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Server CPU Benchmarks Intel Xeon Cascade Lake

Tests for a future article on phoronix.com.

Automated Executive Summary

2 x Intel Xeon Platinum 8280 had the most wins, coming in first place for 44% of the tests.

Based on the geometric mean of all complete results, the fastest (2 x Intel Xeon Platinum 8280) was 1.732x the speed of the slowest (AMD EPYC 7551). Intel Xeon Platinum 8280 was 0.89x the speed of 2 x Intel Xeon Platinum 8280, 2 x AMD EPYC 7601 was 0.931x the speed of Intel Xeon Platinum 8280, 2 x Intel Xeon Gold 6138 was 0.97x the speed of 2 x AMD EPYC 7601, AMD EPYC 7601 was 0.858x the speed of 2 x Intel Xeon Gold 6138, AMD EPYC 7551 was 0.839x the speed of AMD EPYC 7601.

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

Stream (Type: Copy) at 5.843x
Stream (Type: Add) at 5.431x
Stream (Type: Triad) at 5.417x
Stream (Type: Scale) at 5.341x
POV-Ray (Trace Time) at 5.117x
SVT-VP9 (1080p 8-bit YUV To VP9 Video Encode) at 4.469x
Sysbench (Test: Memory) at 4.367x

NAS Parallel Benchmarks (Test / Class: EP.C) at 4.156x
Novabench (Test: RAM) at 3.923x
NAS Parallel Benchmarks (Test / Class: LU.C) at 3.496x.

Test Systems:

AMD EPYC 7551

Processor: AMD EPYC 7551 32-Core @ 2.00GHz (32 Cores / 64 Threads), Motherboard: GIGABYTE MZ31-AR0-00 v01010101 (F10 BIOS), Chipset: AMD Family 17h, Memory: 32768MB, Disk: Samsung SSD 960 EVO 500GB + 525GB 2115, Graphics: llvmpipe 31GB, Monitor: VE228, Network: Realtek RTL8111/8168/8411 + 2 x Broadcom NetXtreme II BCM57810 10

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 128 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: __user pointer sanitization + Full AMD retpoline IBPB: conditional STIBP: disabled RSB filling + SSB disabled via prctl and seccomp

AMD EPYC 7601

Processor: AMD EPYC 7601 32-Core @ 2.20GHz (32 Cores / 64 Threads), Motherboard: TYAN B8026T70AE24HR (V1.02.B10 BIOS), Chipset: AMD Family 17h, Memory: 129024MB, Disk: 280GB INTEL SSDPE21D280GA + 525GB 2115, Graphics: llvmpipe 126GB, Monitor: VE228, Network: 2 x Broadcom NetXtreme BCM5720 PCIe

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 128 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: __user pointer sanitization + Full AMD retpoline IBPB: conditional STIBP: disabled RSB filling + SSB disabled via prctl and seccomp

2 x AMD EPYC 7601

Processor: 2 x AMD EPYC 7601 32-Core (64 Cores / 128 Threads), Motherboard: Dell 02MJ3T (1.2.5 BIOS), Chipset: AMD Family 17h, Memory: 516096MB, Disk: 120GB SSDSCKJB120G7R + 20 x 500GB Samsung SSD 860 + 525GB 2115, Graphics: Matrox G200eW3, Monitor: VE228, Network: 2 x Broadcom BCM57416 NetXtreme-E Dual-Media 10G RDMA + 2 x Broadcom NetXtreme BCM5720 PCIe

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 128 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1600x1200

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: __user pointer sanitization + Full AMD retpoline IBPB: conditional STIBP: disabled RSB filling + SSB disabled via prctl and seccomp

2 x Intel Xeon Gold 6138

Processor: 2 x Intel Xeon Gold 6138 @ 3.70GHz (40 Cores / 80 Threads), Motherboard: TYAN S7106 (V1.02.B20 BIOS), Chipset: Intel Sky Lake-E DMI3 Registers, Memory: 96256MB, Disk: Samsung SSD 970 EVO 250GB + 525GB 2115, Graphics: llvmpipe 93GB, Monitor: VE228, Network: 2 x Intel I210 + 2 x QLogic cLOM8214 1/10GbE + Mellanox MT26448

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 256 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling + SSB disabled via prctl and seccomp + PTE Inversion; VMX: conditional cache flushes SMT vulnerable

Intel Xeon Platinum 8280

Processor: Intel Xeon Platinum 8280 @ 4.00GHz (28 Cores / 56 Threads), Motherboard: GIGABYTE MD61-SC2-00 v01000100 (T15 BIOS), Chipset: Intel Sky Lake-E DMI3 Registers, Memory: 192512MB, Disk: 525GB 2115, Graphics: ASPEED Family, Monitor: VE228, Network: 2 x Intel X722 for 1GbE + 2 x QLogic FastLinQ QL41000 10/25/40/50GbE

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 256 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: __user pointer sanitization + Enhanced IBRS IBPB: conditional RSB filling + SSB disabled via prctl and seccomp

2 x Intel Xeon Platinum 8280

Processor: 2 x Intel Xeon Platinum 8280 @ 4.00GHz (56 Cores / 112 Threads), Motherboard: GIGABYTE MD61-SC2-00 v01000100 (T15 BIOS), Chipset: Intel Sky Lake-E DMI3 Registers, Memory: 386048MB, Disk: 525GB 2115, Graphics: llvmpipe 377GB, Monitor: VE228, Network: 2 x Intel X722 for 1GbE + 2 x QLogic FastLinQ QL41000 10/25/40/50GbE

OS: Ubuntu 18.10, Kernel: 5.0.0-050000-generic (x86_64), Desktop: GNOME Shell 3.30.2, Display Server: X Server 1.20.1, Display Driver: modesetting 1.20.1, OpenGL: 3.3 Mesa 19.1.0-devel padoka PPA (LLVM 9.0 256 bits), Compiler: GCC 9.0.1 20190310 + Clang 7.0.0-3, File-System: ext4, Screen Resolution: 1920x1080

Environment Notes: CXXFLAGS=-O3-march=native CFLAGS=-O3-march=native
Compiler Notes: --disable-multilib --enable-checking=release
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.15+ + Python 3.6.7
Security Notes: __user pointer sanitization + Enhanced IBRS IBPB: conditional RSB filling + SSB disabled via prctl and seccomp

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	AMD EPYC 7551	AMD EPYC 7601	2 x AMD EPYC 7601	2 x Intel Xeon Gold 6138	Intel Xeon Platinum	2 x Intel Xeon Platinum
RAMspeed SMP - Add - Integer (MB/s)	23467	34122	34276	30653	32231	33407
Normalized	68.46%	99.55%	100%	89.43%	94.03%	97.46%
RAMspeed SMP - Copy - Integer (MB/s)	23923	28936	29178	31098	33363	33415
Normalized	71.59%	86.6%	87.32%	93.07%	99.84%	100%
RAMspeed SMP - Scale - Integer (MB/s)	20053	24782	26605	25816	31834	29740
Normalized	62.99%	77.85%	83.57%	81.1%	100%	93.42%
RAMspeed SMP - Triad - Integer (MB/s)	18391	27297	28954	30028	31463	33274
Normalized	55.27%	82.04%	87.02%	90.24%	94.56%	100%
RAMspeed SMP - Average - Integer (MB/s)	20169	28438	29994	28975	31947	32263
Normalized	62.51%	88.14%	92.97%	89.81%	99.02%	100%
Stream - Copy (MB/s)	30435	82436	160041	130479	103876	177819
Normalized	17.12%	46.36%	90%	73.38%	58.42%	100%
Standard Deviation	2.1%	2%	3.3%	5.3%	1.4%	11.3%
Stream - Scale (MB/s)	30158	82988	161072	108853	72971	147165
Normalized	18.72%	51.52%	100%	67.58%	45.3%	91.37%
Standard Deviation	5.9%	2.3%	3.3%	1.6%	1.3%	0.8%
Stream - Triad (MB/s)	33102	95205	179321	113517	82482	151641
Normalized	18.46%	53.09%	100%	63.3%	46%	84.56%
Standard Deviation	3.8%	2%	3.2%	4.2%	1.1%	9.1%
Stream - Add (MB/s)	32976	94697	179105	114058	82341	157795
Normalized	18.41%	52.87%	100%	63.68%	45.97%	88.1%
Standard Deviation	4.7%	1.8%	2.2%	2.9%	1%	5.3%
MBW - Memory Copy - 4096 MiB (MiB/s)	9057	12391	12483	4634	9205	4821
Normalized	72.55%	99.26%	100%	37.12%	73.74%	38.62%
Standard Deviation	0.3%	0.3%	1%	1.7%	1.8%	0.1%
MBW - M.C.F.B.S - 4096 MiB (MiB/s)	6138	7925	8048	4970	8422	5293
Normalized	72.88%	94.1%	95.56%	59.01%	100%	62.85%
Standard Deviation	0.2%	0.3%	0.2%	0.8%	0.2%	0.4%
t-test1 - 1 (sec)	40.62	38.64	21.13	19.89	18.34	18.17
Normalized	44.73%	47.02%	85.99%	91.35%	99.07%	100%
Standard Deviation	3.4%	0.4%	0.1%	1.3%	0.9%	0.3%
t-test1 - 2 (sec)	13.48	12.96	8.23	9.07	7.61	7.57
Normalized	56.16%	58.41%	91.98%	83.46%	99.47%	100%
Standard Deviation	1.6%	1.3%	0.7%	0.8%	1.2%	2.2%
NAS Parallel Benchmarks - EP.C (Mop/s)	910	969	1926	2239	1943	3782
Normalized	24.06%	25.62%	50.93%	59.2%	51.37%	100%
Standard Deviation	0.1%	0.1%	0.4%	2.3%	1.4%	0.9%
NAS Parallel Benchmarks - FT.B (Mop/s)	2990	3854	1747	2357	5087	2145
Normalized	58.78%	75.76%	34.34%	46.33%	100%	42.17%
Standard Deviation	3.9%	0.5%	0.4%	1.2%	0.3%	0.3%

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NAS Parallel Benchmarks - LU.C (Mop/s)	33909	60129	115195	76949	59080	118530
Normalized	28.61%	50.73%	97.19%	64.92%	49.84%	100%
Standard Deviation	0.2%	1.9%	0.3%	0.5%	0.3%	1.1%
NAS Parallel Benchmarks - SP.A (Mop/s)	2860	3034	3223	2821	3685	3559
Normalized	77.61%	82.33%	87.46%	76.55%	100%	96.58%
Standard Deviation	1.3%	0.2%	0.2%	1.1%	0.8%	0.9%
Parboil - OpenMP CUTCP (sec)	2.02	1.85	1.84	1.90	1.76	1.37
Normalized	67.82%	74.05%	74.46%	72.11%	77.84%	100%
Standard Deviation	0.2%	3.3%	15.7%	5.3%	0.3%	3.4%
CloverLeaf - L.E.H (sec)	2.22	1.28	1.42	0.86	0.98	0.62
Normalized	27.93%	48.44%	43.66%	72.09%	63.27%	100%
Standard Deviation	13.6%	22.1%	40.8%	17.2%	0.1%	11.3%
Rodinia - OpenMP LavaMD (sec)	15.36	15.28	8.12	13.12	14.10	8.24
Normalized	52.86%	53.14%	100%	61.89%	57.59%	98.54%
Standard Deviation	0.2%	0.7%	2%	1.3%	1.2%	2.6%
Rodinia - OpenMP CFD Solver (sec)	13.95	10.89	11.96	9.42	8.46	7.63
Normalized	54.7%	70.06%	63.8%	81%	90.19%	100%
Standard Deviation	3.2%	1.5%	2.2%	1.4%	0.4%	2%
NAMD - ATPase Simulation - 327,506 Atoms (days/ns)	0.91064	0.91687	0.44857	0.65580	0.69969	0.35819
Normalized	39.33%	39.07%	79.85%	54.62%	51.19%	100%
Standard Deviation	0.4%	0.5%	0%	0.3%	0.1%	0.2%
Timed HMMer Search - P.D.S (sec)	8.24	7.79	6.33	12.64	12.47	12.53
Normalized	76.82%	81.26%	100%	50.08%	50.76%	50.52%
Standard Deviation	0.4%	1.8%	1%	0.7%	1%	1.6%
Timed MAFFT Alignment - M.S.A (sec)	4.34	3.56	3.40	3.62	3.08	4.90
Normalized	70.97%	86.52%	90.59%	85.08%	100%	62.86%
Standard Deviation	11.3%	8%	2.5%	4.2%	3.4%	0.3%
Crafty - Elapsed Time (Nodes/s)	5599295	5952355	5927520	7621166	8291944	8309974
Normalized	67.38%	71.63%	71.33%	91.71%	99.78%	100%
Standard Deviation	0%	0.2%	0.2%	0.3%	0.3%	0.1%
Node.js Express HTTP Load Test (Reqs/sec)	5458	5552	5377	8245	9903	9120
Normalized	55.11%	56.06%	54.3%	83.26%	100%	92.09%
Standard Deviation	0.8%	3.2%	5.2%	5.1%	1.2%	2.2%
SVT-AV1 - 1.8.b.Y.T.A.V.E (FPS)	15.07	15.78	17.40	18.37	21.29	21.82
Normalized	69.07%	72.32%	79.74%	84.19%	97.57%	100%
Standard Deviation	1%	1.5%	1.7%	1.3%	0.5%	1.9%
SVT-HEVC - 1.8.b.Y.T.H.V.E (FPS)	157	164	154	247	325	249
Normalized	48.31%	50.46%	47.38%	76%	100%	76.62%
Standard Deviation	12.3%	17.4%	3%	1.4%	4.6%	24%

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SVT-VP9 - 1.8.b.Y.T.V.V.E (FPS)	83.62	85.67	120.94	270.15	373.72	254.32
Normalized	22.38%	22.92%	32.36%	72.29%	100%	68.05%
Standard Deviation	3.4%	3.4%	8.5%	2.2%	1.3%	24.4%
x264 - H.2.V.E (FPS)	99.20	104.55	145.73	113.48	117.40	114.18
Normalized	68.07%	71.74%	100%	77.87%	80.56%	78.35%
Standard Deviation	7.7%	11.6%	1.2%	3.5%	0.7%	12.1%
x265 - H.2.1.V.E (FPS)	27.58	29.05	35.28	32.40	33.64	33.19
Normalized	78.17%	82.34%	100%	91.84%	95.35%	94.08%
Standard Deviation	0.9%	0.5%	0.4%	0.3%	1.7%	1%
Himeno Benchmark - P.P.S (MFLOPS)	947	1009	1010	2784	3017	3023
Normalized	31.33%	33.38%	33.41%	92.09%	99.8%	100%
Standard Deviation	0.3%	0.2%	0.2%	0.2%	0.2%	0.3%
7-Zip Compression - C.S.T (MIPS)	81841	92589	129624	142205	140070	242479
Normalized	33.75%	38.18%	53.46%	58.65%	57.77%	100%
Standard Deviation	3.5%	0.6%	6.9%	0.3%	0.7%	1.4%
Stockfish - Total Time (Nodes/s)	54843441	58840749	105550514	70606126	67000942	128912982
Normalized	42.54%	45.64%	81.88%	54.77%	51.97%	100%
Standard Deviation	1%	0.7%	2.1%	1.4%	1.9%	0.4%
asmFish - 1.H.M.2.D	58478181	59978329	112777947	73615233	69772195	132974918
Normalized	43.98%	45.1%	84.81%	55.36%	52.47%	100%
Standard Deviation	0.5%	0.8%	0.6%	1.1%	1.4%	1.4%
Swet - Average (Operations/sec)	535215702	573967559	567694927	636200801	770001238	738861117
Normalized	69.51%	74.54%	73.73%	82.62%	100%	95.96%
Standard Deviation	0.5%	2.7%	1.7%	1.1%	0.2%	3.1%
Timed GCC Compilation - Time To Compile (sec)	1076	1037	827	1033	955	917
Normalized	76.86%	79.75%	100%	80.06%	86.6%	90.19%
Timed Linux Kernel Compilation - Time To Compile (sec)	45.90	45.13	27.81	35.96	35.70	24.06
Normalized	52.42%	53.31%	86.52%	66.91%	67.39%	100%
Standard Deviation	3.4%	3.5%	3.8%	4%	3.7%	5.9%
Timed LLVM Compilation - Time To Compile (sec)	264	251	156	179	184	122
Normalized	46.21%	48.61%	78.21%	68.16%	66.3%	100%
C-Ray - Total Time - 4.1.R.P.P (sec)	23.32	22.07	11.40	22.07	22.20	11.45
Normalized	48.89%	51.65%	100%	51.65%	51.35%	99.56%
Standard Deviation	0.1%	0.4%	0.9%	1.3%	0.1%	0.2%
POV-Ray - Trace Time (sec)	22.12	22.03	12.35	63.19	41.73	37.85
Normalized	55.83%	56.06%	100%	19.54%	29.6%	32.63%
Standard Deviation	0.2%	0.6%	0.6%	46%	2.4%	66.9%
Y-Cruncher - C.5.P.D (sec)	23.31	19.56	16.92	12.77	9.83	10.52
Normalized	42.17%	50.26%	58.1%	76.98%	100%	93.44%
Standard Deviation	3.1%	0.6%	1%	0.3%	0.1%	0.5%
XZ Compression - C.u.1.0.3.s.i.i.C.L.9 (sec)	108.74	102.04	112.45	98.86	91.83	91.21
Normalized	83.88%	89.39%	81.11%	92.26%	99.32%	100%

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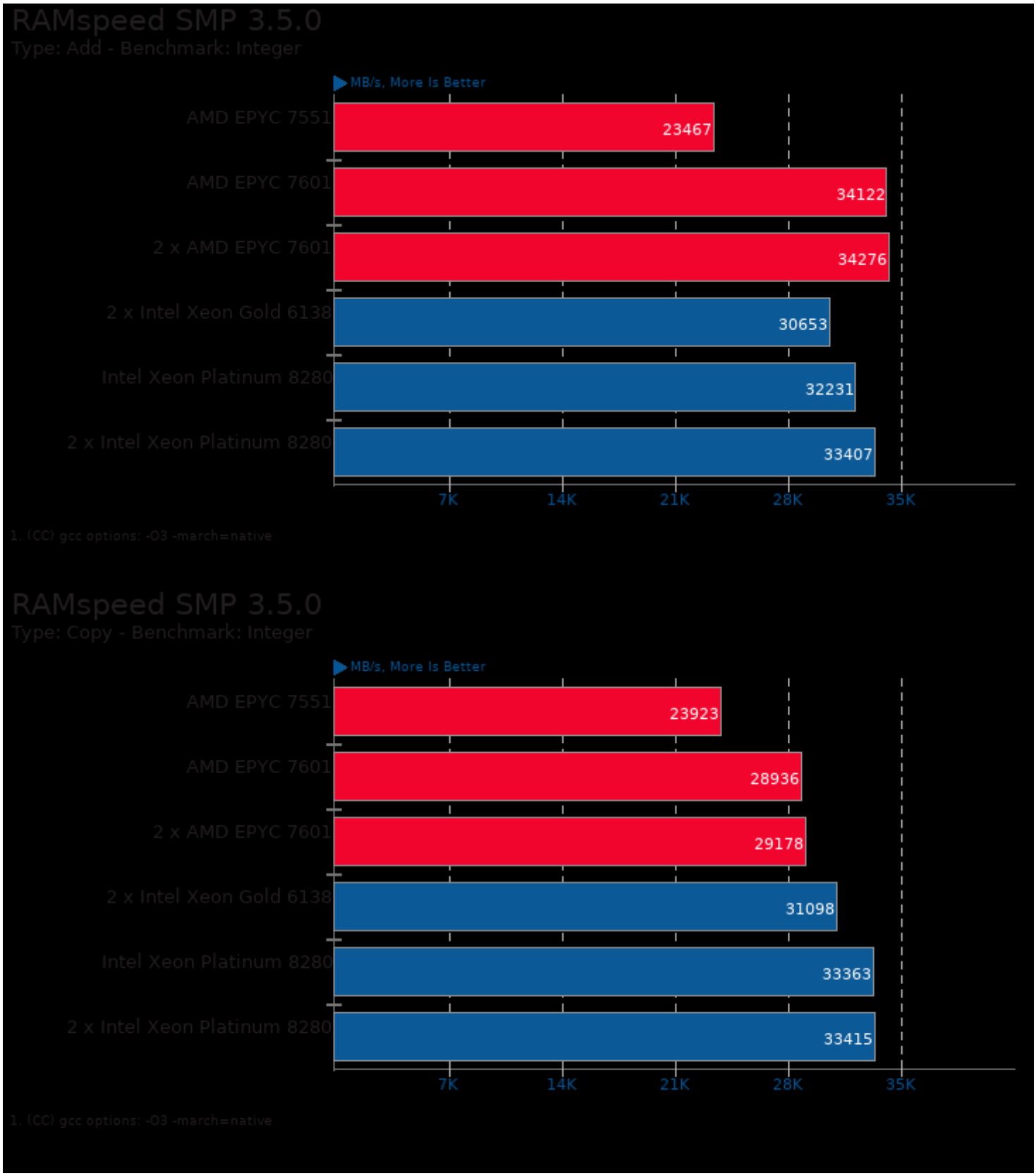
Standard Deviation	1.3%	2.9%	7.6%	1.9%	0.8%	0.9%
Zstd Compression - C.u.1.0.3.s.i.i.C.L.1 (sec)	**16.33**	14.50	13.48	11.01	**8.14**	9.29
Normalized	49.85%	56.14%	60.39%	73.93%	100%	87.62%
Standard Deviation	3.2%	1.7%	3.4%	4.2%	5.7%	5.4%
Cython benchmark (sec)	**35.04**	32.49	32.56	25.12	**23.13**	23.28
Normalized	66.01%	71.19%	71.04%	92.08%	100%	99.36%
Standard Deviation	0.6%	0.8%	1.7%	0.1%	0%	0.3%
m-queens - Time To Solve (sec)	28.07	27.26	**13.46**	28.02	**31.94**	16.35
Normalized	47.95%	49.38%	100%	48.04%	42.14%	82.32%
Standard Deviation	0.1%	0.7%	0.2%	0.4%	0%	0.5%
OpenCV Benchmark (sec)	**119**	112	118	105	**88.82**	111.92
Normalized	74.64%	79.3%	75.27%	84.59%	100%	79.36%
Standard Deviation	1.2%	1.1%	2.5%	1.8%	0.4%	2.8%
Radiance Benchmark - Serial (sec)	**1087**	1019	1016	836	777	**774**
Normalized	71.21%	75.96%	76.18%	92.58%	99.61%	100%
Radiance Benchmark - SMP Parallel (sec)	**332**	312	308	255	250	**235**
Normalized	70.78%	75.32%	76.3%	92.16%	94%	100%
R Benchmark (sec)	**0.5024**	0.4655	0.4718	0.4304	**0.3476**	0.3758
Normalized	69.19%	74.67%	73.68%	80.76%	100%	92.5%
Standard Deviation	0.5%	0.9%	0.4%	1.4%	0.2%	3.4%
OpenSSL - R.4.b.P	**4368**	4572	9223	7937	6956	**13698**
Normalized	31.89%	33.38%	67.33%	57.94%	50.78%	100%
Standard Deviation	0%	0.7%	0.2%	0.7%	1.1%	0.6%
Cryptsetup - PBKDF2-sha512	**882147**	938463	937905	1406255	**1529280**	1512504
Normalized	57.68%	61.37%	61.33%	91.96%	100%	98.9%
Standard Deviation	0.2%	0.1%	0.2%	0.6%	0.1%	1.2%
Cryptsetup - PBKDF2-whirlpool (Iterations/sec)	**590863**	627389	629399	821345	886129	**892659**
Normalized	66.19%	70.28%	70.51%	92.01%	99.27%	100%
Standard Deviation	0.4%	0.1%	0.2%	0.3%	0.4%	0.1%
libjpeg-turbo tjbench - D.T (Megapixels/sec)	**135**	143	143	163	**178**	**178**
Normalized	75.84%	80.34%	80.34%	91.57%	100%	100%
Standard Deviation	0%	0%	0%	0.4%	0.5%	0.1%
Tensorflow - Cifar10 (sec)	57.81	50.46	**59.75**	55.36	**48.26**	51.84
Normalized	83.48%	95.64%	80.77%	87.17%	100%	93.09%
Standard Deviation	1.6%	0.7%	4%	0.3%	0.6%	0.9%
Darktable - Boat - CPU-only (sec)	**9.86**	5.47	7.20	5.15	4.92	**4.09**
Normalized	41.48%	74.77%	56.81%	79.42%	83.13%	100%
Standard Deviation	29.1%	18.8%	51.2%	7.7%	0.4%	10.1%
Darktable - Masskrug - CPU-only (sec)	**6.69**	5.78	6.15	5.30	**3.42**	4.44
Normalized	51.12%	59.17%	55.61%	64.53%	100%	77.03%
Standard Deviation	4.6%	3.3%	2.7%	2.1%	1.8%	0.5%

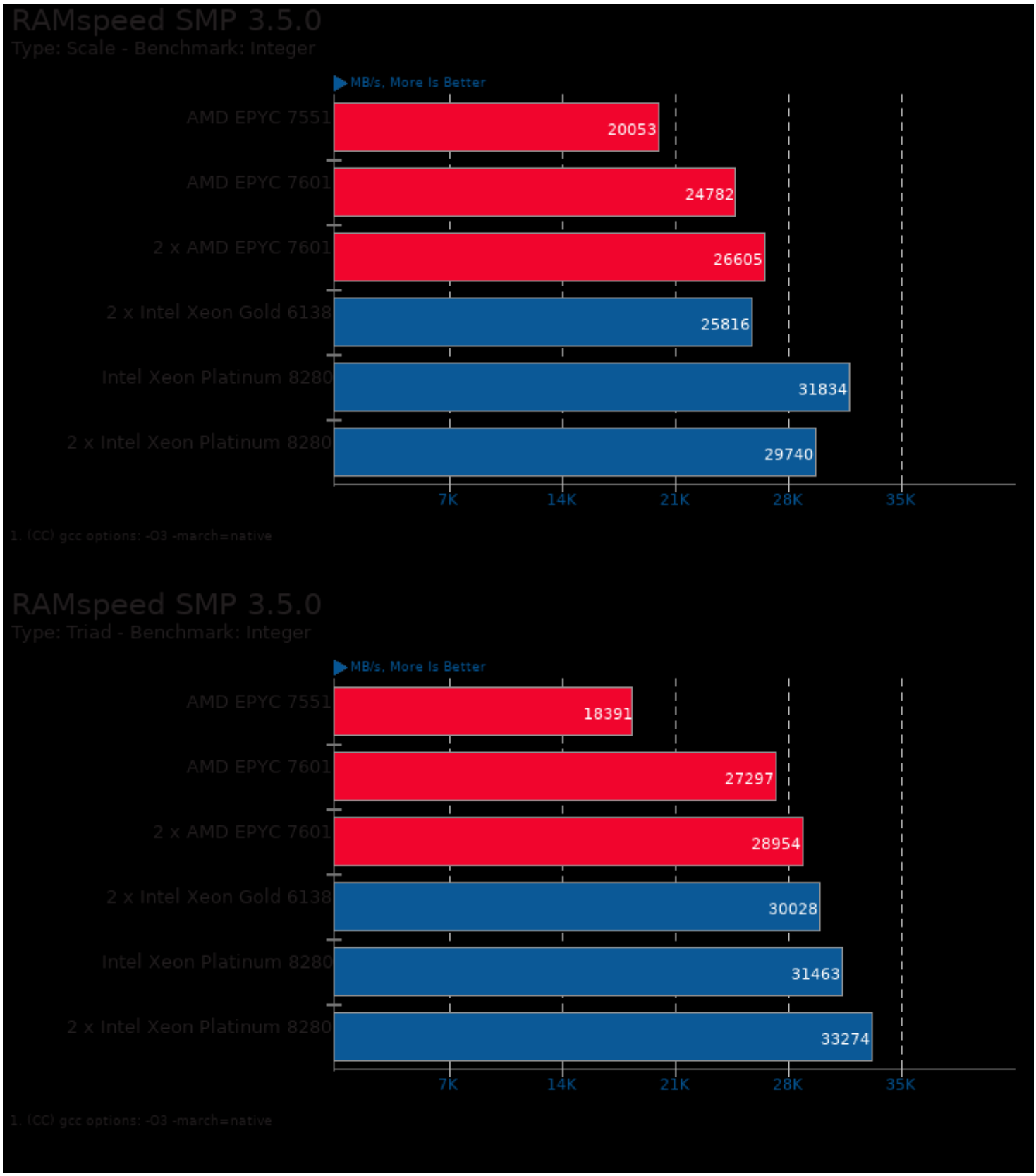
Server CPU Benchmarks Intel Xeon Cascade Lake

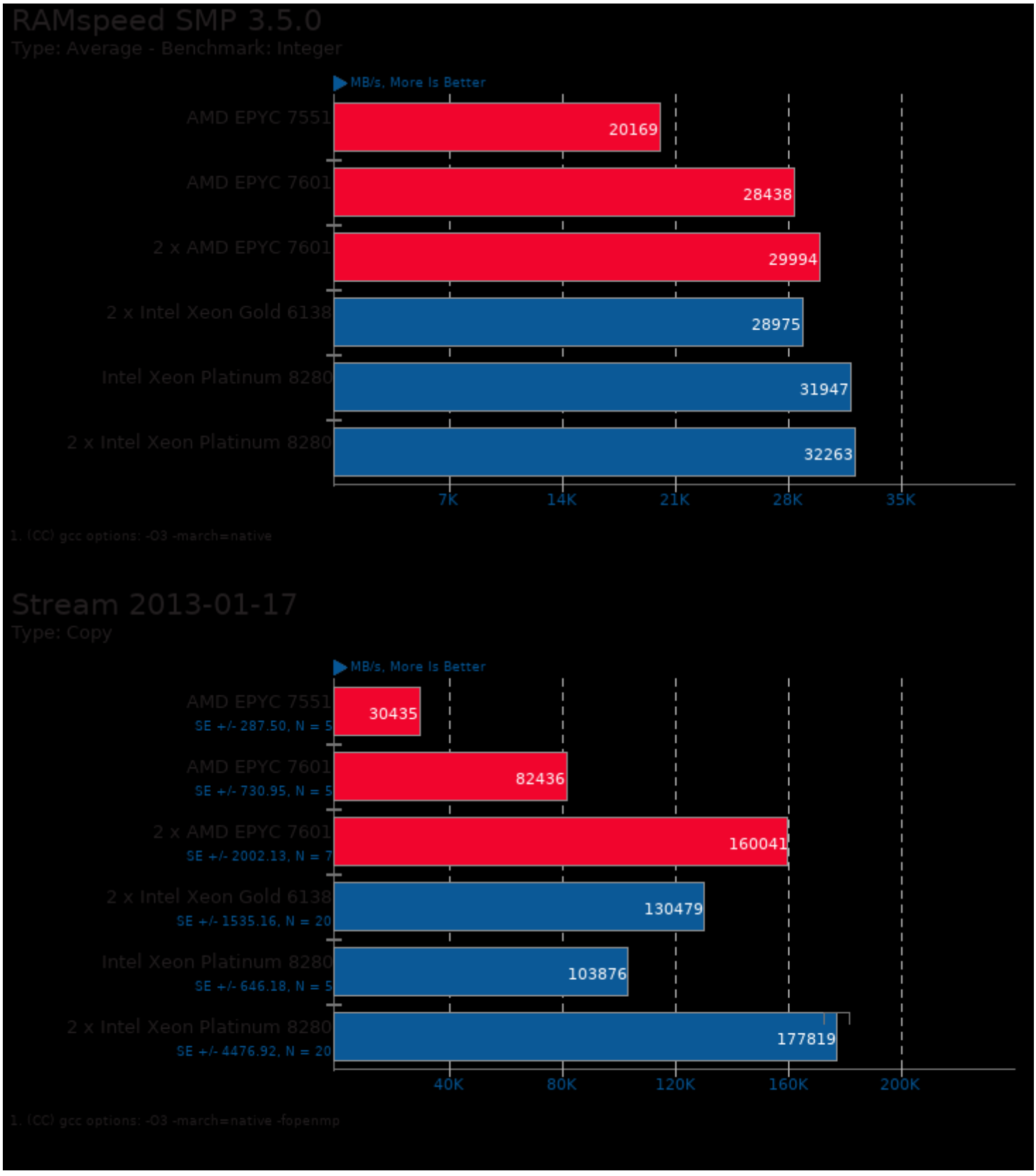
Darktable - Server Rack - CPU-only (sec)	0.17	0.16	0.16	0.11	0.09	0.16
Normalized	52.94%	56.25%	56.25%	81.82%	100%	56.25%
Standard Deviation	6.3%	3.2%	3%	28.4%	1.3%	32.4%
Darktable - Server Room - CPU-only (sec)	3.28	2.55	4.03	2.21	1.87	2.03
Normalized	57.01%	73.33%	46.4%	84.62%	100%	92.12%
Standard Deviation	2%	8%	23.6%	3.5%	0.2%	10.3%
GNU Octave Benchmark	25.67	21.08	21.42	23.23	17.58	19.79
Normalized	68.48%	83.4%	82.07%	75.68%	100%	88.83%
Standard Deviation	1.4%	1.9%	1.5%	4.9%	0.1%	2.6%
ctx_clock - C.S.T (Clocks)	140	132	132	340	127	127
Normalized	90.71%	96.21%	96.21%	37.35%	100%	100%
Standard Deviation					0.9%	0.9%
Sysbench - Memory (Events/sec)	5175945	6010338	4217483	12329387	18417970	12721098
Normalized	28.1%	32.63%	22.9%	66.94%	100%	69.07%
Standard Deviation	0.5%	0.7%	0.9%	2.4%	0.2%	2.5%
Sysbench - CPU	42353	44946	89257	58856	51046	96941
Normalized	43.69%	46.36%	92.07%	60.71%	52.66%	100%
Standard Deviation	0.2%	0.1%	0.7%	0.4%	0.1%	1.5%
IndigoBench - Bedroom (M samples/s)	2.60	2.94	3.30	3.60	3.56	6.15
Normalized	42.28%	47.8%	53.66%	58.54%	57.89%	100%
Standard Deviation	6.2%	0.3%	0.2%	0.2%	0.3%	0.6%
IndigoBench - Supercar (M samples/s)	5.26	5.94	5.35	7.82	8.38	9.89
Normalized	53.19%	60.06%	54.1%	79.07%	84.73%	100%
Standard Deviation	2%	0.9%	1%	0.4%	0.2%	0.5%
Blender - Barbershop - CPU-Only (sec)	529	506	310	381	400	223
Normalized	42.16%	44.07%	71.94%	58.53%	55.75%	100%
Geekbench - Multi Core (Score)	57436	63248	94474	77272	84937	113882
Normalized	50.43%	55.54%	82.96%	67.85%	74.58%	100%
Standard Deviation	0.8%	1.1%	0.3%	3.4%	0.4%	3.2%
Geekbench - Single Core (Score)	3815	4071	4082	4741	5385	5087
Normalized	70.84%	75.6%	75.8%	88.04%	100%	94.47%
Standard Deviation	0.1%	0.1%	0.2%		0.3%	0.6%
Novabench - CPU (CPU Score)		3136	4909	3061	2944	4494
Normalized		63.88%	100%	62.35%	59.97%	91.55%
Standard Deviation		0.2%	0.6%	0.4%		0.7%
Novabench - RAM (RAM Score)		405	485	309	367	396
Normalized		83.51%	100%	63.71%	75.67%	81.65%
Standard Deviation		0.4%			0.2%	0.1%
Novabench - RAM (MB/s)		29690	28726	7569	12002	8309
Normalized		100%	96.75%	25.49%	40.42%	27.99%
Standard Deviation		1.4%	0.5%	0.1%	1.6%	1.3%

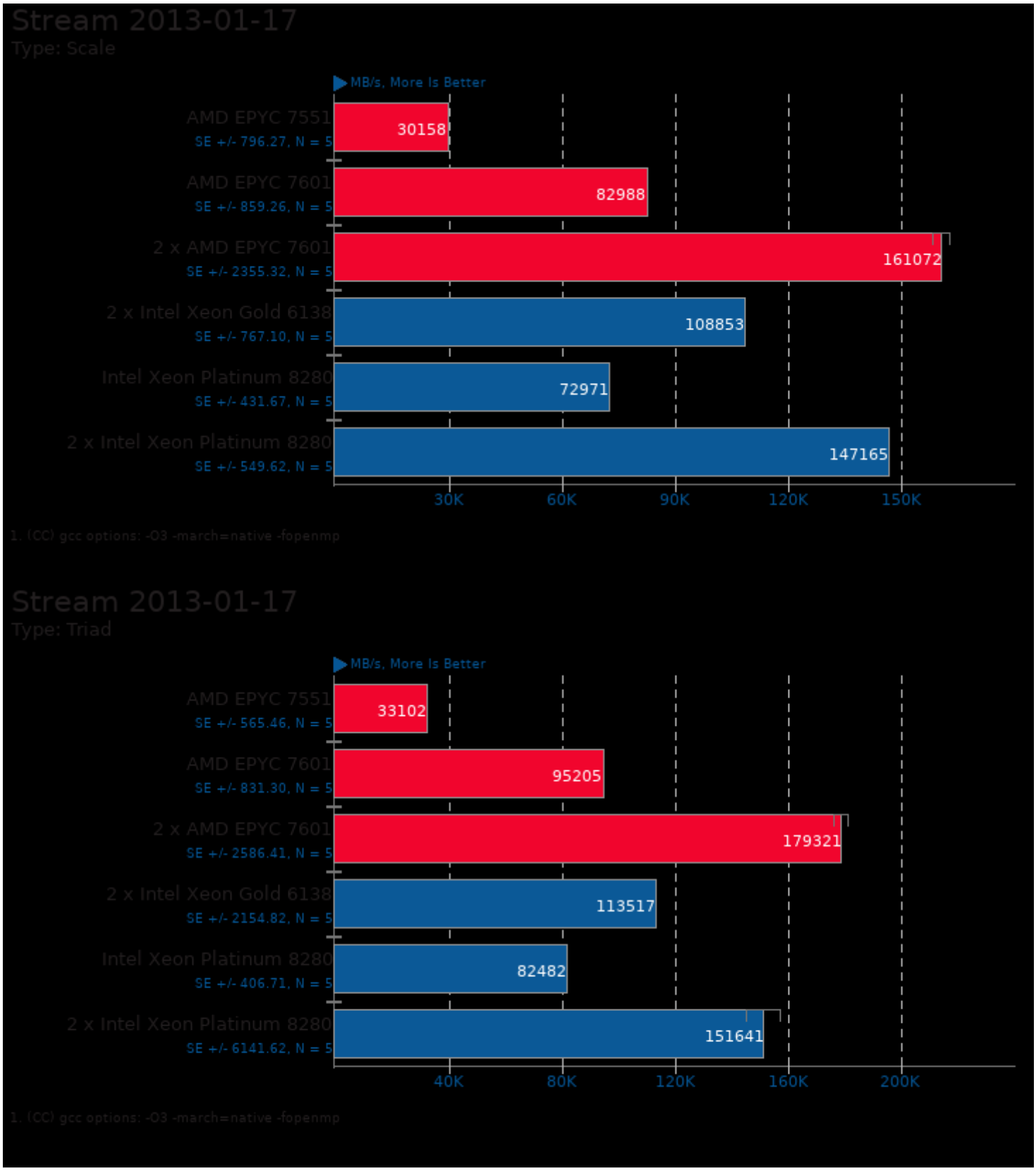
Server CPU Benchmarks Intel Xeon Cascade Lake

