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Xeon E

Intel Xeon E-2288G testing with a Compulab SBC-ATCFL v1.2 (ATOP3.PRD.0.29.2 BIOS) and NVIDIA Quadro RTX 4000 8GB on Ubuntu 20.10 via the Phoronix Test Suite.

Automated Executive Summary

1 had the most wins, coming in first place for 63% of the tests.

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

ASKAP (Test: *tConvolve OpenMP - Gridding*) at 1.106x
ASKAP (Test: *tConvolve OpenMP - Degridding*) at 1.101x
Geekbench (Test: *GPU NVIDIA CUDA*) at 1.046x
Timed HMMer Search (Pfam Database Search) at 1.041x
HPC Challenge (Test / Class: *Max Ping Pong Bandwidth*) at 1.028x
FinanceBench (Benchmark: *Repo OpenMP*) at 1.028x
ASKAP (Test: *tConvolve MPI - Gridding*) at 1.027x
SVT-AV1 (*Encoder Mode: Enc Mode 0 - Input: 1080p*) at 1.027x
Numpy Benchmark at 1.027x
HPC Challenge (Test / Class: *EP-DGEMM*) at 1.026x.

Test Systems:

1

Xeon E

Processor: Intel Xeon E-2288G @ 5.00GHz (8 Cores / 16 Threads), Motherboard: Compulab SBC-ATCFL v1.2 (ATOP3.PRD.0.29.2 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 2 x 32 GB DDR4-2667MT/s Samsung M378A4G43MB1-CTD, Disk: Samsung SSD 970 EVO Plus 250GB, Graphics: NVIDIA Quadro RTX 4000 8GB, Audio: Intel Cannon Lake PCH cAVS, Network: Intel I219-LM + Intel I210

OS: Ubuntu 20.10, Kernel: 5.8.0-26-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenCL: OpenCL 1.2 CUDA 11.1.96, Vulkan: 1.2.142, Compiler: GCC 11.0.0 20201112, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --disable-multilib --enable-checking=release --enable-languages=c,c++,fortran
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xd6
Security Notes: itlb_multihit: KVM: Mitigation of VMX disabled + 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 + srbs: Mitigation of TSX disabled + tsx_async_abort: Mitigation of TSX disabled

2

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OS: Ubuntu 20.10, Kernel: 5.8.0-26-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenCL: OpenCL 1.2 CUDA 11.1.96, Compiler: GCC 11.0.0 20201114, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --disable-multilib --enable-checking=release --enable-languages=c,c++,fortran
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xd6 - Thermald 2.3
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: KVM: Mitigation of VMX disabled + 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 + srbs: Mitigation of TSX disabled + tsx_async_abort: Mitigation of TSX disabled

3**4**

Processor: Intel Xeon E-2288G @ 5.00GHz (8 Cores / 16 Threads), Motherboard: Compulab SBC-ATCFL v1.2 (ATOP3.PRD.0.29.2 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 2 x 32 GB DDR4-2667MT/s Samsung M378A4G43MB1-CTD, Disk: Samsung SSD 970 EVO Plus 250GB, Graphics: NVIDIA Quadro RTX 4000 8GB, Audio: Intel Cannon Lake PCH cAVS, Network: Intel I219-LM + Intel I210

OS: Ubuntu 20.10, Kernel: 5.8.0-26-generic (x86_64), Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenCL: OpenCL 1.2 CUDA 11.1.96, Vulkan: 1.2.142, Compiler: GCC 11.0.0 20201114, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --disable-multilib --enable-checking=release --enable-languages=c,c++,fortran
Processor Notes: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xd6 - Thermald 2.3
Python Notes: Python 3.8.6

Security Notes: `itlb_multithit`: KVM: Mitigation of VMX disabled + `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/swaps barriers and `_user` pointer sanitization + `spectre_v2`: Mitigation of Enhanced IBRS IPB: conditional RSB filling + `srbs`: Mitigation of TSX disabled + `tsx_async_abort`: Mitigation of TSX disabled

1aaa

Intel Xeon E-2288G

Processor: Intel Xeon E-2288G @ 5.00GHz (8 Cores / 16 Threads), Motherboard: Compulab SBC-ATCFL v1.2 (ATOP3.PRD.0.29.2 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 2 x 32 GB DDR4-2667MT/s Samsung M378A4G43MB1-CTD, Disk: Samsung SSD 970 EVO Plus 250GB, Graphics: NVIDIA Quadro RTX 4000 8GB, Audio: Intel Cannon Lake PCH cAVS, Network: Intel I219-LM + Intel I210

OS: Ubuntu 20.10, Kernel: 5.8.0-41-generic (x86_64), Desktop: GNOME Shell 3.38.2, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, OpenCL: OpenCL 1.2 CUDA 11.2.109, Vulkan: 1.2.155, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: `--build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/us,r,hsa --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-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: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xde

Python Notes: Python 3.8.6

Security Notes: `itlb_multithit`: KVM: Mitigation of VMX disabled + `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/swaps barriers and `_user` pointer sanitization + `spectre_v2`: Mitigation of Enhanced IBRS IPB: conditional RSB filling + `srbs`: Mitigation of TSX disabled + `tsx_async_abort`: Mitigation of TSX disabled

22

Processor: Intel Xeon E-2288G @ 5.00GHz (8 Cores / 16 Threads), Motherboard: Compulab SBC-ATCFL v1.2 (ATOP3.PRD.0.29.2 BIOS), Chipset: Intel Cannon Lake PCH, Memory: 2 x 32 GB DDR4-2667MT/s Samsung M378A4G43MB1-CTD, Disk: Samsung SSD 970 EVO Plus 250GB, Graphics: NVIDIA Quadro RTX 4000 8GB, Audio: Intel Cannon Lake PCH cAVS, Network: Intel I219-LM + Intel I210

OS: Ubuntu 20.10, Kernel: 5.8.0-41-generic (x86_64), Desktop: GNOME Shell 3.38.2, Display Server: X Server 1.20.9, Display Driver: NVIDIA, OpenCL: OpenCL 1.2 CUDA 11.2.109, Vulkan: 1.2.155, Compiler: GCC 10.2.0, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: `--build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --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-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/us,r,hsa --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-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: Scaling Governor: intel_pstate powersave - CPU Microcode: 0xde - Thermald 2.3

Python Notes: Python 3.8.6

Security Notes: `itlb_multithit`: KVM: Mitigation of VMX disabled + `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/swaps barriers and `_user` pointer sanitization + `spectre_v2`: Mitigation of Enhanced IBRS IPB: conditional RSB filling + `srbs`: Mitigation of TSX disabled + `tsx_async_abort`: Mitigation of TSX disabled

Xeon E

	1	Xeon E	2	3	4	1aaa	Intel Xeon E-2288G	22
ASTC Encoder - Fast (sec)	5.46			5.50	5.50		5.49	5.50
Normalized	100%			99.27%	99.27%		99.45%	99.27%
Standard Deviation	0.3%			0.5%	0.2%		0.1%	0.2%
ASTC Encoder - Medium (sec)	8.18			8.24	8.19		8.20	8.24
Normalized	100%			99.27%	99.88%		99.76%	99.27%
Standard Deviation	0.1%			0.7%	0.3%		0.1%	0.1%
ASTC Encoder - Thorough (sec)	31.33			31.58	31.51		31.61	31.34
Normalized	100%			99.21%	99.43%		99.11%	99.97%
Standard Deviation	2.7%			2.6%	2.7%		2.7%	2.9%
ASTC Encoder - Exhaustive (sec)	268.33			270.05	269.66		270.84	270.21
Normalized	100%			99.36%	99.51%		99.07%	99.3%
Standard Deviation	0.4%			0.3%	0.4%		0.3%	0.3%
AI Benchmark Alpha - D.I.S (Score)	1128			1120	1120		1120	1115
Normalized	100%			99.29%	99.29%		99.29%	98.85%
AI Benchmark Alpha - D.T.S (Score)	1106			1095	1095		1094	1093
Normalized	100%			99.01%	99.01%		98.92%	98.82%
AI Benchmark Alpha - Device AI Score (Score)	2234			2215	2215		2214	2208
Normalized	100%			99.15%	99.15%		99.1%	98.84%
BYTE Unix Benchmark - Dhrystone 2 (LPS)	46234380			46279837	46266893		46234511	46234980
Normalized	99.9%			100%	99.97%		99.9%	99.9%
Standard Deviation	0.4%			0.3%	0.3%		0.4%	0.5%
eSpeak-NG Speech Engine - T.T.S.S (sec)	23.400			23.463	23.653			
Normalized	100%			99.73%	98.93%			
Standard Deviation	0.3%			0.5%	0.8%			
Hierarchical INTegration - FLOAT	474228741			473163559	467135969		473101083	473260861
Normalized	100%			99.78%	98.5%		99.76%	99.8%
Standard Deviation	0.1%			0.1%	1.2%		0%	0.3%
Geekbench - GPU OpenCL (Score)	91539			92188	92780			
Normalized	98.66%			99.36%	100%			
Standard Deviation	2.8%			1%	0.4%			
Geekbench - GPU Vulkan (Score)	71295			69734	69505			
Normalized	100%			97.81%	97.49%			
Standard Deviation	3.4%			2%	2.8%			
Geekbench - CPU Multi Core (Score)	9049			8928	8947			
Normalized	100%			98.66%	98.87%			
Standard Deviation	0.2%			0.6%	0.4%			

Geekbench - CPU	1422	1408	1409		
Single Core (Score)					
Normalized	100%	99.02%	99.09%		
Standard Deviation	0.1%	0.1%	0.1%		
Geekbench - GPU	96966	94531	92707		
NVIDIA CUDA (Score)					
Normalized	100%	97.49%	95.61%		
Standard Deviation	1.1%	1.3%	0.2%		
Timed HMMer Search - P.D.S (sec)	99.326	99.497	99.319	103.397	103.266
Normalized	99.99%	99.82%	100%	96.06%	96.18%
Standard Deviation	0.1%	0.1%	0%	0.2%	0.1%
Numpy Benchmark (Score)	426.64	426.73	422.21	420.27	415.66
Normalized	99.98%	100%	98.94%	98.49%	97.41%
Standard Deviation	0.2%	0.3%	0.8%	0.3%	0.7%
Darktable - Boat - OpenCL (sec)	2.126	2.127	2.123		
Normalized	99.86%	99.81%	100%		
Standard Deviation	0.4%	1.3%	0.6%		
Darktable - Boat - CPU-only (sec)	14.133	14.142	14.215		
Normalized	100%	99.94%	99.42%		
Standard Deviation	0.8%	1.2%	0.9%		
Darktable - Masskrug - OpenCL (sec)	3.698	3.720	3.699		
Normalized	100%	99.41%	99.97%		
Standard Deviation	0.2%	1.4%	0.1%		
Darktable - Masskrug - CPU-only (sec)	5.427	5.423	5.467		
Normalized	99.93%	100%	99.2%		
Standard Deviation	0.3%	0.1%	0.7%		
Darktable - Server Rack - OpenCL (sec)	0.123	0.122	0.122		
Normalized	99.19%	100%	100%		
Standard Deviation	0.5%	0.5%	0.8%		
Darktable - Server Room - OpenCL (sec)	0.883	0.900	0.885		
Normalized	100%	98.11%	99.77%		
Standard Deviation	0.6%	2%	1.5%		
Darktable - Server Rack - CPU-only (sec)	0.184	0.183	0.184		
Normalized	99.46%	100%	99.46%		
Standard Deviation	1.3%	0%	0.5%		
Darktable - Server Room - CPU-only (sec)	4.264	4.254	4.283		
Normalized	99.77%	100%	99.32%		
Standard Deviation	1.1%	1.1%	1.6%		

