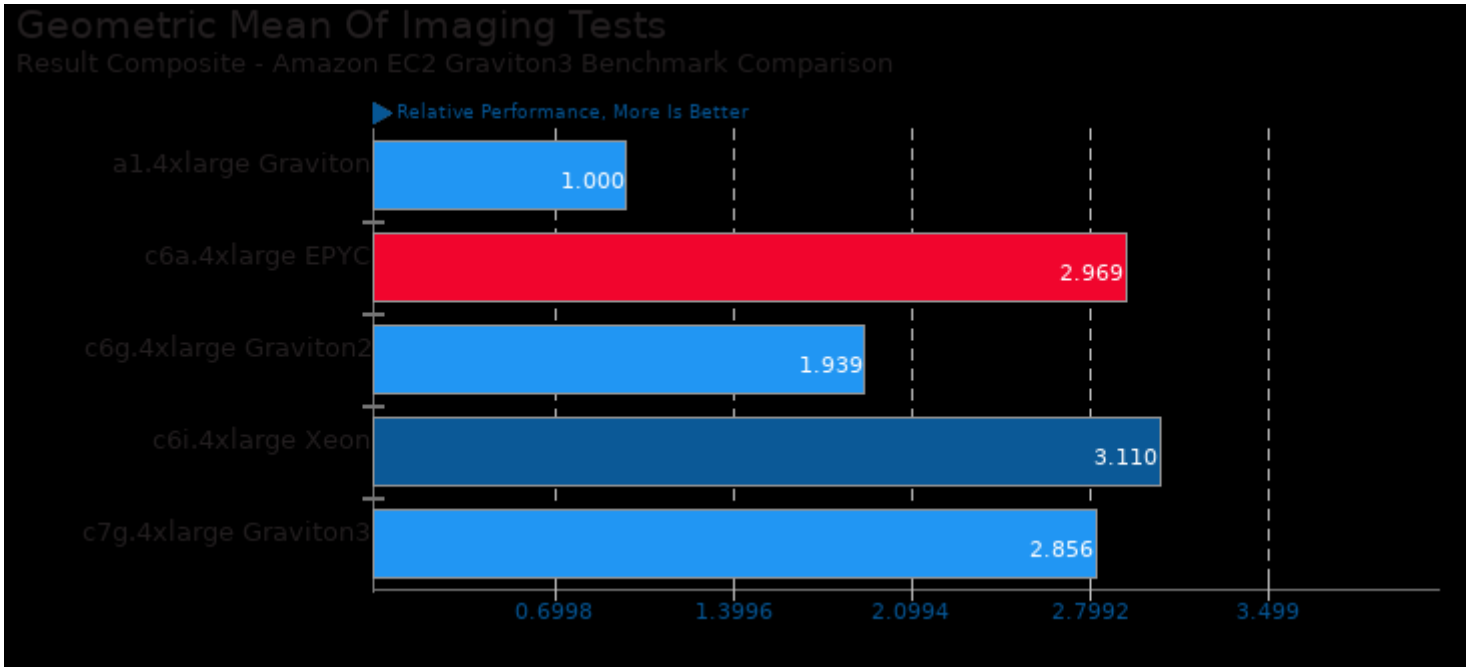


Geometric mean based upon tests: pts/nginx and pts/apache

Amazon EC2 Graviton3 Benchmark Comparison

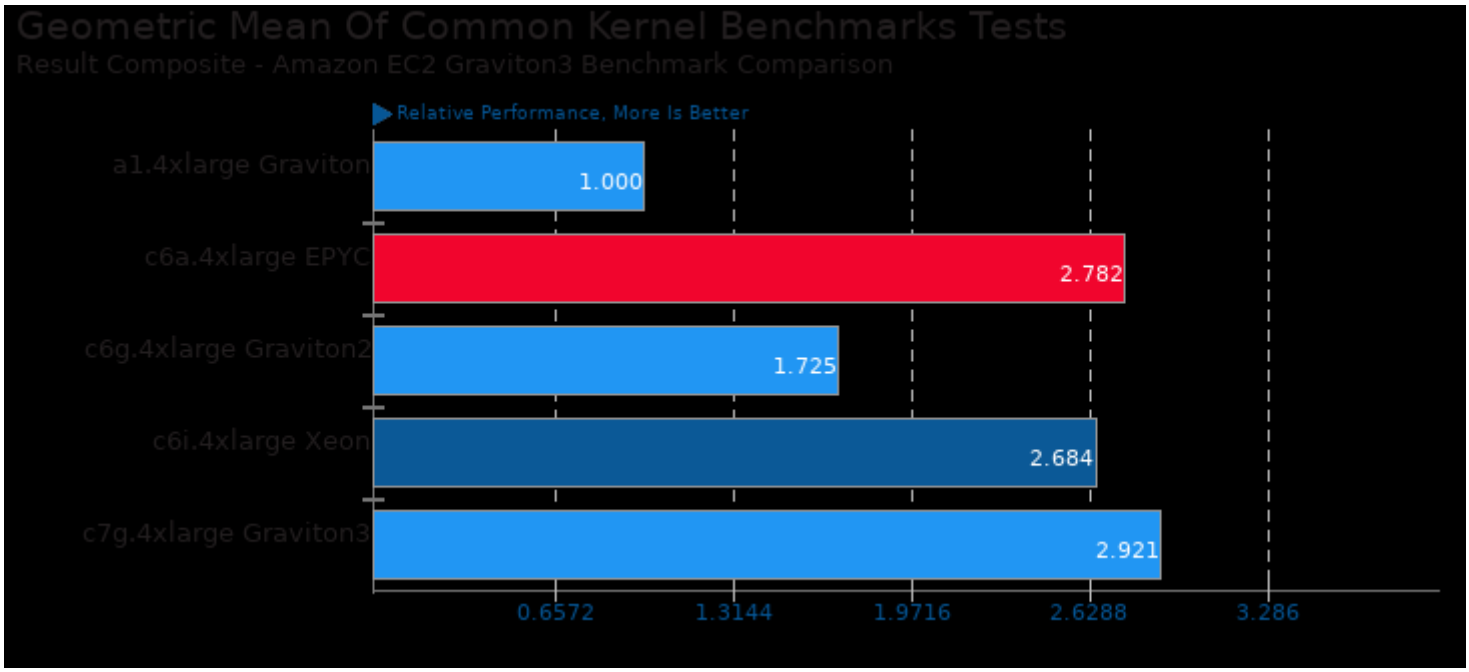


Geometric mean based upon tests: pts/npb, pts/rodinia, pts/hpcg, pts/mt-dgemm, pts/amg, pts/gromacs, pts/lammps, pts/lulesh, pts/incompact3d, pts/mrbayes, pts/gpaw, pts/tensorflow-lite, pts/onnx and pts/lczero