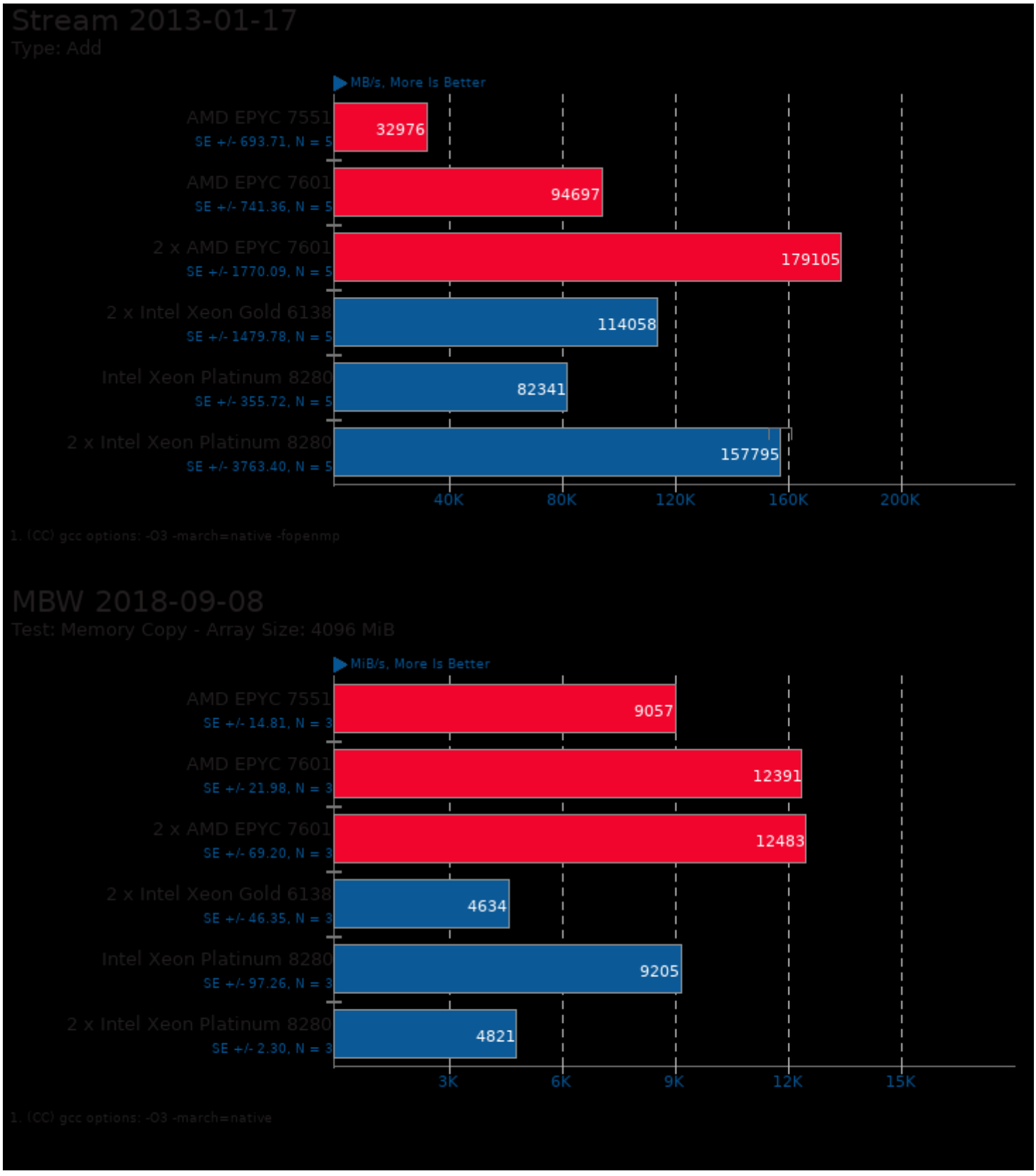
Chaos Group V-RAY - CPU (sec)	38.81	**39.06**	24.75	31.50	31.99	**20.70**
Normalized	53.34%	53%	83.64%	65.71%	64.71%	100%
Standard Deviation	0.2%	0.9%	1.7%	0.3%	0.7%	0.2%
Tesseract OCR - T.T.O.7.I (sec)	**46.18**	42.32	43.43	33.31	**28.15**	32.33
Normalized	60.96%	66.52%	64.82%	84.51%	100%	87.07%
Standard Deviation	0.9%	0.6%	0.4%	0.6%	0.5%	0.3%
Cryptsetup - PBKDF2-whirlpool (Iterations/sec)	**590194**	629146	629399		889646	**891648**
Normalized	66.19%	70.56%	70.59%		99.78%	100%
Standard Deviation	0.2%	0.2%	0.2%		0.5%	0.2%

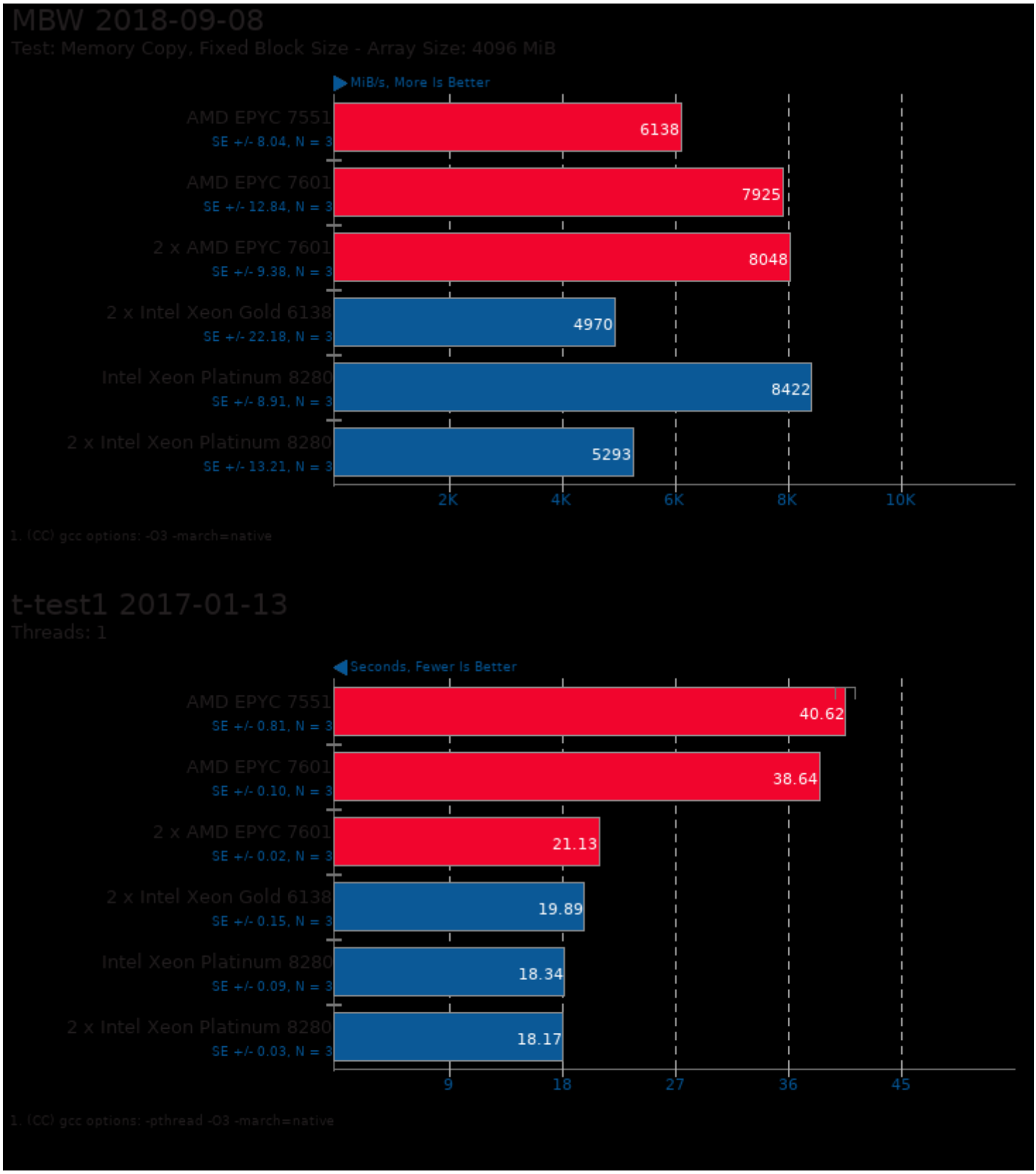

RAMspeed SMP 3.5.0
Type: Add - Benchmark: Integer
MB/s, More Is Better
AMD EPYC 7551
23467
AMD EPYC 7601
34122
2 x AMD EPYC 7601
34276
2 x Intel Xeon Gold 6138
30653
Intel Xeon Platinum 8280
32231
2 x Intel Xeon Platinum 8280
33407
7K
14K
21K
28K
35K
1. (CC) gcc options: -O3 -march=native
RAMspeed SMP 3.5.0
Type: Copy - Benchmark: Integer
MB/s, More Is Better
AMD EPYC 7551
23923
AMD EPYC 7601
28936
2 x AMD EPYC 7601
29178
2 x Intel Xeon Gold 6138
31098
Intel Xeon Platinum 8280
33363
2 x Intel Xeon Platinum 8280
33415
7K
14K
21K
28K
35K
1. (CC) gcc options: -O3 -march=native

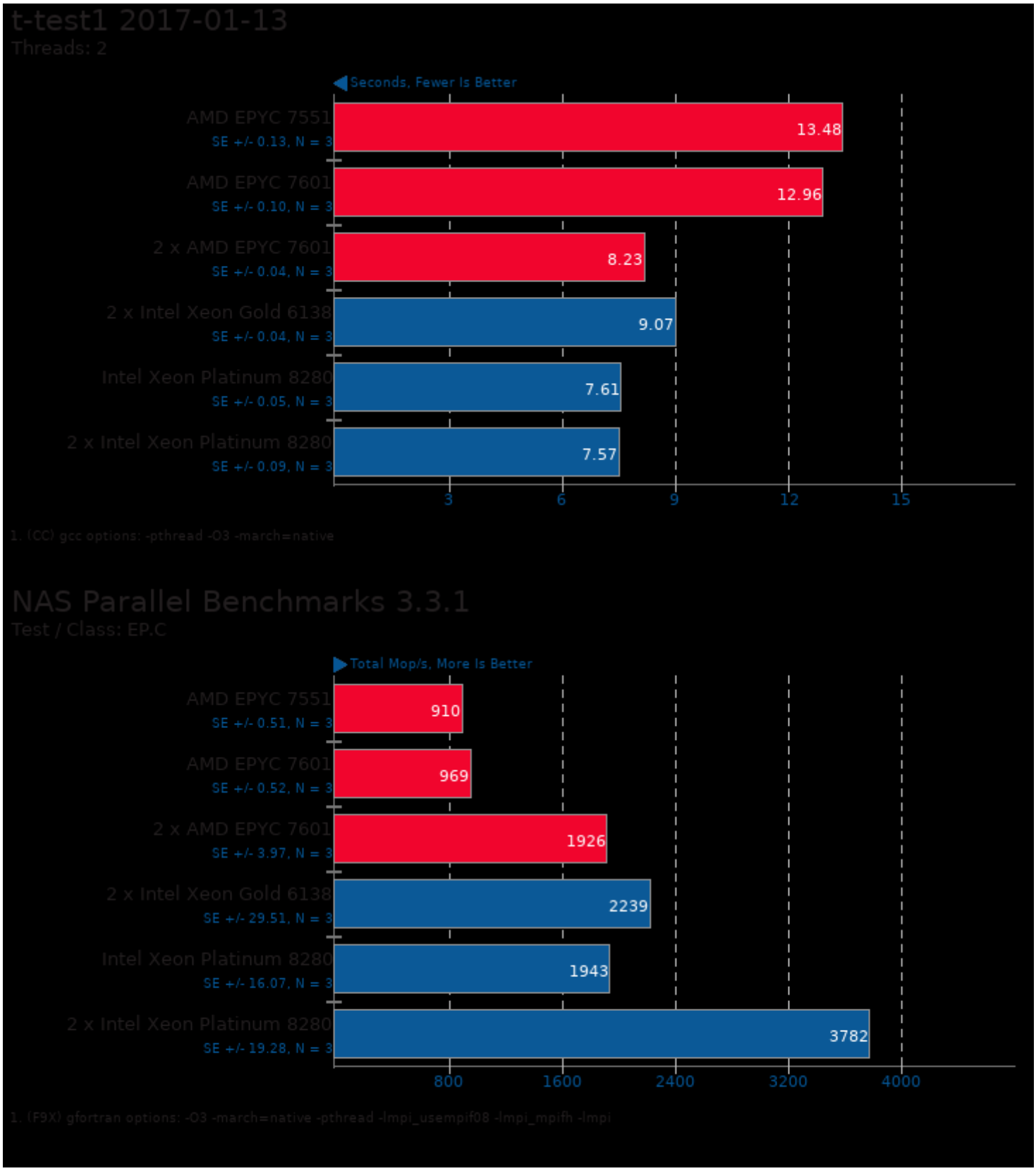

RAMspeed SMP 3.5.0
Type: Scale - Benchmark: Integer
MB/s, More Is Better
AMD EPYC 7551
20053
AMD EPYC 7601
24782
2 x AMD EPYC 7601
26605
2 x Intel Xeon Gold 6138
25816
Intel Xeon Platinum 8280
31834
2 x Intel Xeon Platinum 8280
29740
7K
14K
21K
28K
35K
1. (CC) gcc options: -O3 -march=native
RAMspeed SMP 3.5.0
Type: Triad - Benchmark: Integer
MB/s, More Is Better
AMD EPYC 7551
18391
AMD EPYC 7601
27297
2 x AMD EPYC 7601
28954
2 x Intel Xeon Gold 6138
30028
Intel Xeon Platinum 8280
31463
2 x Intel Xeon Platinum 8280
33274
7K
14K
21K
28K
35K
1. (CC) gcc options: -O3 -march=native

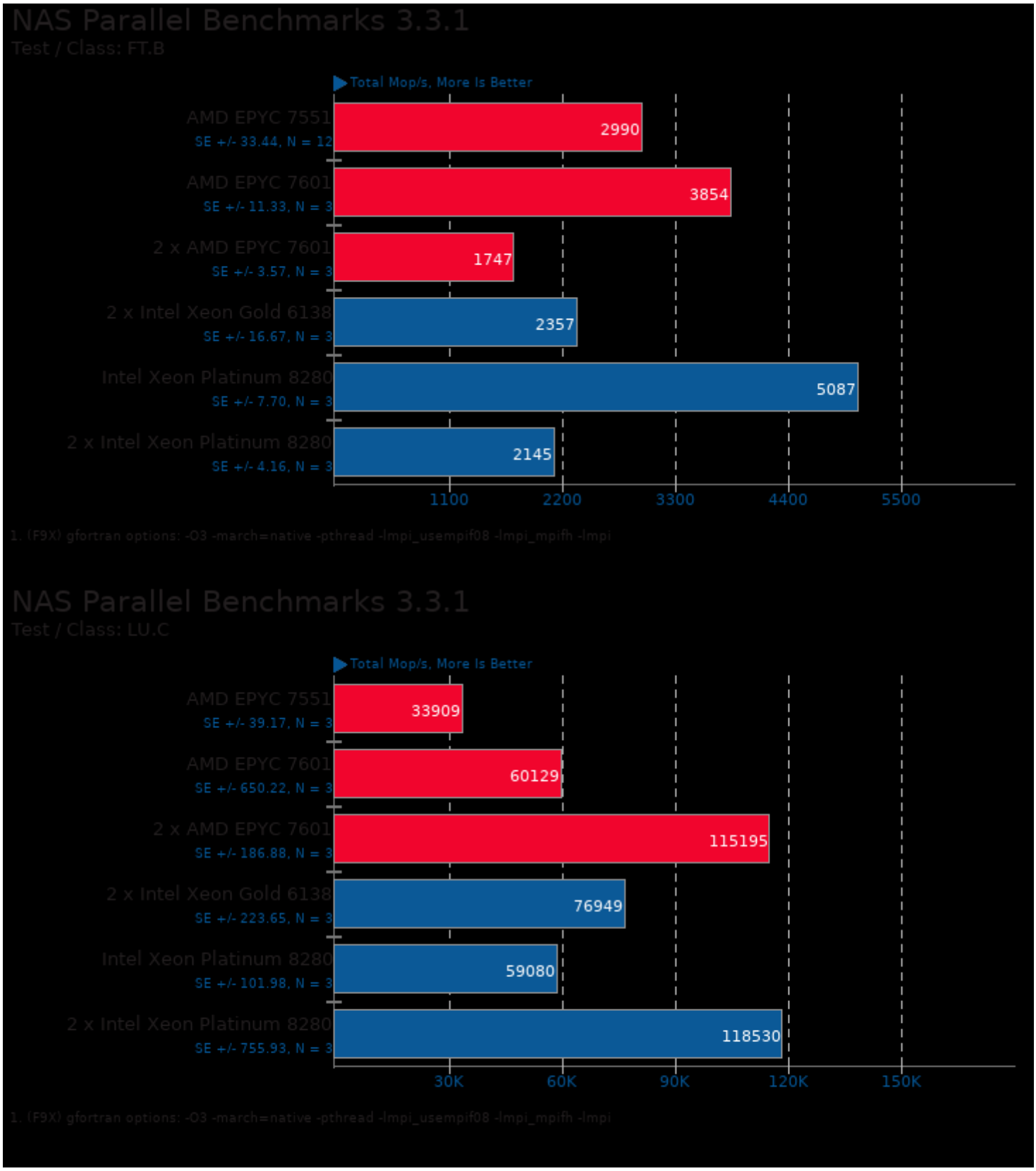

RAMspeed SMP 3.5.0
Type: Average - Benchmark: Integer
MB/s, More Is Better
AMD EPYC 7551
20169
AMD EPYC 7601
28438
2 x AMD EPYC 7601
29994
2 x Intel Xeon Gold 6138
28975
Intel Xeon Platinum 8280
31947
2 x Intel Xeon Platinum 8280
32263
7K
14K
21K
28K
35K
1. (CC) gcc options: -O3 -march=native
Stream 2013-01-17
Type: Copy
MB/s, More Is Better
AMD EPYC 7551
SE +/- 287.50, N = 5
30435
AMD EPYC 7601
SE +/- 730.95, N = 5
82436
2 x AMD EPYC 7601
SE +/- 2002.13, N = 7
160041
2 x Intel Xeon Gold 6138
SE +/- 1535.16, N = 20
130479
Intel Xeon Platinum 8280
SE +/- 646.18, N = 5
103876
2 x Intel Xeon Platinum 8280
SE +/- 4476.92, N = 20
177819
40K
80K
120K
160K
200K
1. (CC) gcc options: -O3 -march=native -fopenmp


Stream 2013-01-17
Type: Scale
MB/s, More Is Better
AMD EPYC 7551
SE +/- 796.27, N = 5
30158
AMD EPYC 7601
SE +/- 859.26, N = 5
82988
2 x AMD EPYC 7601
SE +/- 2355.32, N = 5
161072
2 x Intel Xeon Gold 6138
SE +/- 767.10, N = 5
108853
Intel Xeon Platinum 8280
SE +/- 431.67, N = 5
72971
2 x Intel Xeon Platinum 8280
SE +/- 549.62, N = 5
147165
30K
60K
90K
120K
150K
1. (CC) gcc options: -O3 -march=native -fopenmp
Stream 2013-01-17
Type: Triad
MB/s, More Is Better
AMD EPYC 7551
SE +/- 565.46, N = 5
33102
AMD EPYC 7601
SE +/- 831.30, N = 5
95205
2 x AMD EPYC 7601
SE +/- 2586.41, N = 5
179321
2 x Intel Xeon Gold 6138
SE +/- 2154.82, N = 5
113517
Intel Xeon Platinum 8280
SE +/- 406.71, N = 5
82482
2 x Intel Xeon Platinum 8280
SE +/- 6141.62, N = 5
151641
40K
80K
120K
160K
200K
1. (CC) gcc options: -O3 -march=native -fopenmp


Stream 2013-01-17
Type: Add
MB/s, More Is Better
AMD EPYC 7551
SE +/- 693.71, N = 5
32976
AMD EPYC 7601
SE +/- 741.36, N = 5
94697
2 x AMD EPYC 7601
SE +/- 1770.09, N = 5
179105
2 x Intel Xeon Gold 6138
SE +/- 1479.78, N = 5
114058
Intel Xeon Platinum 8280
SE +/- 355.72, N = 5
82341
2 x Intel Xeon Platinum 8280
SE +/- 3763.40, N = 5
157795
40K
80K
120K
160K
200K
1. (CC) gcc options: -O3 -march=native -fopenmp
MBW 2018-09-08
Test: Memory Copy - Array Size: 4096 MiB
MiB/s, More Is Better
AMD EPYC 7551
SE +/- 14.81, N = 3
9057
AMD EPYC 7601
SE +/- 21.98, N = 3
12391
2 x AMD EPYC 7601
SE +/- 69.20, N = 3
12483
2 x Intel Xeon Gold 6138
SE +/- 46.35, N = 3
4634
Intel Xeon Platinum 8280
SE +/- 97.26, N = 3
9205
2 x Intel Xeon Platinum 8280
SE +/- 2.30, N = 3
4821
3K
6K
9K
12K
15K
1. (CC) gcc options: -O3 -march=native

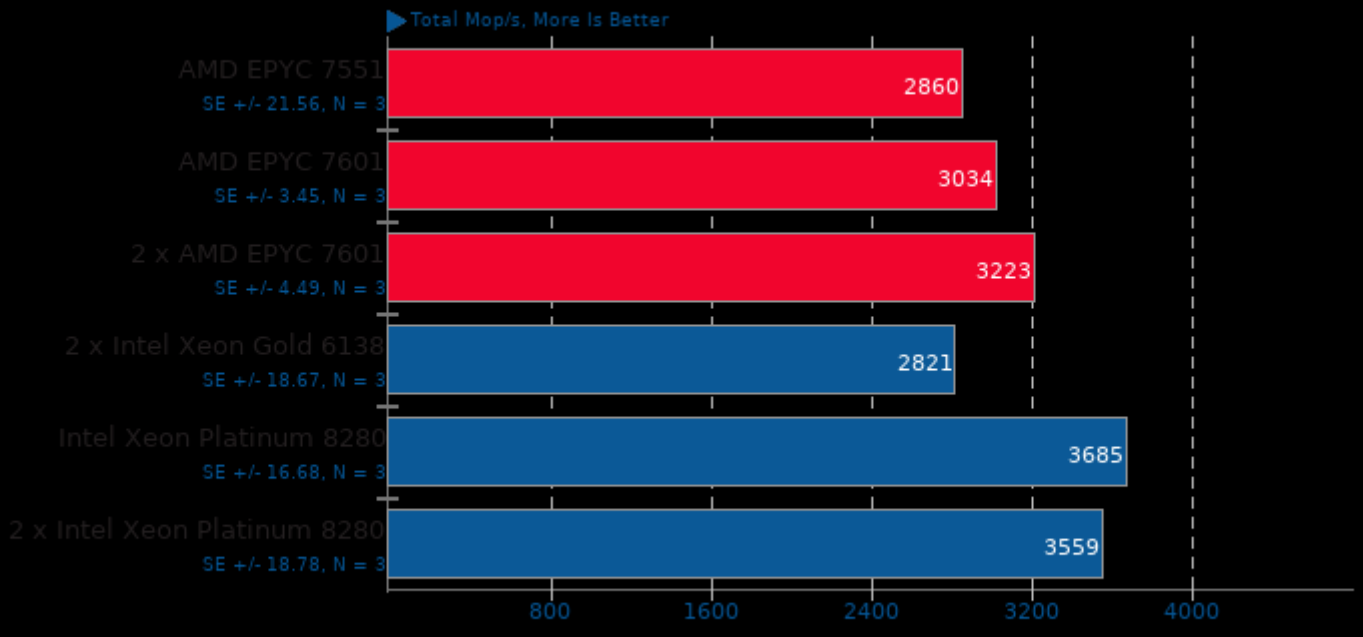

MBW 2018-09-08
Test: Memory Copy, Fixed Block Size - Array Size: 4096 MiB
MiB/s, More Is Better
AMD EPYC 7551
SE +/- 8.04, N = 3
6138
AMD EPYC 7601
SE +/- 12.84, N = 3
7925
2 x AMD EPYC 7601
SE +/- 9.38, N = 3
8048
2 x Intel Xeon Gold 6138
SE +/- 22.18, N = 3
4970
Intel Xeon Platinum 8280
SE +/- 8.91, N = 3
8422
2 x Intel Xeon Platinum 8280
SE +/- 13.21, N = 3
5293
2K
4K
6K
8K
10K
1. (CC) gcc options: -O3 -march=native
t-test1 2017-01-13
Threads: 1
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.81, N = 3
40.62
AMD EPYC 7601
SE +/- 0.10, N = 3
38.64
2 x AMD EPYC 7601
SE +/- 0.02, N = 3
21.13
2 x Intel Xeon Gold 6138
SE +/- 0.15, N = 3
19.89
Intel Xeon Platinum 8280
SE +/- 0.09, N = 3
18.34
2 x Intel Xeon Platinum 8280
SE +/- 0.03, N = 3
18.17
9
18
27
36
45
1. (CC) gcc options: -pthread -O3 -march=native


t-test1 2017-01-13
Threads: 2
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.13, N = 3
13.48
AMD EPYC 7601
SE +/- 0.10, N = 3
12.96
2 x AMD EPYC 7601
SE +/- 0.04, N = 3
8.23
2 x Intel Xeon Gold 6138
SE +/- 0.04, N = 3
9.07
Intel Xeon Platinum 8280
SE +/- 0.05, N = 3
7.61
2 x Intel Xeon Platinum 8280
SE +/- 0.09, N = 3
7.57
3
6
9
12
15
1. (CC) gcc options: -pthread -O3 -march=native
NAS Parallel Benchmarks 3.3.1
Test / Class: EP.C
Total Mop/s, More Is Better
AMD EPYC 7551
SE +/- 0.51, N = 3
910
AMD EPYC 7601
SE +/- 0.52, N = 3
969
2 x AMD EPYC 7601
SE +/- 3.97, N = 3
1926
2 x Intel Xeon Gold 6138
SE +/- 29.51, N = 3
2239
Intel Xeon Platinum 8280
SE +/- 16.07, N = 3
1943
2 x Intel Xeon Platinum 8280
SE +/- 19.28, N = 3
3782
800
1600
2400
3200
4000
1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi


NAS Parallel Benchmarks 3.3.1
Test / Class: FT.B
Total Mop/s, More Is Better
AMD EPYC 7551
SE +/- 33.44, N = 12
2990
AMD EPYC 7601
SE +/- 11.33, N = 3
3854
2 x AMD EPYC 7601
SE +/- 3.57, N = 3
1747
2 x Intel Xeon Gold 6138
SE +/- 16.67, N = 3
2357
Intel Xeon Platinum 8280
SE +/- 7.70, N = 3
5087
2 x Intel Xeon Platinum 8280
SE +/- 4.16, N = 3
2145
1100
2200
3300
4400
5500
1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi
NAS Parallel Benchmarks 3.3.1
Test / Class: LU.C
Total Mop/s, More Is Better
AMD EPYC 7551
SE +/- 39.17, N = 3
33909
AMD EPYC 7601
SE +/- 650.22, N = 3
60129
2 x AMD EPYC 7601
SE +/- 186.88, N = 3
115195
2 x Intel Xeon Gold 6138
SE +/- 223.65, N = 3
76949
Intel Xeon Platinum 8280
SE +/- 101.98, N = 3
59080
2 x Intel Xeon Platinum 8280
SE +/- 755.93, N = 3
118530
30K
60K
90K
120K
150K
1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi

NAS Parallel Benchmarks 3.3.1

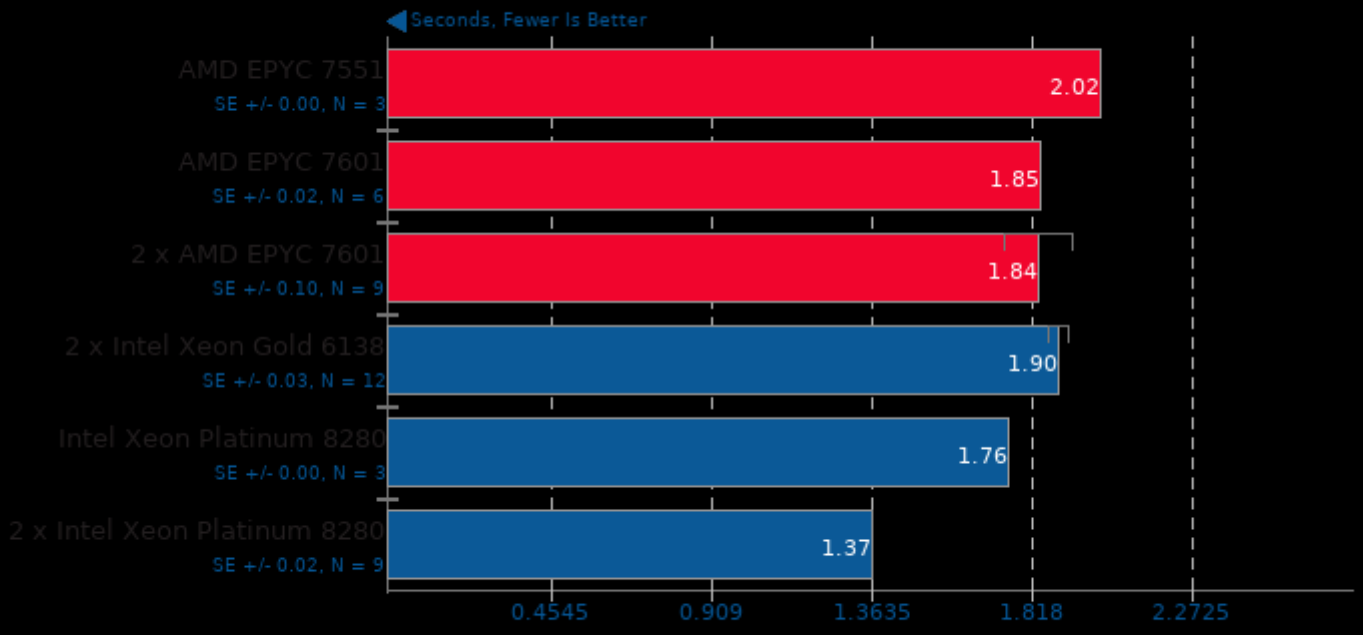
Test / Class: SP.A



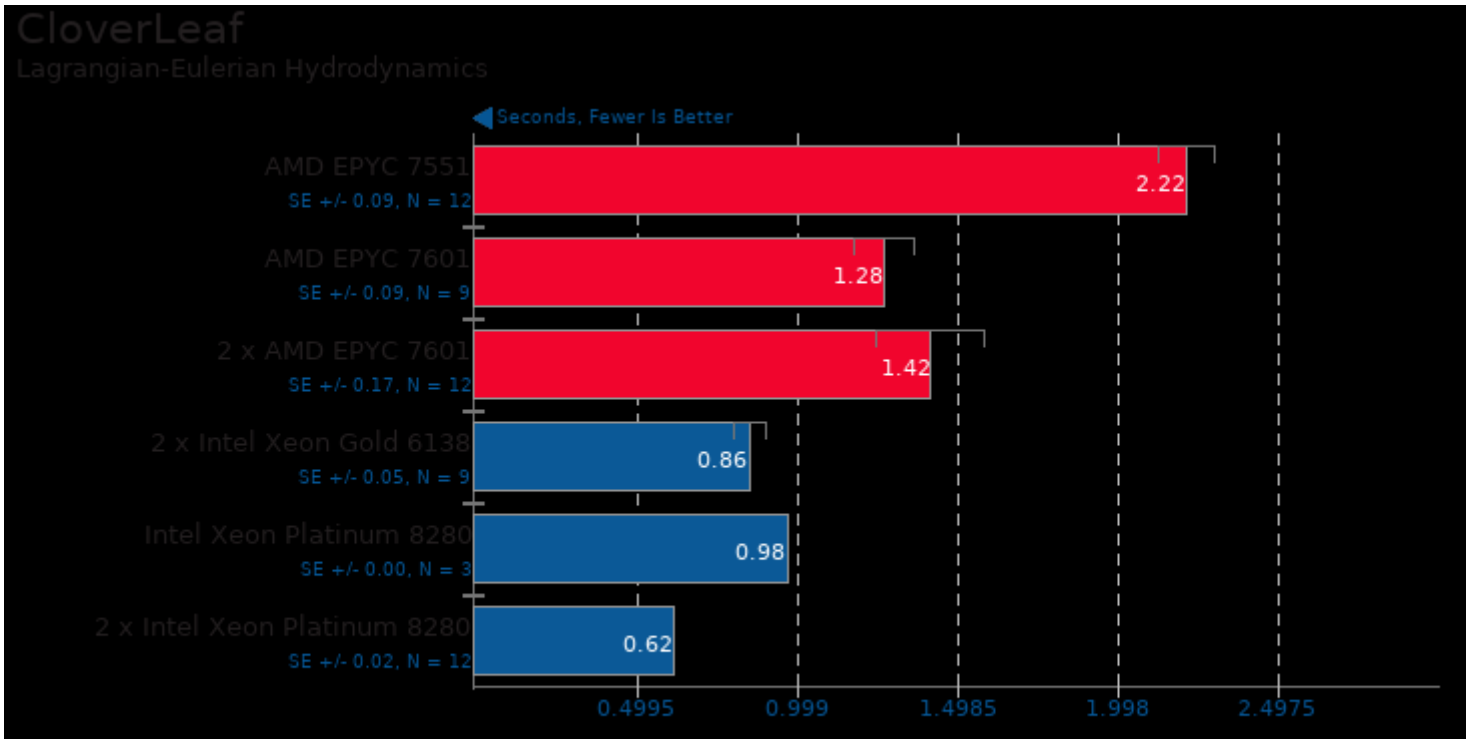
1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi

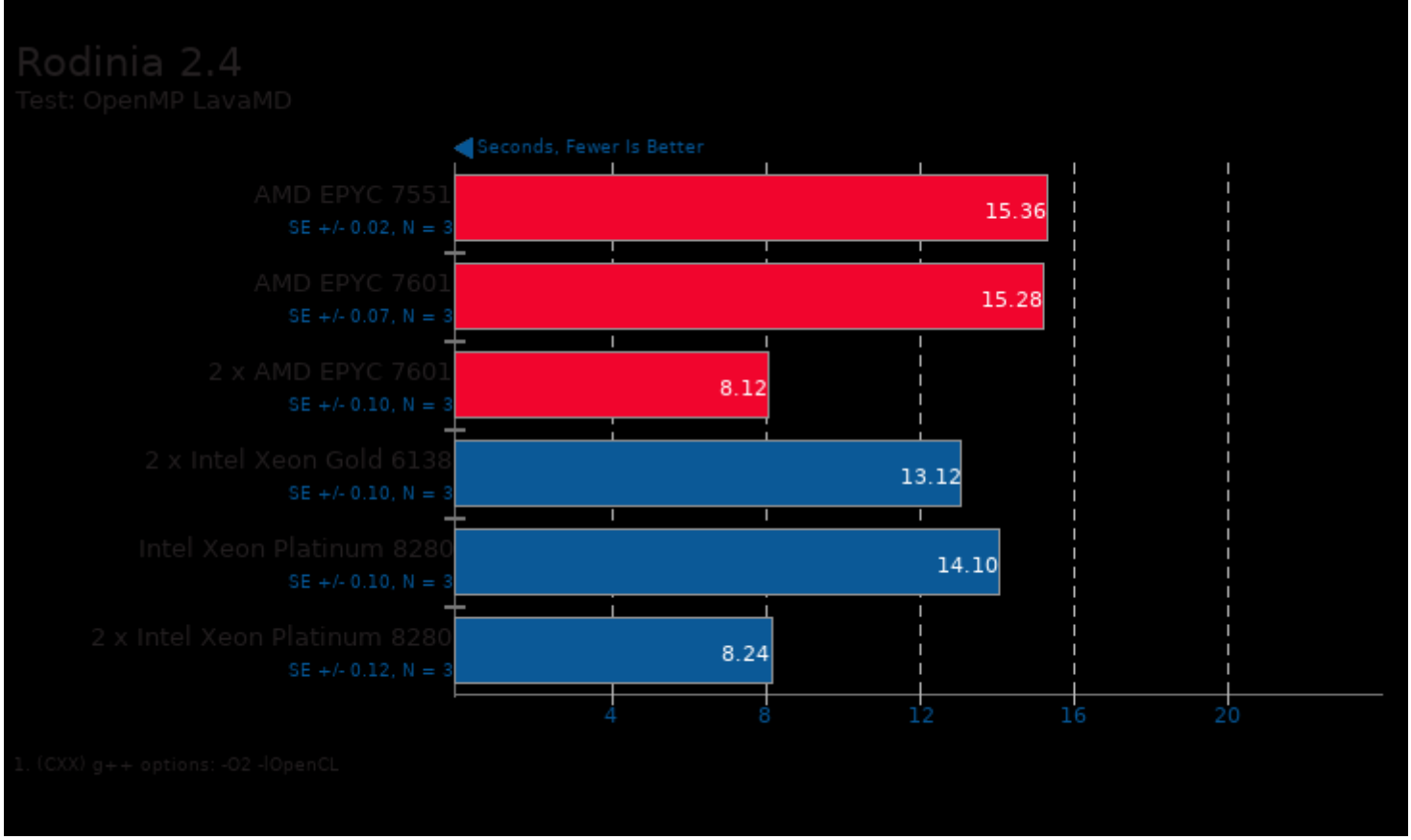
Parboil 2.5

Test: OpenMP CUTCP



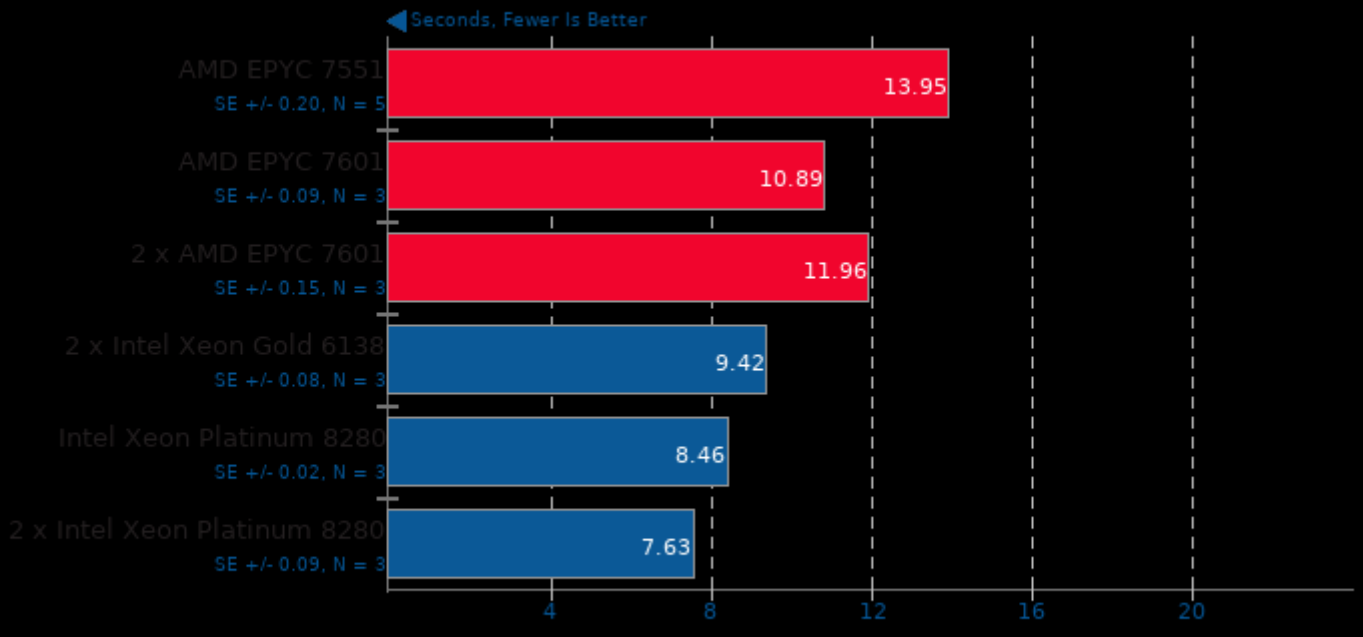
1. (CXX) g++ options: -lm -lpthread -lgomp -O3 -ffast-math -fopenmp