High Performance Conjugate Gradient (GFLOP/s)	4.07680	4.07522	4.07359
Normalized Standard Deviation	100%	99.96%	99.92%
HPC Challenge - G-HPL (GFLOPS)	0.1%	0.1%	0%
Normalized Standard Deviation	135.60833	134.79233	135.75933
HPC Challenge - G-Fft (GFLOPS)	99.89%	99.29%	100%
Normalized Standard Deviation	1.6%	0.5%	2.4%
HPC Challenge - G-Fft (GFLOPS)	5.02907	5.04432	5.03791
Normalized Standard Deviation	99.7%	100%	99.87%
HPC Challenge - EP-DGEMM (GFLOPS)	0.8%	0.3%	0.3%
Normalized Standard Deviation	28.90460	28.29730	28.15893
HPC Challenge - G-Ptrans (GB/s)	100%	97.9%	97.42%
Normalized Standard Deviation	2%	4.7%	4.2%
HPC Challenge - G-Ptrans (GB/s)	2.67813	2.67969	2.69046
Normalized Standard Deviation	99.54%	99.6%	100%
HPC Challenge - EP-STREAM Triad (GB/s)	0.2%	0.5%	0.3%
Normalized Standard Deviation	3.02130	3.02279	3.03194
HPC Challenge - EP-STREAM Triad (GB/s)	100%	99.7%	100%
Normalized Standard Deviation	0.1%	0.3%	0%
HPC Challenge - G-Rand Access (GUP/s)	0.03735	0.03757	0.03725
Normalized Standard Deviation	99.41%	100%	99.15%
HPC Challenge - G-Rand Access (GUP/s)	1.6%	2.5%	2%
Normalized Standard Deviation	0.27447	0.27200	0.27517
HPC Challenge - R.R.L (usecs)	99.1%	100%	98.85%
Normalized Standard Deviation	0.8%	1.4%	0.5%
HPC Challenge - R.R.B (GB/s)	1.68418	1.70255	1.71004
Normalized Standard Deviation	98.49%	99.56%	100%
HPC Challenge - R.R.B (GB/s)	0.2%	0.6%	0.8%
Normalized Standard Deviation	17142	17597	17119
HPC Challenge - M.P.P.B (MB/s)	98.49%	99.56%	100%
Normalized Standard Deviation	0.2%	0.6%	0.8%
CloverLeaf - L.E.H (sec)	176.87	177.02	177.08
Normalized Standard Deviation	100%	99.92%	99.88%
CP2K Molecular Dynamics - Fayalite-FIST Data (sec)	0.3%	0.1%	0.3%
Normalized Standard Deviation	1104	1107	1103
Fayalite-FIST Data (sec)	99.92%	99.63%	100%

NAMD - ATPase	1.97278	1.99278	1.97814
Simulation - 327,506			
Atoms (days/ns)			
Normalized	100%	99%	99.73%
Standard Deviation	0.7%	2.5%	2.2%
Dolfyn - C.F.D (sec)	16.793	16.815	16.676
Normalized	99.3%	99.17%	100%
Standard Deviation	1.3%	1.2%	0.6%
QMCPACK -	28.281	28.335	27.926
simple-H2O (Execution			
Normalized	98.74%	98.56%	100%
Standard Deviation	1.7%	3%	2.9%
LAMMPS Molecular	5.861	5.871	5.866
Dynamics Simulator -			
20k Atoms (ns/day)			
Normalized	99.83%	100%	99.91%
Standard Deviation	0.3%	0.4%	0.6%
LAMMPS Molecular	6.725	6.756	6.705
Dynamics Simulator -			
Rhodopsin Protein			
(ns/day)			
Normalized	99.54%	100%	99.25%
Standard Deviation	0.9%	0.9%	0.8%
LULESH (z/s)	4821	4826	4841
Normalized	99.6%	99.7%	100%
Standard Deviation	0.2%	0.1%	0.1%
JPEG XL - PNG - 5	62.53	62.55	62.69
(MP/s)			
Normalized	99.74%	99.78%	100%
Standard Deviation	0.3%	0.3%	0.2%
JPEG XL - PNG - 7	9.36	9.38	9.40
(MP/s)			
Normalized	99.57%	99.79%	100%
Standard Deviation	0.1%	0.2%	0.2%
JPEG XL - PNG - 8	0.84	0.85	0.85
(MP/s)			
Normalized	98.82%	100%	100%
Standard Deviation	0.7%	0.7%	0%
JPEG XL - JPEG - 5	64.05	63.80	64.18
(MP/s)			
Normalized	99.8%	99.41%	100%
Standard Deviation	0.6%	1.1%	0.2%
JPEG XL - JPEG - 7	63.36	63.53	64.31
(MP/s)			
Normalized	98.52%	98.79%	100%
Standard Deviation	0.8%	1.5%	0.9%
JPEG XL - JPEG - 8	28.67	28.64	28.44
(MP/s)			
Normalized	100%	99.9%	99.2%
Standard Deviation	0.8%	1.5%	0.3%

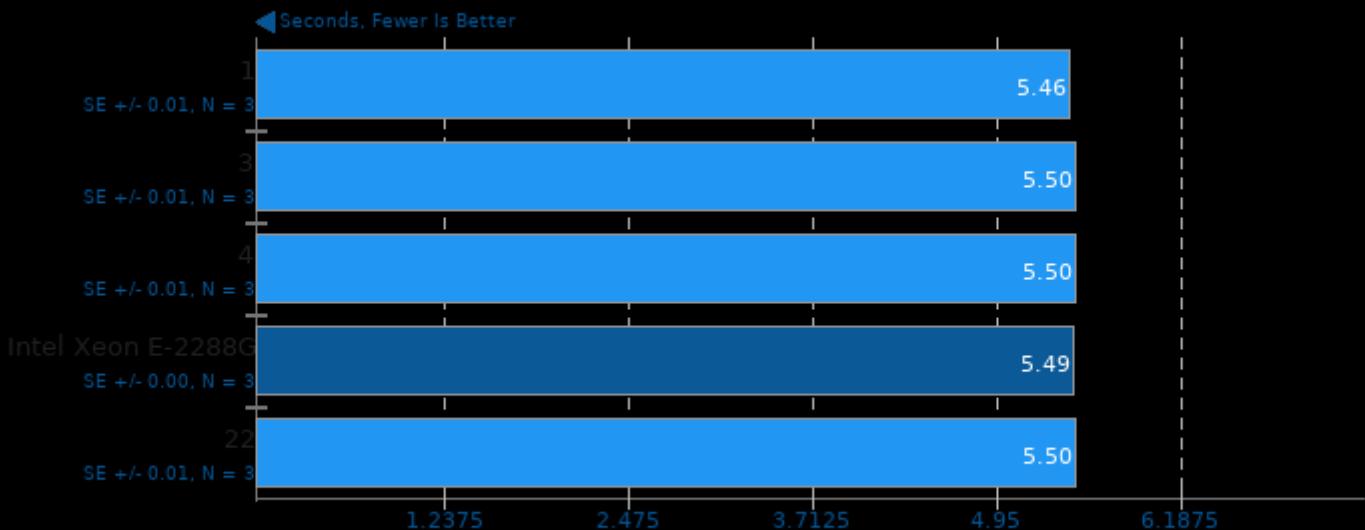
JPEG XL Decoding - 1 (MP/s)	44.65	44.71	44.82
Normalized Standard Deviation	99.62% 0.2%	99.75% 0%	100% 0.3%
JPEG XL Decoding - All (MP/s)	188.37	188.41	189.93
Normalized Standard Deviation	99.18% 0.8%	99.2% 1%	100% 1%
rav1e - 1 (FPS)	0.492	0.487	0.490
Normalized Standard Deviation	100% 0.1%	98.98% 0.5%	99.59% 0.6%
rav1e - 5 (FPS)	1.395	1.392	1.395
Normalized Standard Deviation	100% 0.8%	99.78% 2.9%	100% 1.2%
rav1e - 6 (FPS)	1.865	1.871	1.868
Normalized Standard Deviation	99.68% 0.4%	100% 0.5%	99.84% 1.4%
rav1e - 10 (FPS)	3.961	3.987	4.033
Normalized Standard Deviation	98.21% 0.7%	98.86% 1.7%	100% 2.6%
SVT-AV1 - Enc Mode 0 - 1080p (FPS)	0.114	0.111	0.114
Normalized Standard Deviation	100% 4.2%	97.37% 1.9%	100% 0.9%
SVT-AV1 - Enc Mode 4 - 1080p (FPS)	3.002	3.002	3.026
Normalized Standard Deviation	99.21% 1.3%	99.21% 2.7%	100% 1.6%
SVT-AV1 - Enc Mode 8 - 1080p (FPS)	27.227	27.291	27.214
Normalized Standard Deviation	99.77% 2.9%	100% 2.5%	99.72% 2.9%
SVT-VP9 - VMAF	162.22	160.20	162.31
Optimized - Bosphorus 1080p (FPS)			
Normalized Standard Deviation	99.94% 0.1%	98.7% 2.2%	100% 0.2%
SVT-VP9 - P.S.O - Bosphorus 1080p (FPS)	166.87	167.01	166.77
Normalized Standard Deviation	99.92% 0.4%	100% 0.1%	99.86% 0.3%
SVT-VP9 - V.Q.O - Bosphorus 1080p (FPS)	133.53	133.53	133.13
Normalized Standard Deviation	100% 0.2%	100% 0.5%	99.7% 0.3%
x264 - H.2.V.E (FPS)	93.32	94.40	94.20
Normalized Standard Deviation	98.86% 2.5%	100% 1.3%	99.79% 1.3%
x265 - Bosphorus 4K (FPS)	12.42	12.15	12.23
Normalized Standard Deviation	100% 0.6%	97.83% 1.9%	98.47% 2.8%