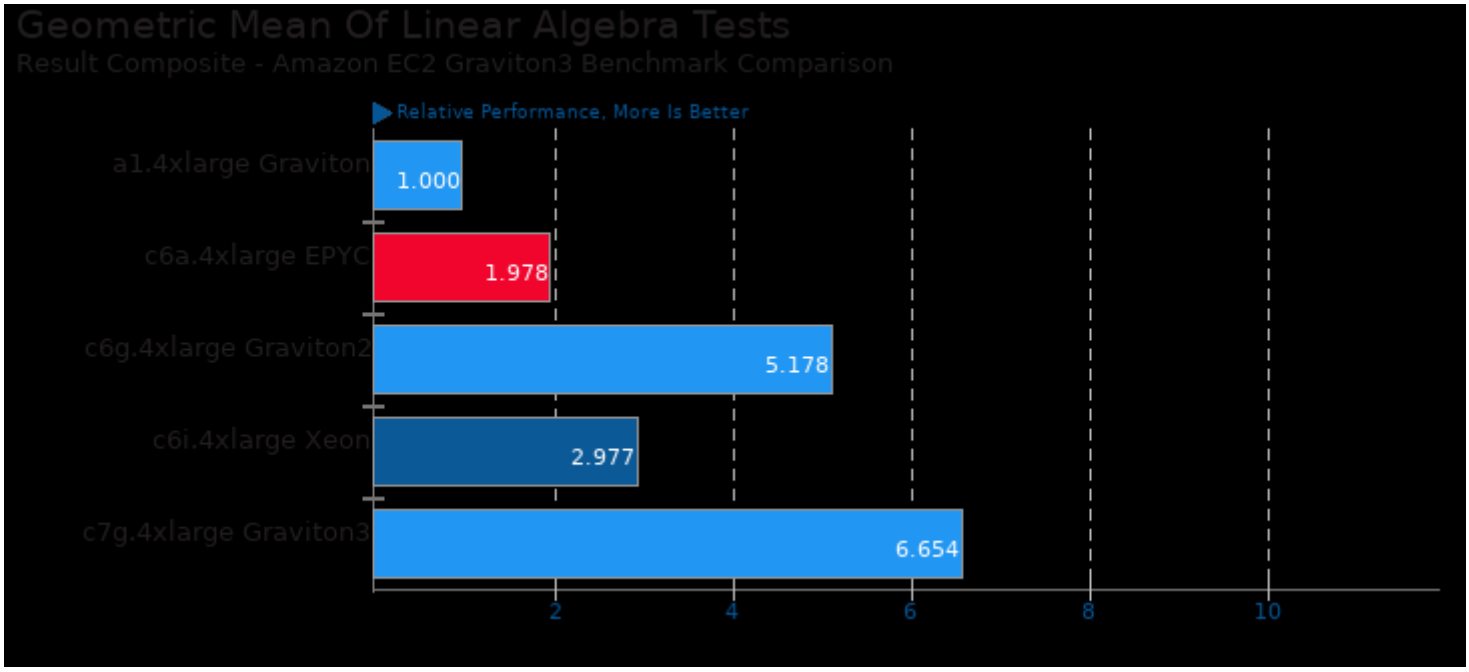


Geometric mean based upon tests: pts/webp and pts/avifenc

Amazon EC2 Graviton3 Benchmark Comparison

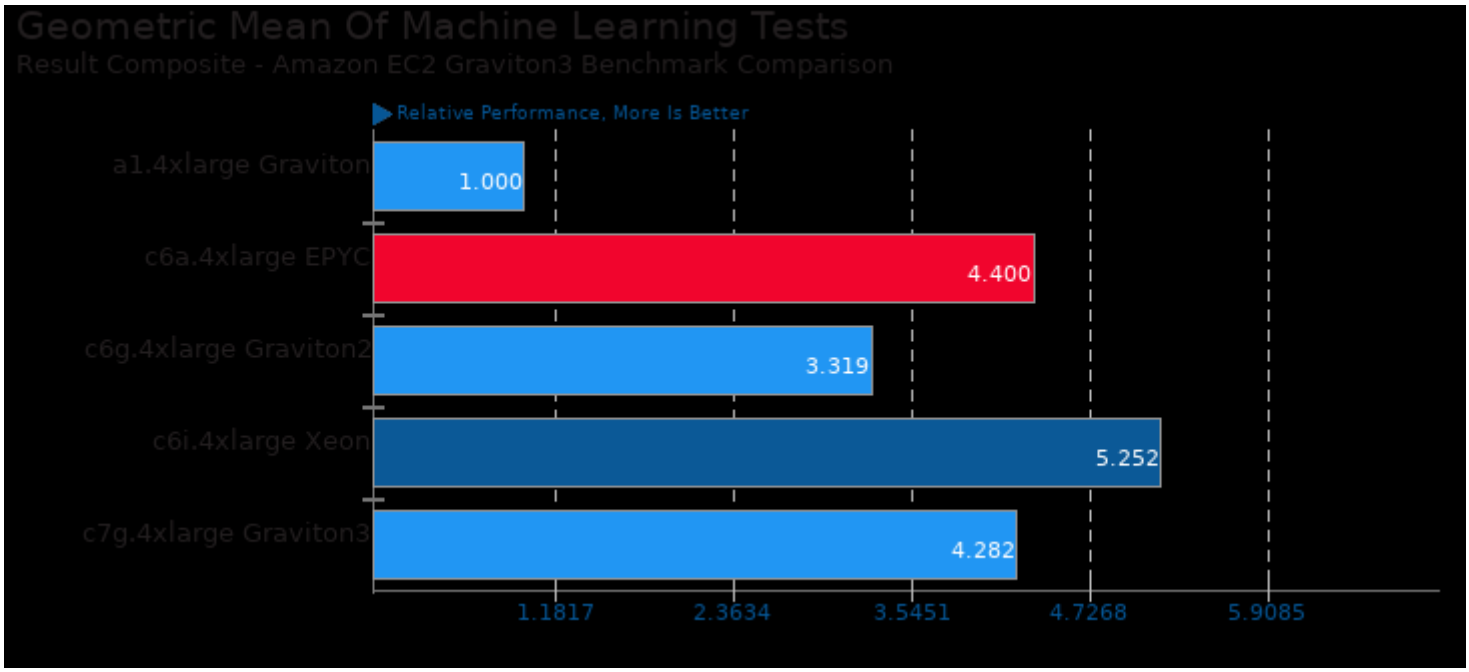


Geometric mean based upon tests: pts/apache, pts/openssl and pts/stress-ng

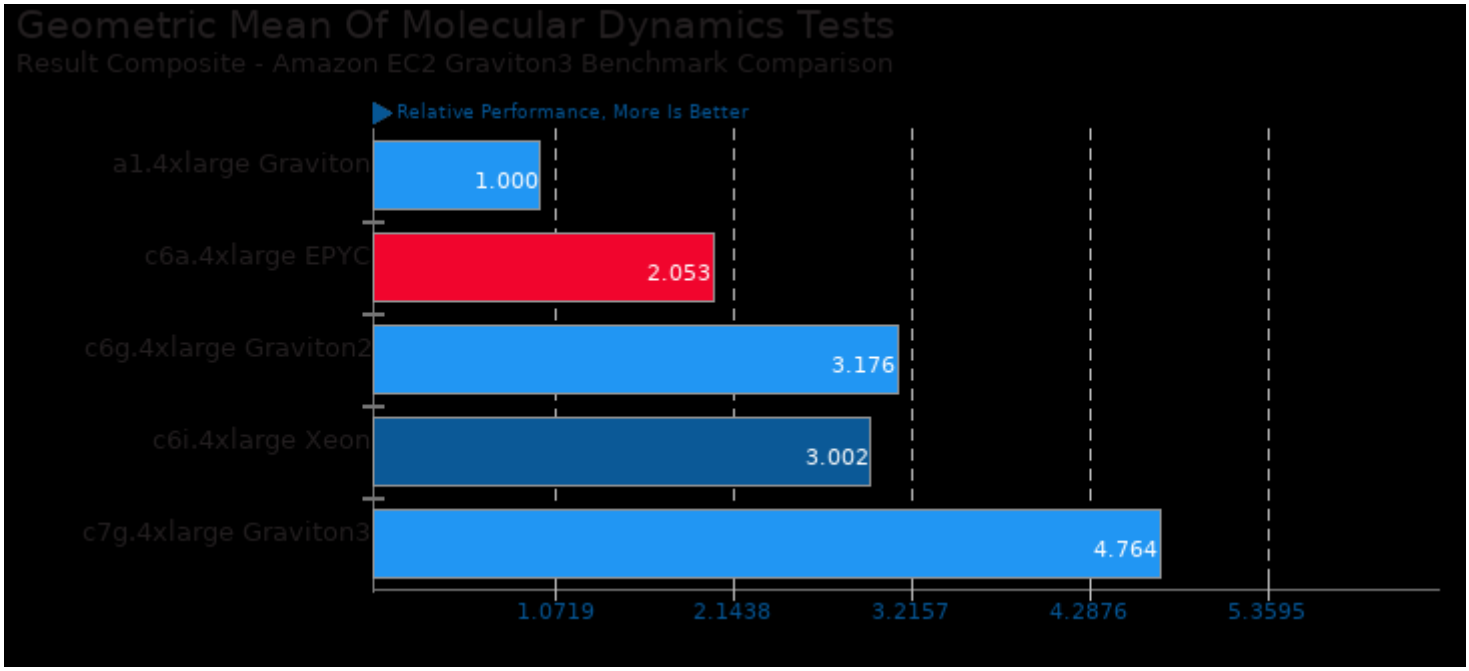


Geometric mean based upon tests: pts/mt-dgemm and pts/amg

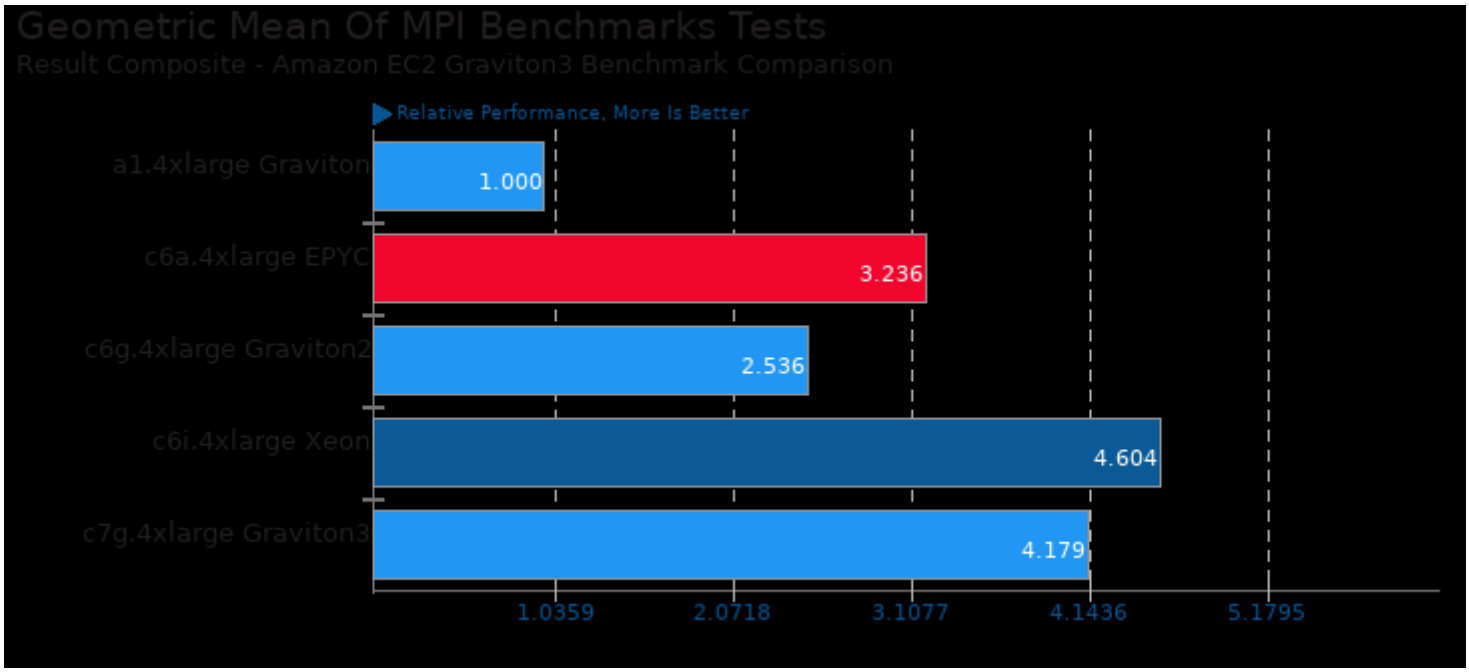
Amazon EC2 Graviton3 Benchmark Comparison