CloverLeaf
Lagrangian-Eulerian Hydrodynamics
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.09, N = 12
2.22
AMD EPYC 7601
SE +/- 0.09, N = 9
1.28
2 x AMD EPYC 7601
SE +/- 0.17, N = 12
1.42
2 x Intel Xeon Gold 6138
SE +/- 0.05, N = 9
0.86
Intel Xeon Platinum 8280
SE +/- 0.00, N = 3
0.98
2 x Intel Xeon Platinum 8280
SE +/- 0.02, N = 12
0.62
0.4995
0.999
1.4985
1.998
2.4975
1. (F9X) gfortran options: -O3 -march=native -funroll-loops -fopenmp


Rodinia 2.4
Test: OpenMP LavaMD
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.02, N = 3
15.36
AMD EPYC 7601
SE +/- 0.07, N = 3
15.28
2 x AMD EPYC 7601
SE +/- 0.10, N = 3
8.12
2 x Intel Xeon Gold 6138
SE +/- 0.10, N = 3
13.12
Intel Xeon Platinum 8280
SE +/- 0.10, N = 3
14.10
2 x Intel Xeon Platinum 8280
SE +/- 0.12, N = 3
8.24
4
8
12
16
20
1. (CXX) g++ options: -O2 -lOpenCL

Rodinia 2.4

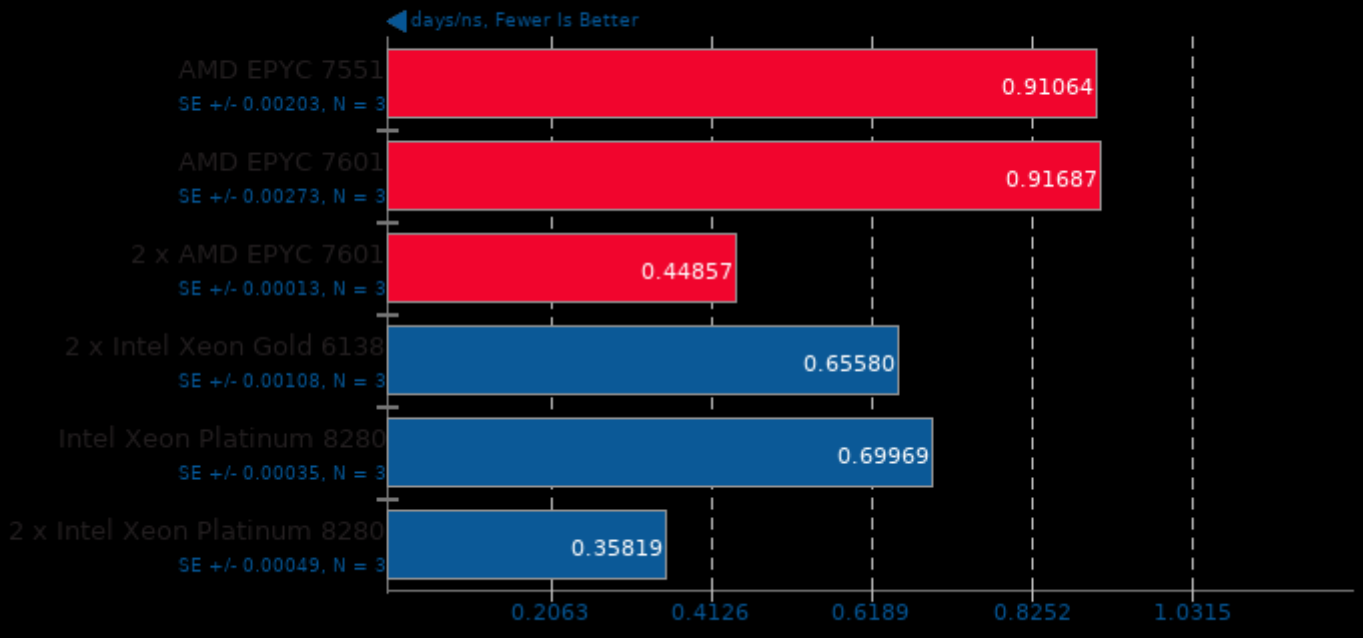
Test: OpenMP CFD Solver

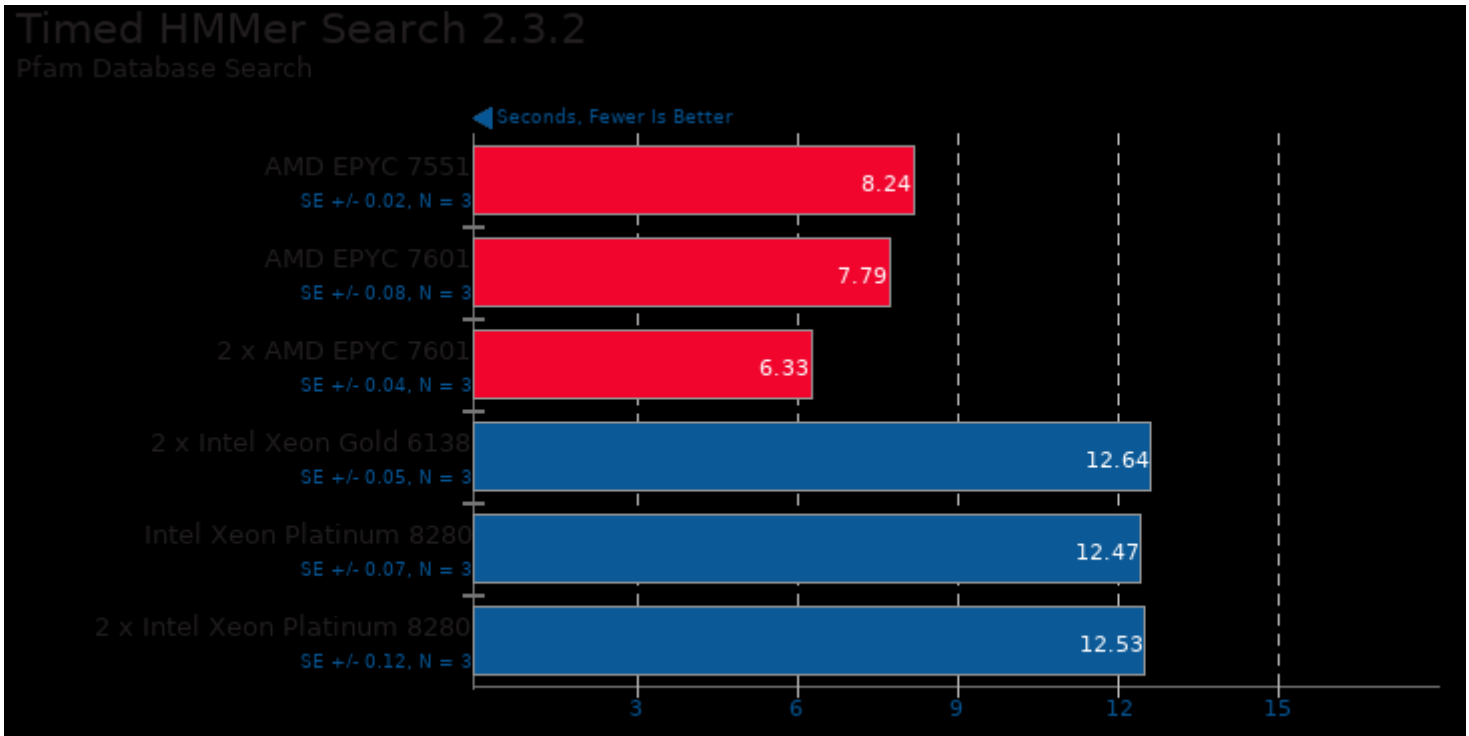


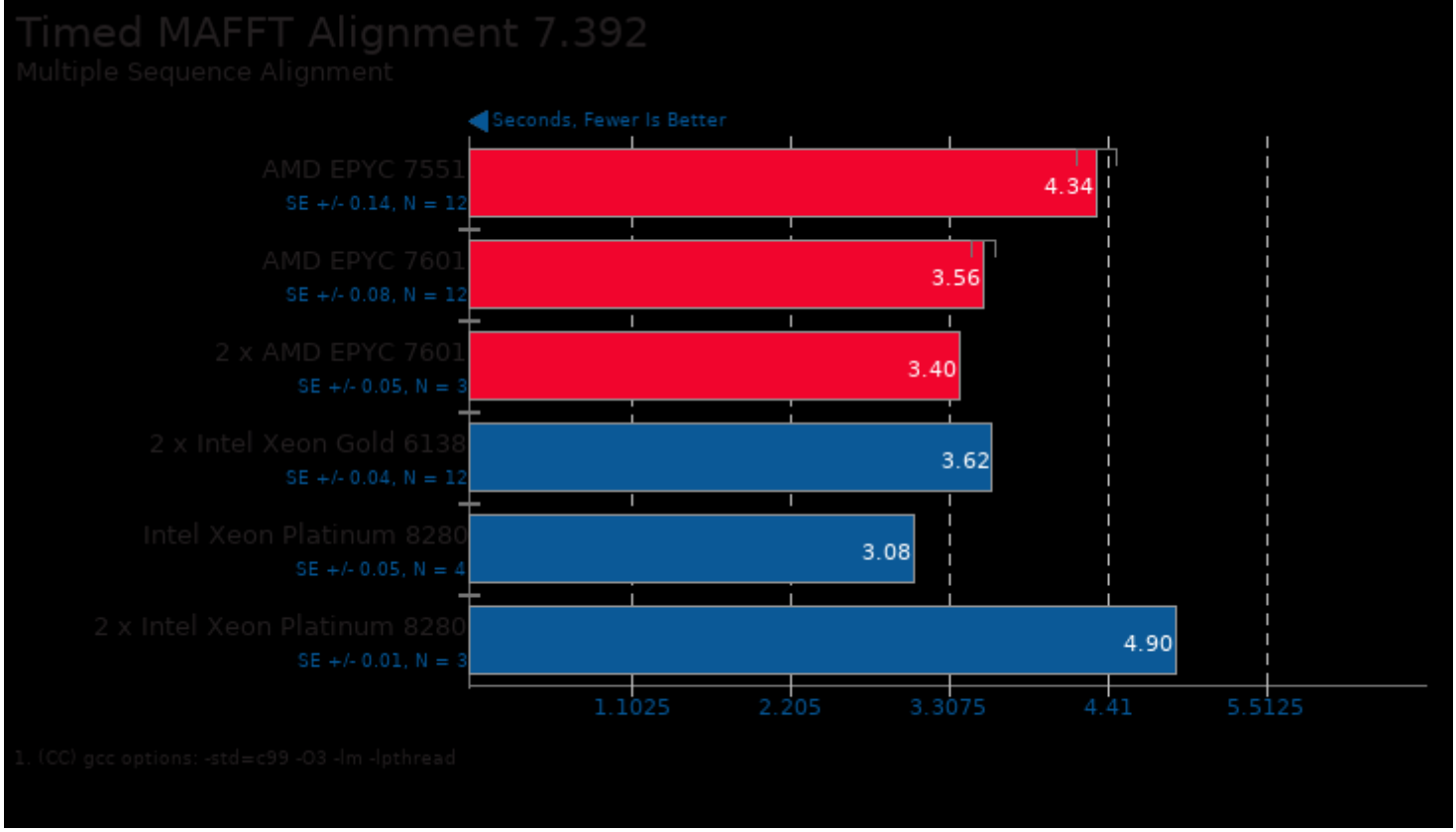
1. (CXX) g++ options: -O2 -lOpenCL

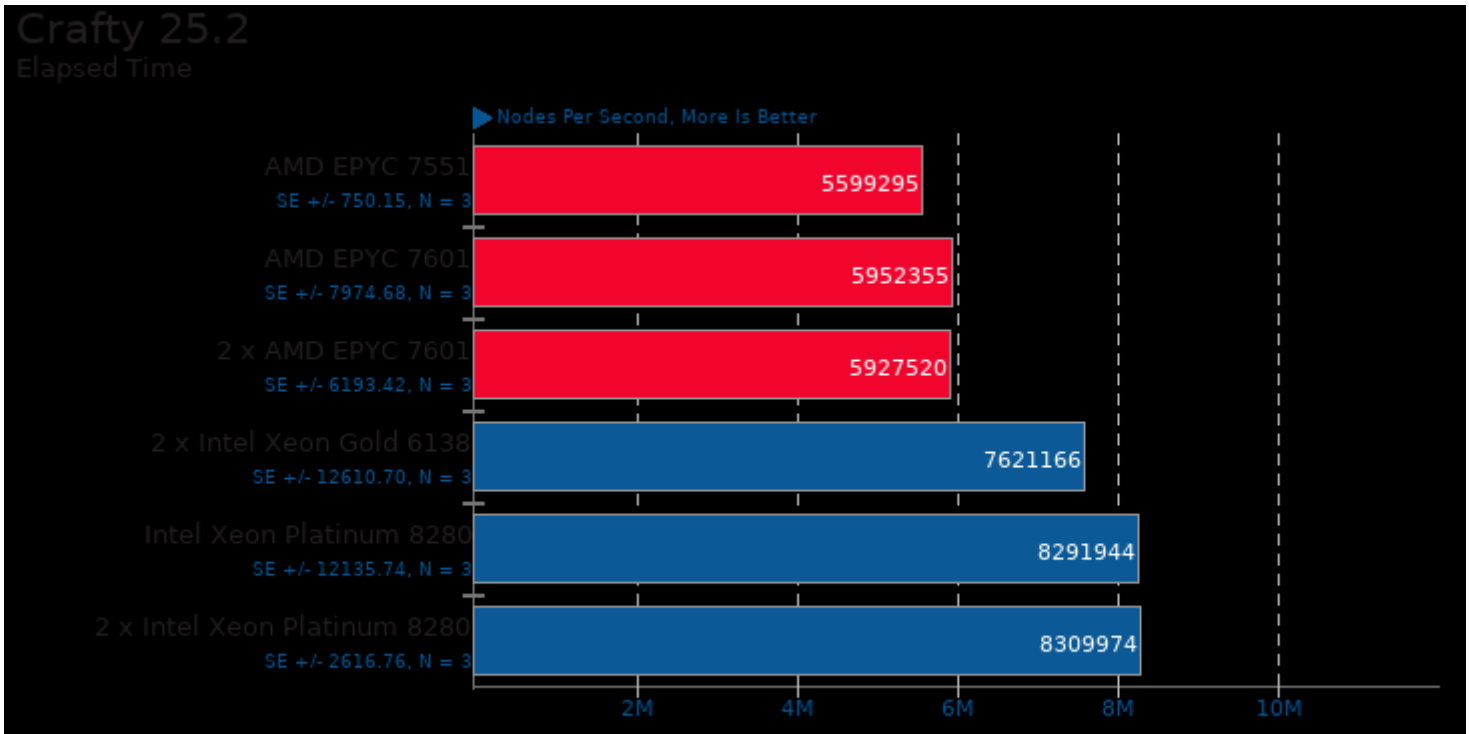
NAMD 2.13b1

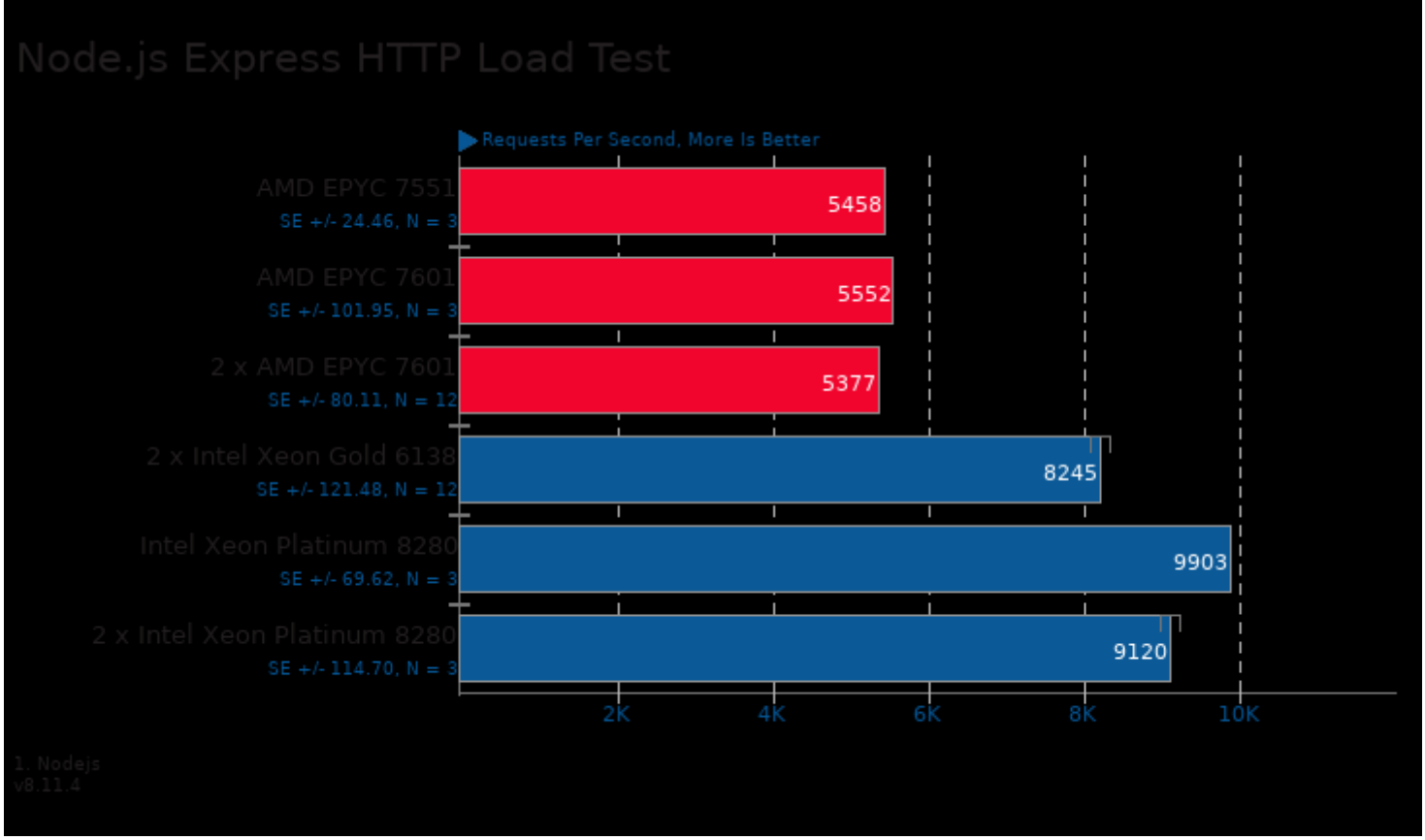
ATPase Simulation - 327,506 Atoms

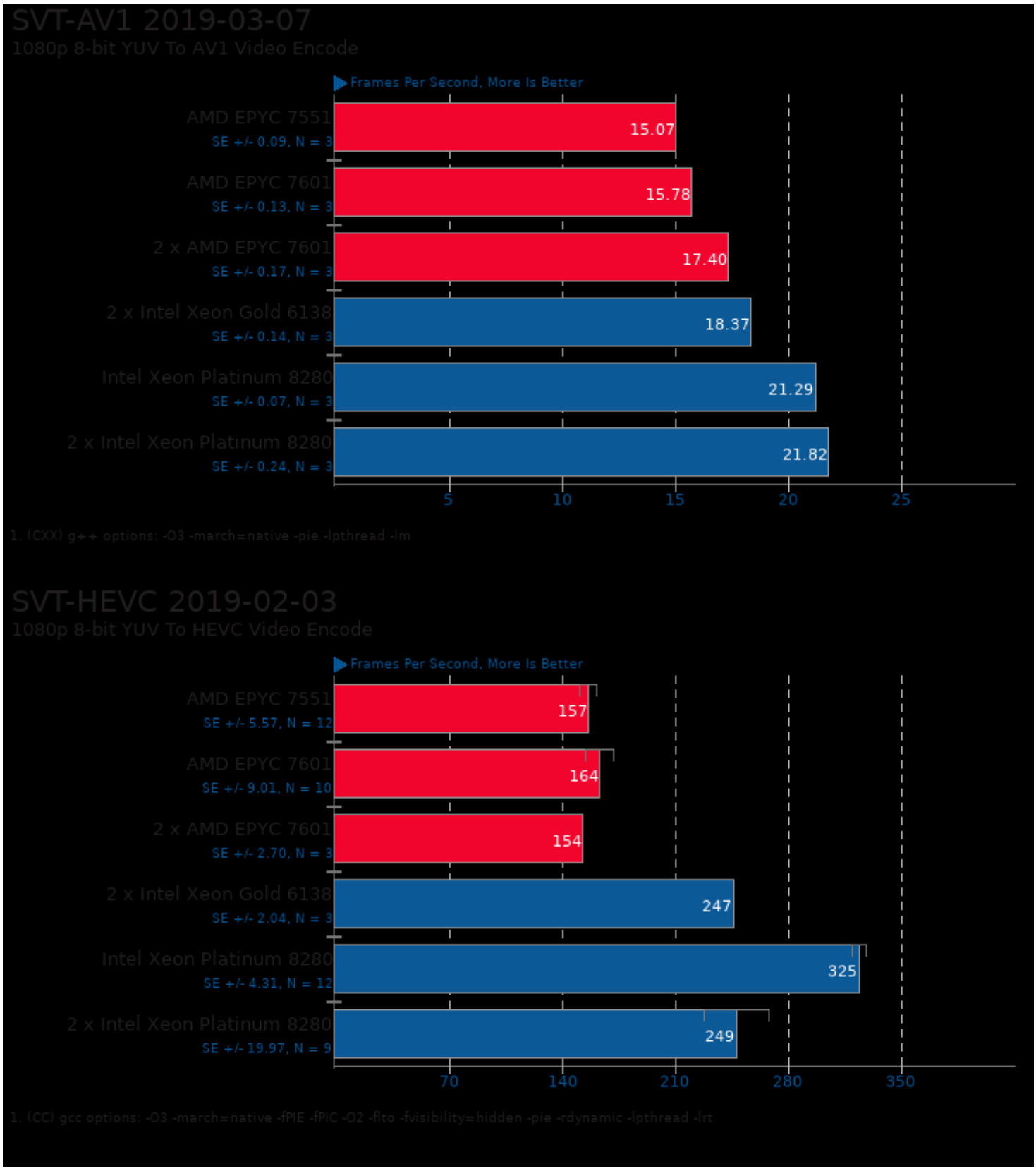


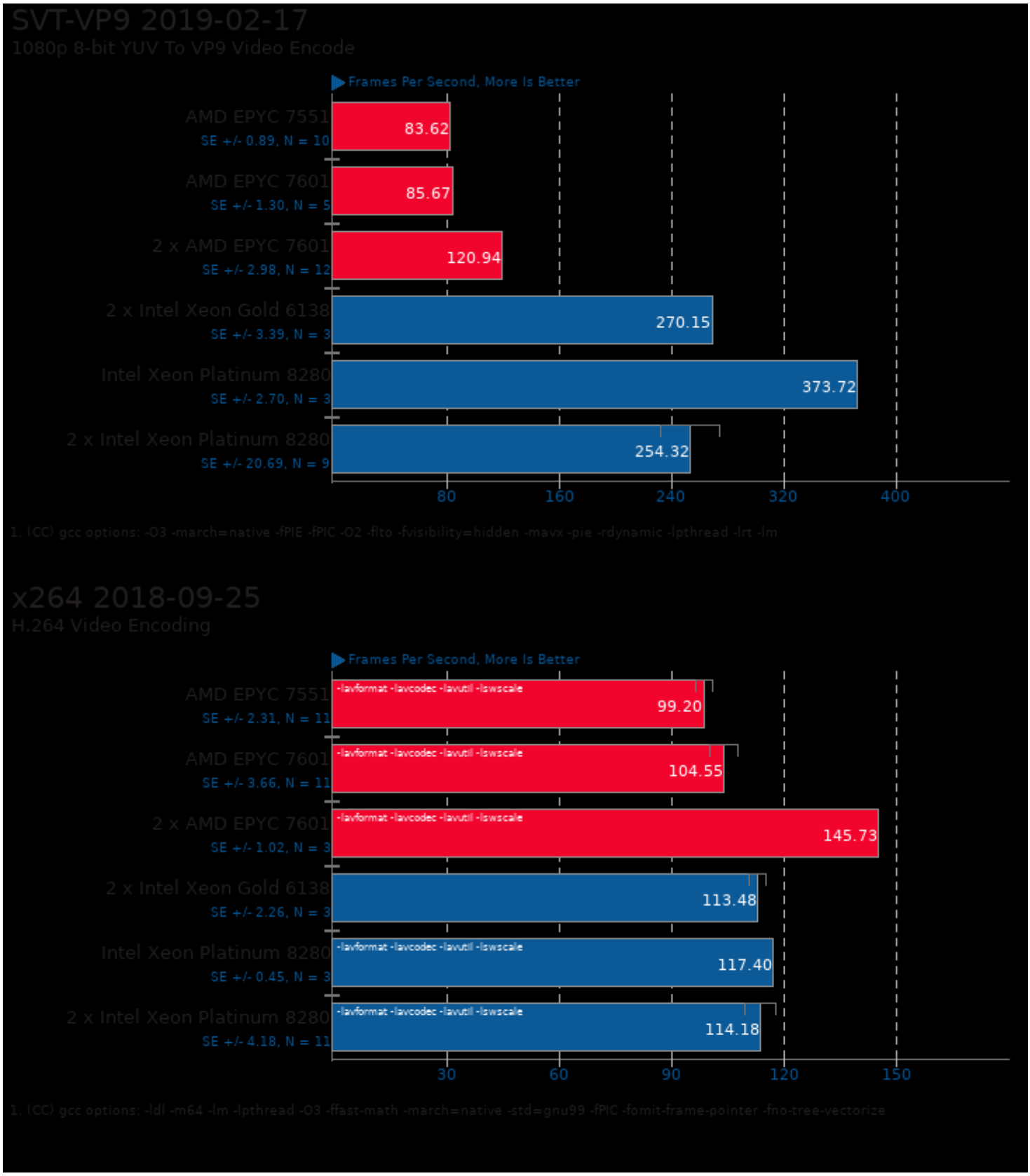

Timed HMMer Search 2.3.2
Pfam Database Search
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.02, N = 3
8.24
AMD EPYC 7601
SE +/- 0.08, N = 3
7.79
2 x AMD EPYC 7601
SE +/- 0.04, N = 3
6.33
2 x Intel Xeon Gold 6138
SE +/- 0.05, N = 3
12.64
Intel Xeon Platinum 8280
SE +/- 0.07, N = 3
12.47
2 x Intel Xeon Platinum 8280
SE +/- 0.12, N = 3
12.53
3
6
9
12
15
1. (CC) gcc options: -O3 -march=native -pthread -lhmmer -lsquid -lm

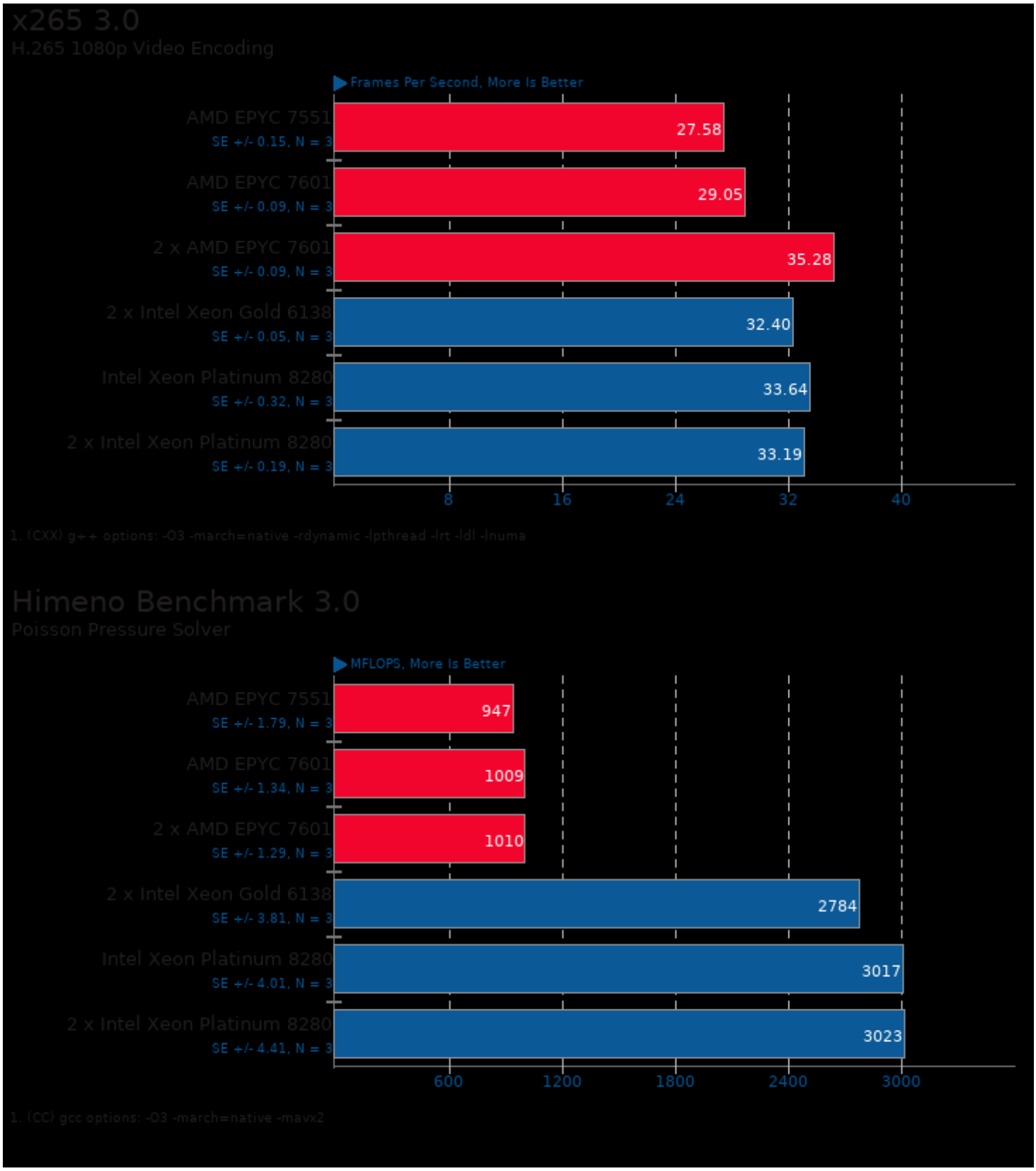

Timed MAFFT Alignment 7.392
Multiple Sequence Alignment
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.14, N = 12
4.34
AMD EPYC 7601
SE +/- 0.08, N = 12
3.56
2 x AMD EPYC 7601
SE +/- 0.05, N = 3
3.40
2 x Intel Xeon Gold 6138
SE +/- 0.04, N = 12
3.62
Intel Xeon Platinum 8280
SE +/- 0.05, N = 4
3.08
2 x Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
4.90
1.1025
2.205
3.3075
4.41
5.5125
1. (CC) gcc options: -std=c99 -O3 -lm -lpthread

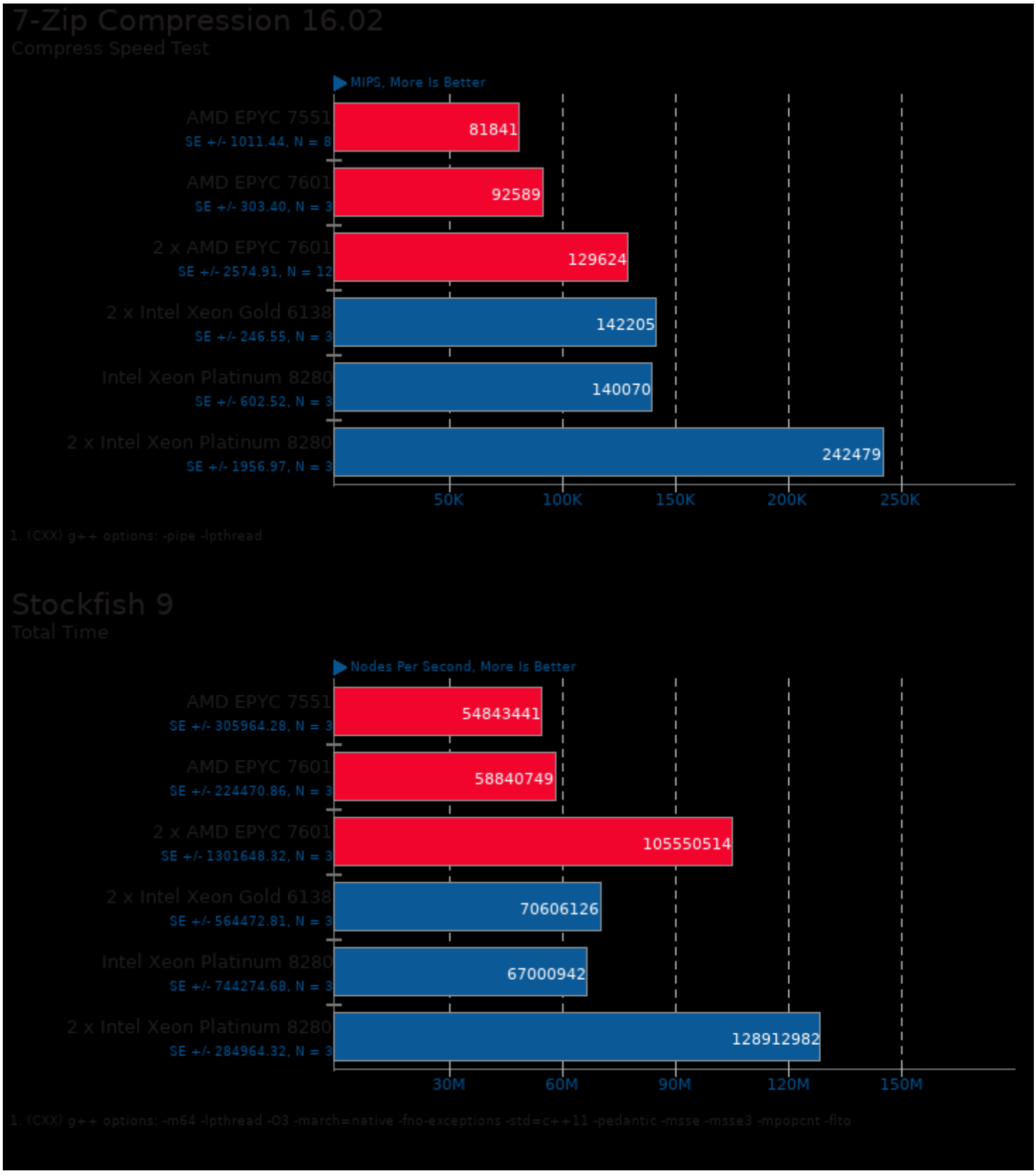

Crafty 25.2
Elapsed Time
Nodes Per Second, More Is Better
AMD EPYC 7551
SE +/- 750.15, N = 3
5599295
AMD EPYC 7601
SE +/- 7974.68, N = 3
5952355
2 x AMD EPYC 7601
SE +/- 6193.42, N = 3
5927520
2 x Intel Xeon Gold 6138
SE +/- 12610.70, N = 3
7621166
Intel Xeon Platinum 8280
SE +/- 12135.74, N = 3
8291944
2 x Intel Xeon Platinum 8280
SE +/- 2616.76, N = 3
8309974
2M
4M
6M
8M
10M
1. (CC) gcc options: -pthread -lstdc++ -fprofile-use -lm