x265 - Bosphorus	55.80	55.01	55.73
1080p (FPS)			
Normalized	100%	98.58%	99.87%
Standard Deviation	1.5%	2.8%	2.1%
WebP2 Image Encode - Default (sec)	4.256	4.283	4.296
Normalized	100%	99.37%	99.07%
Standard Deviation	0.4%	0.6%	0.4%
WebP2 Image Encode - Q.7.C.E.7 (sec)	275.728	276.079	276.689
Normalized	100%	99.87%	99.65%
Standard Deviation	0.1%	0.1%	0.2%
WebP2 Image Encode - Q.9.C.E.7 (sec)	509.209	509.111	507.994
Normalized	99.76%	99.78%	100%
Standard Deviation	0.3%	0.3%	0.2%
WebP2 Image Encode - Q.1.C.E.5 (sec)	15.279	15.323	15.309
Normalized	100%	99.71%	99.8%
Standard Deviation	2.9%	2.9%	2.7%
WebP2 Image Encode - Q.1.L.C (sec)	1041	1043	1044
Normalized	100%	99.76%	99.74%
Standard Deviation	0.1%	0.1%	0%
Google SynthMark - VoiceMark_100	767.011	769.811	773.950
Normalized	99.1%	99.47%	100%
Standard Deviation	1.4%	0.5%	0.2%
FinanceBench - Repo	38096	37065	37365
Normalized	97.3%	100%	99.2%
Standard Deviation	2.8%	2.6%	2.8%
FinanceBench - Bonds	53433	53546	53475
Normalized	100%	99.79%	99.92%
Standard Deviation	0.7%	0.4%	0.5%
FinanceBench - Monte-Carlo OpenCL	738.707988	734.801005	738.327677
(ms)			
Normalized	97.3%	100%	99.2%
Standard Deviation	2.8%	2.6%	2.8%
FinanceBench - B.S.O	23.224333	22.917001	22.928667
(ms)			
Normalized	99.47%	100%	99.52%
Standard Deviation	0.5%	0.4%	0.3%
ASKAP - tConvolve MT	1137	1137	1135
- Gridding (Million Grid Points/sec)			
Normalized	98.68%	100%	99.95%
Standard Deviation	1.3%	0.2%	0%

ASKAP - tConvolve MT	1724	1720	1719
- Degridding (Million Grid Points/sec)			
Normalized	100%	99.74%	99.71%
Standard Deviation	0.2%	0.4%	0.4%
ASKAP - tConvolve MPI	1888	1892	1874
- Degridding (Mpix/sec)			
Normalized	99.76%	100%	99.05%
Standard Deviation	0.7%	0.4%	0.7%
ASKAP - tConvolve MPI	1920	1915	1869
- Gridding (Mpix/sec)			
Normalized	100%	99.75%	97.32%
Standard Deviation	1.1%	0.7%	3.5%
ASKAP - tConvolve	1258	1392	1384
OpenMP - Gridding (Million Grid			
Normalized	90.4%	100%	99.48%
Standard Deviation	0.5%	0.3%	0.8%
ASKAP - tConvolve	2027	2231	2219
OpenMP - Degridding (Million Grid			
Normalized	90.86%	100%	99.44%
Standard Deviation	0.4%	0.5%	0%
ASKAP - H.C.O (Iterations/sec)	175.147	176.576	176.581
GROMACS -			
water_GMX50_bare (Ns/Day)			
Normalized	99.19%	100%	100%
Standard Deviation	1.1%	0.4%	0.7%
Kripke (Throughput	0.819	0.812	0.812
Normalized	100%	99.15%	99.15%
Standard Deviation	0.1%	0.3%	0.3%
Chaos Group V-RAY - CPU (vsamples)	30362030	30297030	30306600
Normalized	100%	99.79%	99.82%
Standard Deviation	0.3%	0.6%	0.4%
8421	8436	8472	
Normalized	99.4%	99.58%	100%
Standard Deviation	0.4%	0.4%	0.1%

ASTC Encoder 2.0

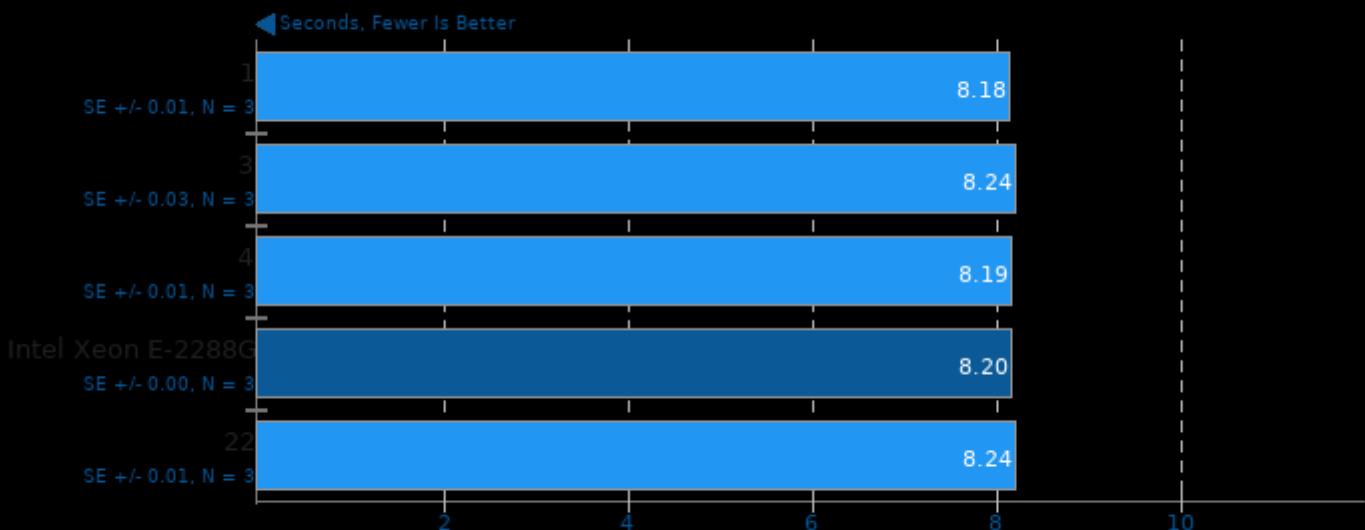
Preset: Fast



1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno -mfpmath=sse -mavx2 -mpopcnt -lpthread

ASTC Encoder 2.0

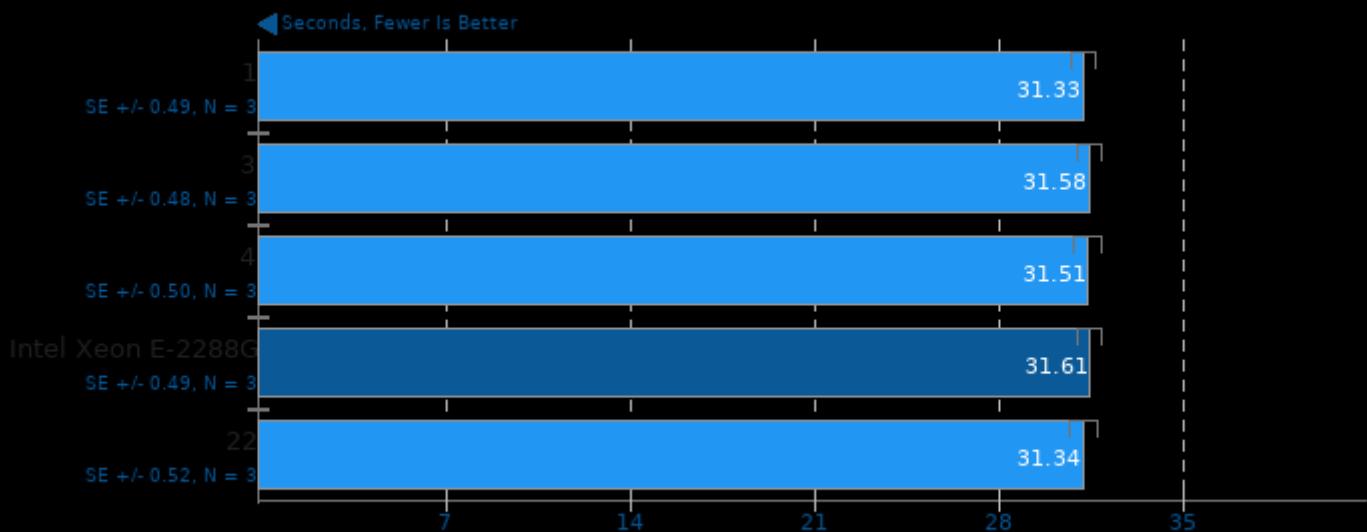
Preset: Medium



1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno -mfpmath=sse -mavx2 -mpopcnt -lpthread

ASTC Encoder 2.0

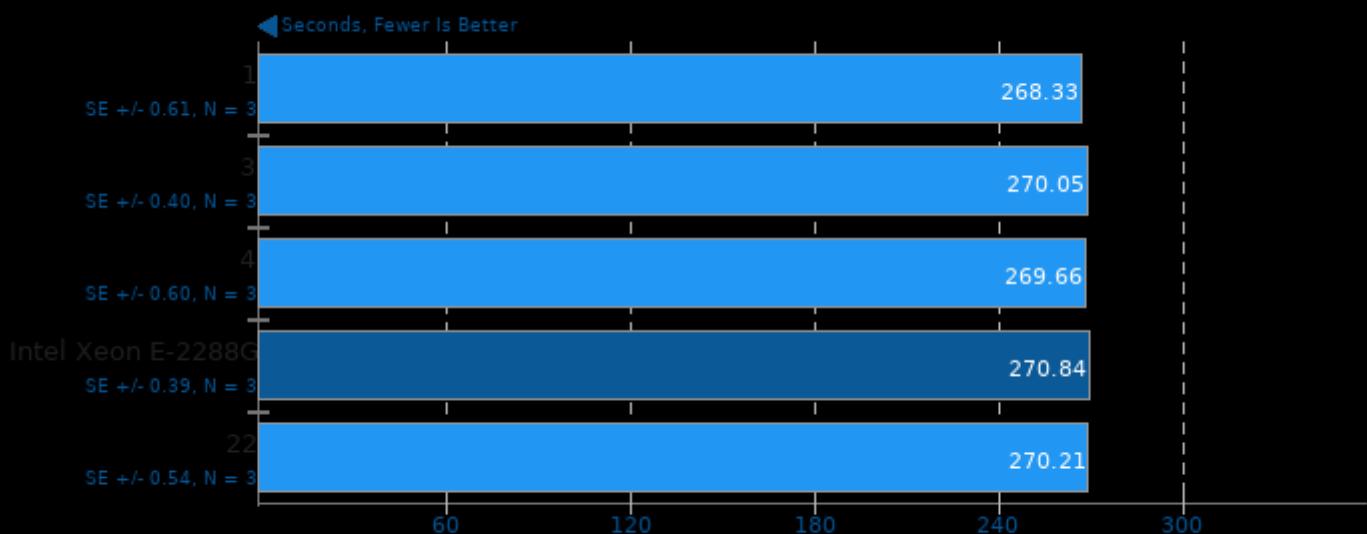
Preset: Thorough



1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno -mfpmath=sse -mavx2 -mpopcnt -lpthread