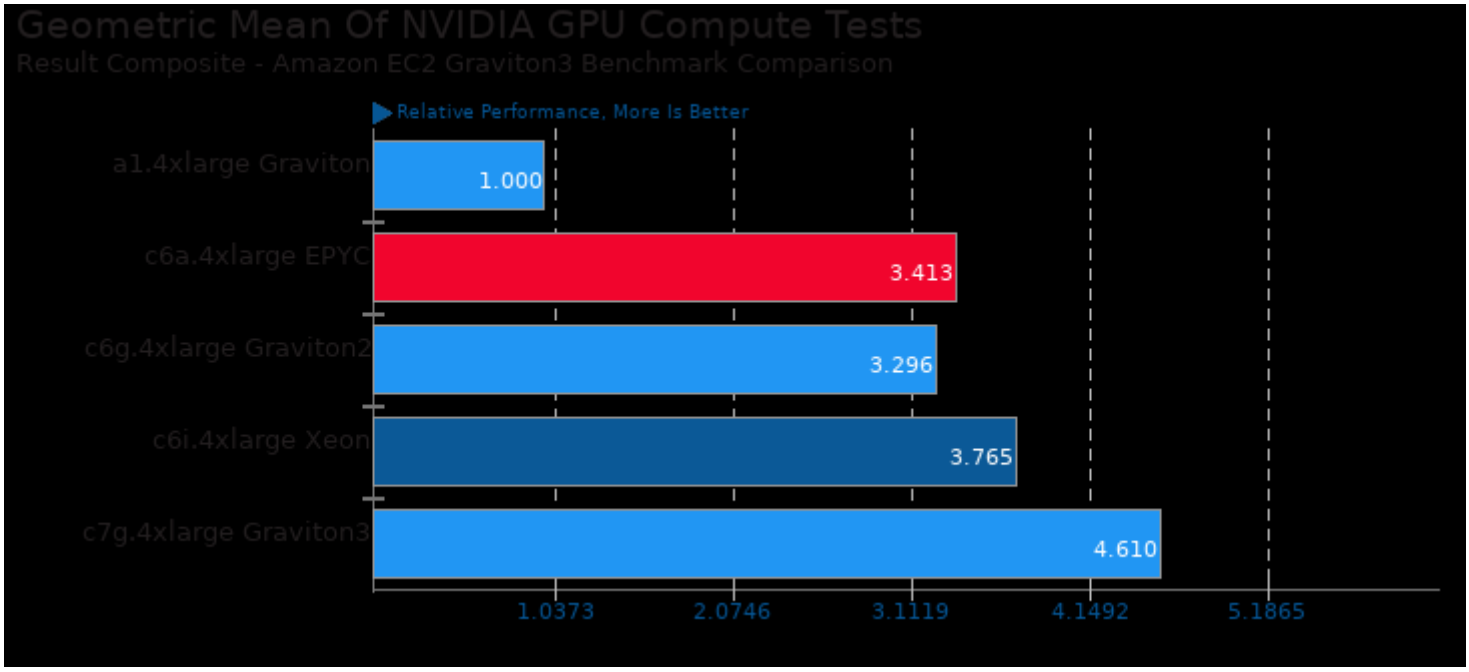
Geometric mean based upon tests: pts/tensorflow-lite, pts/onnx and pts/lczero



Geometric mean based upon tests: pts/gromacs, pts/lammps, pts/lulesh and pts/incompact3d

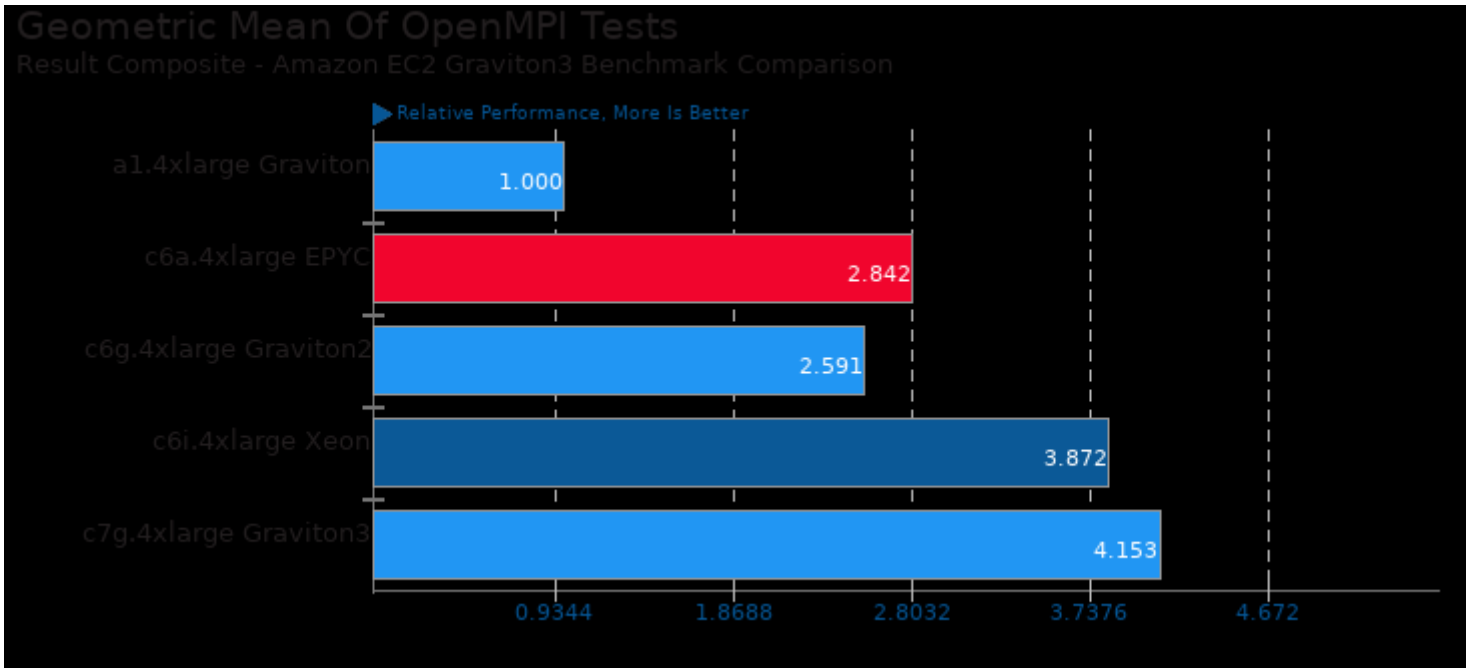


Geometric mean based upon tests: pts/lammps, pts/incompact3d, pts/gpaw, pts/gromacs, pts/hpcg, pts/mrbayes and pts/npb