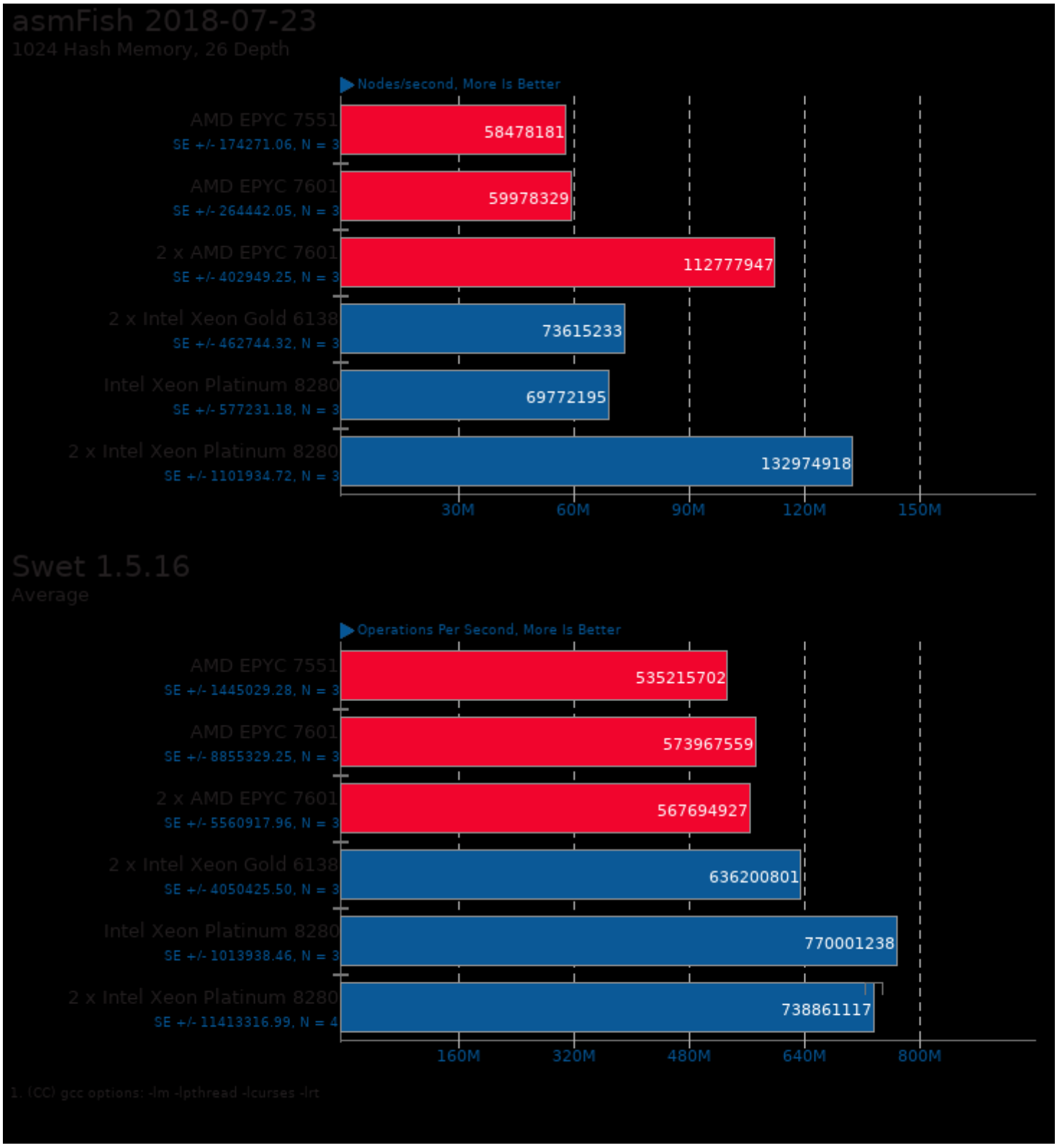

Node.js Express HTTP Load Test
Requests Per Second, More Is Better
AMD EPYC 7551
SE +/- 24.46, N = 3
5458
AMD EPYC 7601
SE +/- 101.95, N = 3
5552
2 x AMD EPYC 7601
SE +/- 80.11, N = 12
5377
2 x Intel Xeon Gold 6138
SE +/- 121.48, N = 12
8245
Intel Xeon Platinum 8280
SE +/- 69.62, N = 3
9903
2 x Intel Xeon Platinum 8280
SE +/- 114.70, N = 3
9120
2K
4K
6K
8K
10K
1. Nodejs
v8.11.4

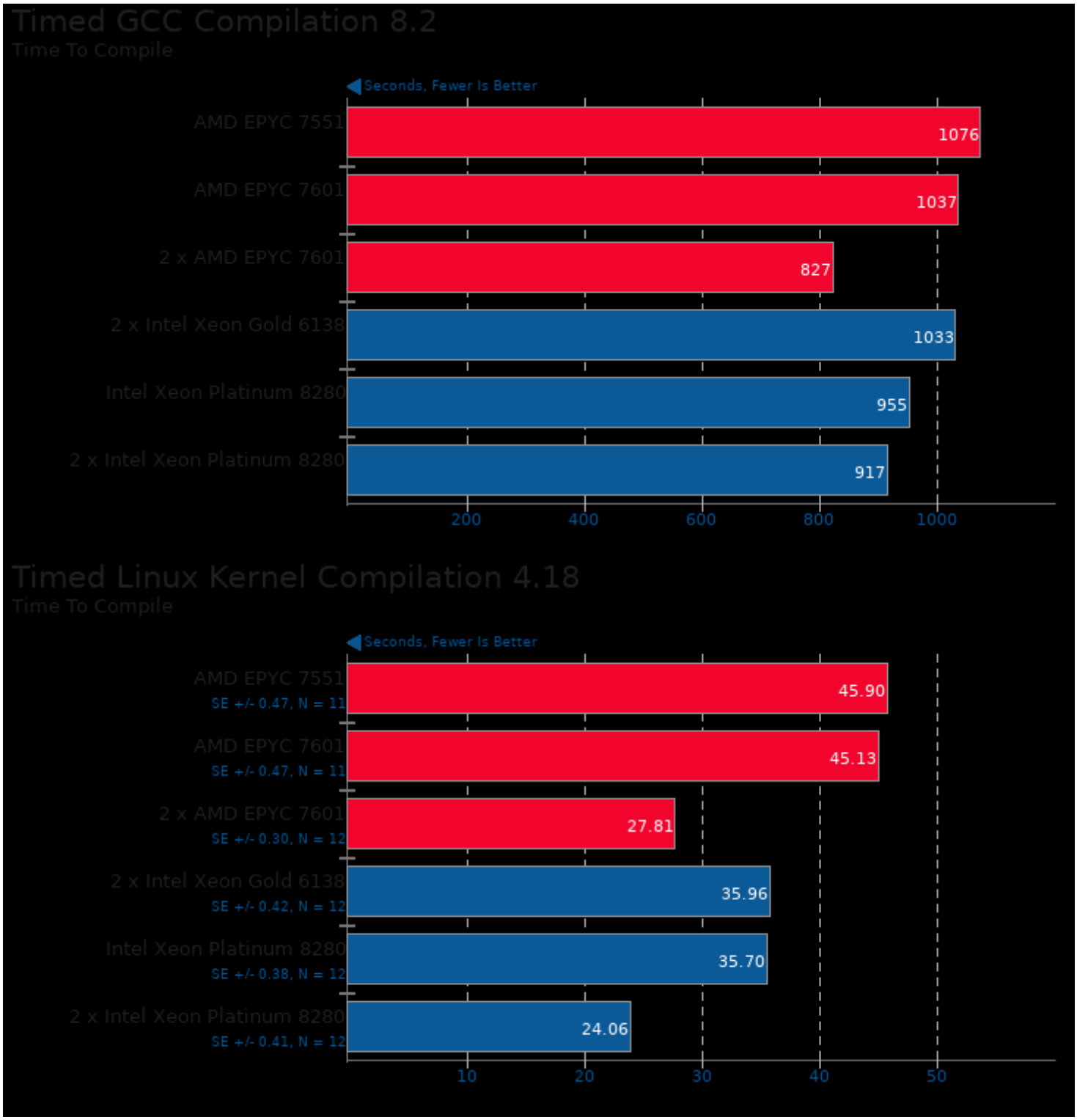

SVT-AV1 2019-03-07
1080p 8-bit YUV To AV1 Video Encode
Frames Per Second, More Is Better
AMD EPYC 7551
SE +/- 0.09, N = 3
15.07
AMD EPYC 7601
SE +/- 0.13, N = 3
15.78
2 x AMD EPYC 7601
SE +/- 0.17, N = 3
17.40
2 x Intel Xeon Gold 6138
SE +/- 0.14, N = 3
18.37
Intel Xeon Platinum 8280
SE +/- 0.07, N = 3
21.29
2 x Intel Xeon Platinum 8280
SE +/- 0.24, N = 3
21.82
5
10
15
20
25
1. (CXX) g++ options: -O3 -march=native -pie -lpthread -lm
SVT-HEVC 2019-02-03
1080p 8-bit YUV To HEVC Video Encode
Frames Per Second, More Is Better
AMD EPYC 7551
SE +/- 5.57, N = 12
157
AMD EPYC 7601
SE +/- 9.01, N = 10
164
2 x AMD EPYC 7601
SE +/- 2.70, N = 3
154
2 x Intel Xeon Gold 6138
SE +/- 2.04, N = 3
247
Intel Xeon Platinum 8280
SE +/- 4.31, N = 12
325
2 x Intel Xeon Platinum 8280
SE +/- 19.97, N = 9
249
70
140
210
280
350
1. (CC) gcc options: -O3 -march=native -fPIE -fPIC -O2 -flto -fvisibility=hidden -pie -rdynamic -lpthread -lrt

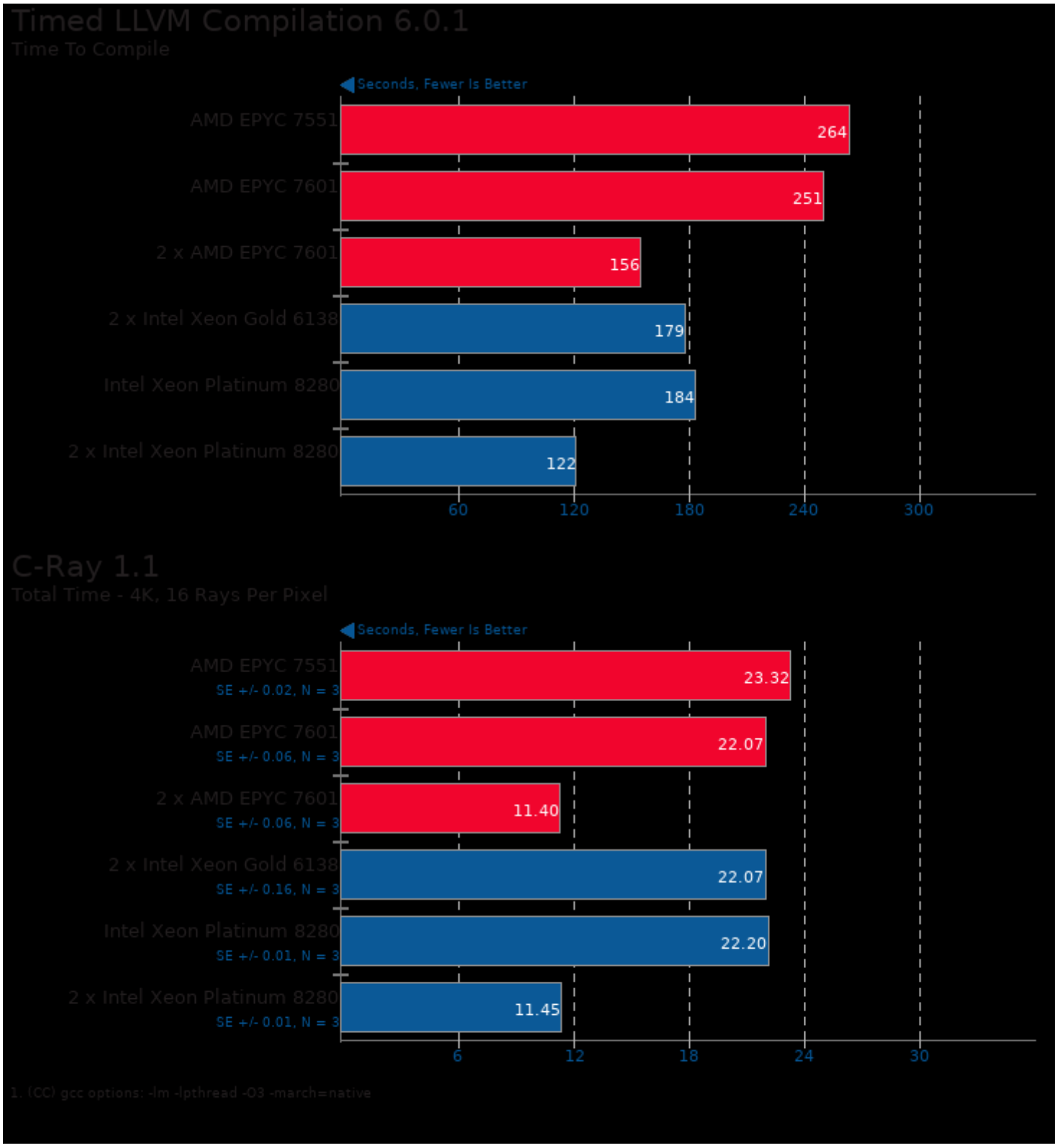

SVT-VP9 2019-02-17
1080p 8-bit YUV To VP9 Video Encode
Frames Per Second, More Is Better
AMD EPYC 7551
SE +/- 0.89, N = 10
83.62
AMD EPYC 7601
SE +/- 1.30, N = 5
85.67
2 x AMD EPYC 7601
SE +/- 2.98, N = 12
120.94
2 x Intel Xeon Gold 6138
SE +/- 3.39, N = 3
270.15
Intel Xeon Platinum 8280
SE +/- 2.70, N = 3
373.72
2 x Intel Xeon Platinum 8280
SE +/- 20.69, N = 9
254.32
80
160
240
320
400
1. (CC) gcc options: -O3 -march=native -fPIE -fPIC -O2 -flto -fvisibility=hidden -mavx -pie -rdynamic -lpthread -lrt -lm
x264 2018-09-25
H.264 Video Encoding
Frames Per Second, More Is Better
AMD EPYC 7551
SE +/- 2.31, N = 11
-lavformat -lavcodec -lavutil -lswscale
99.20
AMD EPYC 7601
SE +/- 3.66, N = 11
-lavformat -lavcodec -lavutil -lswscale
104.55
2 x AMD EPYC 7601
SE +/- 1.02, N = 3
-lavformat -lavcodec -lavutil -lswscale
145.73
2 x Intel Xeon Gold 6138
SE +/- 2.26, N = 3
113.48
Intel Xeon Platinum 8280
SE +/- 0.45, N = 3
-lavformat -lavcodec -lavutil -lswscale
117.40
2 x Intel Xeon Platinum 8280
SE +/- 4.18, N = 11
-lavformat -lavcodec -lavutil -lswscale
114.18
30
60
90
120
150
1. (CC) gcc options: -ldl -m64 -lm -lpthread -O3 -ffast-math -march=native -std=gnu99 -fPIC -fomit-frame-pointer -fno-tree-vectorize

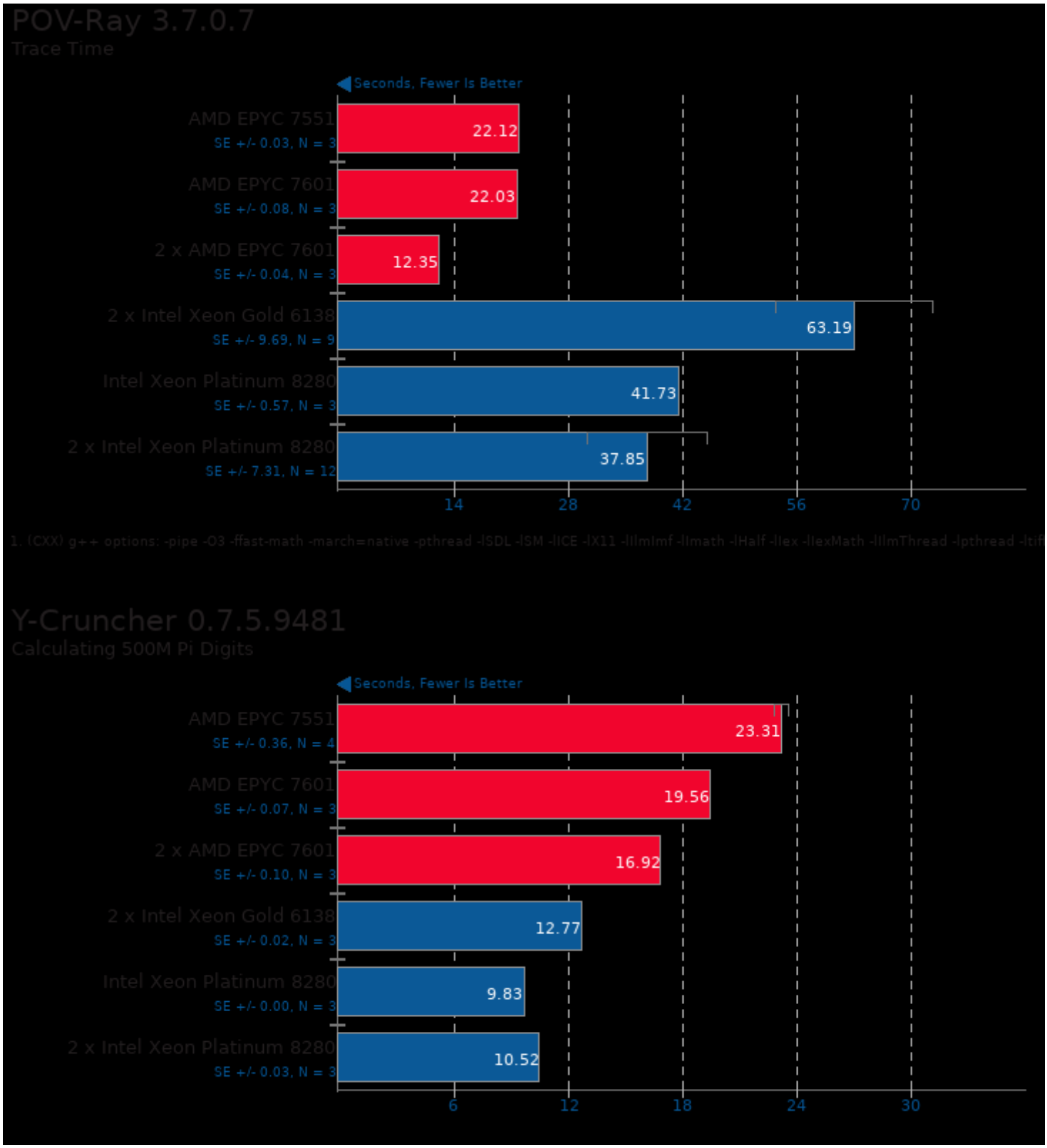

x265 3.0
H.265 1080p Video Encoding
Frames Per Second, More Is Better
AMD EPYC 7551
SE +/- 0.15, N = 3
27.58
AMD EPYC 7601
SE +/- 0.09, N = 3
29.05
2 x AMD EPYC 7601
SE +/- 0.09, N = 3
35.28
2 x Intel Xeon Gold 6138
SE +/- 0.05, N = 3
32.40
Intel Xeon Platinum 8280
SE +/- 0.32, N = 3
33.64
2 x Intel Xeon Platinum 8280
SE +/- 0.19, N = 3
33.19
8
16
24
32
40
1. (CXX) g++ options: -O3 -march=native -rdynamic -lpthread -lrt -ldl -lnuma
Himeno Benchmark 3.0
Poisson Pressure Solver
MFLOPS, More Is Better
AMD EPYC 7551
SE +/- 1.79, N = 3
947
AMD EPYC 7601
SE +/- 1.34, N = 3
1009
2 x AMD EPYC 7601
SE +/- 1.29, N = 3
1010
2 x Intel Xeon Gold 6138
SE +/- 3.81, N = 3
2784
Intel Xeon Platinum 8280
SE +/- 4.01, N = 3
3017
2 x Intel Xeon Platinum 8280
SE +/- 4.41, N = 3
3023
600
1200
1800
2400
3000
1. (CC) gcc options: -O3 -march=native -mavx2

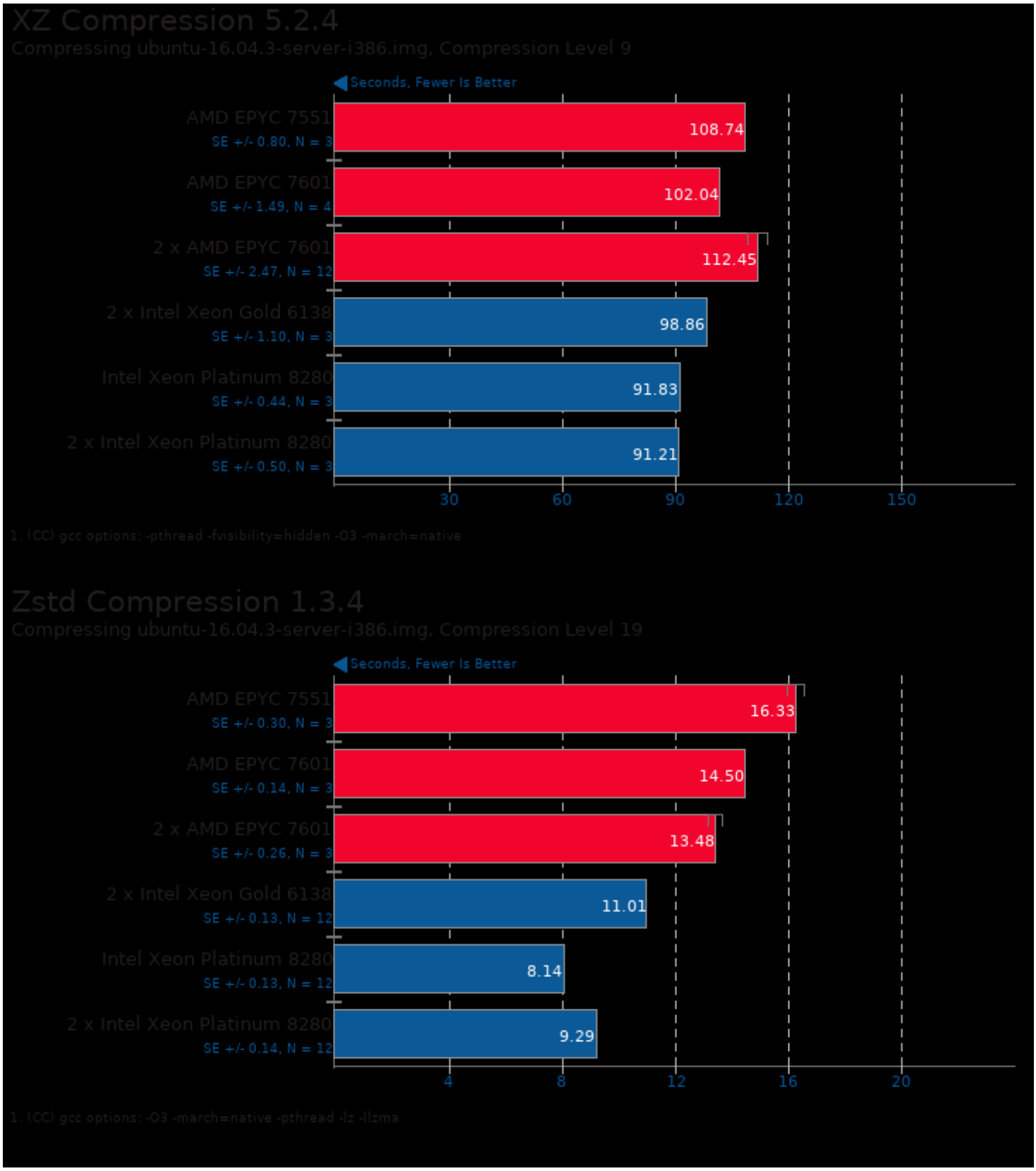

7-Zip Compression 16.02
Compress Speed Test
MIPS, More Is Better
AMD EPYC 7551
SE +/- 1011.44, N = 8
81841
AMD EPYC 7601
SE +/- 303.40, N = 3
92589
2 x AMD EPYC 7601
SE +/- 2574.91, N = 12
129624
2 x Intel Xeon Gold 6138
SE +/- 246.55, N = 3
142205
Intel Xeon Platinum 8280
SE +/- 602.52, N = 3
140070
2 x Intel Xeon Platinum 8280
SE +/- 1956.97, N = 3
242479
50K
100K
150K
200K
250K
1. (CXX) g++ options: -pipe -lpthread
Stockfish 9
Total Time
Nodes Per Second, More Is Better
AMD EPYC 7551
SE +/- 305964.28, N = 3
54843441
AMD EPYC 7601
SE +/- 224470.86, N = 3
58840749
2 x AMD EPYC 7601
SE +/- 1301648.32, N = 3
105550514
2 x Intel Xeon Gold 6138
SE +/- 564472.81, N = 3
70606126
Intel Xeon Platinum 8280
SE +/- 744274.68, N = 3
67000942
2 x Intel Xeon Platinum 8280
SE +/- 284964.32, N = 3
128912982
30M
60M
90M
120M
150M
1. (CXX) g++ options: -m64 -lpthread -O3 -march=native -fno-exceptions -std=c++11 -pedantic -msse -msse3 -mpopcnt -flto

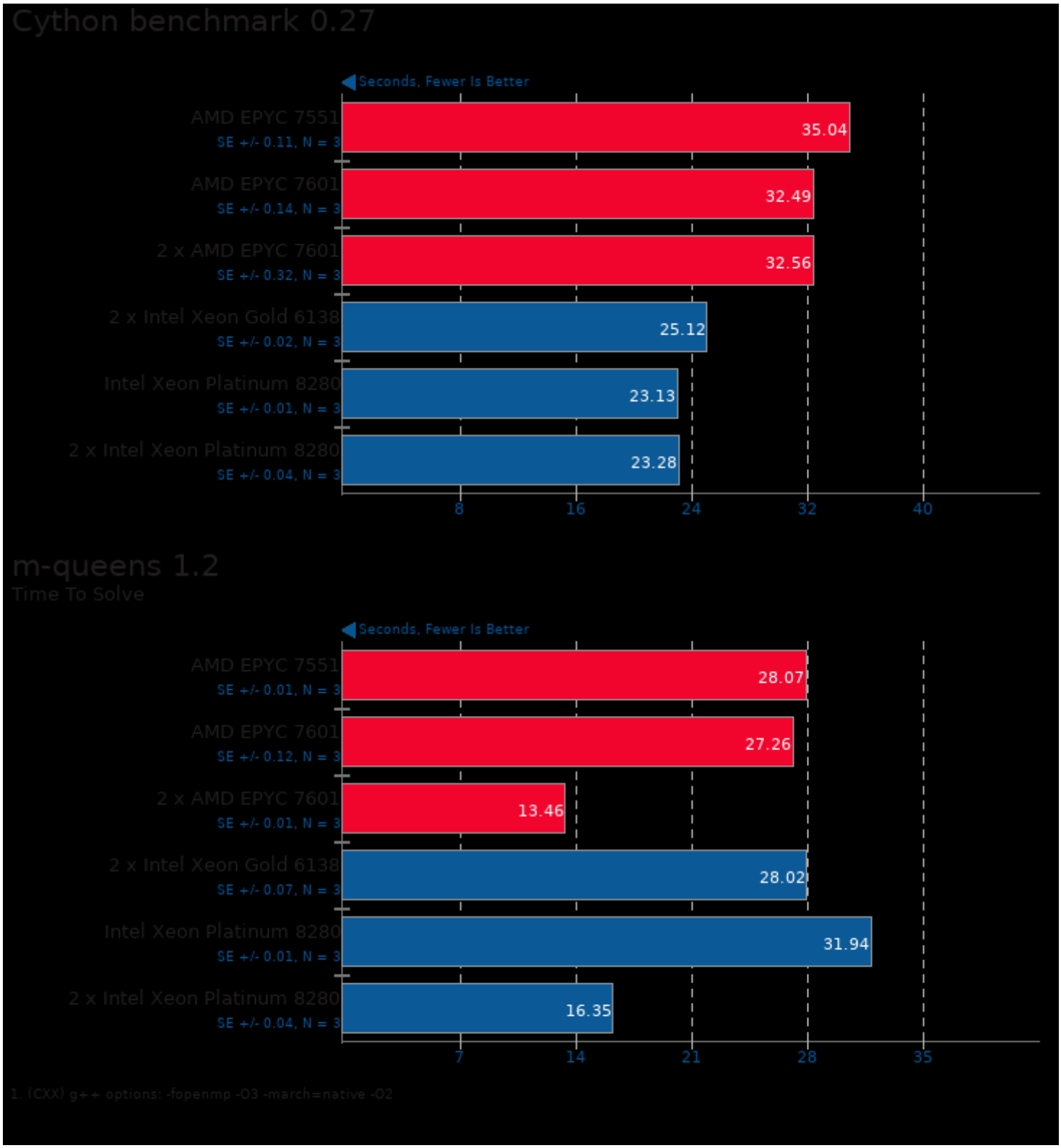

asmFish 2018-07-23
1024 Hash Memory, 26 Depth
Nodes/second, More Is Better
AMD EPYC 7551
SE +/- 174271.06, N = 3
58478181
AMD EPYC 7601
SE +/- 264442.05, N = 3
59978329
2 x AMD EPYC 7601
SE +/- 402949.25, N = 3
112777947
2 x Intel Xeon Gold 6138
SE +/- 462744.32, N = 3
73615233
Intel Xeon Platinum 8280
SE +/- 577231.18, N = 3
69772195
2 x Intel Xeon Platinum 8280
SE +/- 1101934.72, N = 3
132974918
30M
60M
90M
120M
150M
Swet 1.5.16
Average
Operations Per Second, More Is Better
AMD EPYC 7551
SE +/- 1445029.28, N = 3
535215702
AMD EPYC 7601
SE +/- 8855329.25, N = 3
573967559
2 x AMD EPYC 7601
SE +/- 5560917.96, N = 3
567694927
2 x Intel Xeon Gold 6138
SE +/- 4050425.50, N = 3
636200801
Intel Xeon Platinum 8280
SE +/- 1013938.46, N = 3
770001238
2 x Intel Xeon Platinum 8280
SE +/- 11413316.99, N = 4
738861117
160M
320M
480M
640M
800M
1. (CC) gcc options: -lm -lpthread -lcurses -lrt

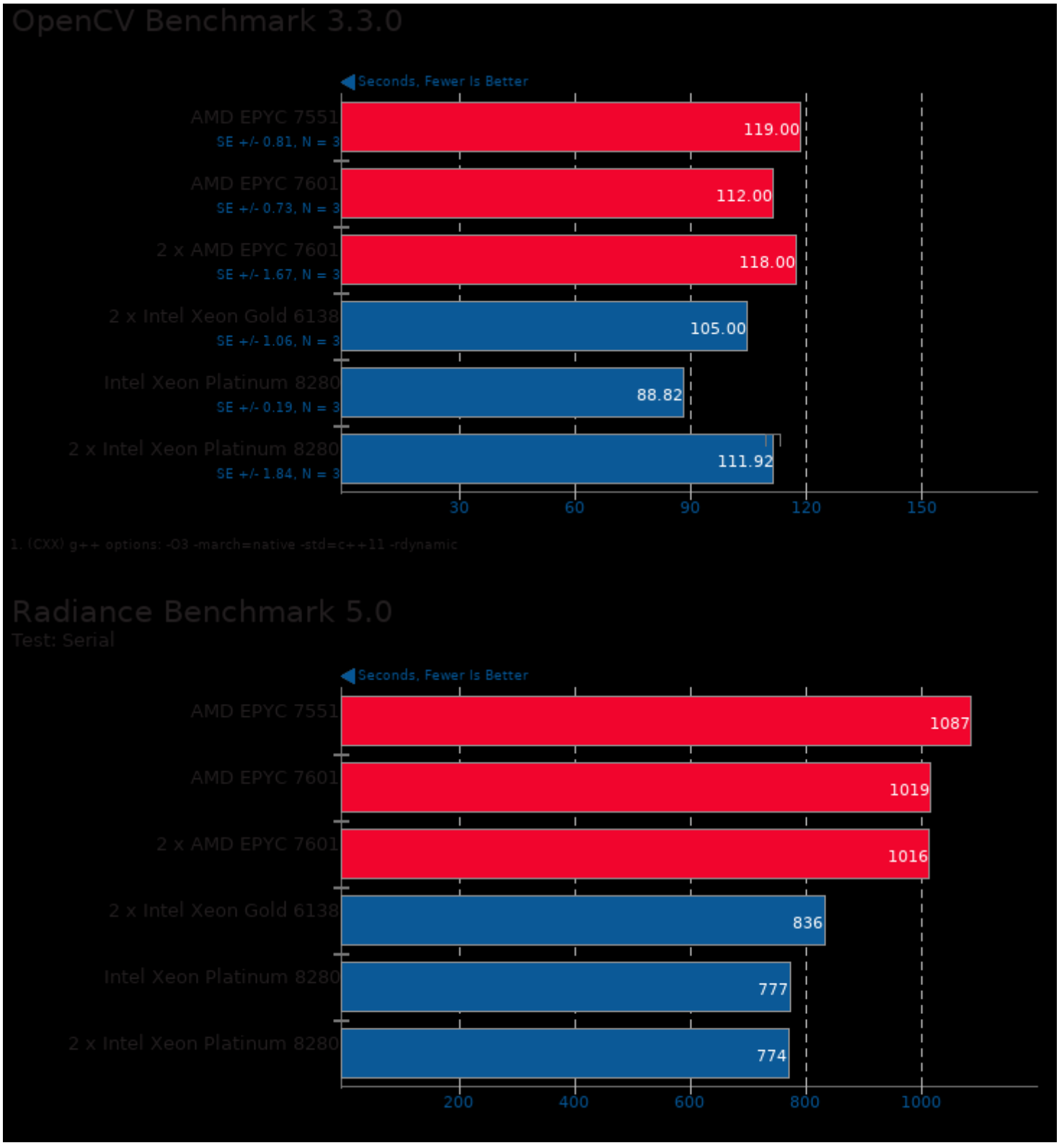

Timed GCC Compilation 8.2
Time To Compile
Seconds, Fewer Is Better
AMD EPYC 7551
1076
AMD EPYC 7601
1037
2 x AMD EPYC 7601
827
2 x Intel Xeon Gold 6138
1033
Intel Xeon Platinum 8280
955
2 x Intel Xeon Platinum 8280
917
200
400
600
800
1000
Timed Linux Kernel Compilation 4.18
Time To Compile
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.47, N = 11
45.90
AMD EPYC 7601
SE +/- 0.47, N = 11
45.13
2 x AMD EPYC 7601
SE +/- 0.30, N = 12
27.81
2 x Intel Xeon Gold 6138
SE +/- 0.42, N = 12
35.96
Intel Xeon Platinum 8280
SE +/- 0.38, N = 12
35.70
2 x Intel Xeon Platinum 8280
SE +/- 0.41, N = 12
24.06
10
20
30
40
50

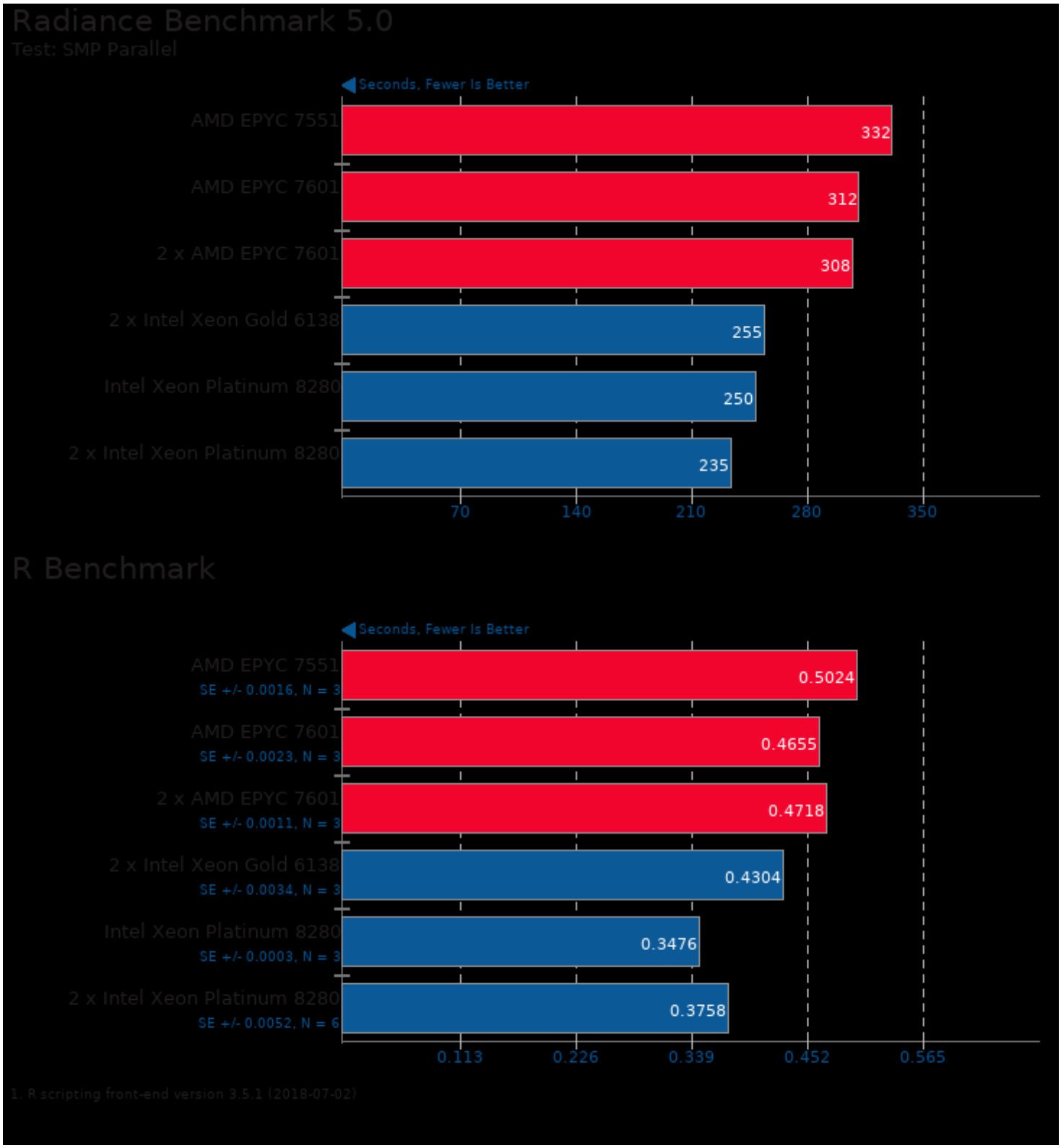

Timed LLVM Compilation 6.0.1
Time To Compile
Seconds, Fewer Is Better
AMD EPYC 7551
264
AMD EPYC 7601
251
2 x AMD EPYC 7601
156
2 x Intel Xeon Gold 6138
179
Intel Xeon Platinum 8280
184
2 x Intel Xeon Platinum 8280
122
60
120
180
240
300
C-Ray 1.1
Total Time - 4K, 16 Rays Per Pixel
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.02, N = 3
23.32
AMD EPYC 7601
SE +/- 0.06, N = 3
22.07
2 x AMD EPYC 7601
SE +/- 0.06, N = 3
11.40
2 x Intel Xeon Gold 6138
SE +/- 0.16, N = 3
22.07
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
22.20
2 x Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
11.45
6
12
18
24
30
1. (CC) gcc options: -lm -lpthread -O3 -march=native