ASTC Encoder 2.0

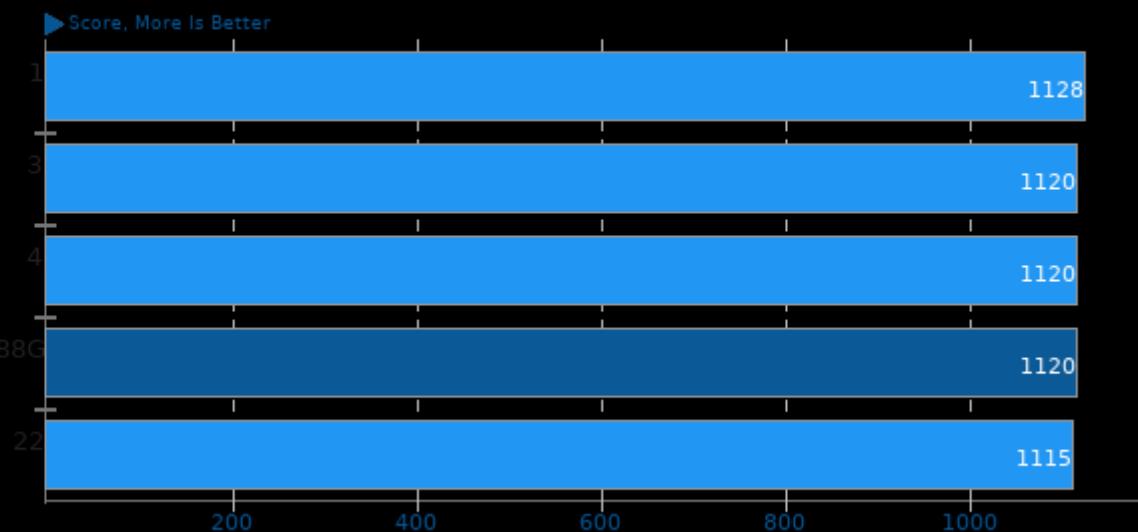
Preset: Exhaustive



1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno -mfpmath=sse -mavx2 -mpopcnt -lpthread