Geometric mean based upon tests: pts/gromacs, pts/rodinia and pts/lczero

Amazon EC2 Graviton3 Benchmark Comparison



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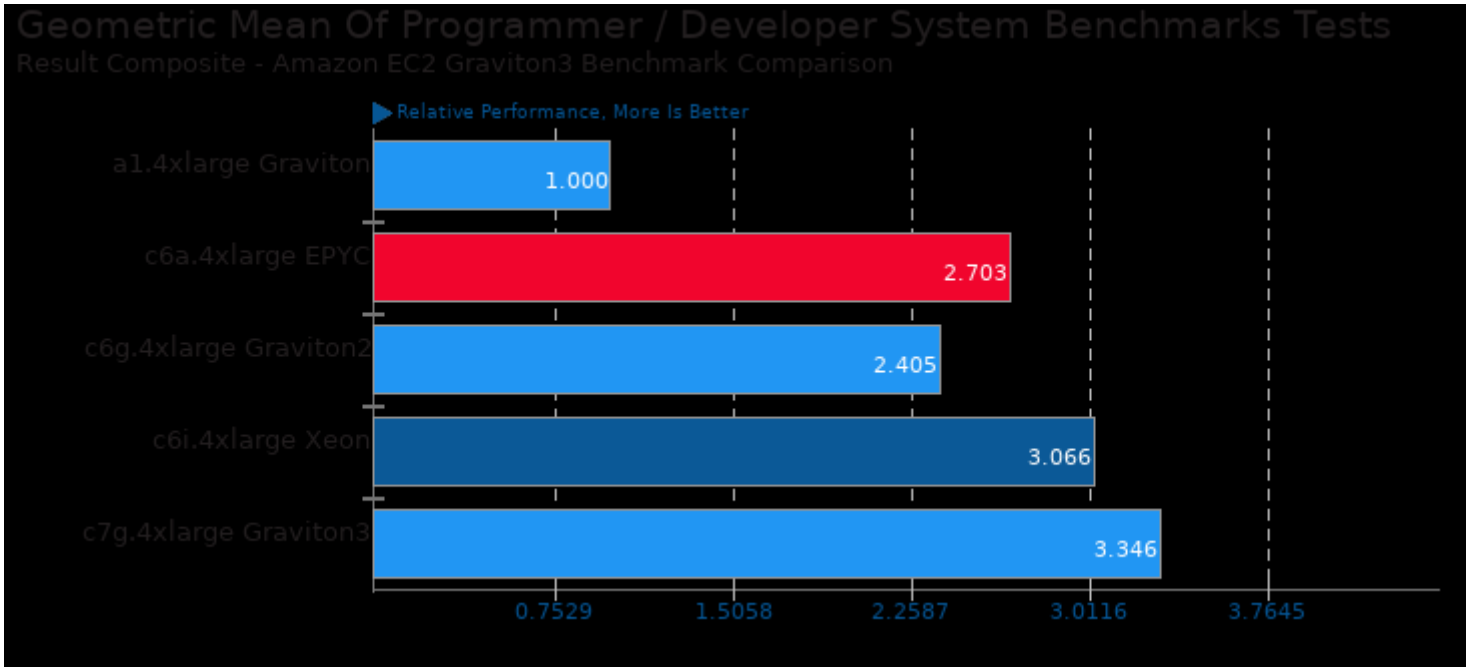
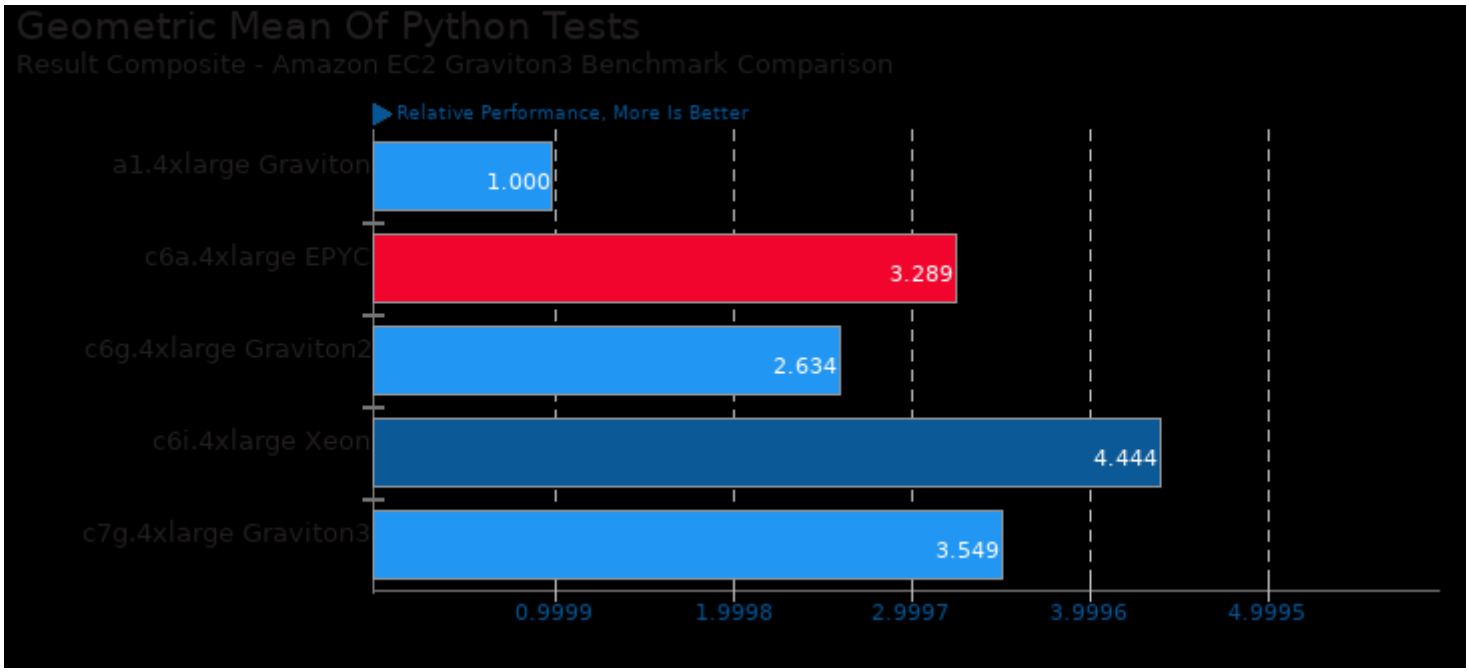
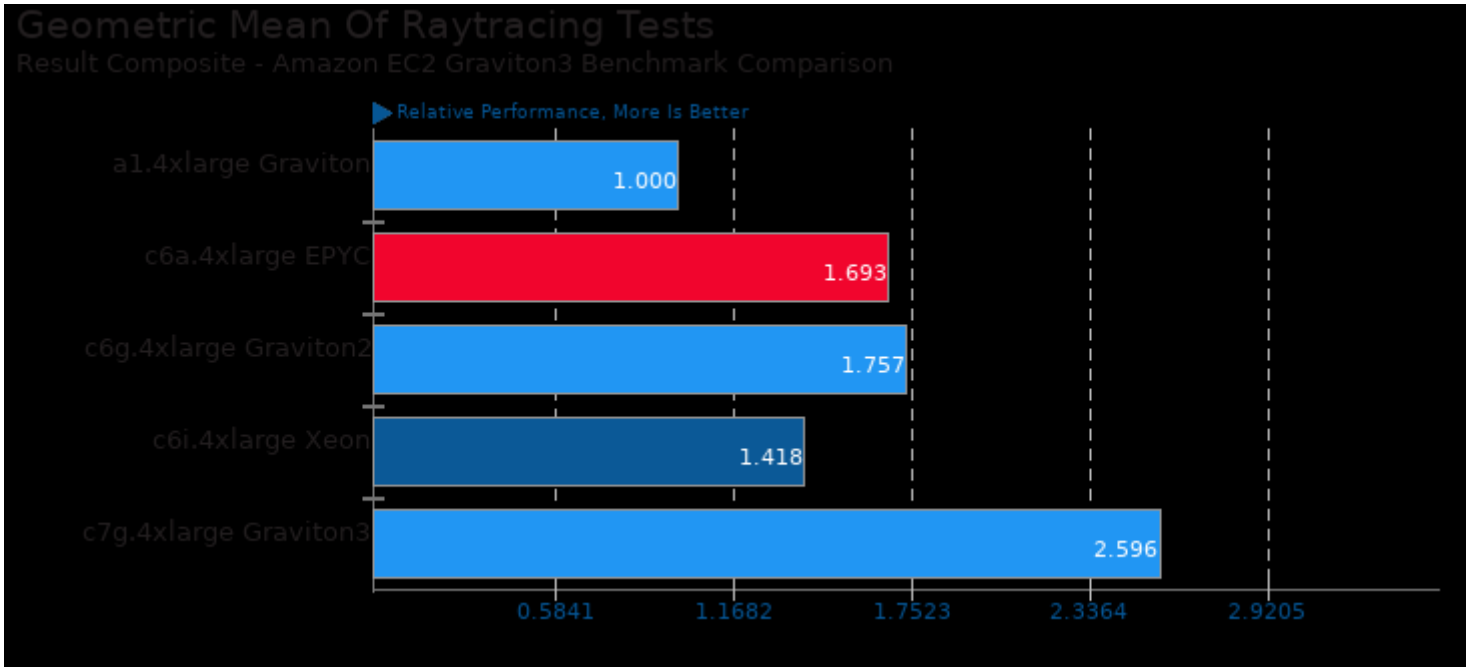