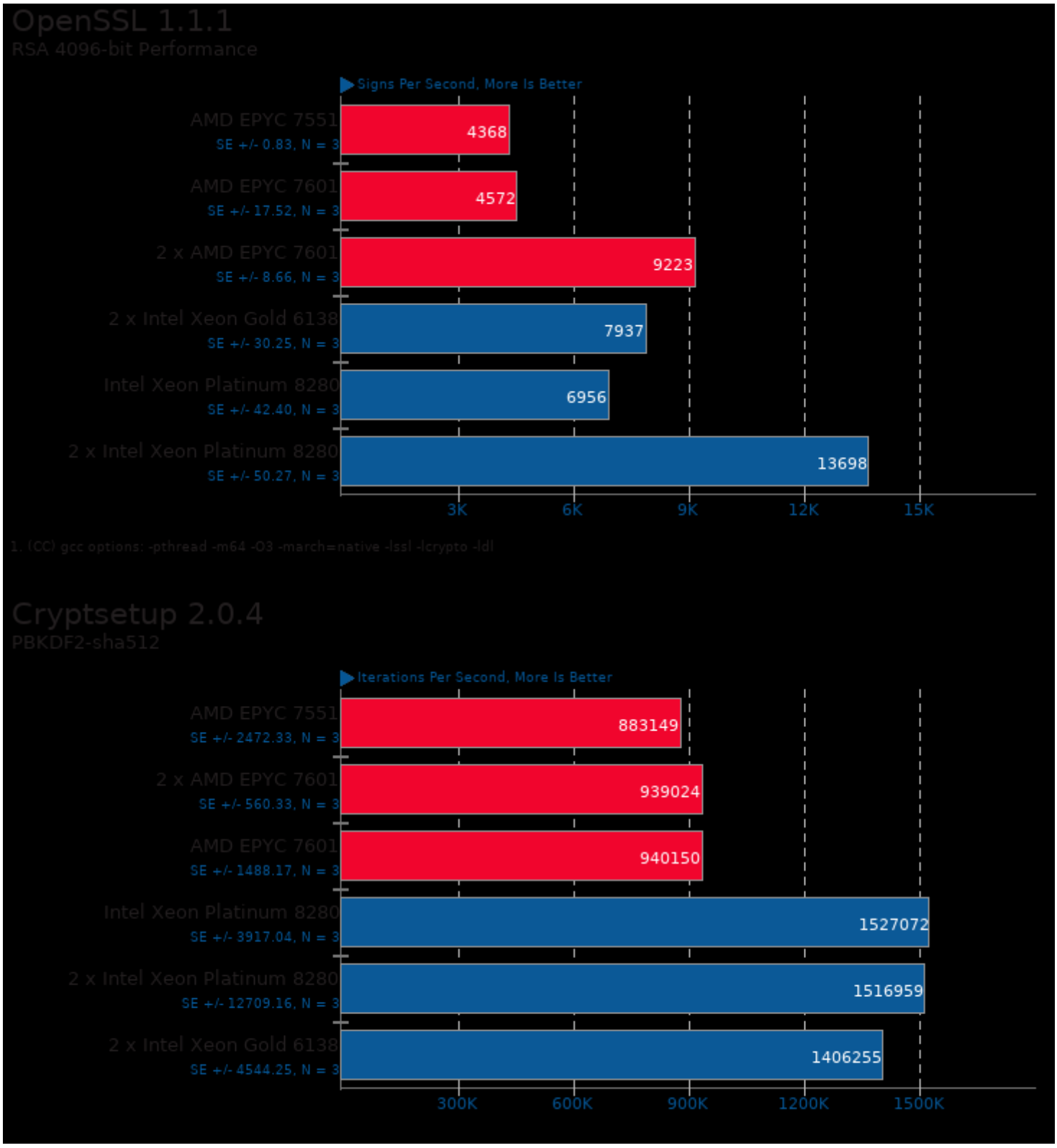

POV-Ray 3.7.0.7
Trace Time
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.03, N = 3
22.12
AMD EPYC 7601
SE +/- 0.08, N = 3
22.03
2 x AMD EPYC 7601
SE +/- 0.04, N = 3
12.35
2 x Intel Xeon Gold 6138
SE +/- 9.69, N = 9
63.19
Intel Xeon Platinum 8280
SE +/- 0.57, N = 3
41.73
2 x Intel Xeon Platinum 8280
SE +/- 7.31, N = 12
37.85
14
28
42
56
70
1. (CXX) g++ options: -pipe -O3 -ffast-math -march=native -pthread -lSDL -lSM -lICE -lX11 -lIlmImf -lImath -lHalf -lIex -lIexMath -lIlmThread -lpthread -lti
Y-Cruncher 0.7.5.9481
Calculating 500M Pi Digits
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.36, N = 4
23.31
AMD EPYC 7601
SE +/- 0.07, N = 3
19.56
2 x AMD EPYC 7601
SE +/- 0.10, N = 3
16.92
2 x Intel Xeon Gold 6138
SE +/- 0.02, N = 3
12.77
Intel Xeon Platinum 8280
SE +/- 0.00, N = 3
9.83
2 x Intel Xeon Platinum 8280
SE +/- 0.03, N = 3
10.52
6
12
18
24
30

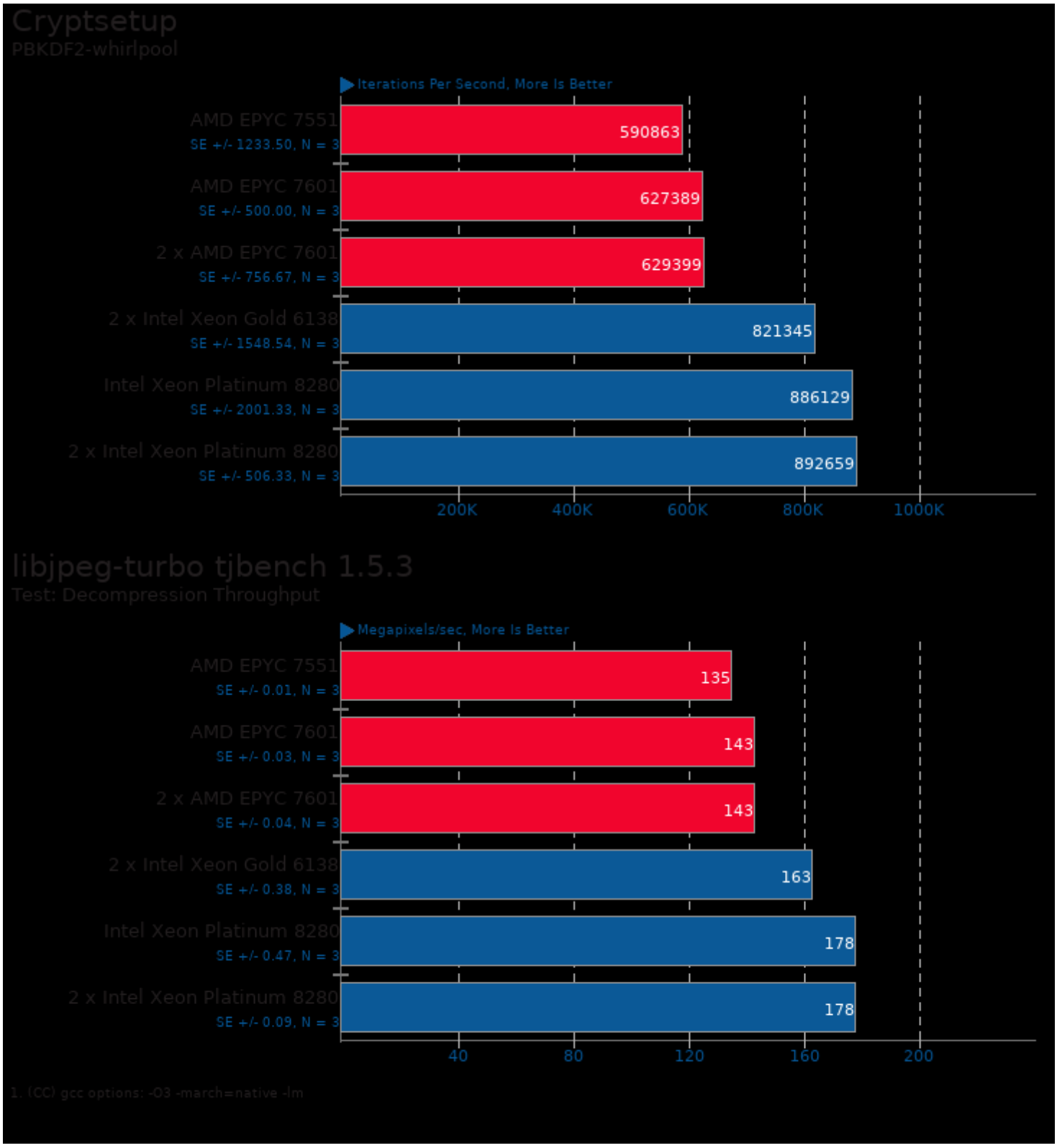

XZ Compression 5.2.4
Compressing ubuntu-16.04.3-server-i386.img, Compression Level 9
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.80, N = 3
108.74
AMD EPYC 7601
SE +/- 1.49, N = 4
102.04
2 x AMD EPYC 7601
SE +/- 2.47, N = 12
112.45
2 x Intel Xeon Gold 6138
SE +/- 1.10, N = 3
98.86
Intel Xeon Platinum 8280
SE +/- 0.44, N = 3
91.83
2 x Intel Xeon Platinum 8280
SE +/- 0.50, N = 3
91.21
30
60
90
120
150
1. (CC) gcc options: -pthread -fvisibility=hidden -O3 -march=native
Zstd Compression 1.3.4
Compressing ubuntu-16.04.3-server-i386.img, Compression Level 19
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.30, N = 3
16.33
AMD EPYC 7601
SE +/- 0.14, N = 3
14.50
2 x AMD EPYC 7601
SE +/- 0.26, N = 3
13.48
2 x Intel Xeon Gold 6138
SE +/- 0.13, N = 12
11.01
Intel Xeon Platinum 8280
SE +/- 0.13, N = 12
8.14
2 x Intel Xeon Platinum 8280
SE +/- 0.14, N = 12
9.29
4
8
12
16
20
1. (CC) gcc options: -O3 -march=native -pthread -lz -llzma

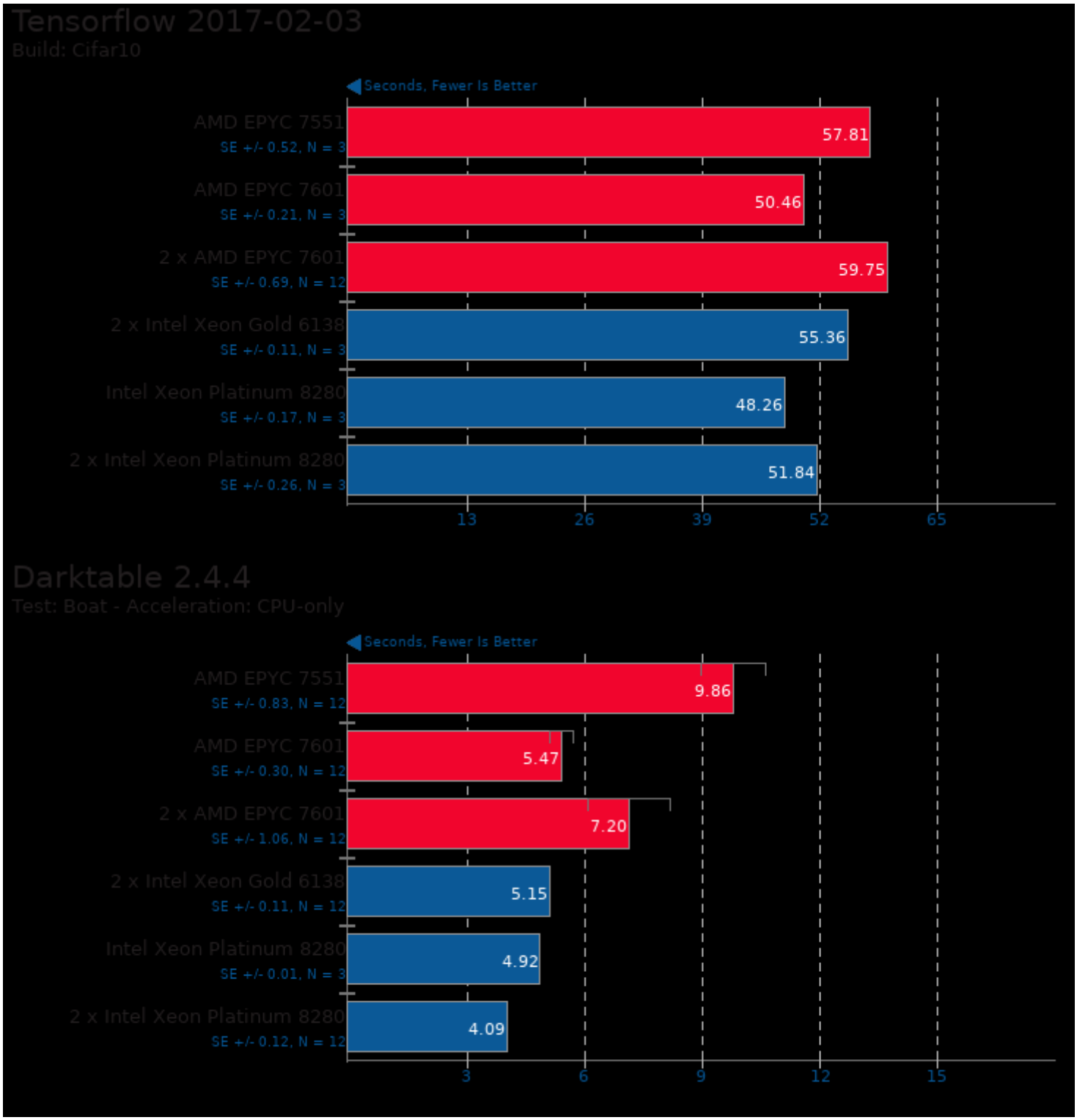

Cython benchmark 0.27
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.11, N = 3
35.04
AMD EPYC 7601
SE +/- 0.14, N = 3
32.49
2 x AMD EPYC 7601
SE +/- 0.32, N = 3
32.56
2 x Intel Xeon Gold 6138
SE +/- 0.02, N = 3
25.12
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
23.13
2 x Intel Xeon Platinum 8280
SE +/- 0.04, N = 3
23.28
8
16
24
32
40
m-queens 1.2
Time To Solve
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.01, N = 3
28.07
AMD EPYC 7601
SE +/- 0.12, N = 3
27.26
2 x AMD EPYC 7601
SE +/- 0.01, N = 3
13.46
2 x Intel Xeon Gold 6138
SE +/- 0.07, N = 3
28.02
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
31.94
2 x Intel Xeon Platinum 8280
SE +/- 0.04, N = 3
16.35
7
14
21
28
35
1. (CXX) g++ options: -fopenmp -O3 -march=native -O2

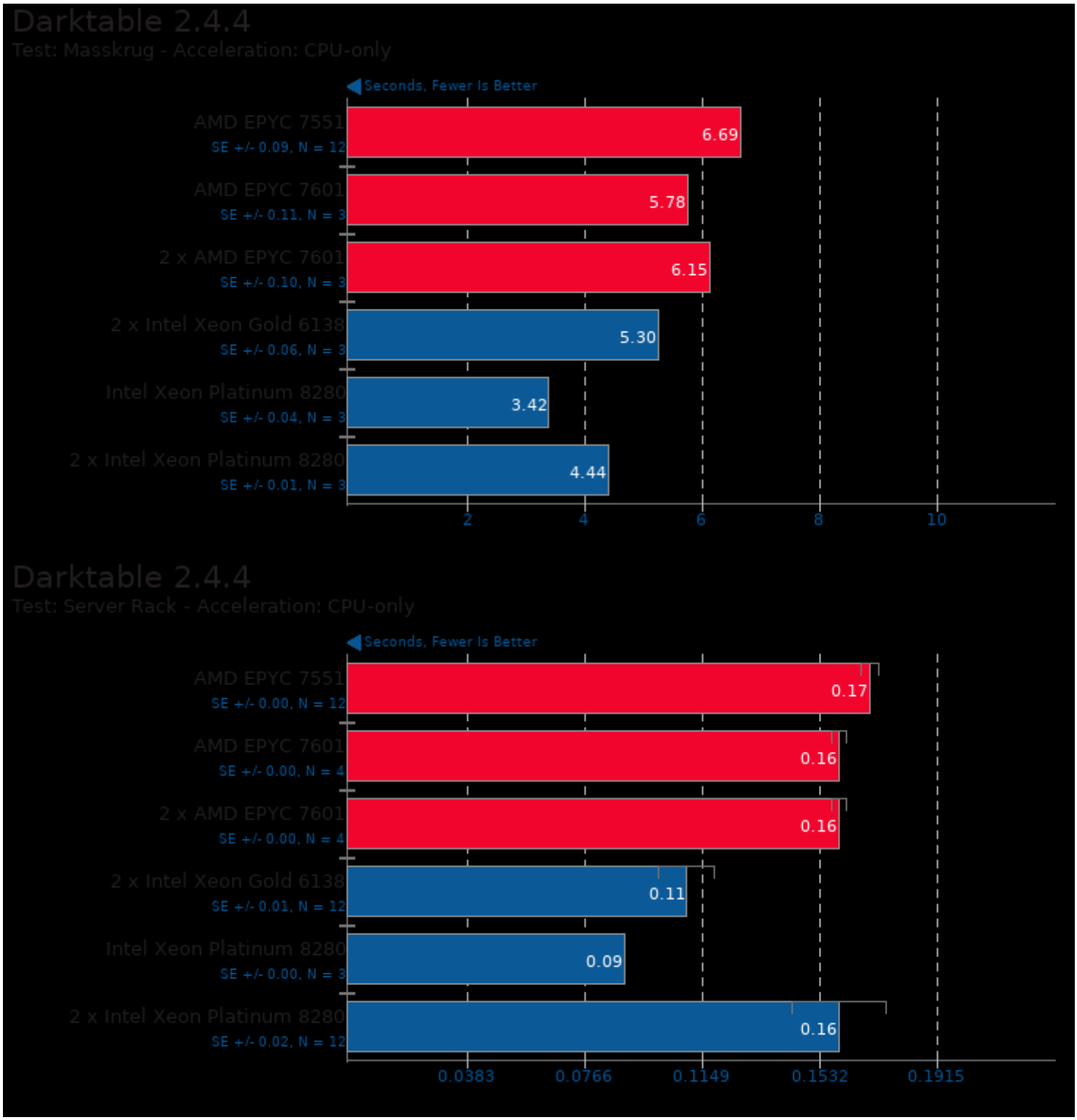

OpenCV Benchmark 3.3.0
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.81, N = 3
119.00
AMD EPYC 7601
SE +/- 0.73, N = 3
112.00
2 x AMD EPYC 7601
SE +/- 1.67, N = 3
118.00
2 x Intel Xeon Gold 6138
SE +/- 1.06, N = 3
105.00
Intel Xeon Platinum 8280
SE +/- 0.19, N = 3
88.82
2 x Intel Xeon Platinum 8280
SE +/- 1.84, N = 3
111.92
30
60
90
120
150
1. (CXX) g++ options: -O3 -march=native -std=c++11 -rdynamic
Radiance Benchmark 5.0
Test: Serial
Seconds, Fewer Is Better
AMD EPYC 7551
1087
AMD EPYC 7601
1019
2 x AMD EPYC 7601
1016
2 x Intel Xeon Gold 6138
836
Intel Xeon Platinum 8280
777
2 x Intel Xeon Platinum 8280
774
200
400
600
800
1000

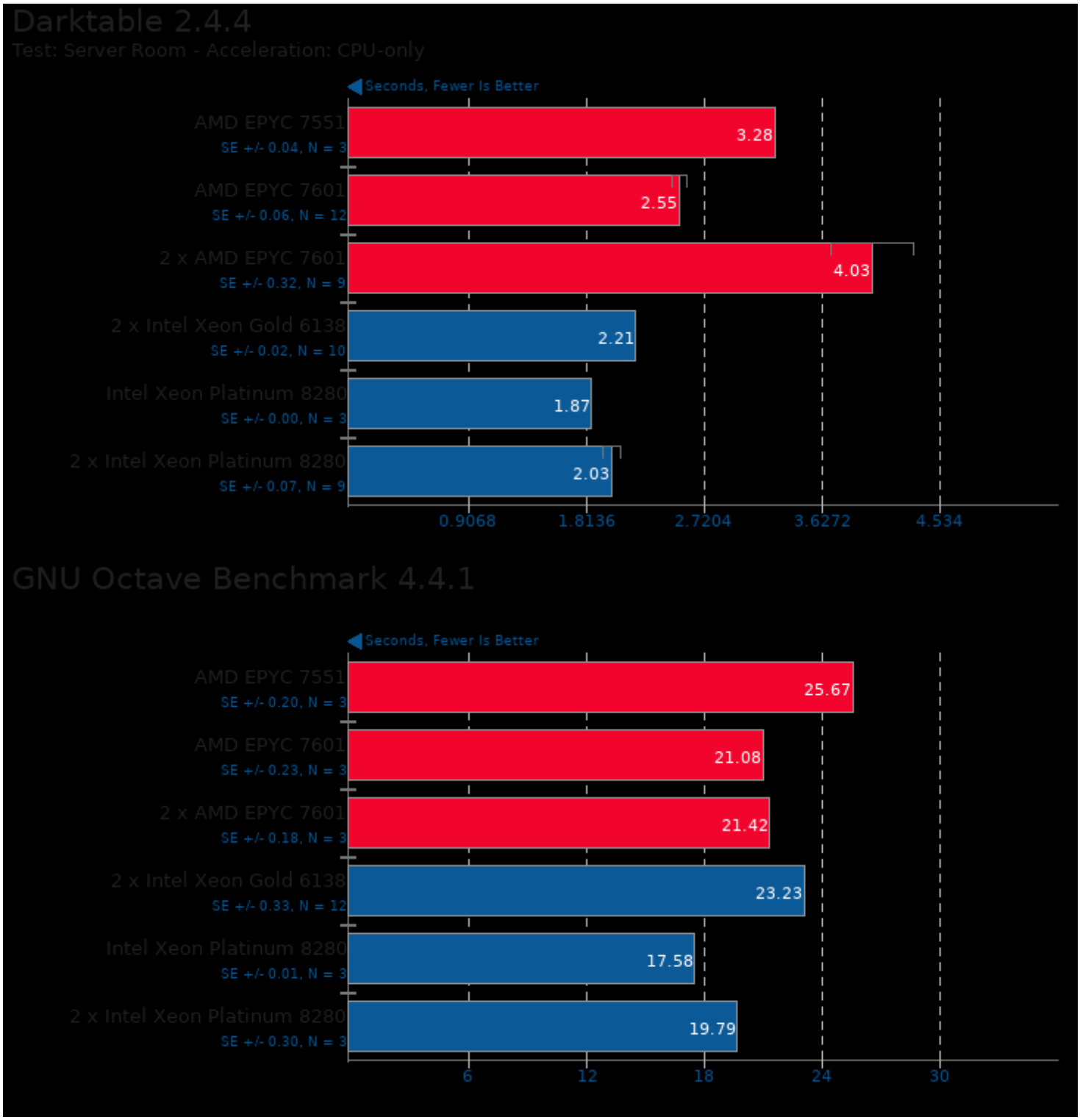

Radiance Benchmark 5.0
Test: SMP Parallel
Seconds, Fewer Is Better
AMD EPYC 7551
332
AMD EPYC 7601
312
2 x AMD EPYC 7601
308
2 x Intel Xeon Gold 6138
255
Intel Xeon Platinum 8280
250
2 x Intel Xeon Platinum 8280
235
70
140
210
280
350
R Benchmark
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.0016, N = 3
0.5024
AMD EPYC 7601
SE +/- 0.0023, N = 3
0.4655
2 x AMD EPYC 7601
SE +/- 0.0011, N = 3
0.4718
2 x Intel Xeon Gold 6138
SE +/- 0.0034, N = 3
0.4304
Intel Xeon Platinum 8280
SE +/- 0.0003, N = 3
0.3476
2 x Intel Xeon Platinum 8280
SE +/- 0.0052, N = 6
0.3758
0.113
0.226
0.339
0.452
0.565
1. R scripting front-end version 3.5.1 (2018-07-02)

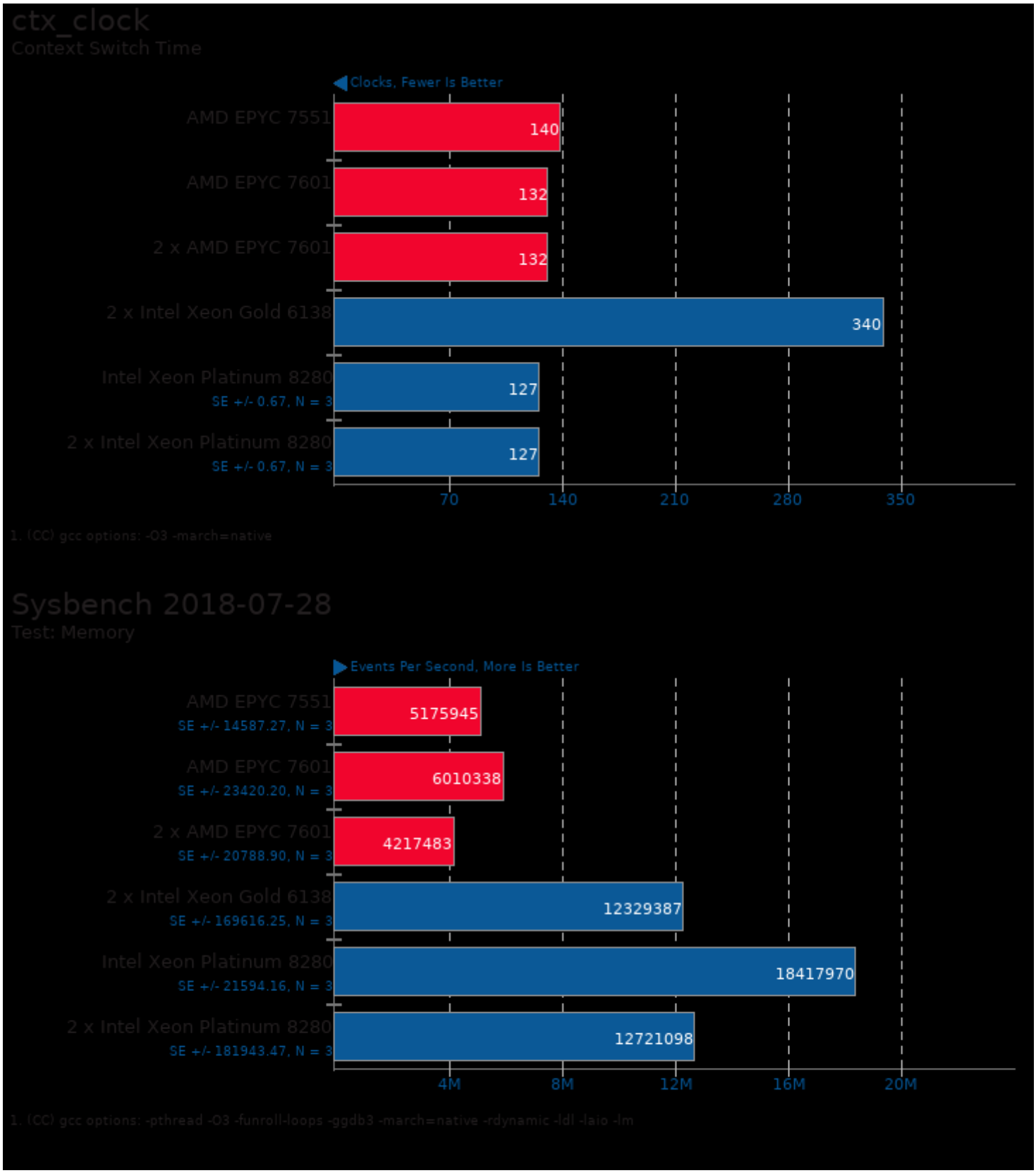

OpenSSL 1.1.1
RSA 4096-bit Performance
Signs Per Second, More Is Better
AMD EPYC 7551
SE +/- 0.83, N = 3
4368
AMD EPYC 7601
SE +/- 17.52, N = 3
4572
2 x AMD EPYC 7601
SE +/- 8.66, N = 3
9223
2 x Intel Xeon Gold 6138
SE +/- 30.25, N = 3
7937
Intel Xeon Platinum 8280
SE +/- 42.40, N = 3
6956
2 x Intel Xeon Platinum 8280
SE +/- 50.27, N = 3
13698
3K
6K
9K
12K
15K
1. (CC) gcc options: -pthread -m64 -O3 -march=native -lssl -lcrypto -ldl
Cryptsetup 2.0.4
PBKDF2-sha512
Iterations Per Second, More Is Better
AMD EPYC 7551
SE +/- 2472.33, N = 3
883149
2 x AMD EPYC 7601
SE +/- 560.33, N = 3
939024
AMD EPYC 7601
SE +/- 1488.17, N = 3
940150
Intel Xeon Platinum 8280
SE +/- 3917.04, N = 3
1527072
2 x Intel Xeon Platinum 8280
SE +/- 12709.16, N = 3
1516959
2 x Intel Xeon Gold 6138
SE +/- 4544.25, N = 3
1406255
300K
600K
900K
1200K
1500K

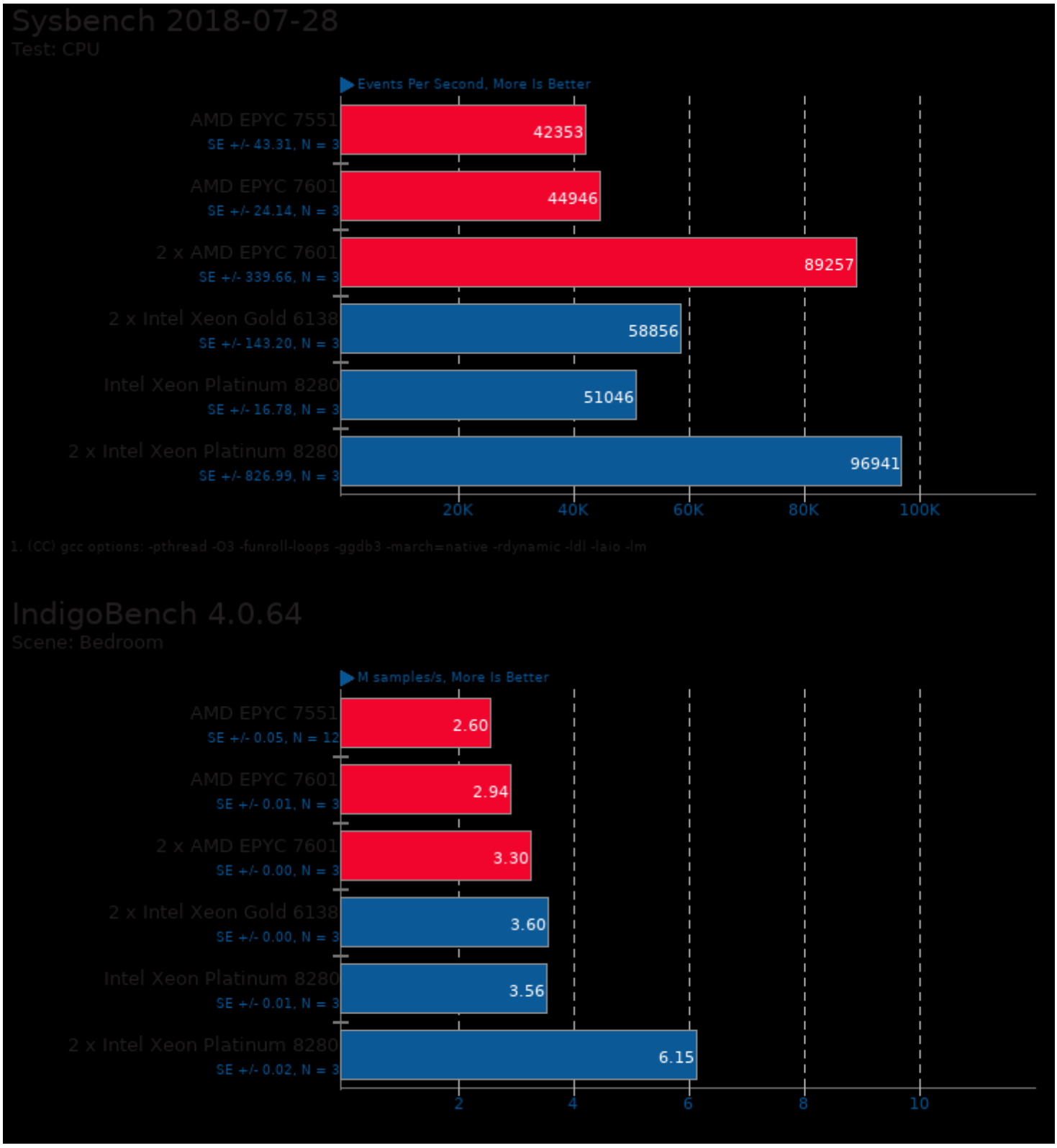

Cryptsetup
PBKDF2-whirlpool
Iterations Per Second, More Is Better
AMD EPYC 7551
SE +/- 1233.50, N = 3
590863
AMD EPYC 7601
SE +/- 500.00, N = 3
627389
2 x AMD EPYC 7601
SE +/- 756.67, N = 3
629399
2 x Intel Xeon Gold 6138
SE +/- 1548.54, N = 3
821345
Intel Xeon Platinum 8280
SE +/- 2001.33, N = 3
886129
2 x Intel Xeon Platinum 8280
SE +/- 506.33, N = 3
892659
200K
400K
600K
800K
1000K
libjpeg-turbo tjbench 1.5.3
Test: Decompression Throughput
Megapixels/sec, More Is Better
AMD EPYC 7551
SE +/- 0.01, N = 3
135
AMD EPYC 7601
SE +/- 0.03, N = 3
143
2 x AMD EPYC 7601
SE +/- 0.04, N = 3
143
2 x Intel Xeon Gold 6138
SE +/- 0.38, N = 3
163
Intel Xeon Platinum 8280
SE +/- 0.47, N = 3
178
2 x Intel Xeon Platinum 8280
SE +/- 0.09, N = 3
178
40
80
120
160
200
1. (CC) gcc options: -O3 -march=native -lm

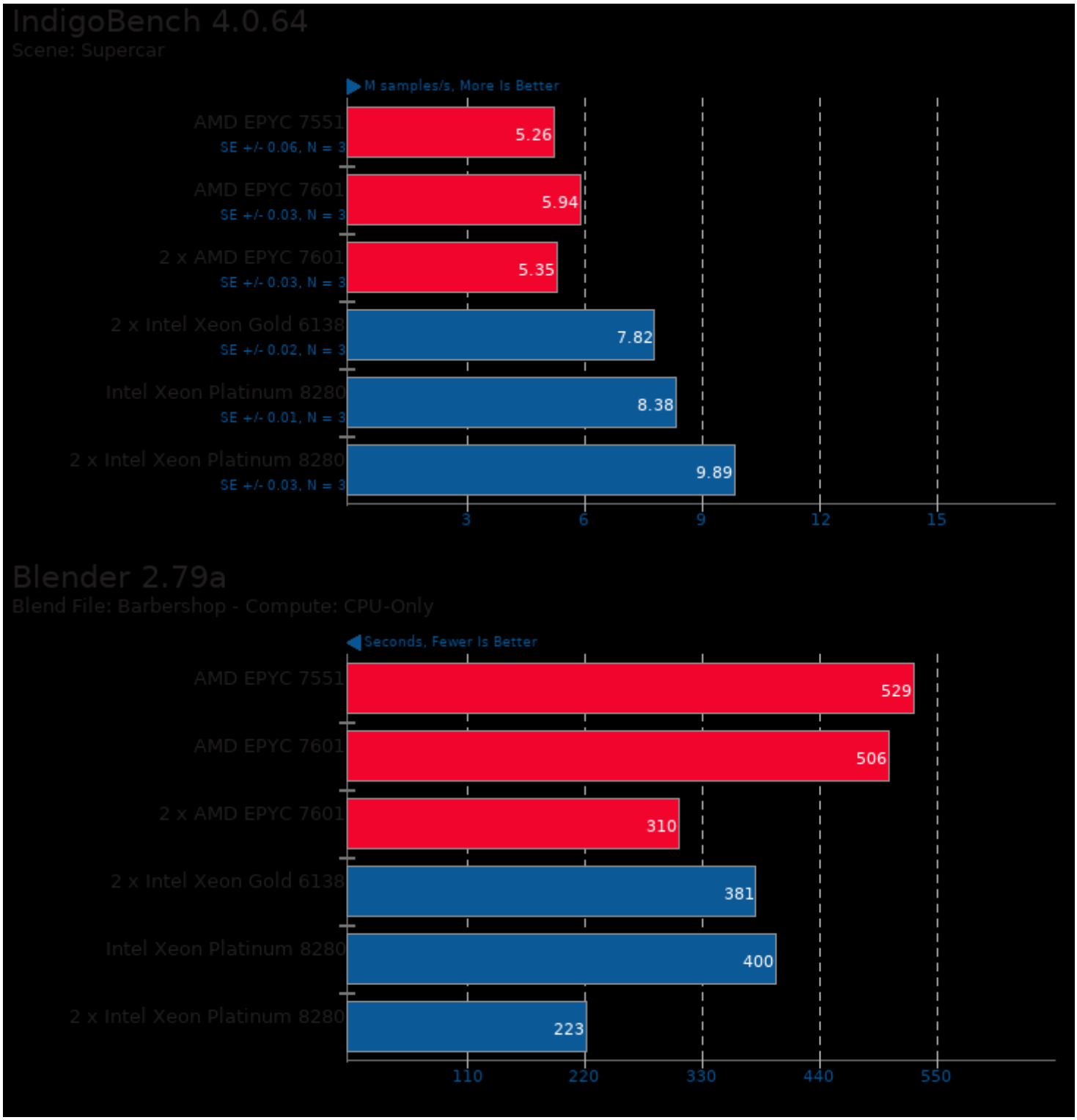

Tensorflow 2017-02-03
Build: Cifar10
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.52, N = 3
57.81
AMD EPYC 7601
SE +/- 0.21, N = 3
50.46
2 x AMD EPYC 7601
SE +/- 0.69, N = 12
59.75
2 x Intel Xeon Gold 6138
SE +/- 0.11, N = 3
55.36
Intel Xeon Platinum 8280
SE +/- 0.17, N = 3
48.26
2 x Intel Xeon Platinum 8280
SE +/- 0.26, N = 3
51.84
13
26
39
52
65
Darktable 2.4.4
Test: Boat - Acceleration: CPU-only
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.83, N = 12
9.86
AMD EPYC 7601
SE +/- 0.30, N = 12
5.47
2 x AMD EPYC 7601
SE +/- 1.06, N = 12
7.20
2 x Intel Xeon Gold 6138
SE +/- 0.11, N = 12
5.15
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
4.92
2 x Intel Xeon Platinum 8280
SE +/- 0.12, N = 12
4.09
3
6
9
12
15