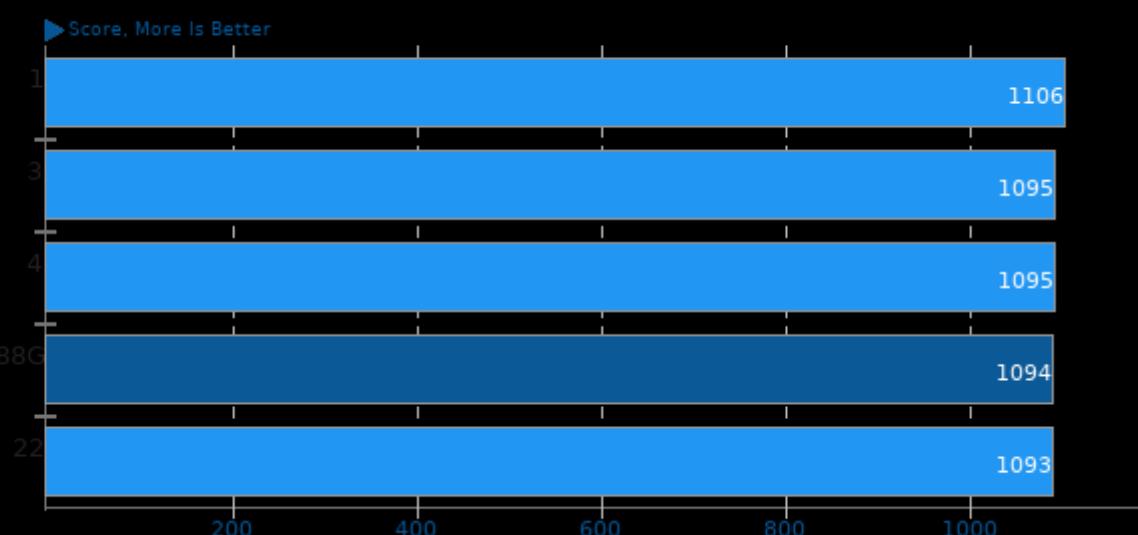
AI Benchmark Alpha 0.1.2

Device Inference Score



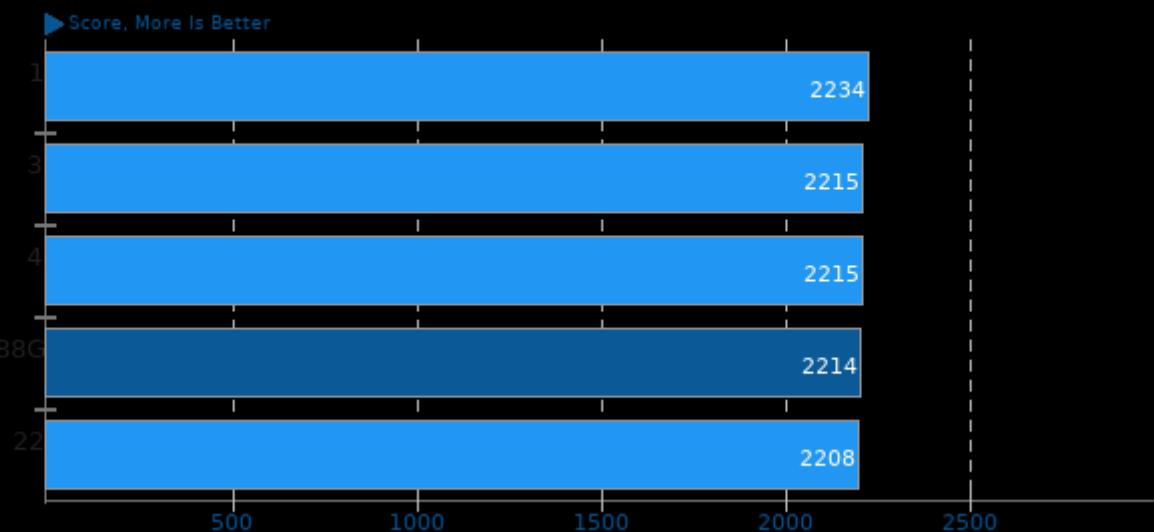
AI Benchmark Alpha 0.1.2

Device Training Score

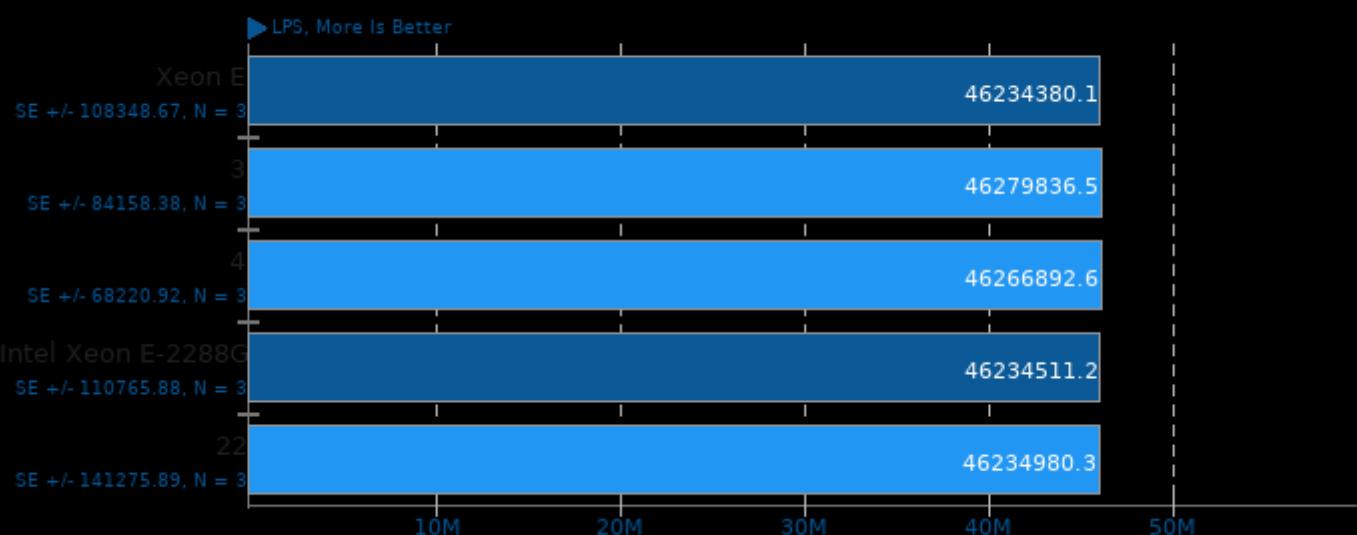


Xeon E**AI Benchmark Alpha 0.1.2**

Device AI Score

**BYTE Unix Benchmark 3.6**

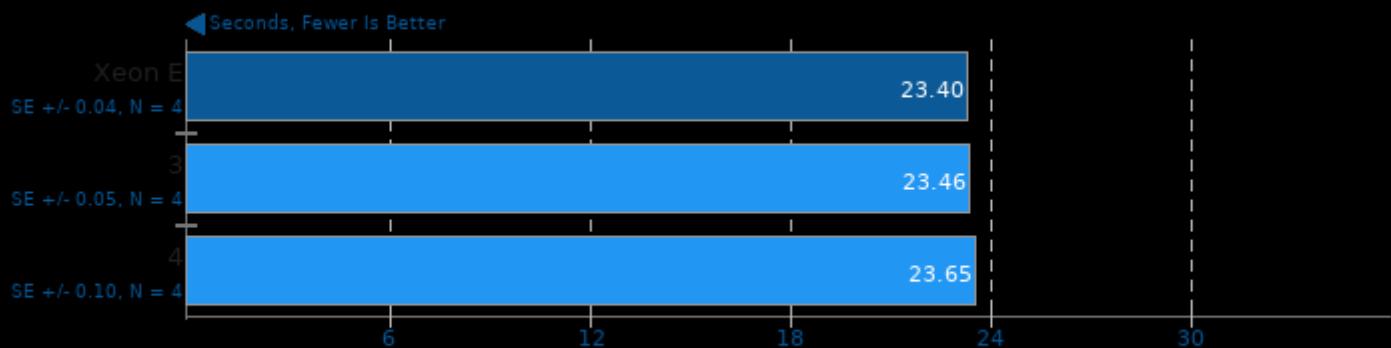
Computational Test: Dhrystone 2



Xeon E

eSpeak-NG Speech Engine 20200907

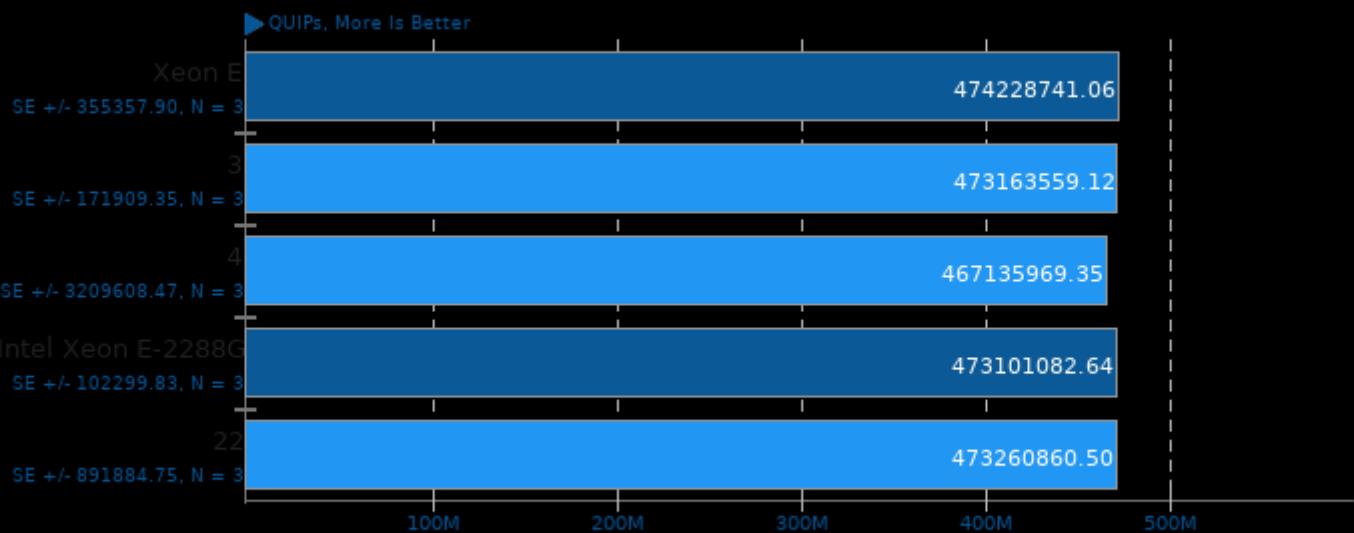
Text-To-Speech Synthesis



1. (CC) gcc options: -O2 -std=c99

Hierarchical INTegration 1.0

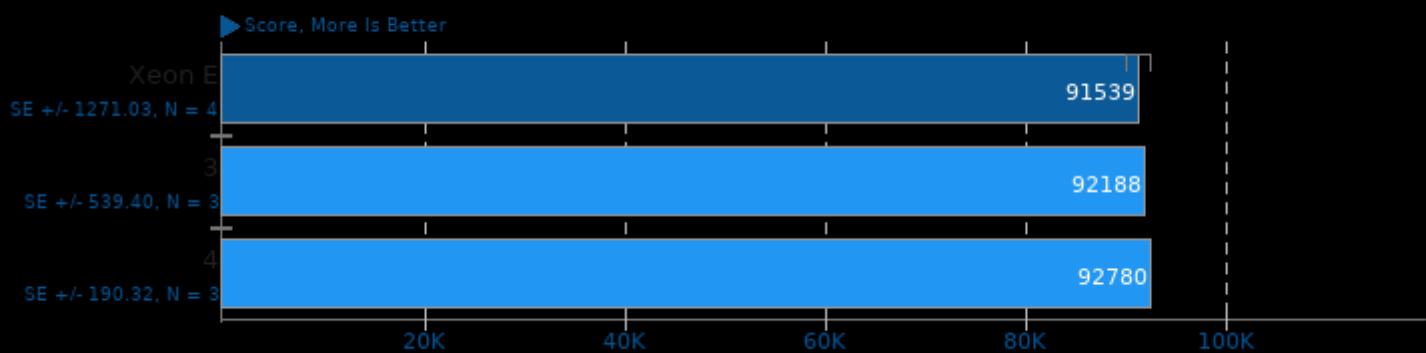
Test: FLOAT