Geometric mean based upon tests: pts/simdjson, pts/compress-zstd, pts/pybench, pts/build-apache, pts/build-php, pts/build-imagemagick, pts/build-llvm, pts/build2, pts/build-nodejs, pts/build-gem5, pts/mt-dgemm and pts/amg

Amazon EC2 Graviton3 Benchmark Comparison

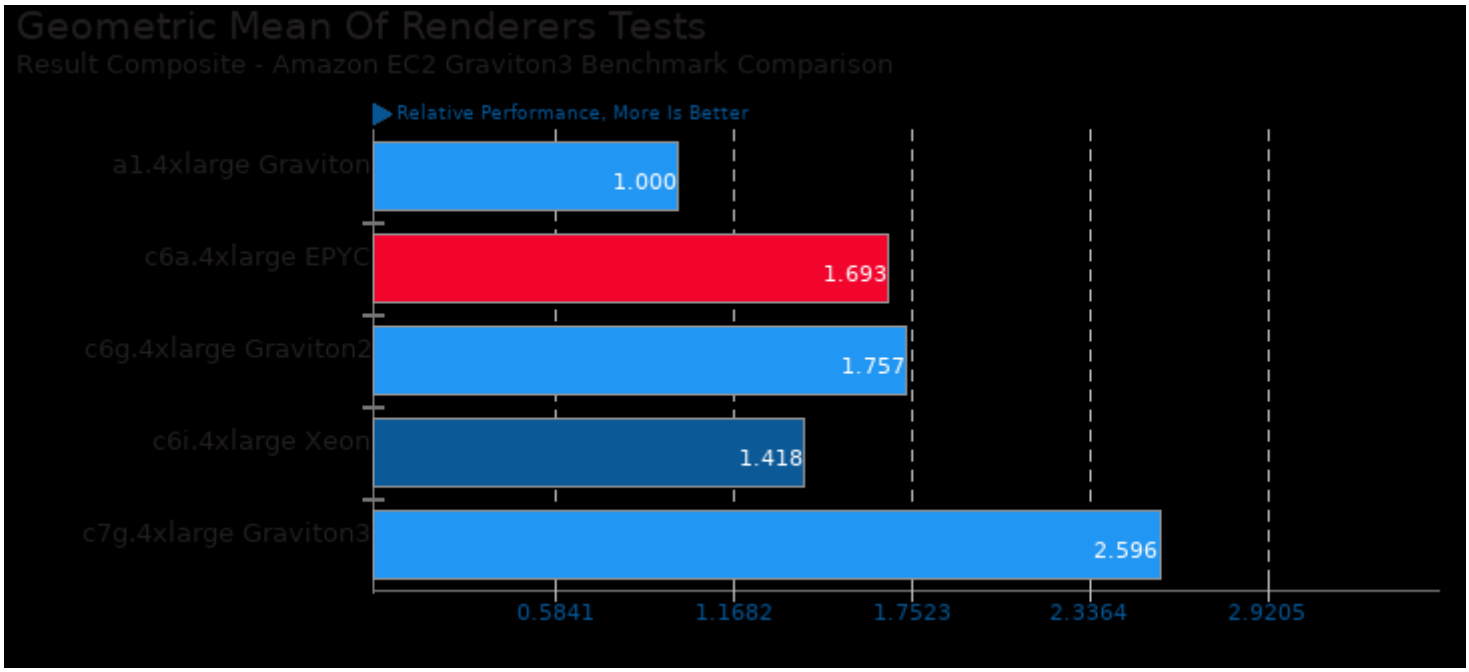


Geometric mean based upon tests: pts/build-gem5, pts/build-llvm, pts/build-nodejs, pts/gpaw, pts/pybench and pts/onnx