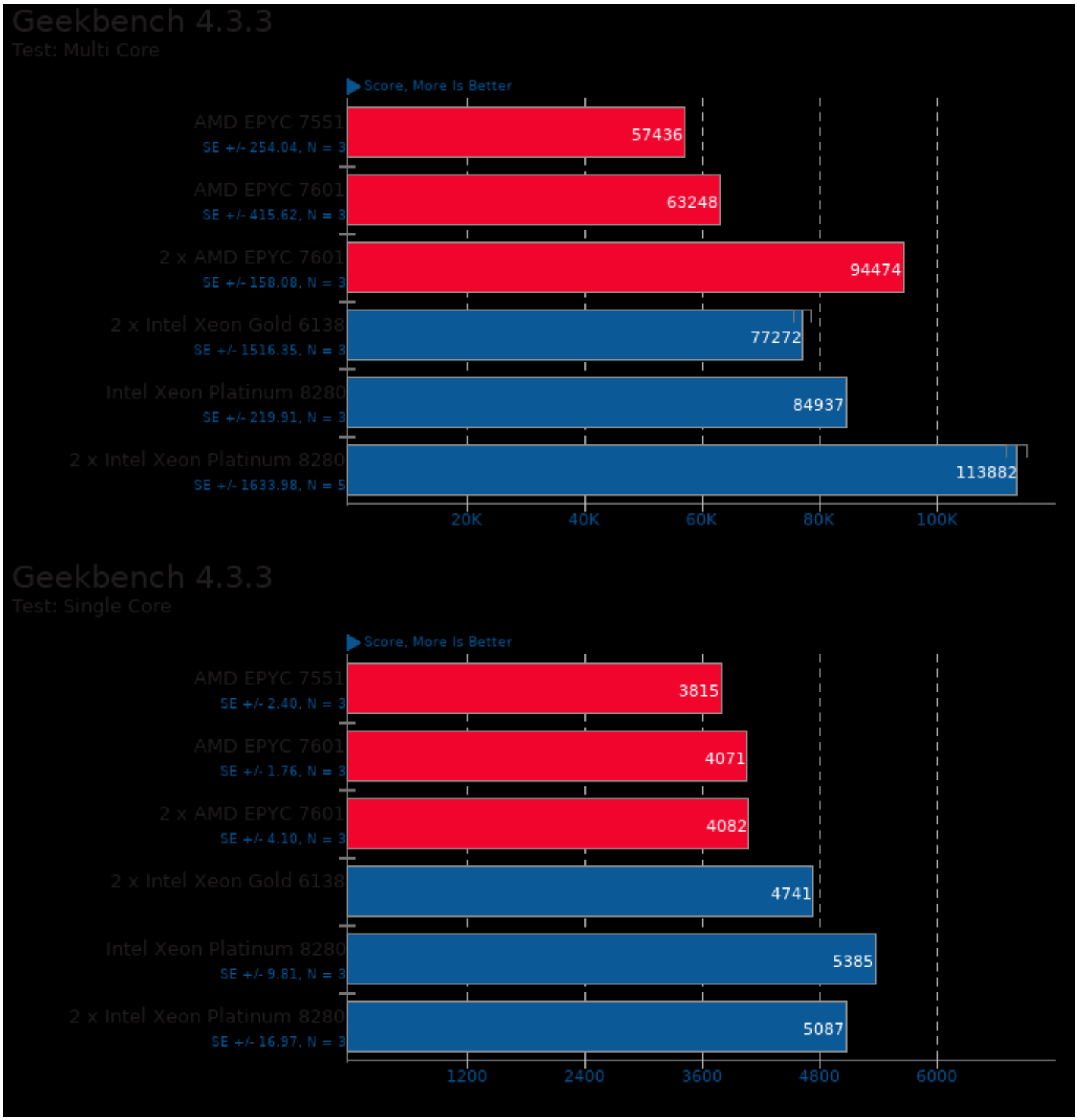

Darktable 2.4.4
Test: Masskrug - Acceleration: CPU-only
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.09, N = 12
6.69
AMD EPYC 7601
SE +/- 0.11, N = 3
5.78
2 x AMD EPYC 7601
SE +/- 0.10, N = 3
6.15
2 x Intel Xeon Gold 6138
SE +/- 0.06, N = 3
5.30
Intel Xeon Platinum 8280
SE +/- 0.04, N = 3
3.42
2 x Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
4.44
2
4
6
8
10
Darktable 2.4.4
Test: Server Rack - Acceleration: CPU-only
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.00, N = 12
0.17
AMD EPYC 7601
SE +/- 0.00, N = 4
0.16
2 x AMD EPYC 7601
SE +/- 0.00, N = 4
0.16
2 x Intel Xeon Gold 6138
SE +/- 0.01, N = 12
0.11
Intel Xeon Platinum 8280
SE +/- 0.00, N = 3
0.09
2 x Intel Xeon Platinum 8280
SE +/- 0.02, N = 12
0.16
0.0383
0.0766
0.1149
0.1532
0.1915


Darktable 2.4.4
Test: Server Room - Acceleration: CPU-only
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.04, N = 3
3.28
AMD EPYC 7601
SE +/- 0.06, N = 12
2.55
2 x AMD EPYC 7601
SE +/- 0.32, N = 9
4.03
2 x Intel Xeon Gold 6138
SE +/- 0.02, N = 10
2.21
Intel Xeon Platinum 8280
SE +/- 0.00, N = 3
1.87
2 x Intel Xeon Platinum 8280
SE +/- 0.07, N = 9
2.03
0.9068
1.8136
2.7204
3.6272
4.534
GNU Octave Benchmark 4.4.1
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.20, N = 3
25.67
AMD EPYC 7601
SE +/- 0.23, N = 3
21.08
2 x AMD EPYC 7601
SE +/- 0.18, N = 3
21.42
2 x Intel Xeon Gold 6138
SE +/- 0.33, N = 12
23.23
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
17.58
2 x Intel Xeon Platinum 8280
SE +/- 0.30, N = 3
19.79
6
12
18
24
30

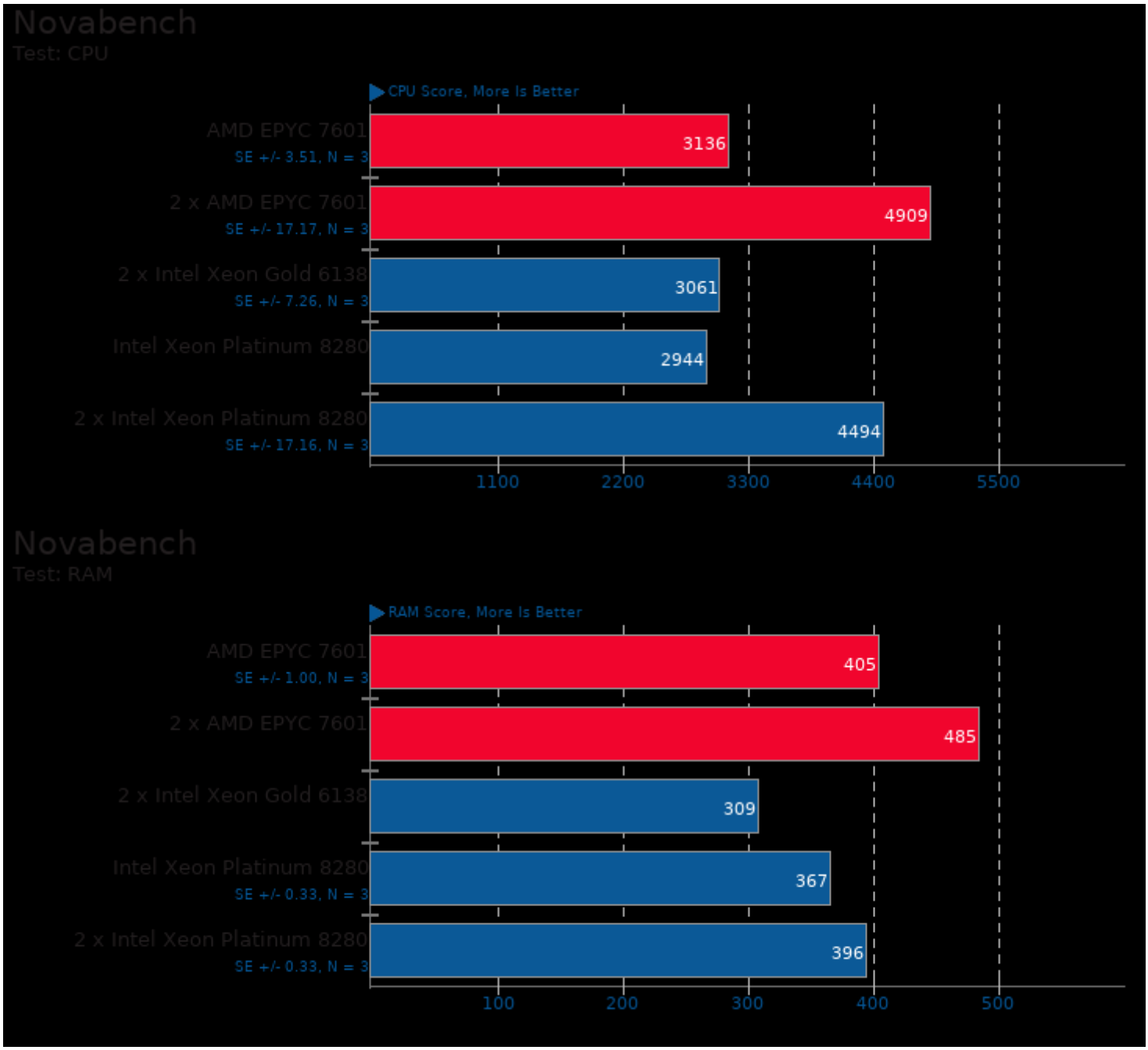

ctx_clock
Context Switch Time
Clocks, Fewer Is Better
AMD EPYC 7551
140
AMD EPYC 7601
132
2 x AMD EPYC 7601
132
2 x Intel Xeon Gold 6138
340
Intel Xeon Platinum 8280
SE +/- 0.67, N = 3
127
2 x Intel Xeon Platinum 8280
SE +/- 0.67, N = 3
127
70
140
210
280
350
1. (CC) gcc options: -O3 -march=native
Sysbench 2018-07-28
Test: Memory
Events Per Second, More Is Better
AMD EPYC 7551
SE +/- 14587.27, N = 3
5175945
AMD EPYC 7601
SE +/- 23420.20, N = 3
6010338
2 x AMD EPYC 7601
SE +/- 20788.90, N = 3
4217483
2 x Intel Xeon Gold 6138
SE +/- 169616.25, N = 3
12329387
Intel Xeon Platinum 8280
SE +/- 21594.16, N = 3
18417970
2 x Intel Xeon Platinum 8280
SE +/- 181943.47, N = 3
12721098
4M
8M
12M
16M
20M
1. (CC) gcc options: -pthread -O3 -funroll-loops -ggdb3 -march=native -rdynamic -ldl -laio -lm


Sysbench 2018-07-28
Test: CPU
Events Per Second, More Is Better
AMD EPYC 7551
SE +/- 43.31, N = 3
42353
AMD EPYC 7601
SE +/- 24.14, N = 3
44946
2 x AMD EPYC 7601
SE +/- 339.66, N = 3
89257
2 x Intel Xeon Gold 6138
SE +/- 143.20, N = 3
58856
Intel Xeon Platinum 8280
SE +/- 16.78, N = 3
51046
2 x Intel Xeon Platinum 8280
SE +/- 826.99, N = 3
96941
20K
40K
60K
80K
100K
1. (CC) gcc options: -pthread -O3 -funroll-loops -ggdb3 -march=native -rdynamic -ldl -laio -lm
IndigoBench 4.0.64
Scene: Bedroom
M samples/s, More Is Better
AMD EPYC 7551
SE +/- 0.05, N = 12
2.60
AMD EPYC 7601
SE +/- 0.01, N = 3
2.94
2 x AMD EPYC 7601
SE +/- 0.00, N = 3
3.30
2 x Intel Xeon Gold 6138
SE +/- 0.00, N = 3
3.60
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
3.56
2 x Intel Xeon Platinum 8280
SE +/- 0.02, N = 3
6.15
2
4
6
8
10

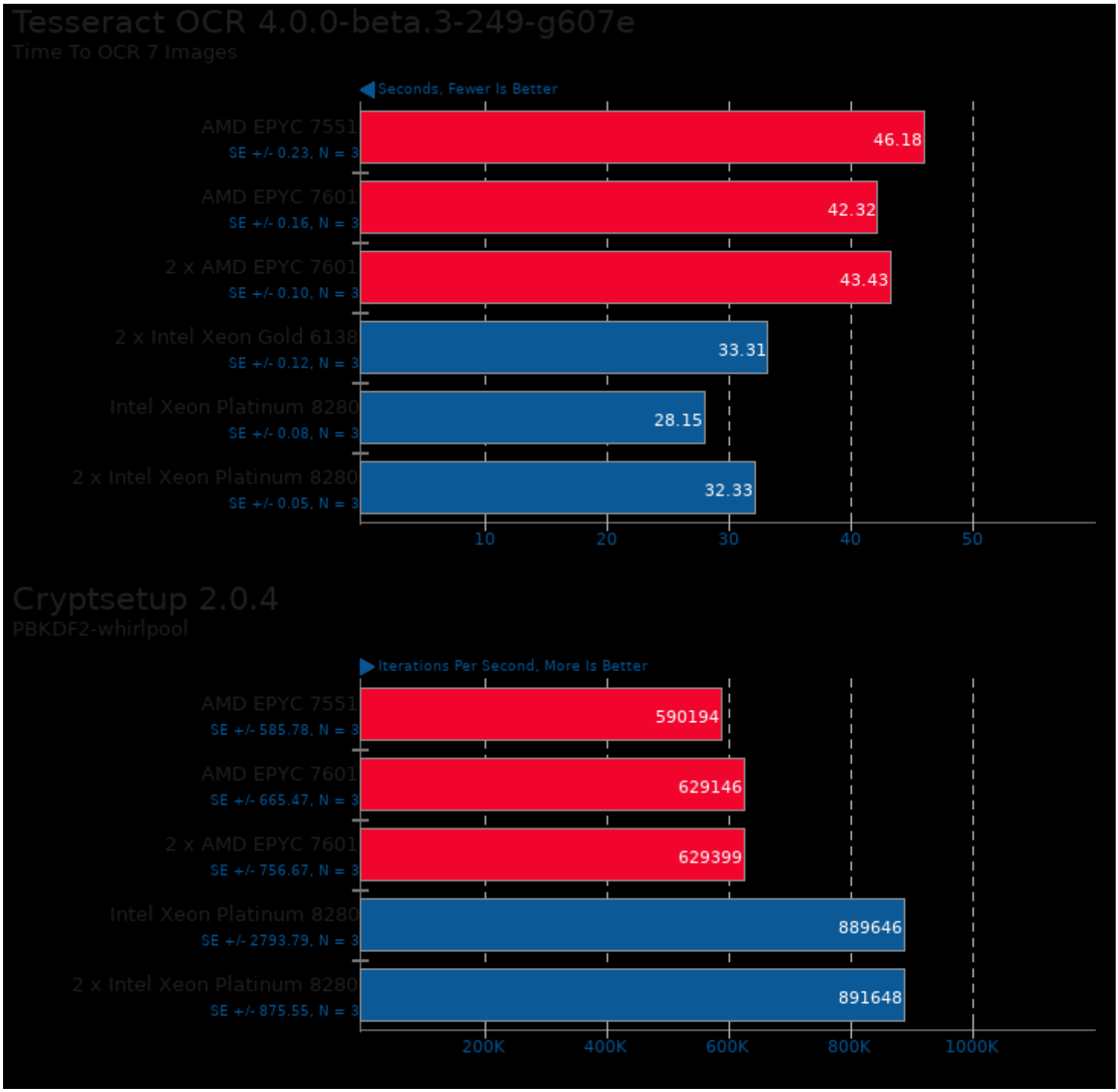

IndigoBench 4.0.64
Scene: Supercar
M samples/s, More Is Better
AMD EPYC 7551
SE +/- 0.06, N = 3
5.26
AMD EPYC 7601
SE +/- 0.03, N = 3
5.94
2 x AMD EPYC 7601
SE +/- 0.03, N = 3
5.35
2 x Intel Xeon Gold 6138
SE +/- 0.02, N = 3
7.82
Intel Xeon Platinum 8280
SE +/- 0.01, N = 3
8.38
2 x Intel Xeon Platinum 8280
SE +/- 0.03, N = 3
9.89
3
6
9
12
15
Blender 2.79a
Blend File: Barbershop - Compute: CPU-Only
Seconds, Fewer Is Better
AMD EPYC 7551
529
AMD EPYC 7601
506
2 x AMD EPYC 7601
310
2 x Intel Xeon Gold 6138
381
Intel Xeon Platinum 8280
400
2 x Intel Xeon Platinum 8280
223
110
220
330
440
550


Geekbench 4.3.3
Test: Multi Core
Score, More Is Better
AMD EPYC 7551
SE +/- 254.04, N = 3
57436
AMD EPYC 7601
SE +/- 415.62, N = 3
63248
2 x AMD EPYC 7601
SE +/- 158.08, N = 3
94474
2 x Intel Xeon Gold 6138
SE +/- 1516.35, N = 3
77272
Intel Xeon Platinum 8280
SE +/- 219.91, N = 3
84937
2 x Intel Xeon Platinum 8280
SE +/- 1633.98, N = 5
113882
20K
40K
60K
80K
100K
Geekbench 4.3.3
Test: Single Core
Score, More Is Better
AMD EPYC 7551
SE +/- 2.40, N = 3
3815
AMD EPYC 7601
SE +/- 1.76, N = 3
4071
2 x AMD EPYC 7601
SE +/- 4.10, N = 3
4082
2 x Intel Xeon Gold 6138
4741
Intel Xeon Platinum 8280
SE +/- 9.81, N = 3
5385
2 x Intel Xeon Platinum 8280
SE +/- 16.97, N = 3
5087
1200
2400
3600
4800
6000

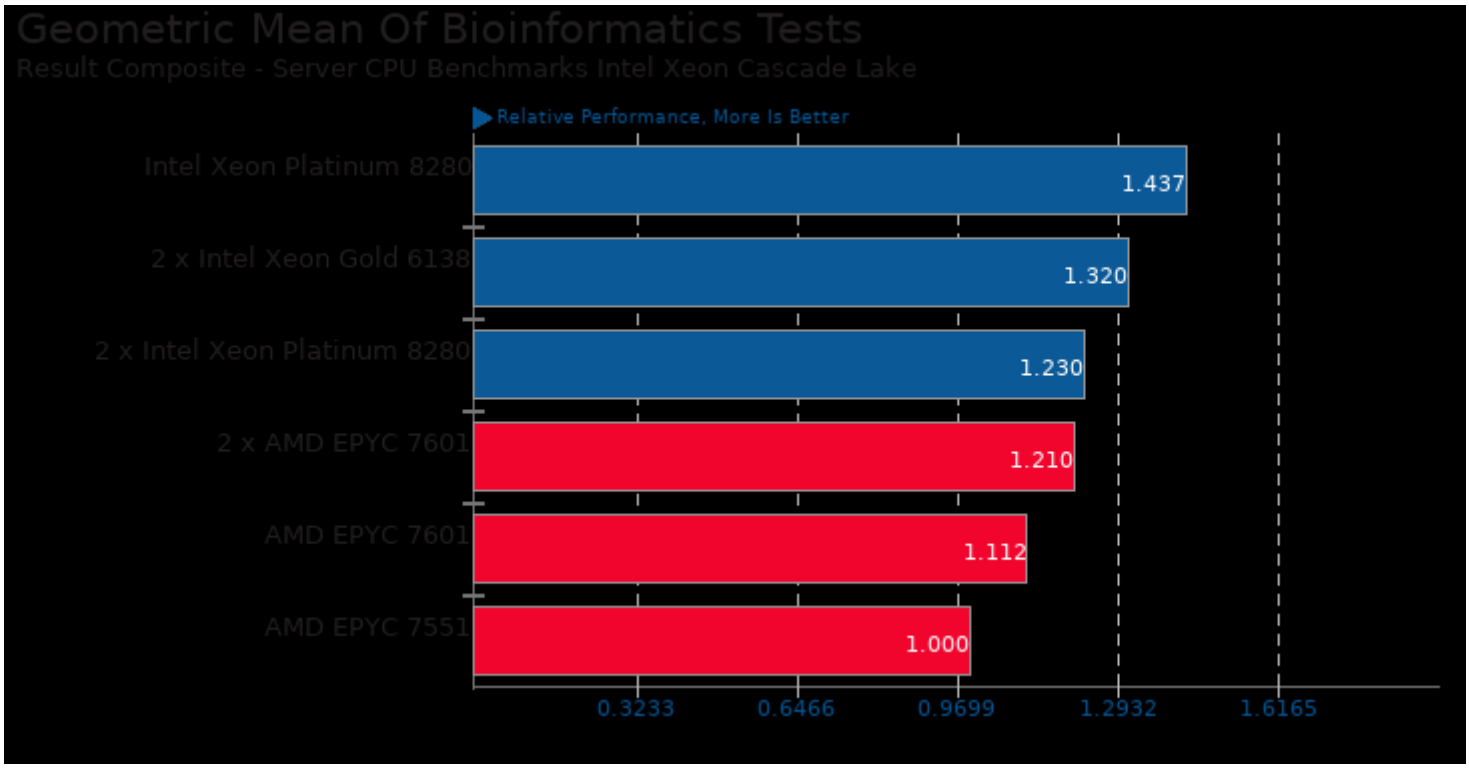
Server CPU Benchmarks Intel Xeon Cascade Lake



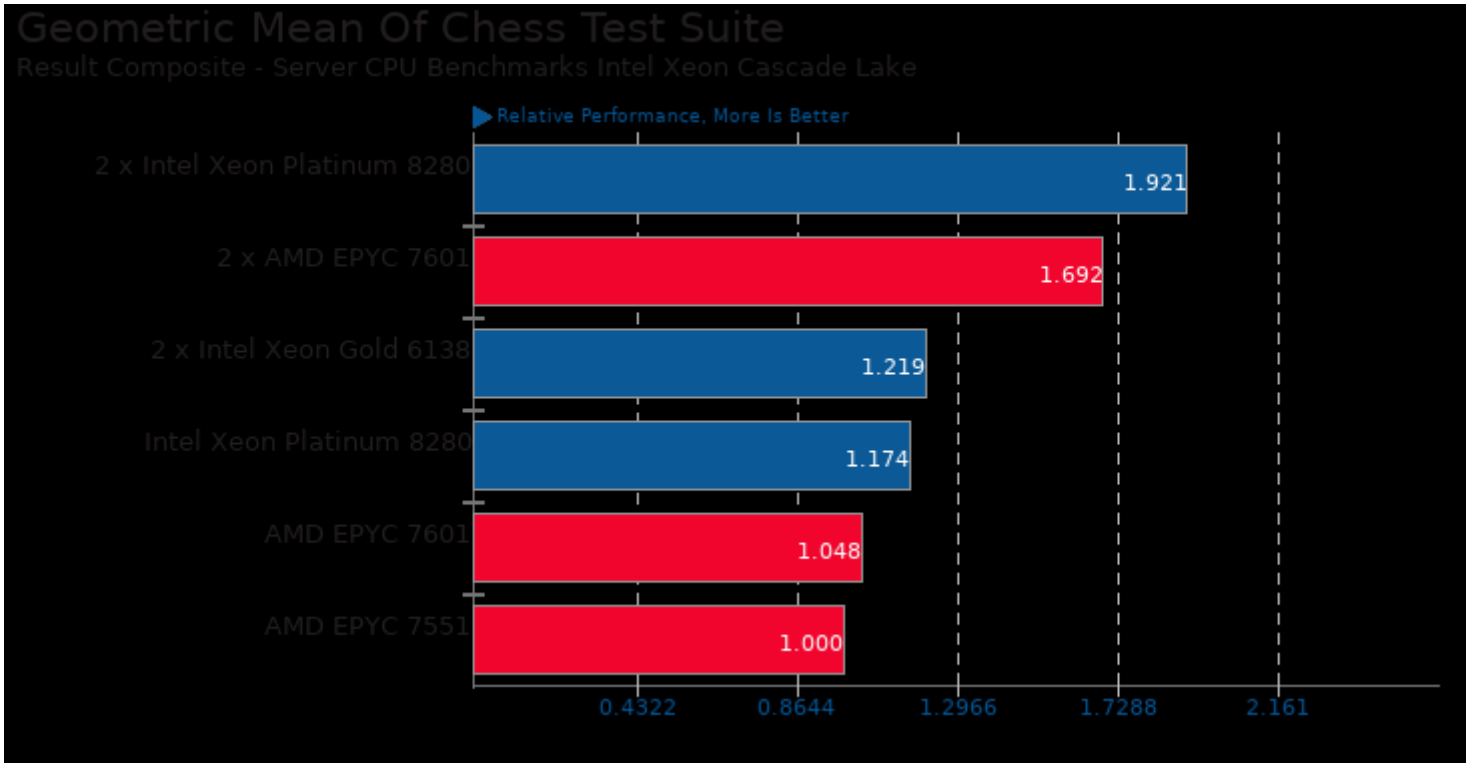

Novabench
Test: RAM
MB/s, More Is Better
AMD EPYC 7601
SE +/- 244.50, N = 3
29690
2 x AMD EPYC 7601
SE +/- 90.05, N = 3
28726
2 x Intel Xeon Gold 6138
SE +/- 4.10, N = 3
7569
Intel Xeon Platinum 8280
SE +/- 110.08, N = 3
12002
2 x Intel Xeon Platinum 8280
SE +/- 61.66, N = 3
8309
6K
12K
18K
24K
30K
Chaos Group V-RAY 1.1.0
Mode: CPU
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.05, N = 3
38.81
AMD EPYC 7601
SE +/- 0.21, N = 3
39.06
2 x AMD EPYC 7601
SE +/- 0.25, N = 3
24.75
2 x Intel Xeon Gold 6138
SE +/- 0.06, N = 3
31.50
Intel Xeon Platinum 8280
SE +/- 0.12, N = 3
31.99
2 x Intel Xeon Platinum 8280
SE +/- 0.03, N = 3
20.70
9
18
27
36
45


Tesseract OCR 4.0.0-beta.3-249-g607e
Time To OCR 7 Images
Seconds, Fewer Is Better
AMD EPYC 7551
SE +/- 0.23, N = 3
46.18
AMD EPYC 7601
SE +/- 0.16, N = 3
42.32
2 x AMD EPYC 7601
SE +/- 0.10, N = 3
43.43
2 x Intel Xeon Gold 6138
SE +/- 0.12, N = 3
33.31
Intel Xeon Platinum 8280
SE +/- 0.08, N = 3
28.15
2 x Intel Xeon Platinum 8280
SE +/- 0.05, N = 3
32.33
10
20
30
40
50
Cryptsetup 2.0.4
PBKDF2-whirlpool
Iterations Per Second, More Is Better
AMD EPYC 7551
SE +/- 585.78, N = 3
590194
AMD EPYC 7601
SE +/- 665.47, N = 3
629146
2 x AMD EPYC 7601
SE +/- 756.67, N = 3
629399
Intel Xeon Platinum 8280
SE +/- 2793.79, N = 3
889646
2 x Intel Xeon Platinum 8280
SE +/- 875.55, N = 3
891648
200K
400K
600K
800K
1000K

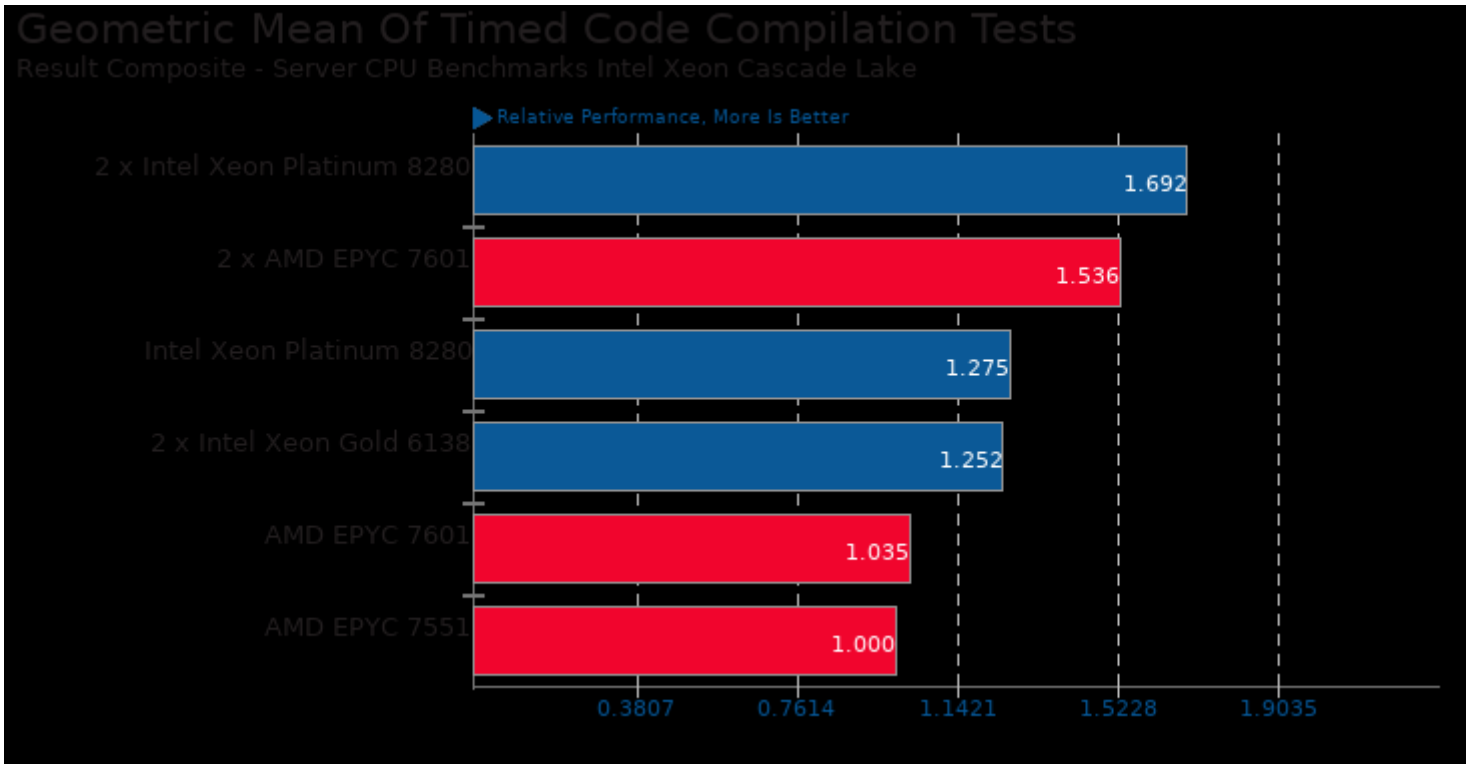
These geometric means are based upon test groupings / test suites for this result file.



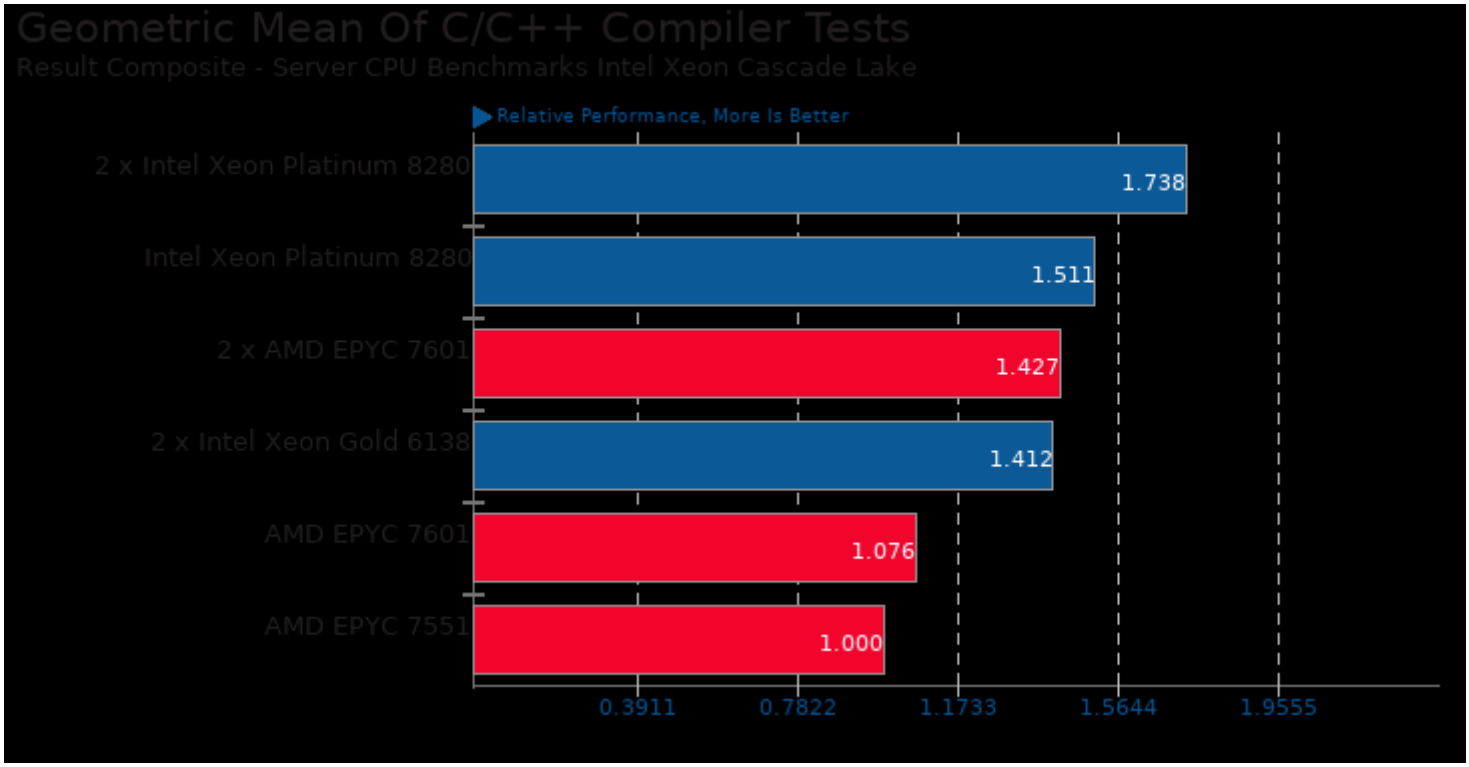
Geometric mean based upon tests: pts/himeno, pts/hmmer and pts/mafft



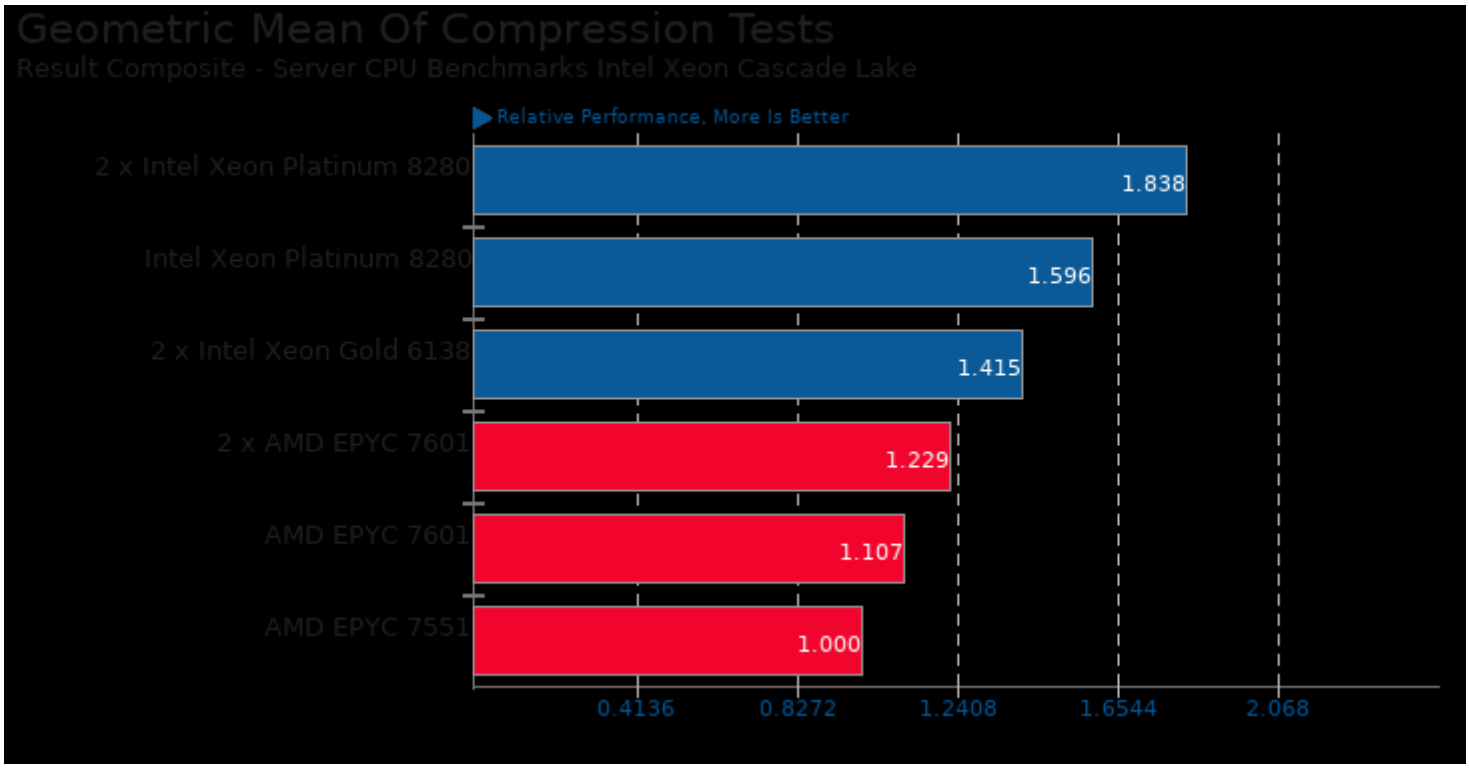
Geometric mean based upon tests: pts/crafty, pts/stockfish, pts/asmfish and pts/m-queens