1. (CC) gcc options: -O3 -march=native -lm

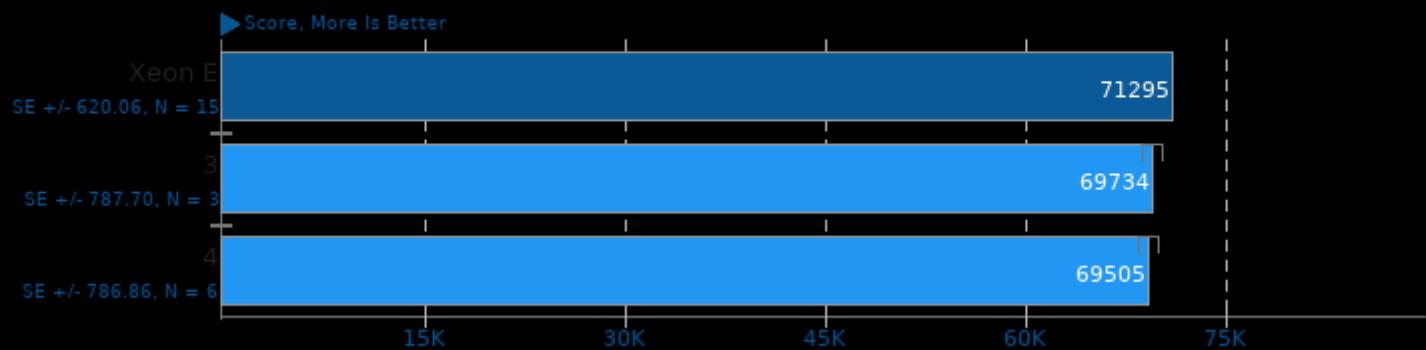
Geekbench 5

Test: GPU OpenCL



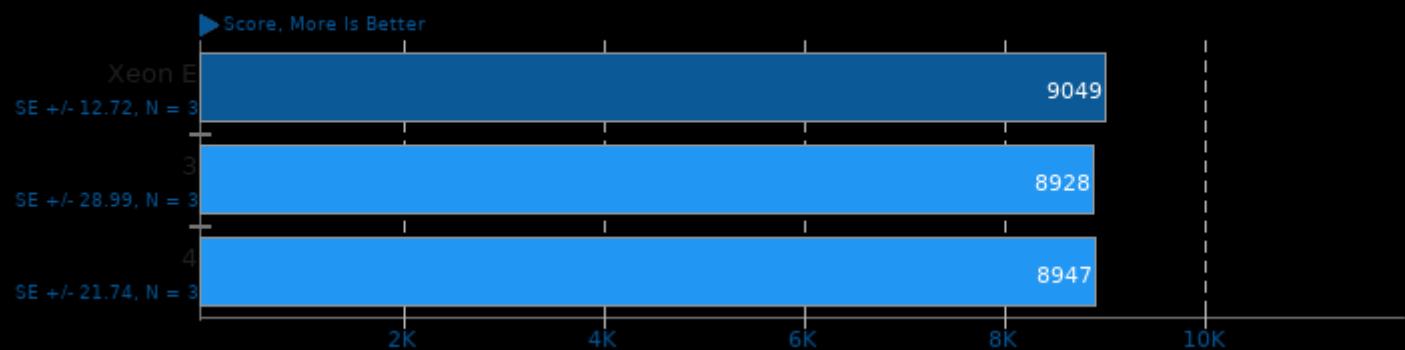
Geekbench 5

Test: GPU Vulkan



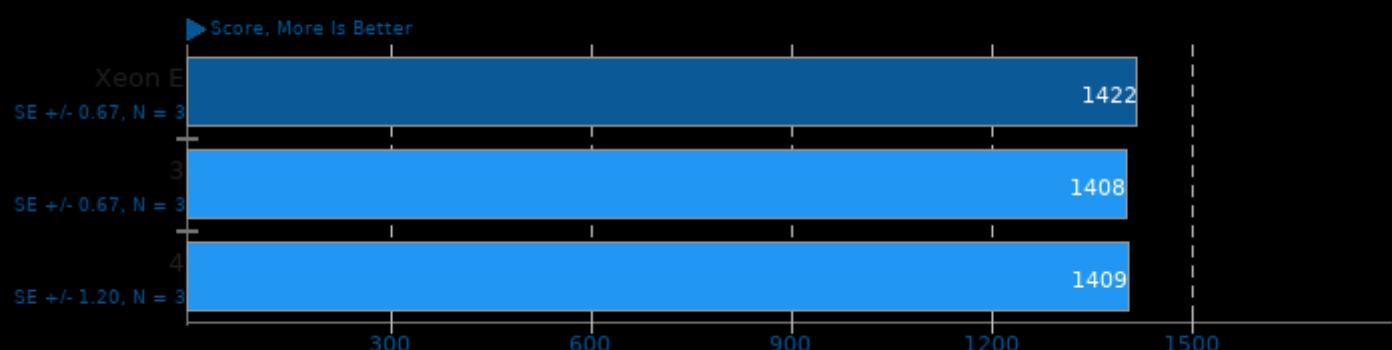
Geekbench 5

Test: CPU Multi Core



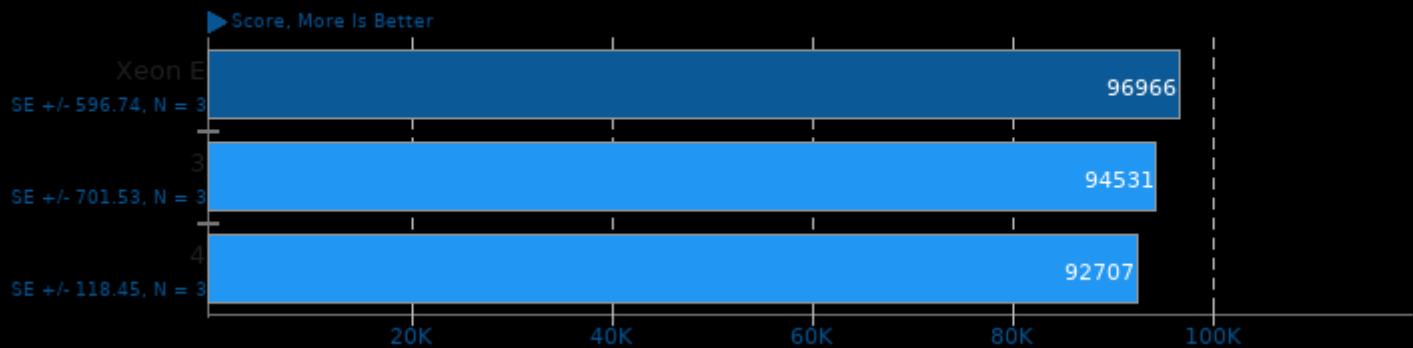
Geekbench 5

Test: CPU Single Core



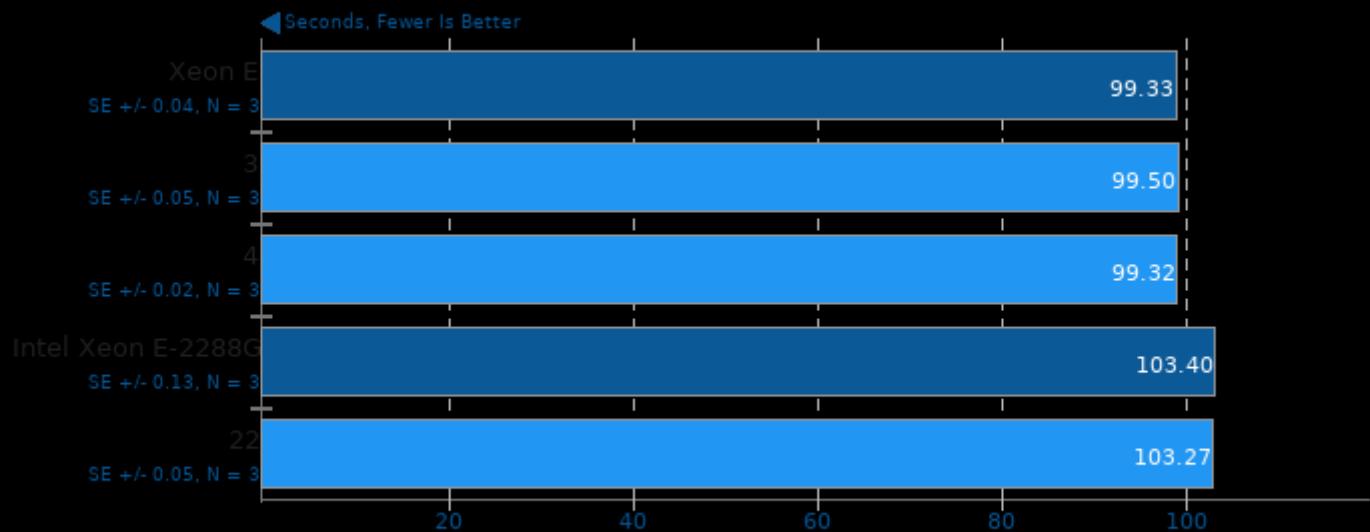
Geekbench 5

Test: GPU NVIDIA CUDA



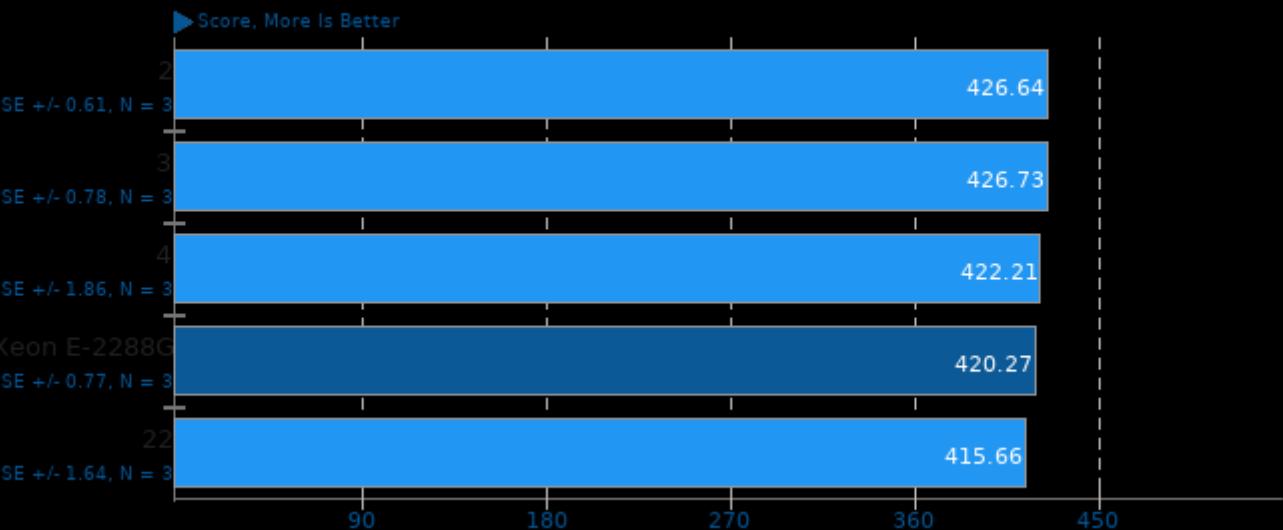
Timed HMMer Search 3.3.1

Pfam Database Search



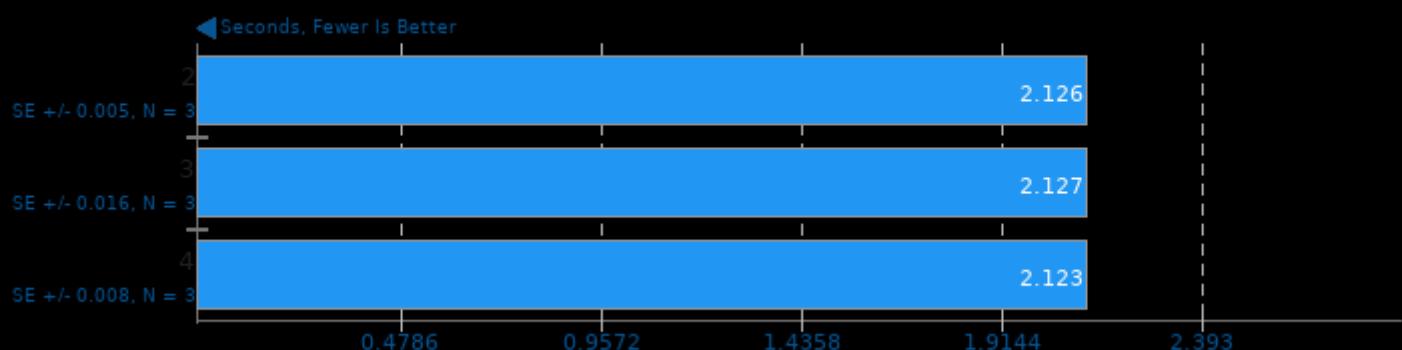
1. (CC) gcc options: -O3 -pthread -lhmmer -leasel -lm