Geometric mean based upon tests: pts/c-ray and pts/povray

Amazon EC2 Graviton3 Benchmark Comparison



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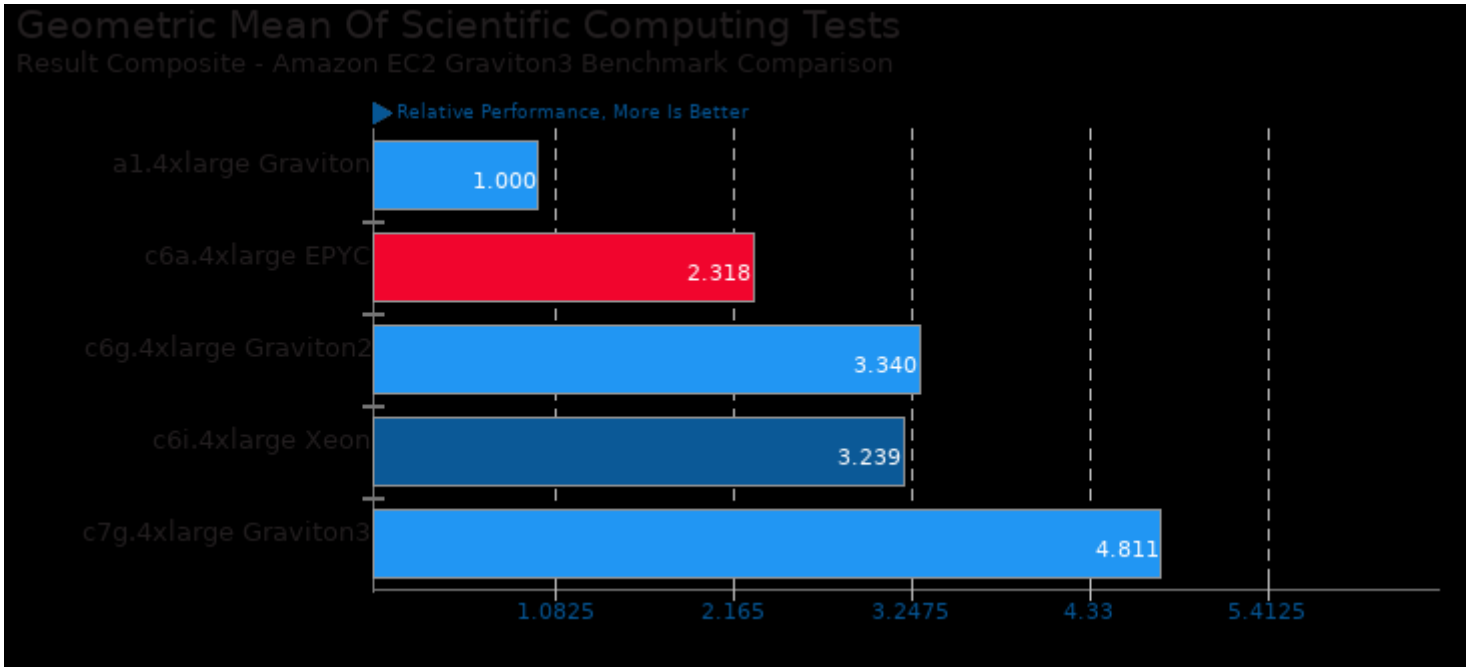
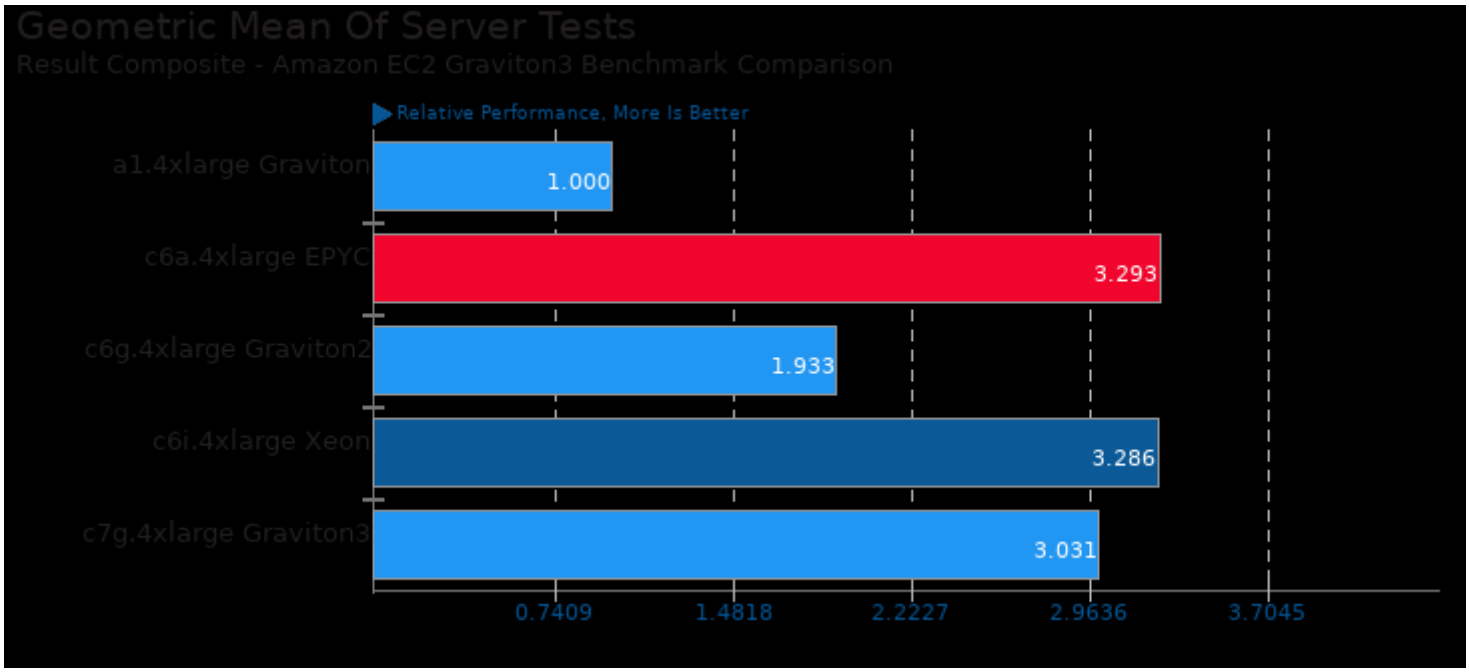
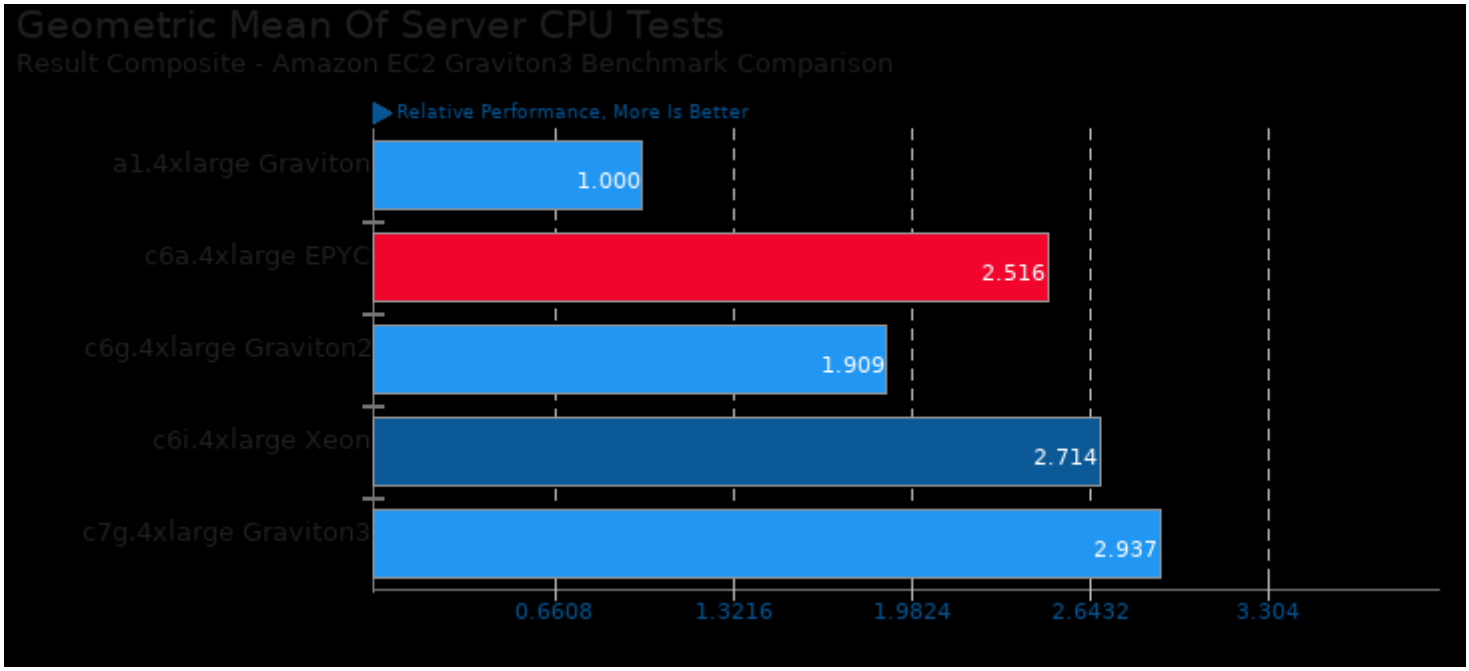