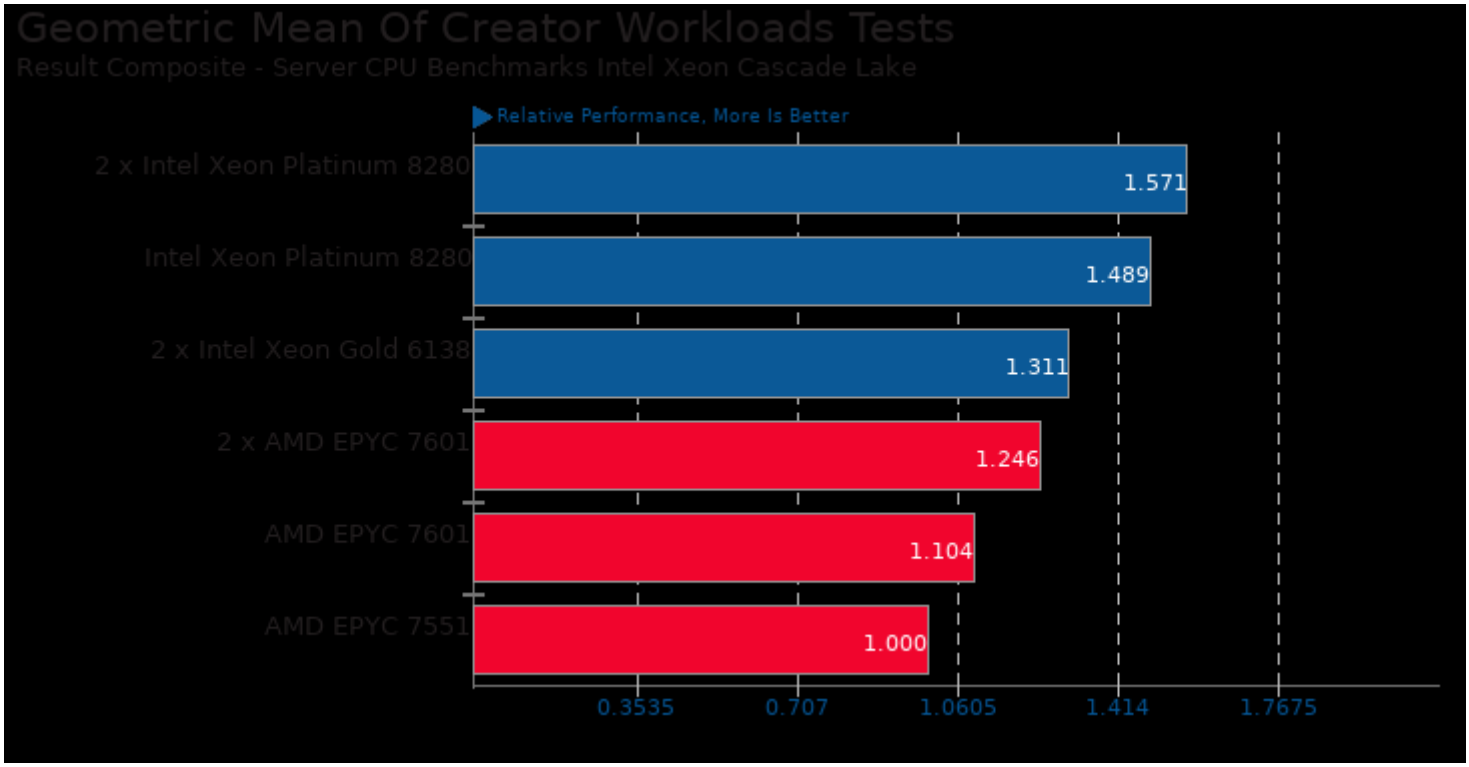
Geometric mean based upon tests: pts/build-linux-kernel, pts/build-gcc and pts/build-llvm



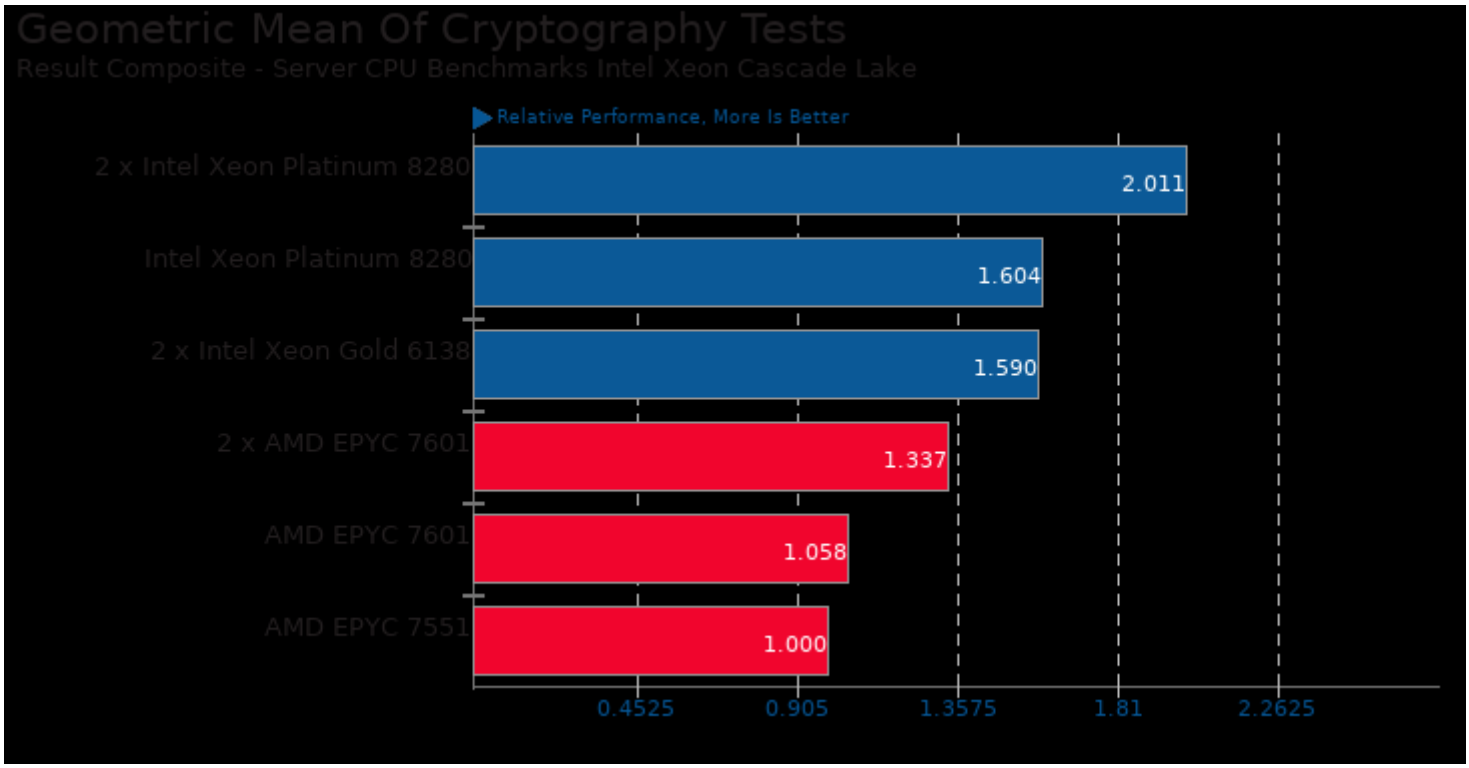
Geometric mean based upon tests: pts/mafft, pts/himeno, pts/stockfish, pts/hmmer, pts/build-llvm, pts/c-ray, pts/compress-7zip, pts/x264, pts/x265, pts/compress-xz, pts/compress-zstd, pts/openssl, pts/svt-av1 and pts/svt-vp9



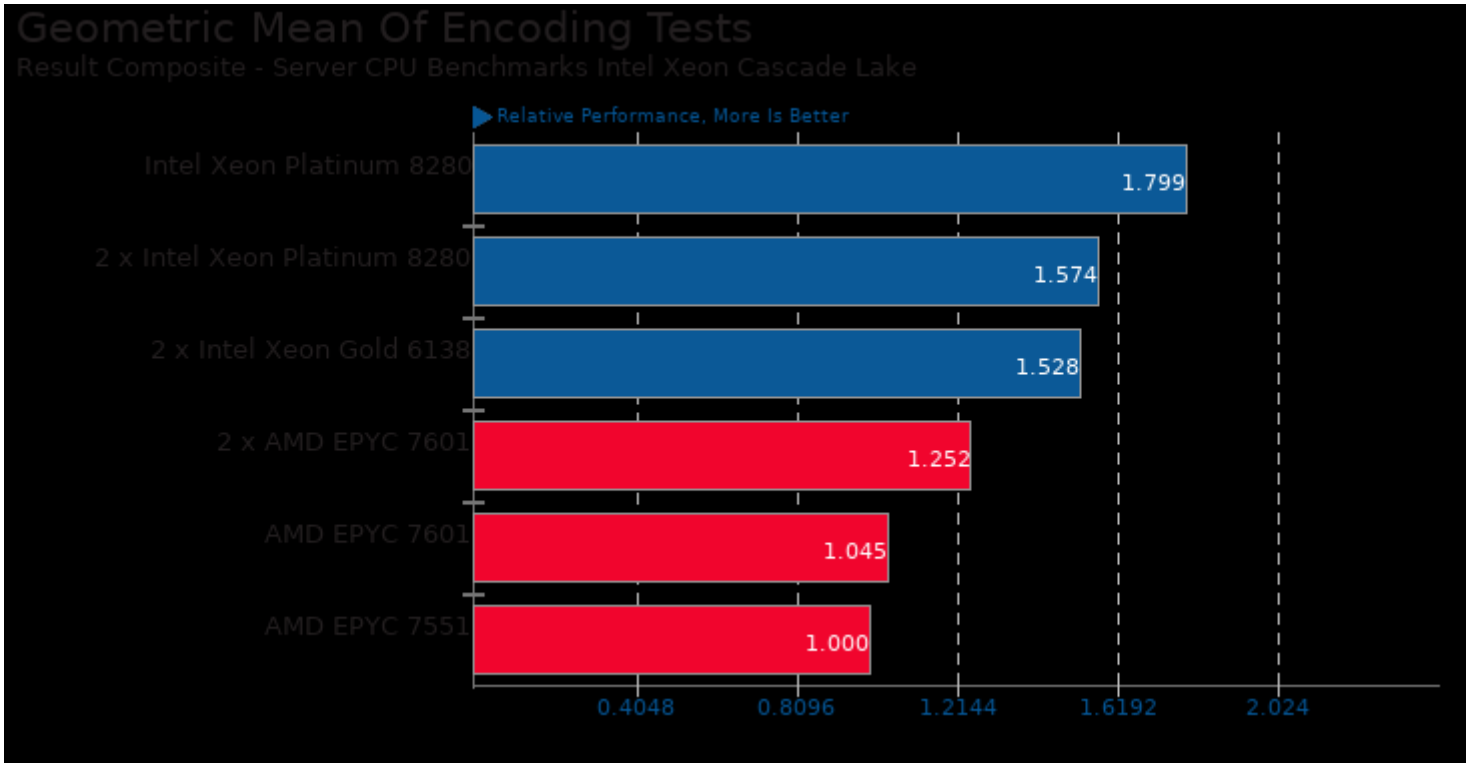
Geometric mean based upon tests: pts/compress-7zip, pts/compress-zstd and pts/compress-xz



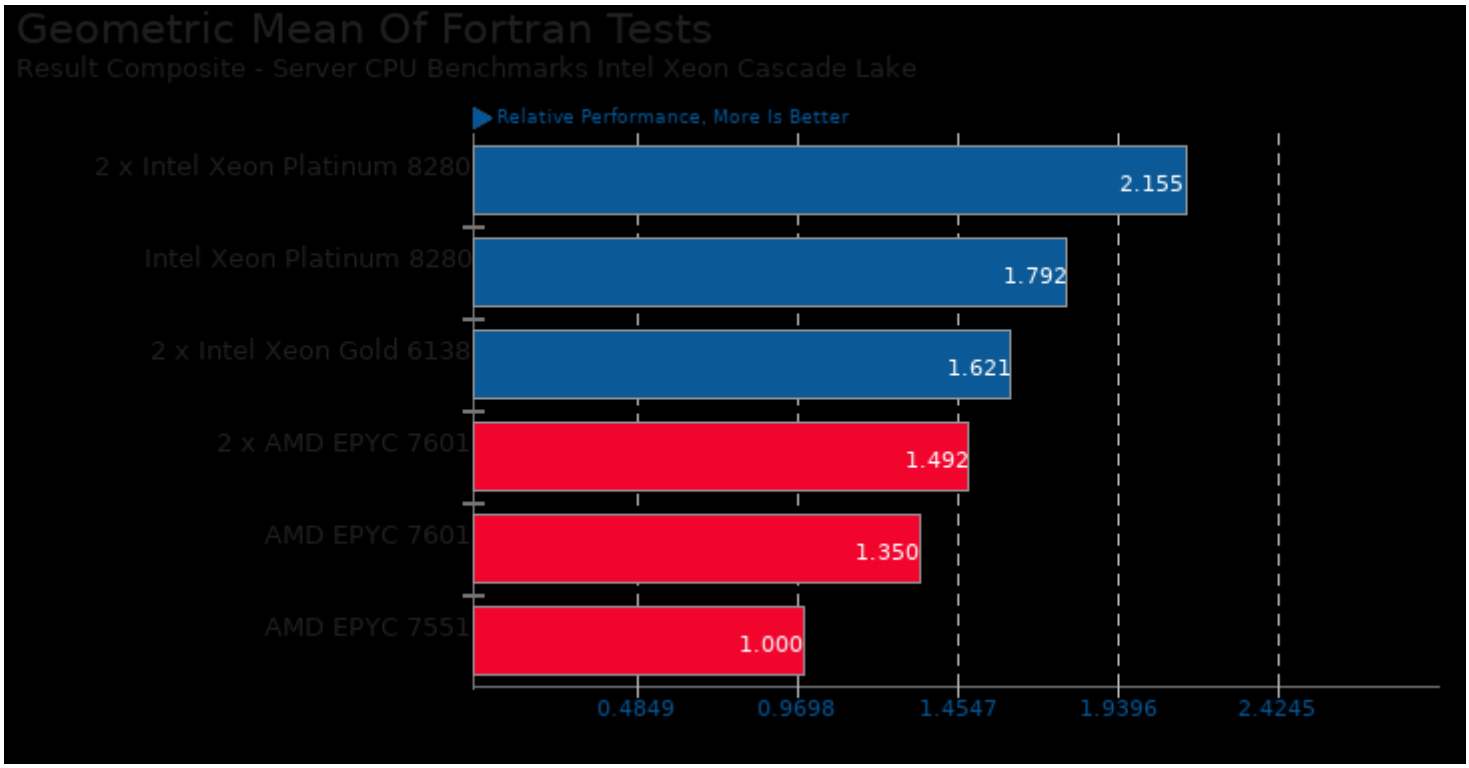
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/blender, pts/radiance, pts/v-ray, pts/indigobench, system/tesseract-ocr, pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265, pts/svt-av1, pts/tjbench and system/darktable



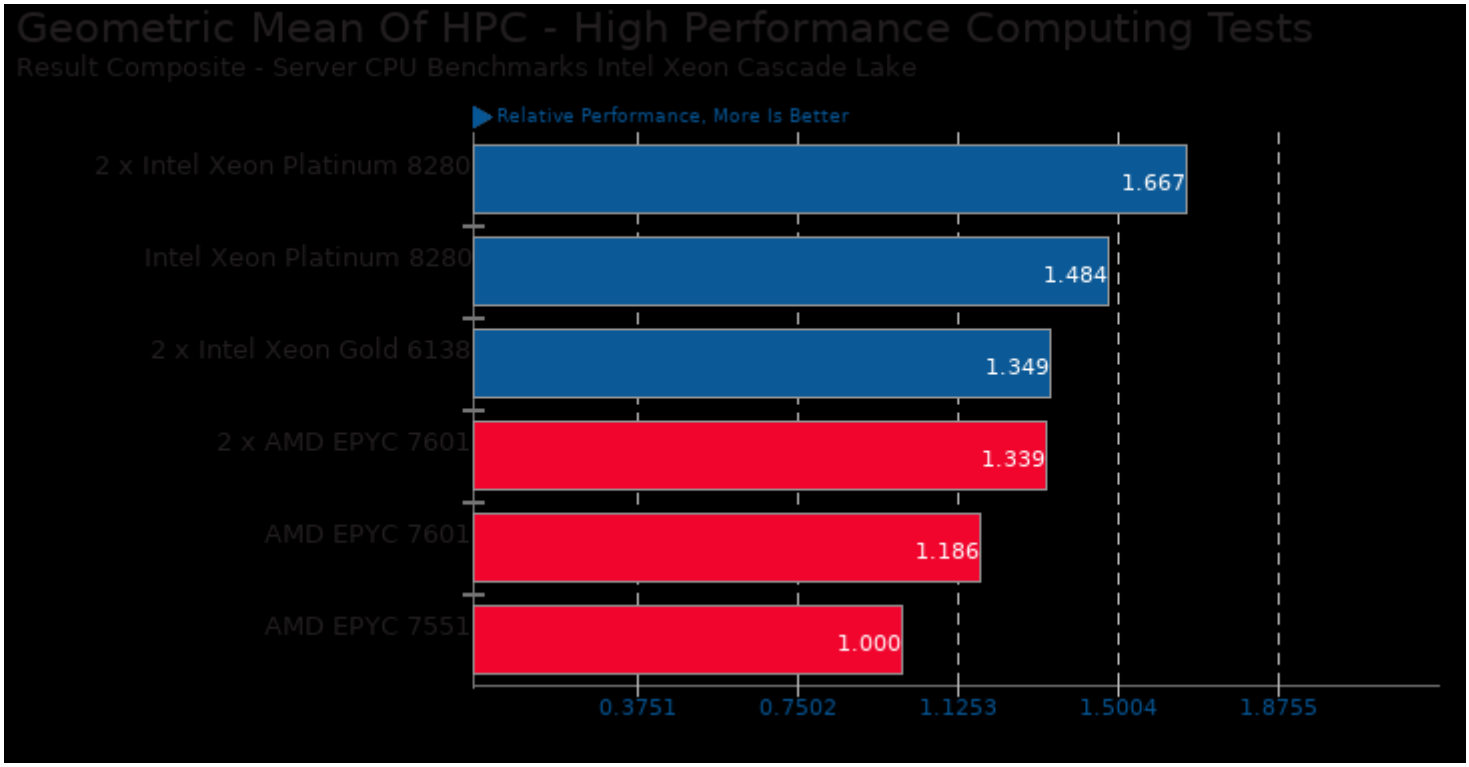
Geometric mean based upon tests: pts/openssl and system/cryptsetup



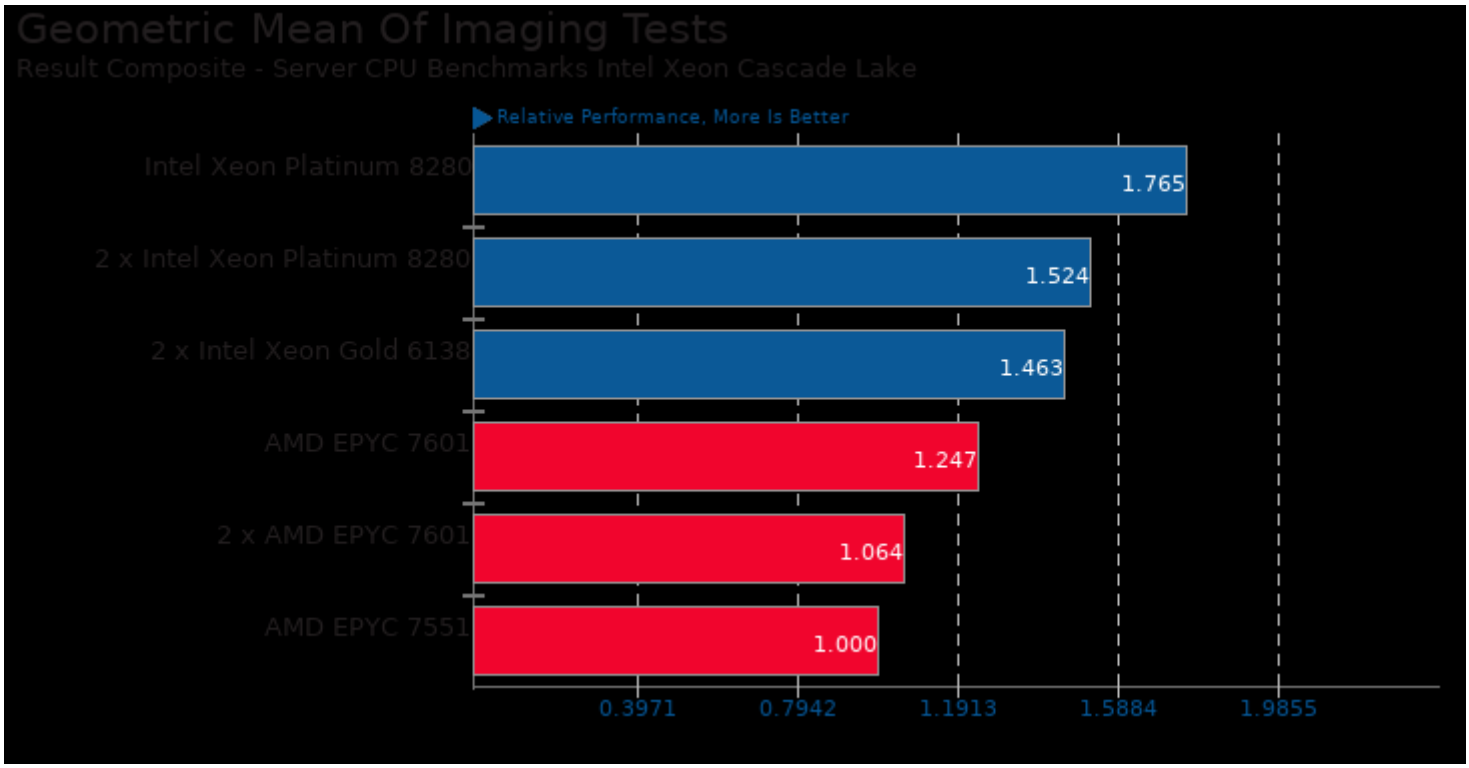
Geometric mean based upon tests: pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265 and pts/svt-av1



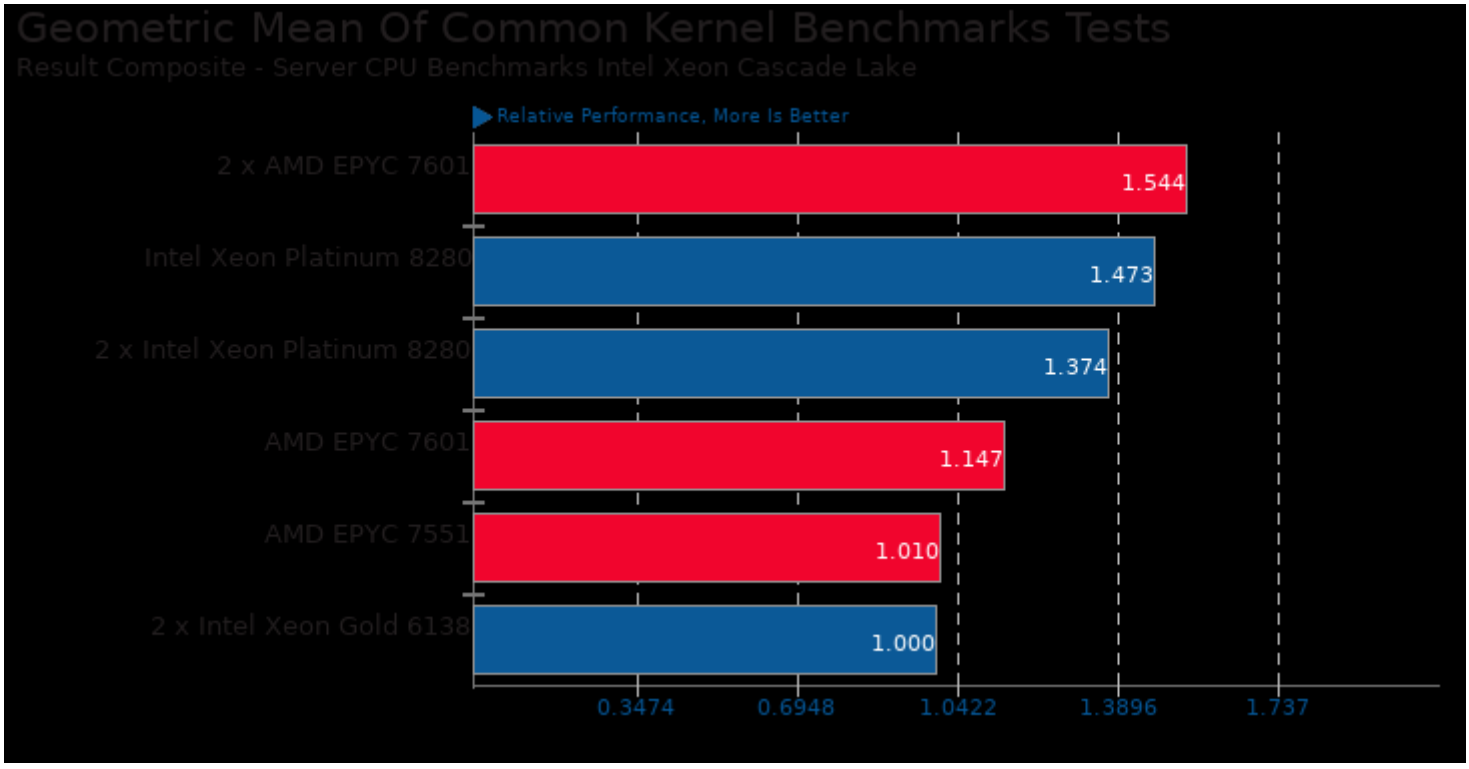
Geometric mean based upon tests: pts/npb and pts/cloverleaf



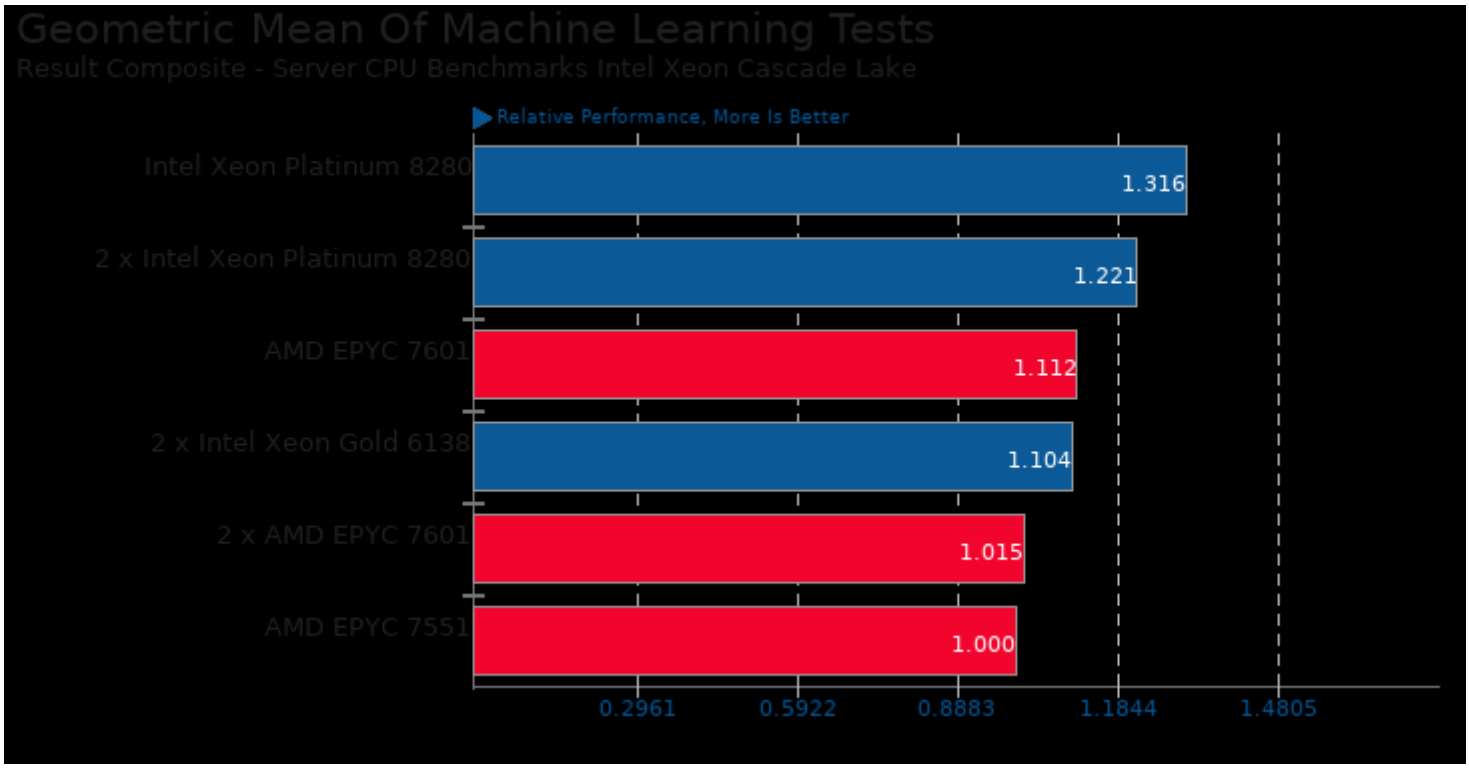
Geometric mean based upon tests: pts/npb, pts/rodinia, pts/parboil, system/octave-benchmark, pts/namd, pts/cloverleaf, pts/himeno, pts/hmmer, pts/mafft, pts/rbenchmark and pts/tensorflow



Geometric mean based upon tests: pts/tjbench and system/darktable



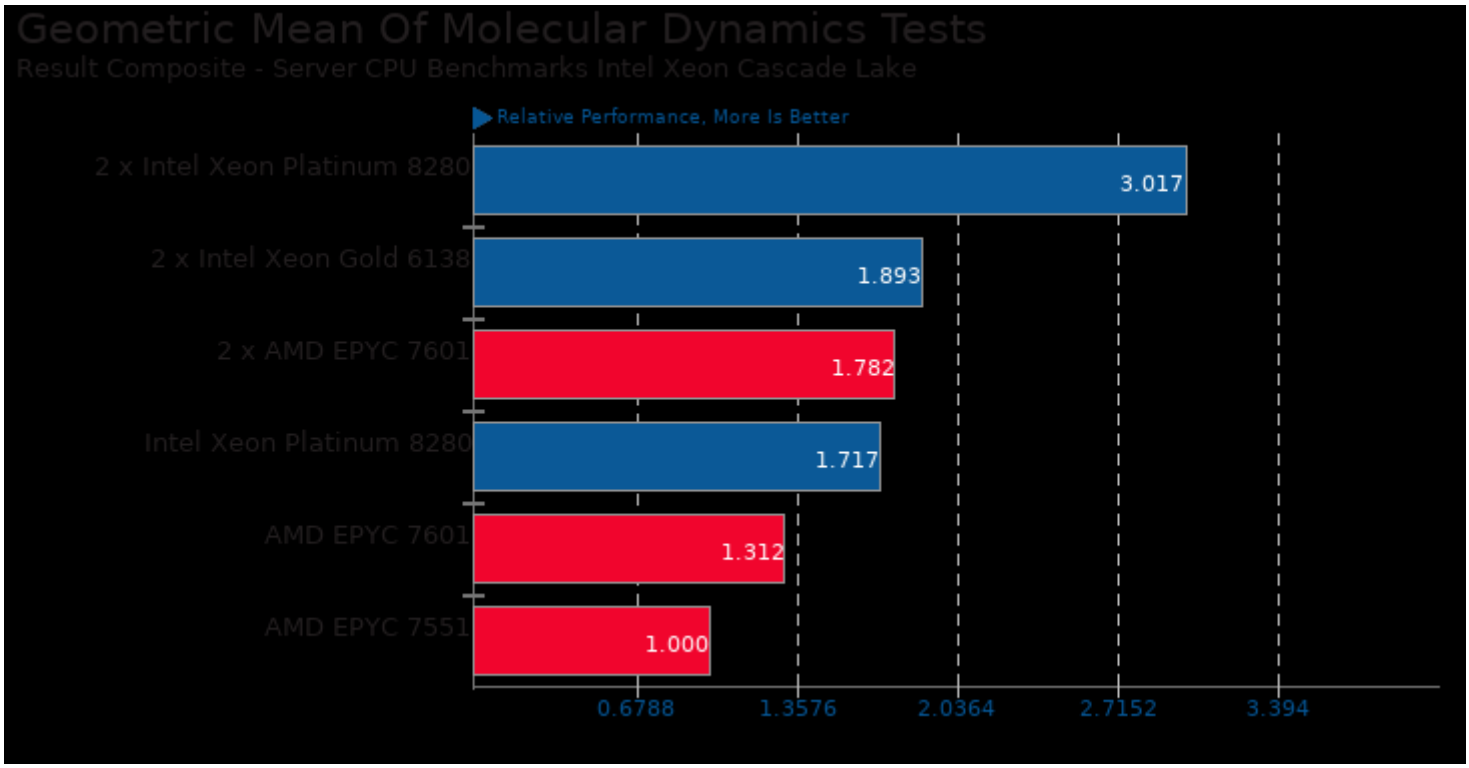
Geometric mean based upon tests: pts/mbw, pts/t-test1, pts/openssl and pts/ctx-clock



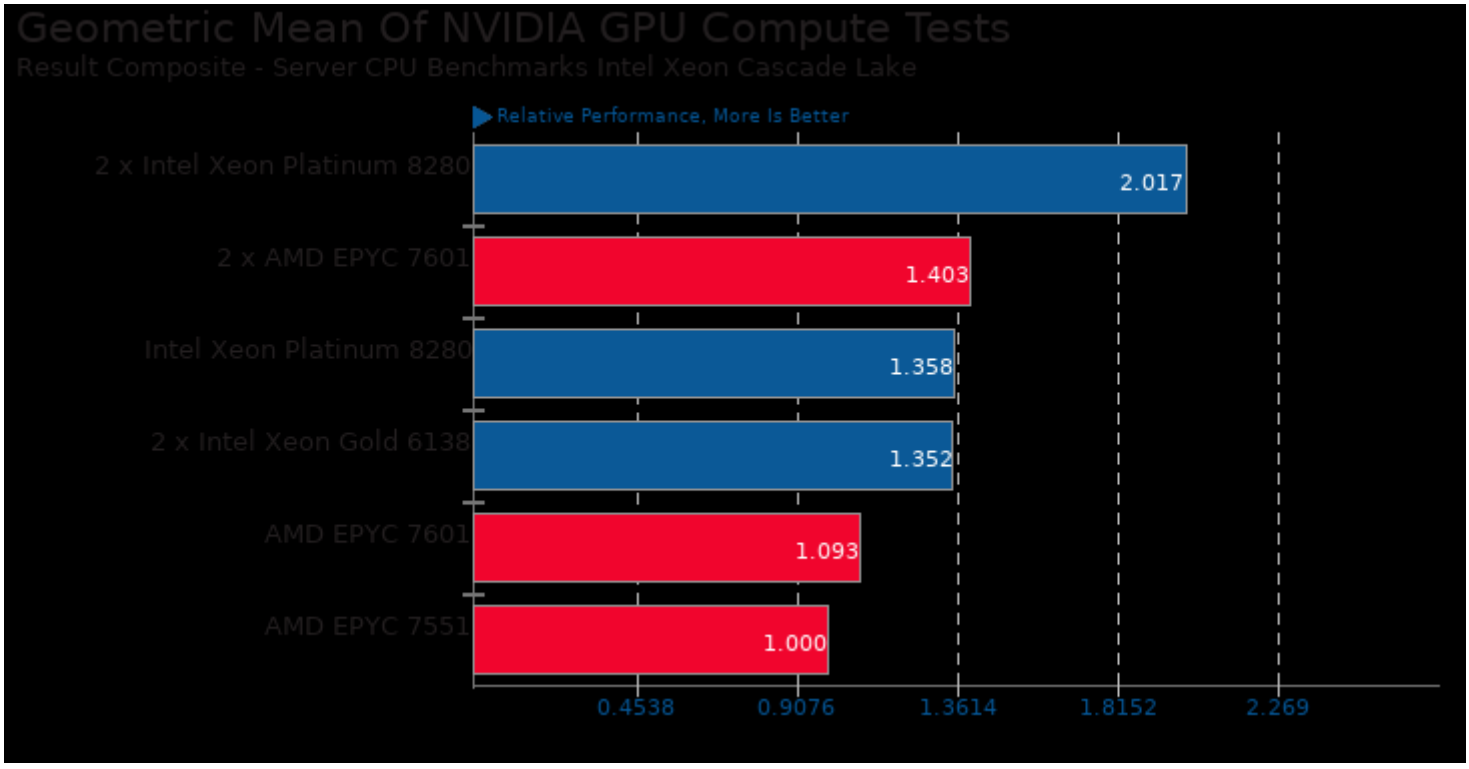
Geometric mean based upon tests: pts/rbenchmark and pts/tensorflow



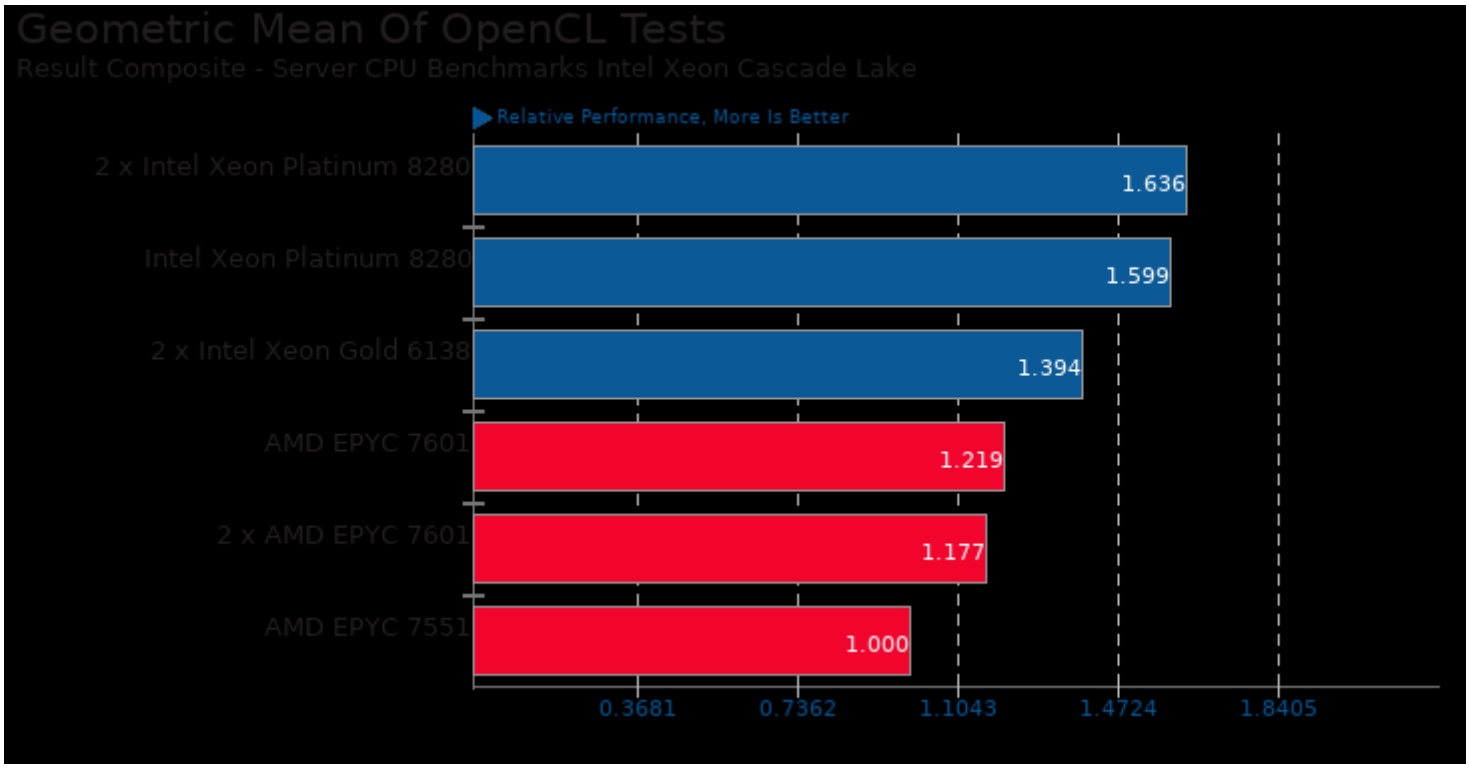
Geometric mean based upon tests: pts/ramspeed, pts/stream, pts/t-test1 and pts/mbw