Numpy Benchmark



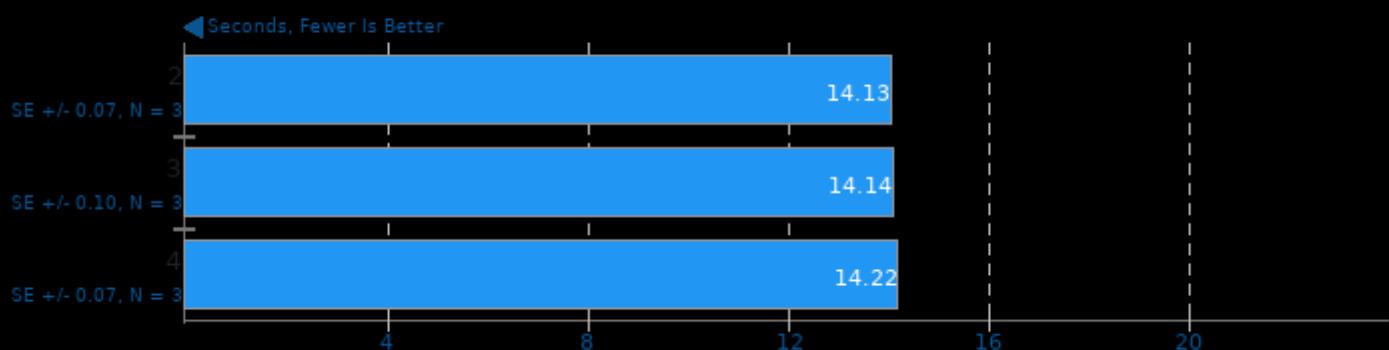
Darktable 3.2.1

Test: Boat - Acceleration: OpenCL



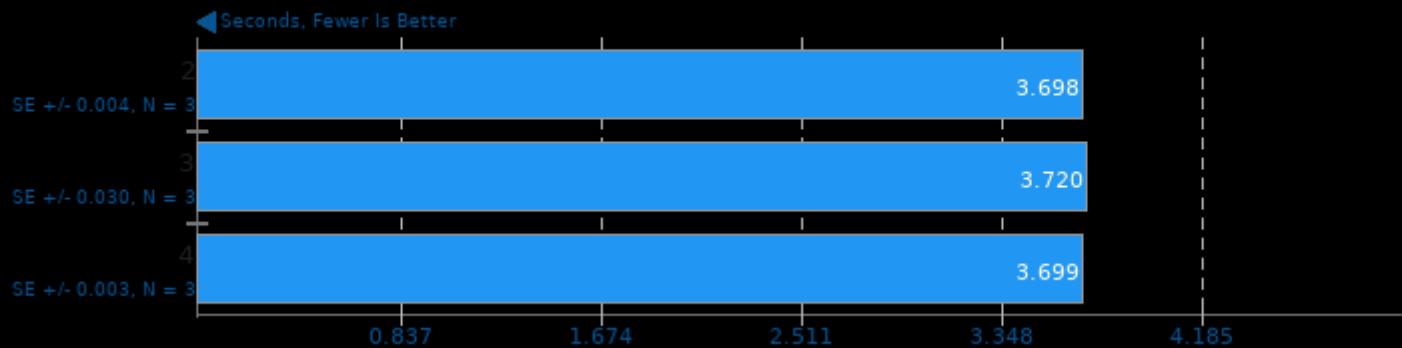
Darktable 3.2.1

Test: Boat - Acceleration: CPU-only



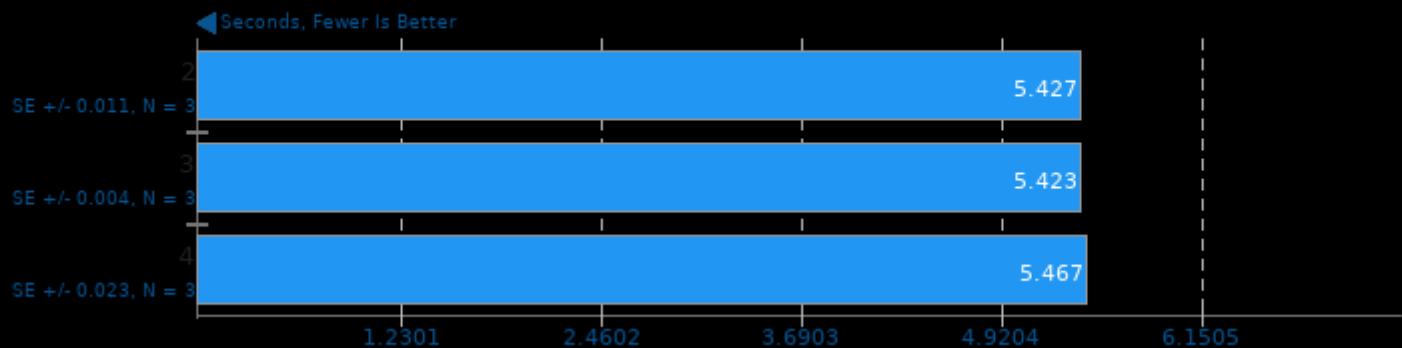
Darktable 3.2.1

Test: Masskrug - Acceleration: OpenCL



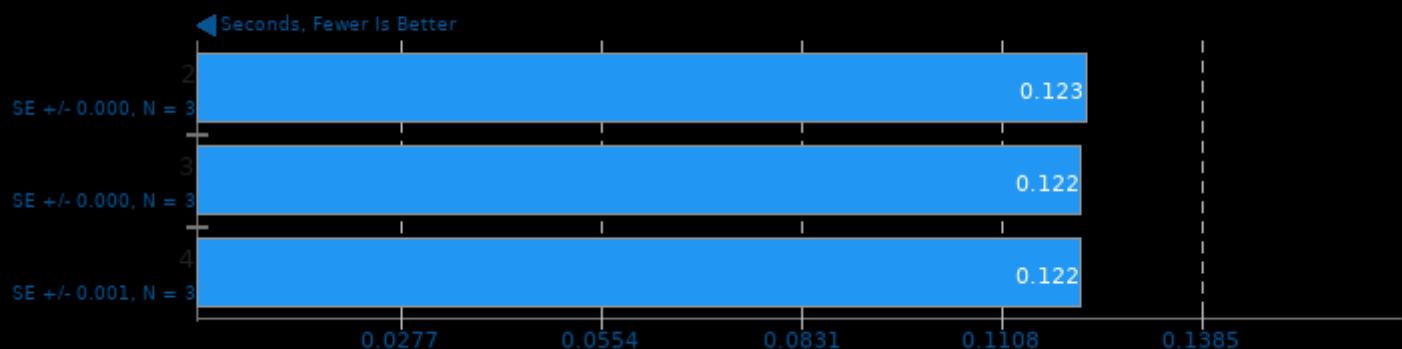
Darktable 3.2.1

Test: Masskrug - Acceleration: CPU-only



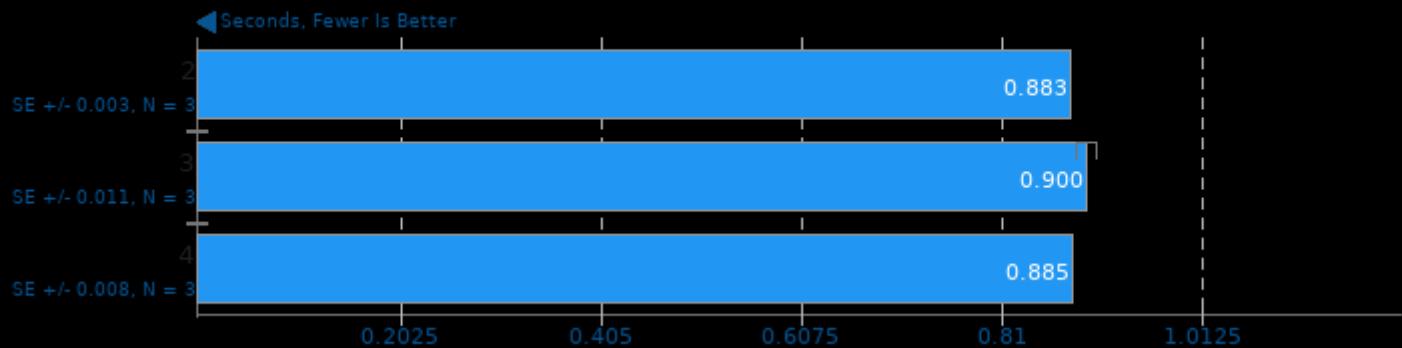
Darktable 3.2.1

Test: Server Rack - Acceleration: OpenCL



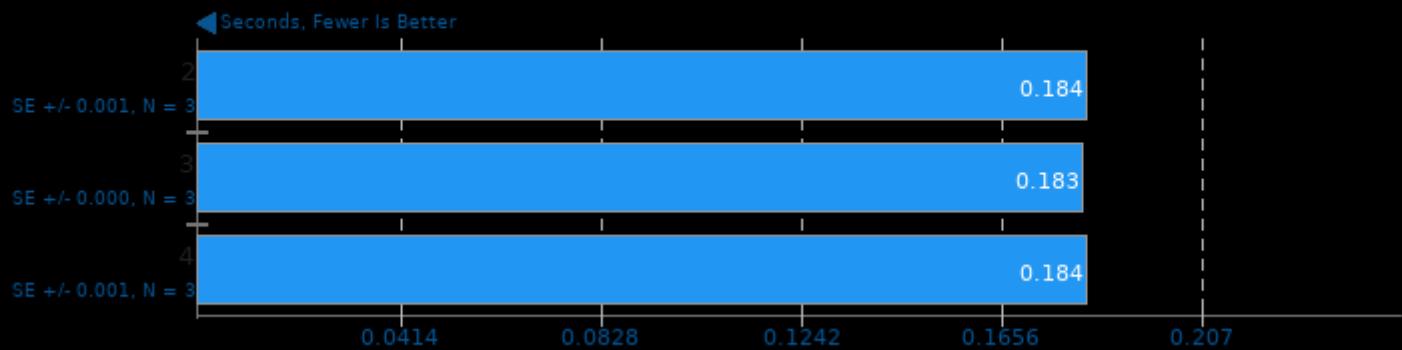
Darktable 3.2.1

Test: Server Room - Acceleration: OpenCL



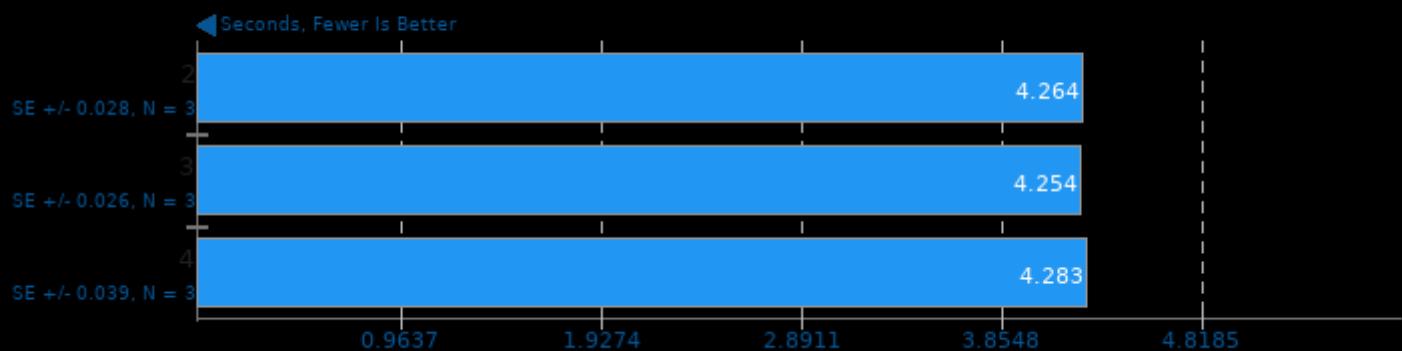
Darktable 3.2.1

Test: Server Rack - Acceleration: CPU-only

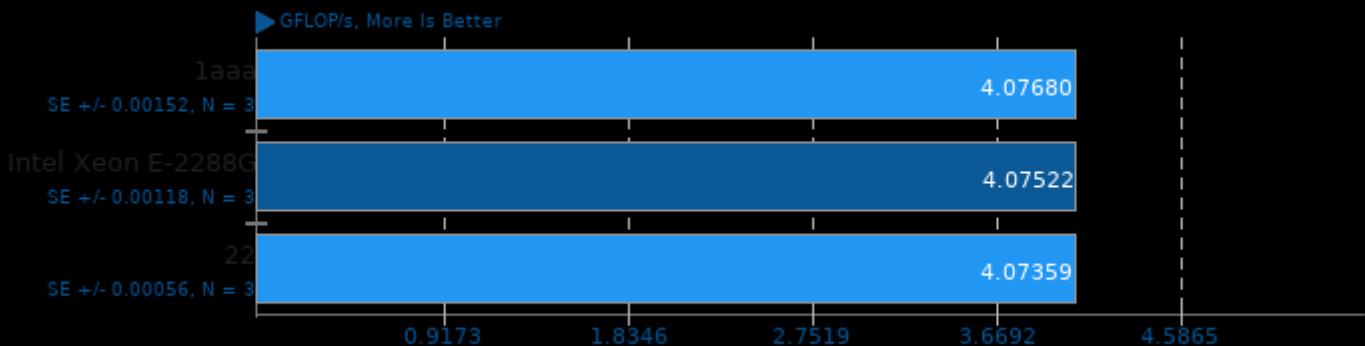


Darktable 3.2.1

Test: Server Room - Acceleration: CPU-only



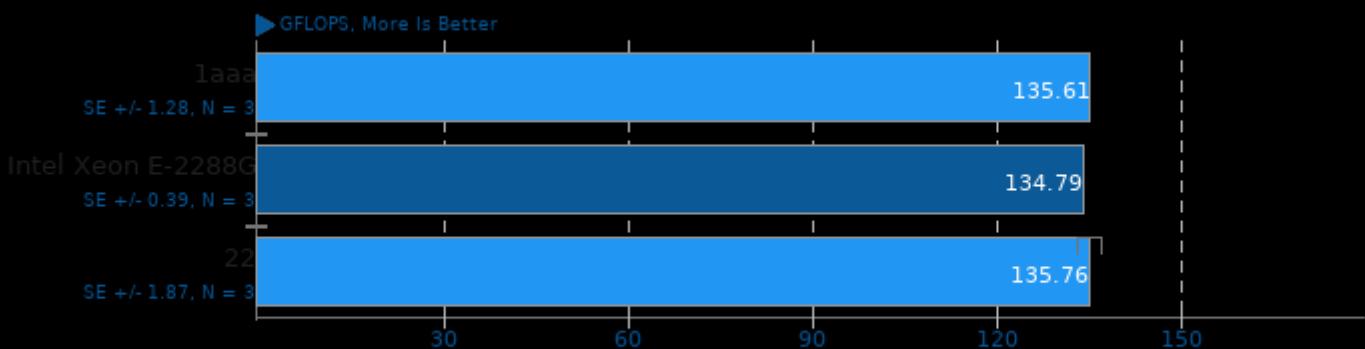
High Performance Conjugate Gradient 3.1



1. (CXX) g++ options: -O3 -ffast-math -fno-free-vectorize -fthread -lmpi_cxx -lmpi