Geometric mean based upon tests: pts/mt-dgemm, pts/amg, pts/gromacs, pts/lammps, pts/lulesh, pts/incompact3d, pts/mrbayes and pts/gpaw

Amazon EC2 Graviton3 Benchmark Comparison

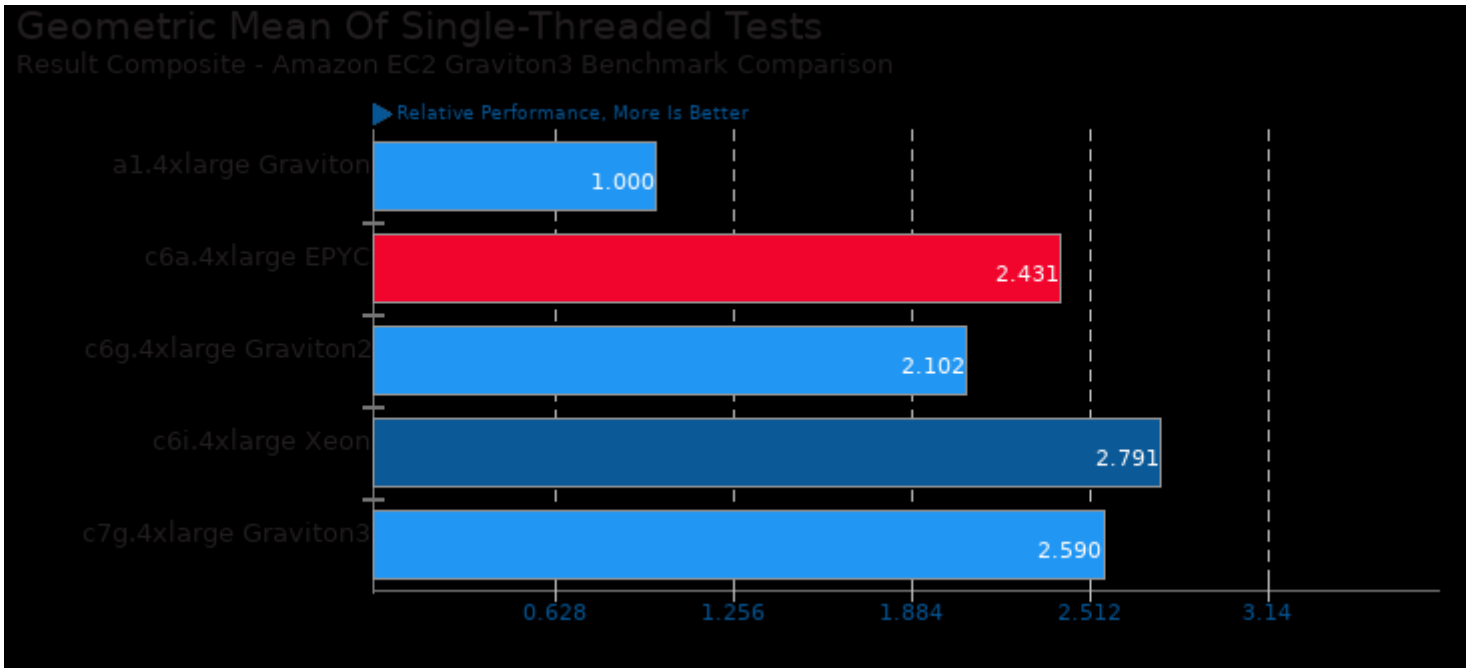


Geometric mean based upon tests: pts/apache, pts/nginx, pts/phpbench, pts/openssl and pts/simdjson



Geometric mean based upon tests: pts/npb, pts/rodinia, pts/dacapobench, pts/compress-7zip, pts/stockfish, pts/asmfish, pts/build-php, pts/build-llvm, pts/c-ray, pts/povray, pts/compress-zstd, pts/m-queens, pts/openssl, pts/stress-ng, pts/pybench and pts/phpbench

Amazon EC2 Graviton3 Benchmark Comparison



Geometric mean based upon tests: pts/pybench, pts/phpbench and pts/nginx

This file was automatically generated via the Phoronix Test Suite benchmarking software on Friday, 29 March 2024 01:39.