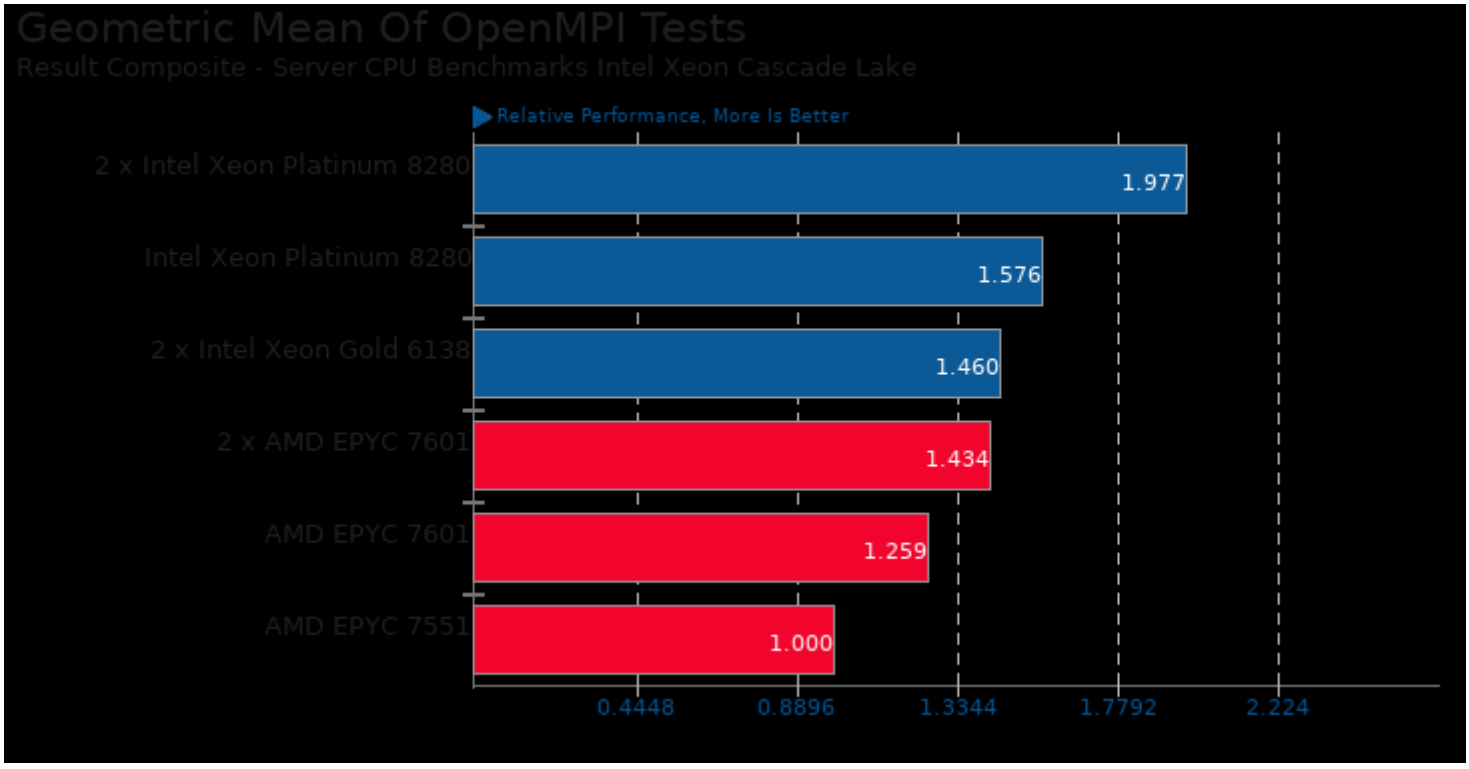
Geometric mean based upon tests: pts/namd and pts/cloverleaf



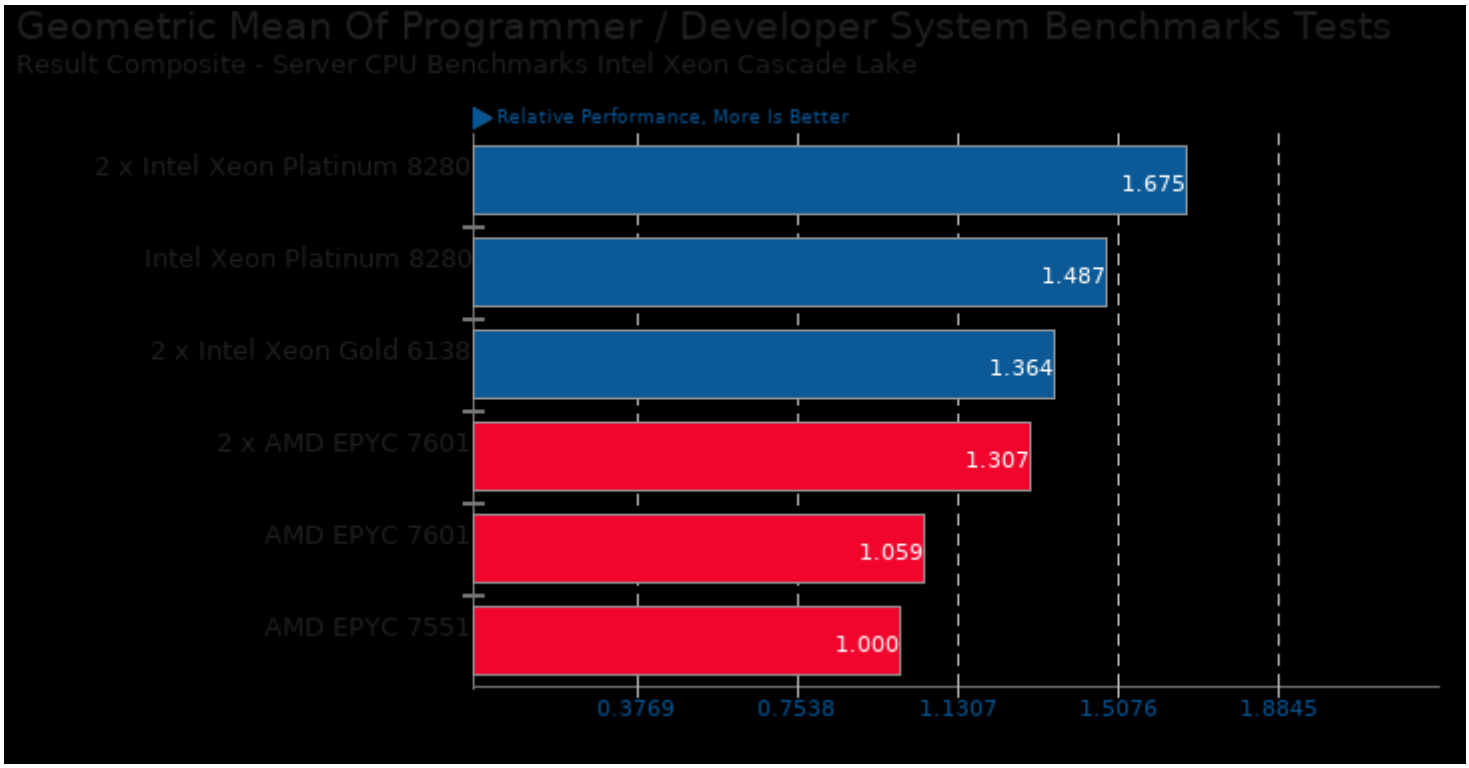
Geometric mean based upon tests: pts/rodinia, pts/indigobench, pts/v-ray and pts/blender



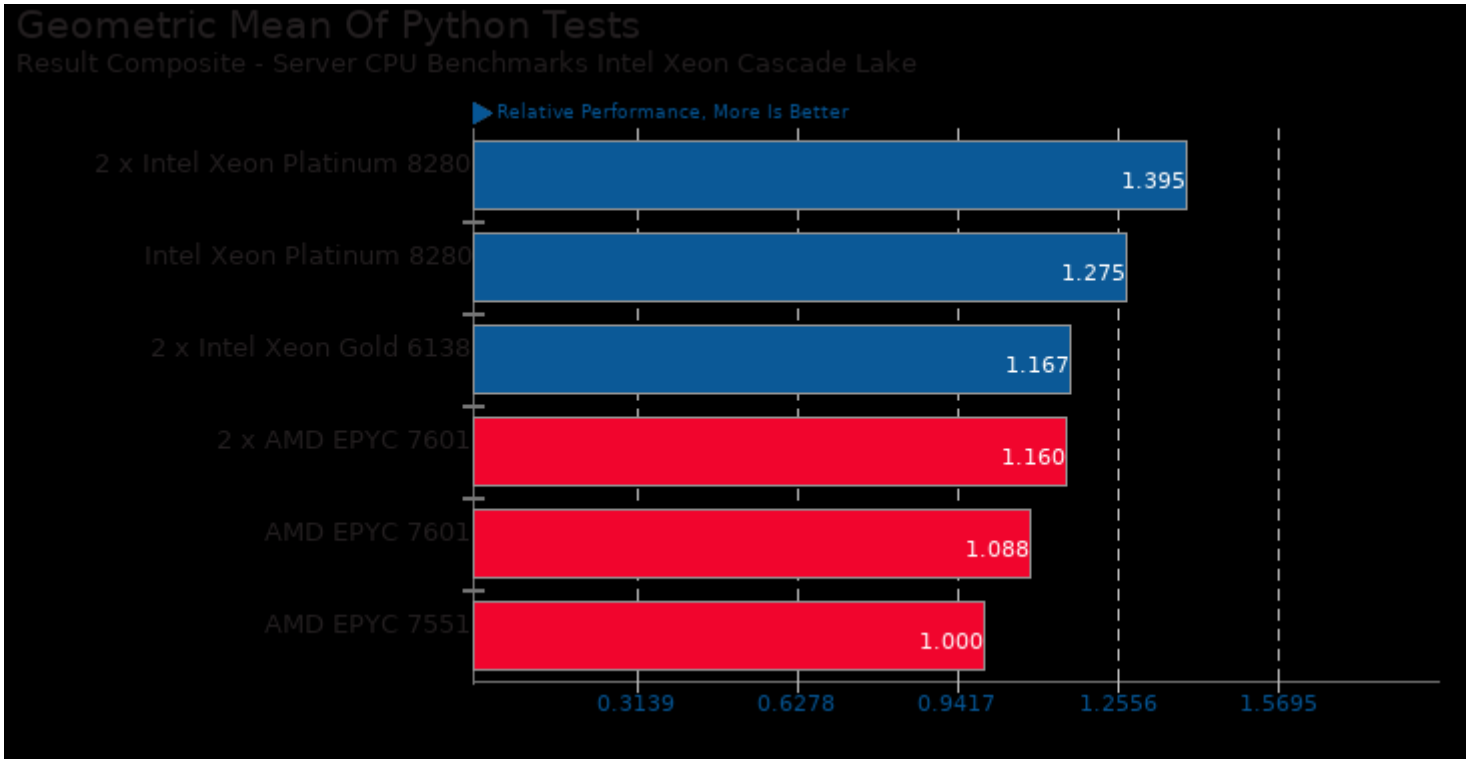
Geometric mean based upon tests: pts/rodinia, pts/parboil and system/darktable



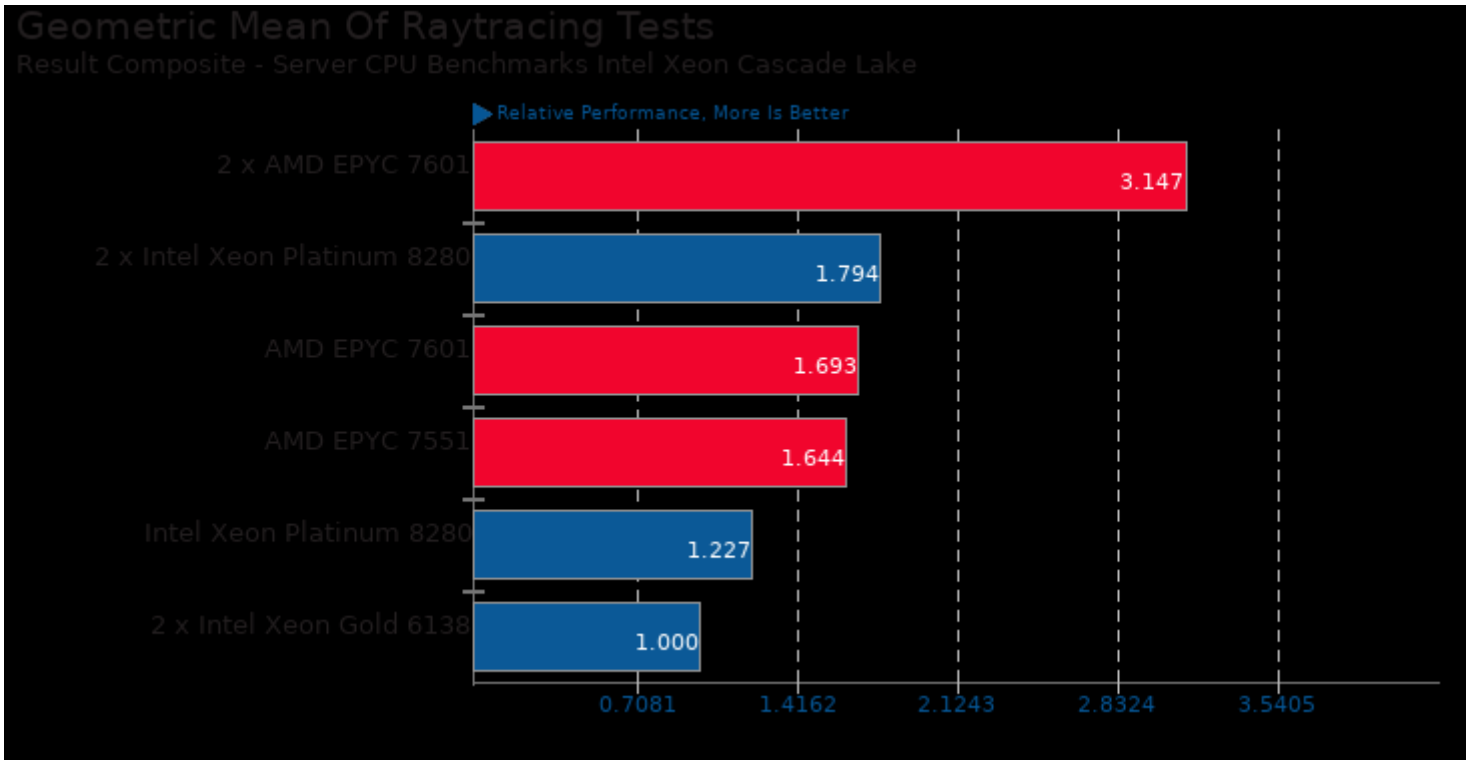
Geometric mean based upon tests: pts/npb, pts/parboil, pts/cloverleaf and pts/rodinia



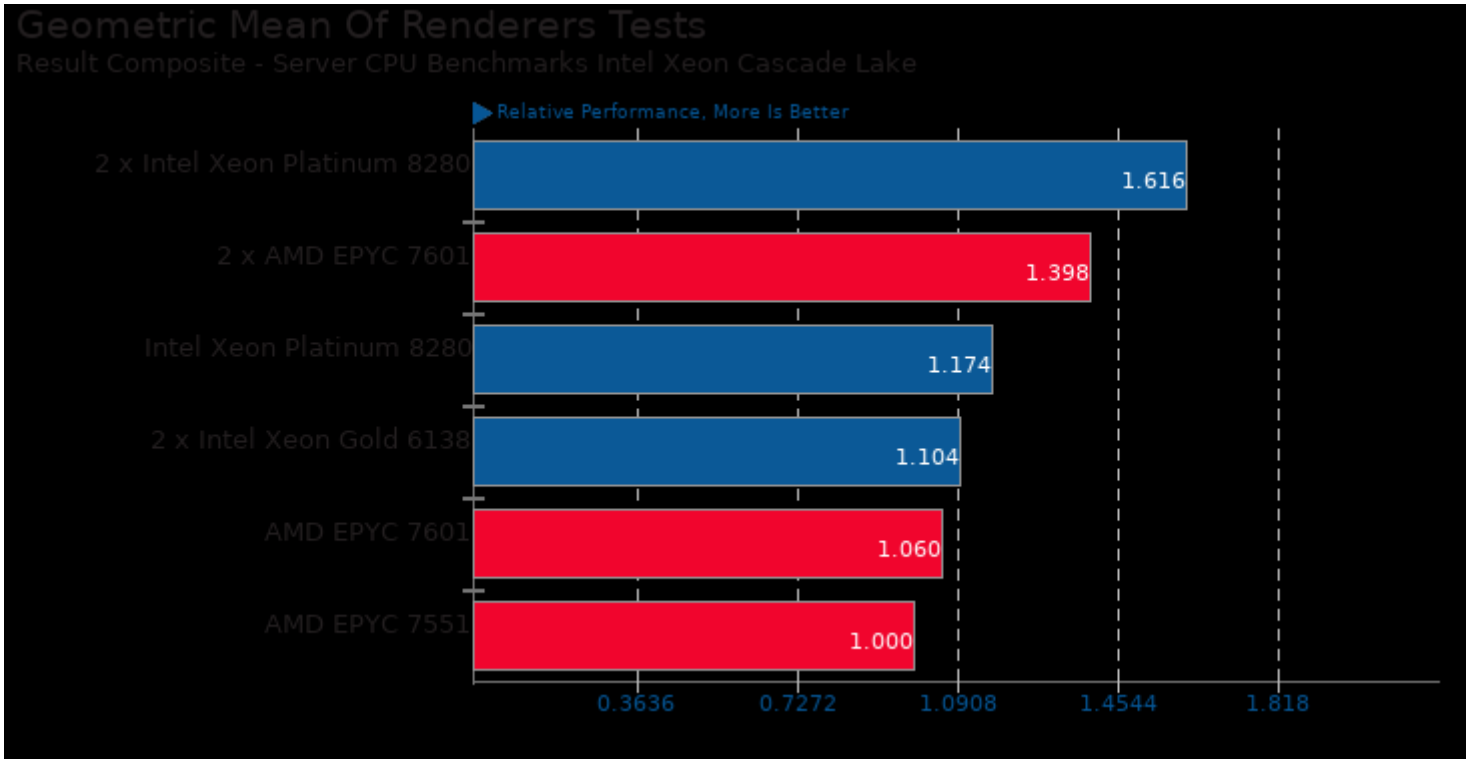
Geometric mean based upon tests: pts/compress-zstd, system/cryptsetup, pts/build-linux-kernel, pts/build-gcc and pts/build-llvm



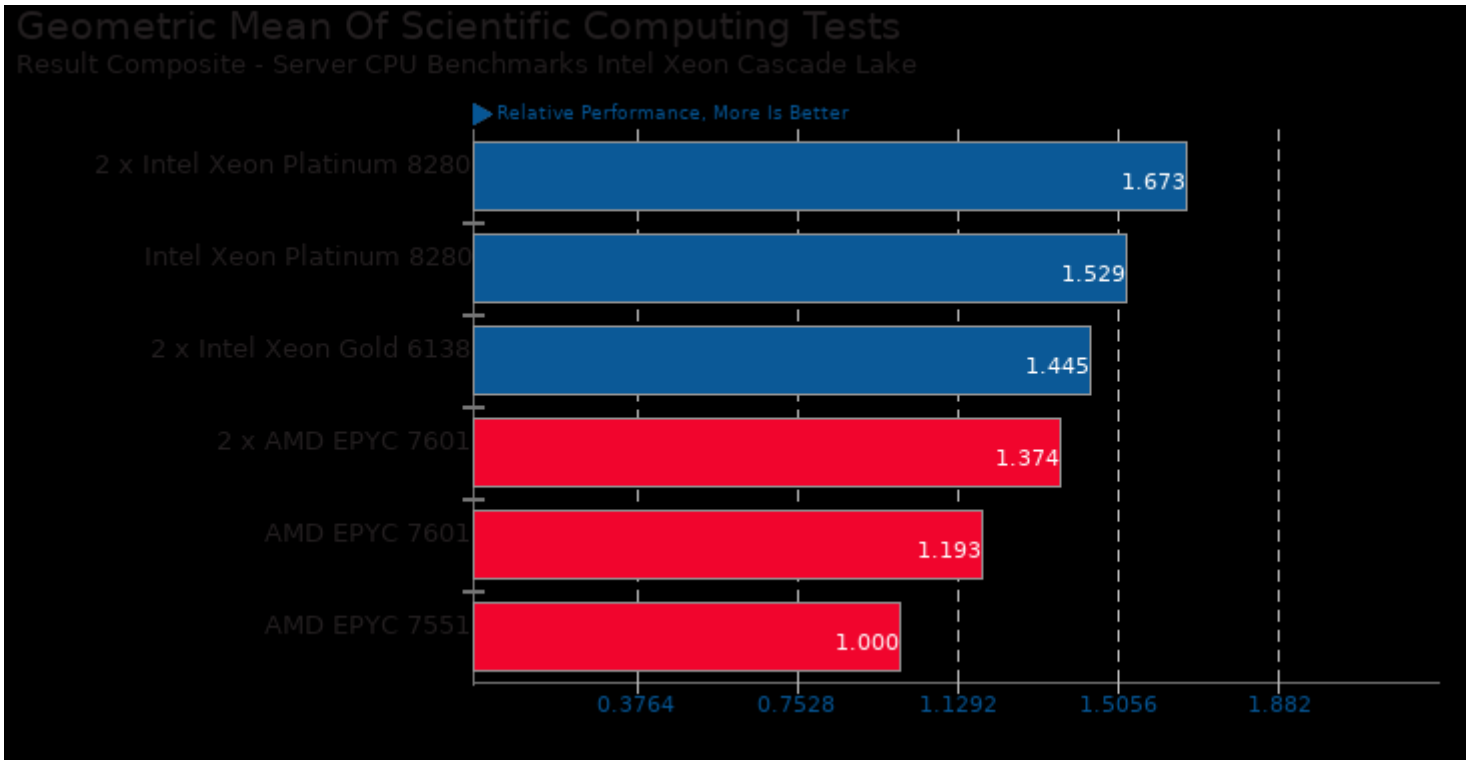
Geometric mean based upon tests: pts/parboil, pts/build-llvm, pts/opencv-bench and pts/tensorflow



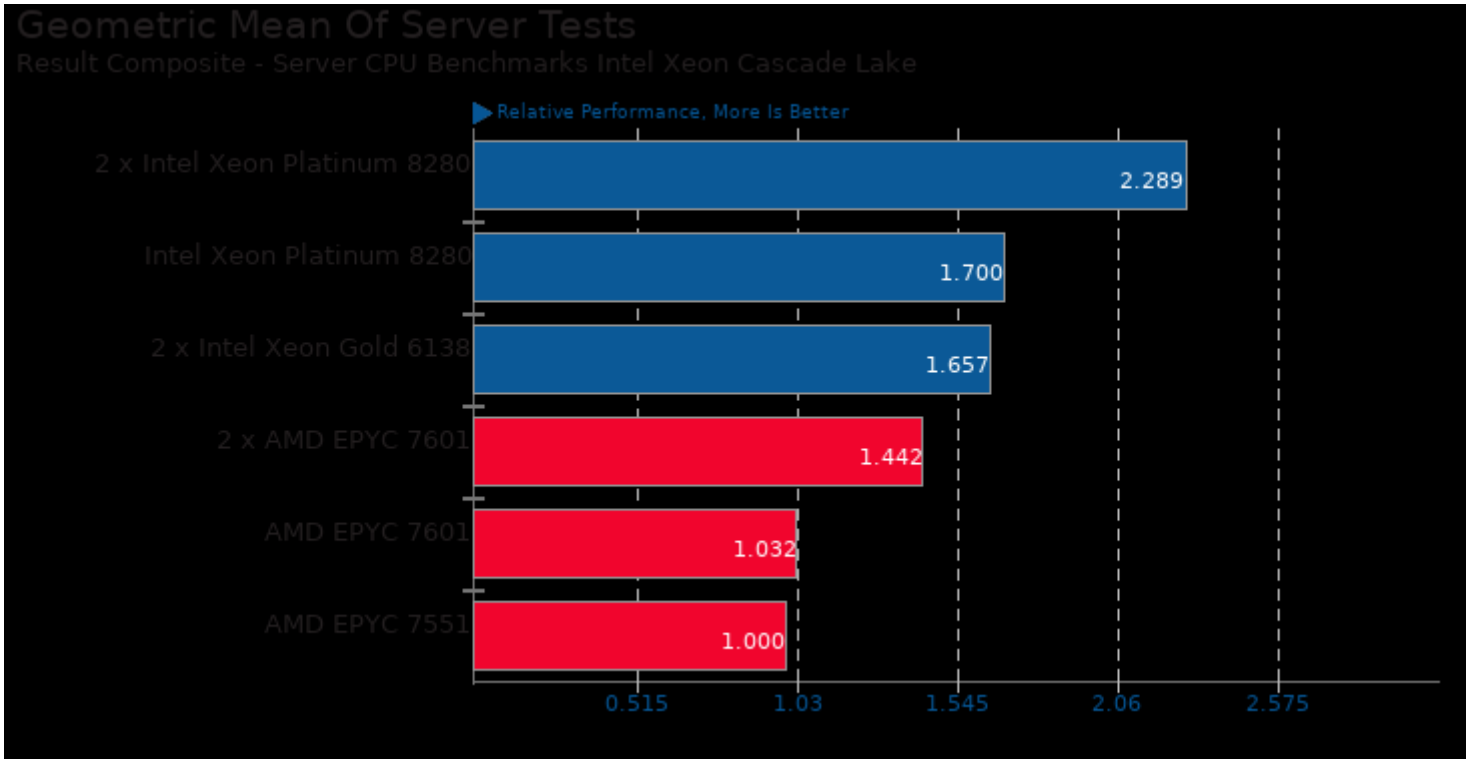
Geometric mean based upon tests: pts/c-ray and pts/povray



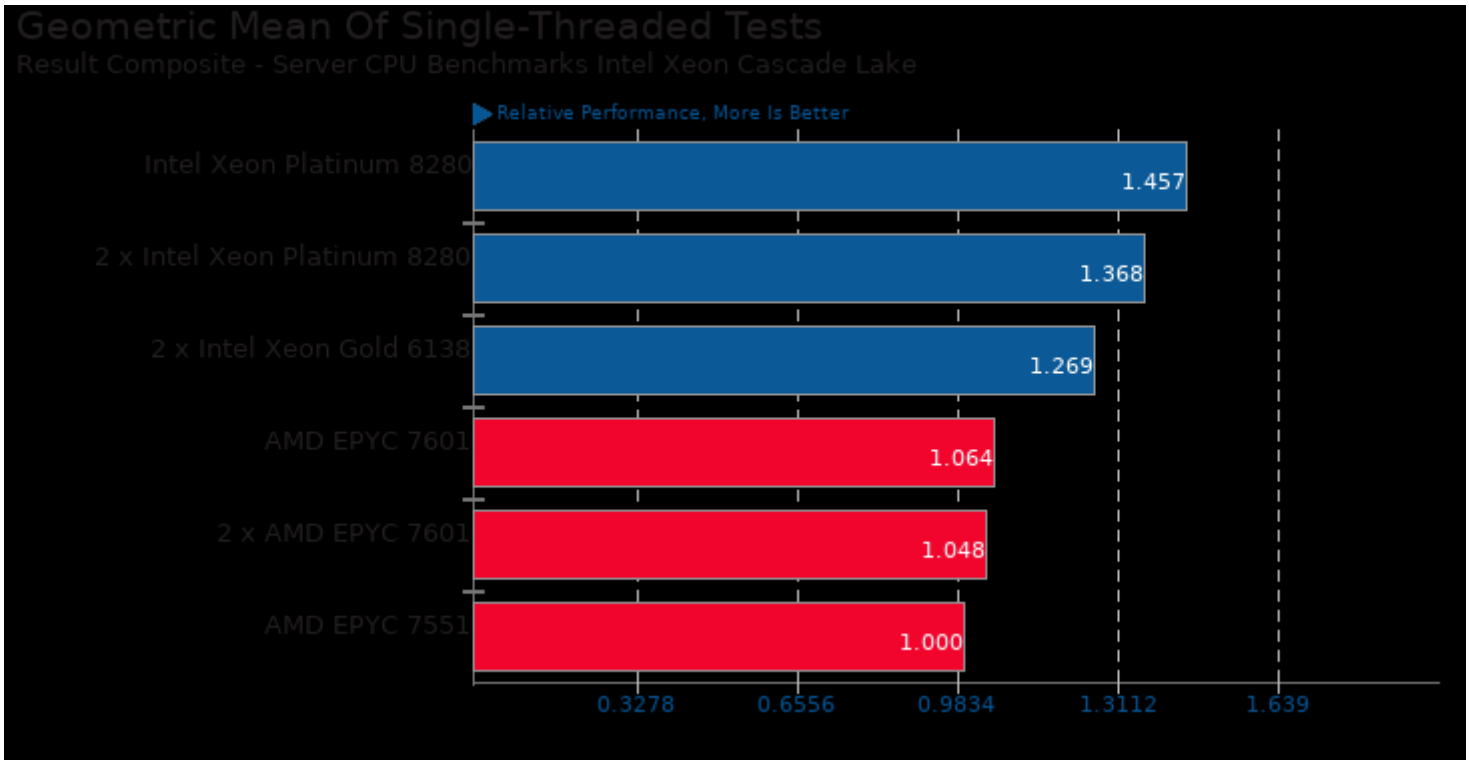
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/blender, pts/radiance, pts/v-ray and pts/indigobench



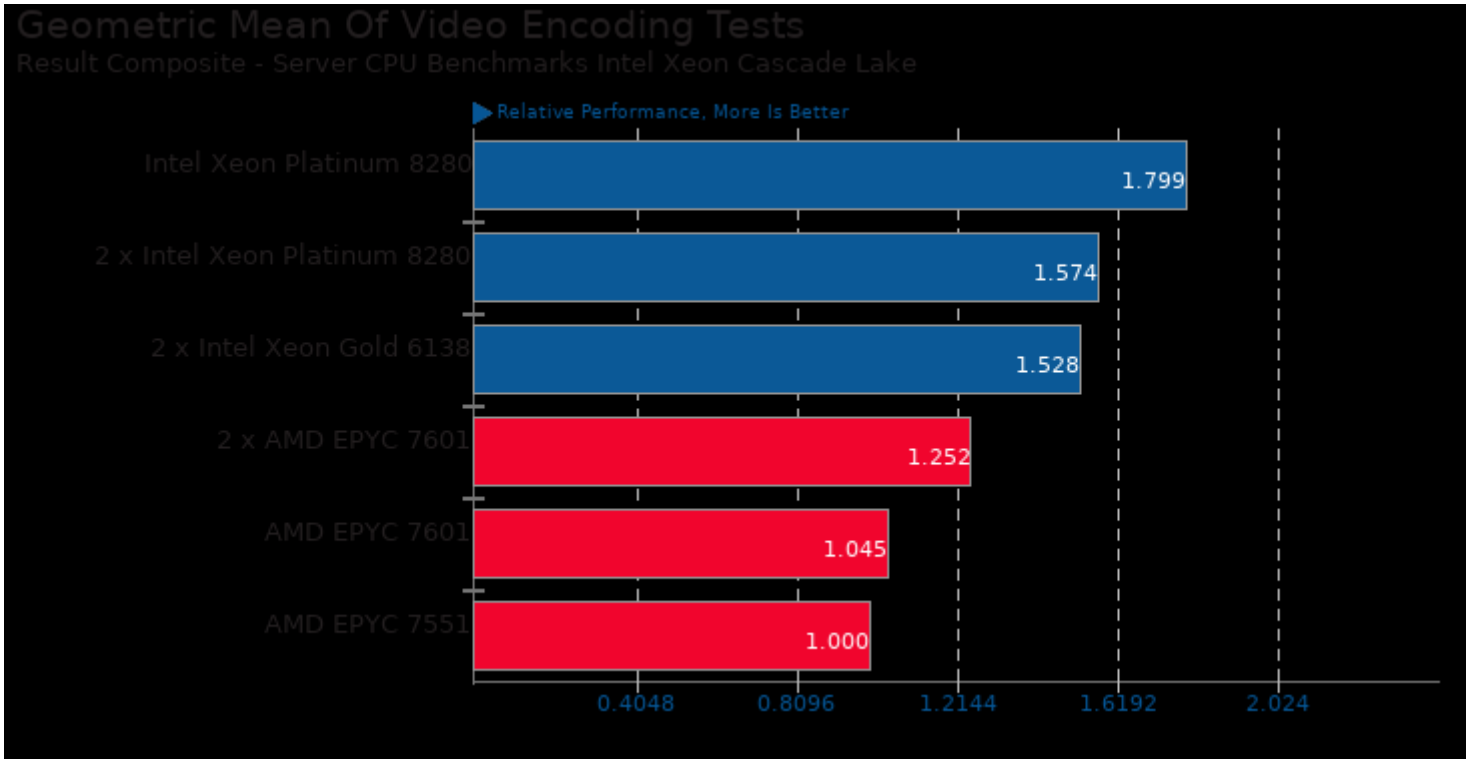
Geometric mean based upon tests: system/octave-benchmark, pts/namd, pts/cloverleaf, pts/himeno, pts/hmmer and pts/mafft



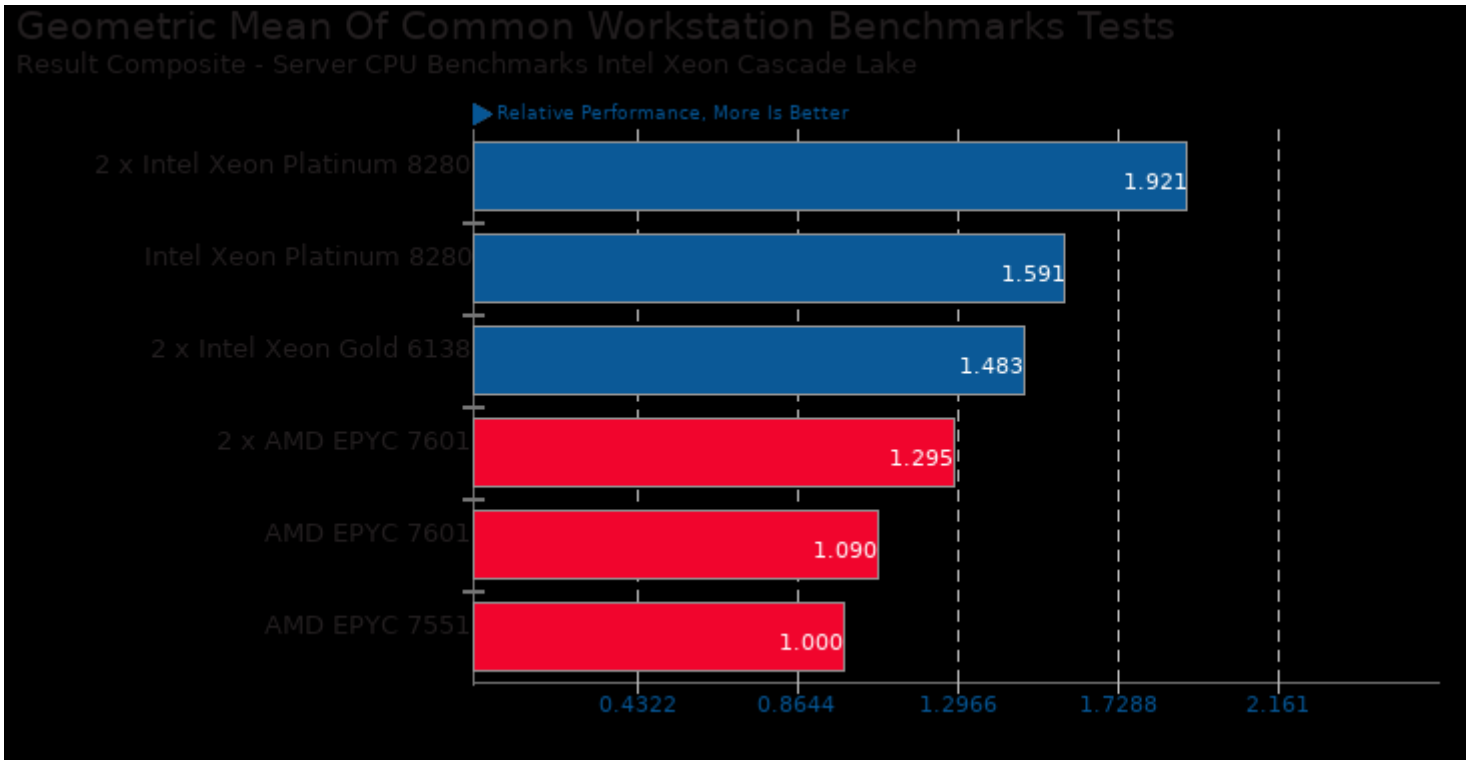
Geometric mean based upon tests: pts/node-express-loadtest and pts/openssl



Geometric mean based upon tests: pts/node-express-loadtest, pts/swet, pts/opencv-bench, pts/radiance, pts/rbenchmark, pts/tjbench and system/tesseract-ocr



Geometric mean based upon tests: pts/svt-vp9, pts/svt-hevc, pts/x264, pts/x265 and pts/svt-av1



Geometric mean based upon tests: pts/blender, pts/rodinia, pts/parboil, pts/himeno, pts/x265, pts/swet and pts/sysbench

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