HPC Challenge 1.5.0

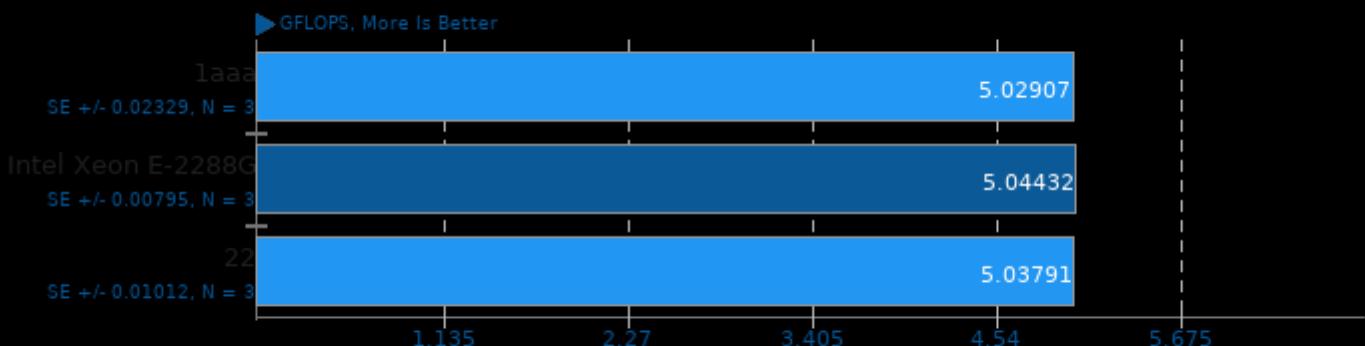
Test / Class: G-HPL



1. (CC) gcc options: -lblas -lm -fthread -lmpi -fomit-frame-pointer -funroll-loops
2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

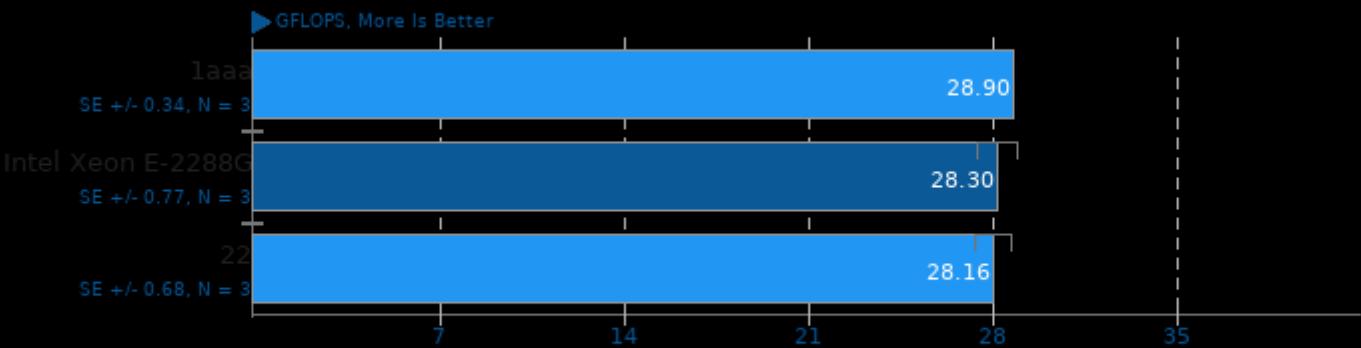
Test / Class: G-Ffte



1. (CC) gcc options: -lblas -lm -fthread -lmpi -fomit-frame-pointer -funroll-loops
2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: EP-DGEMM

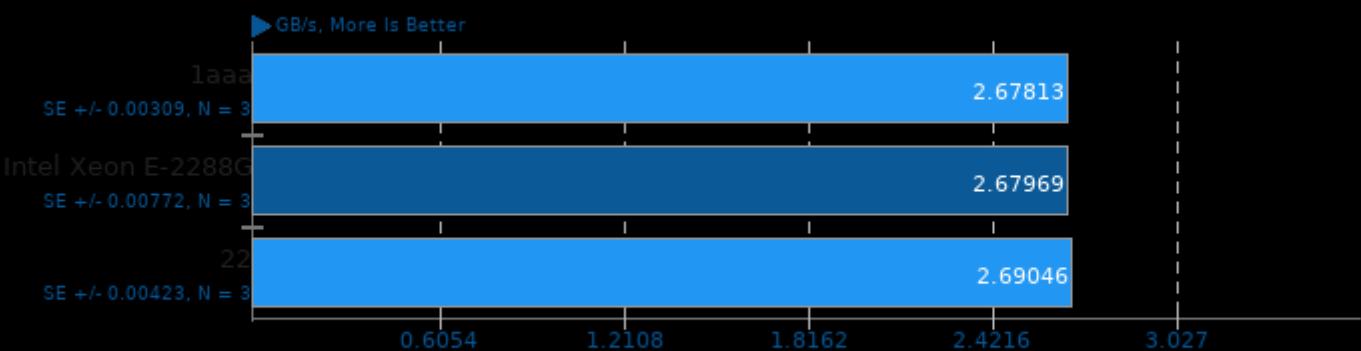


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: G-Ptrans

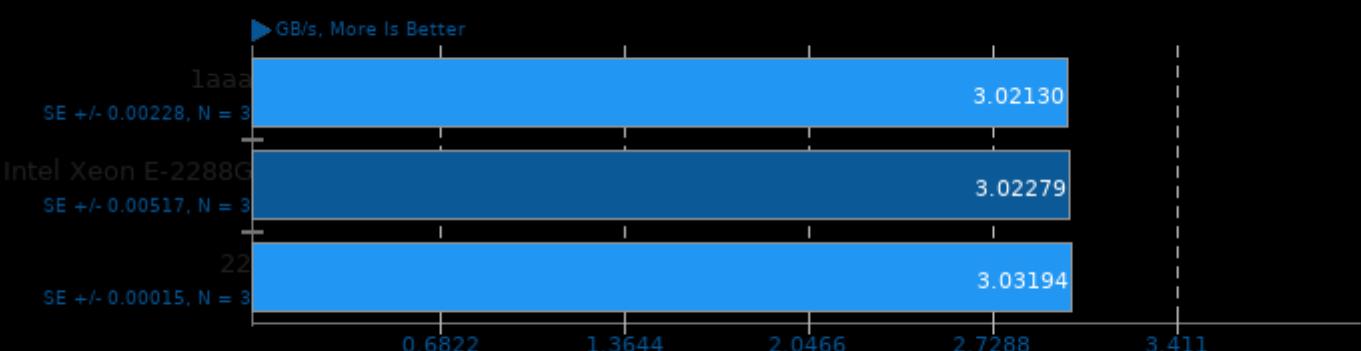


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: EP-STREAM Triad

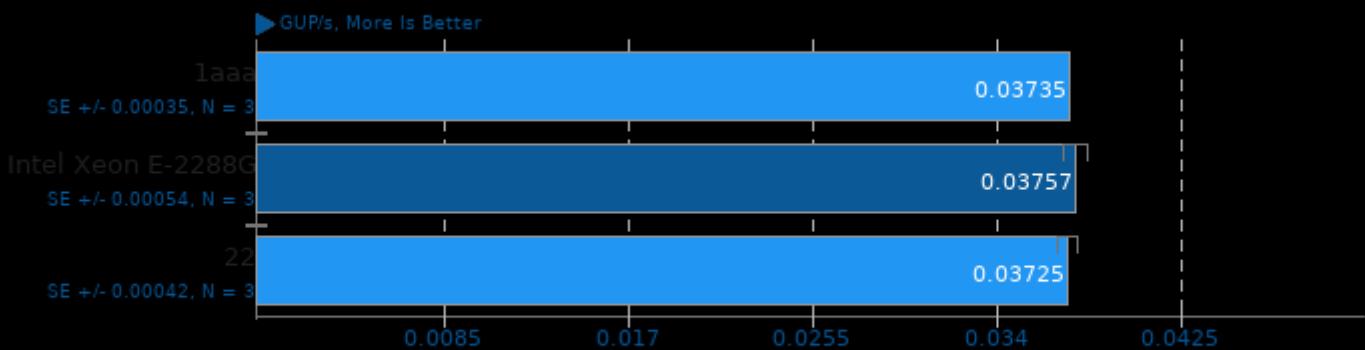


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: G-Random Access

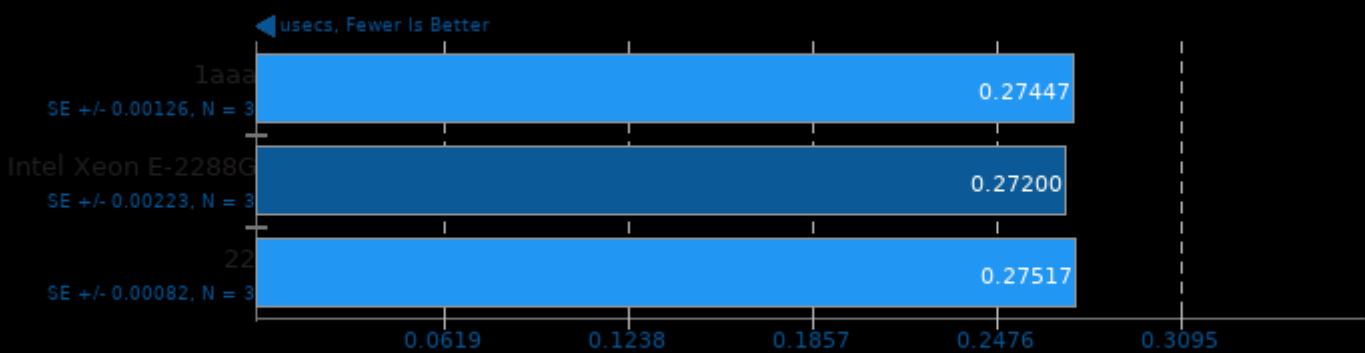


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: Random Ring Latency

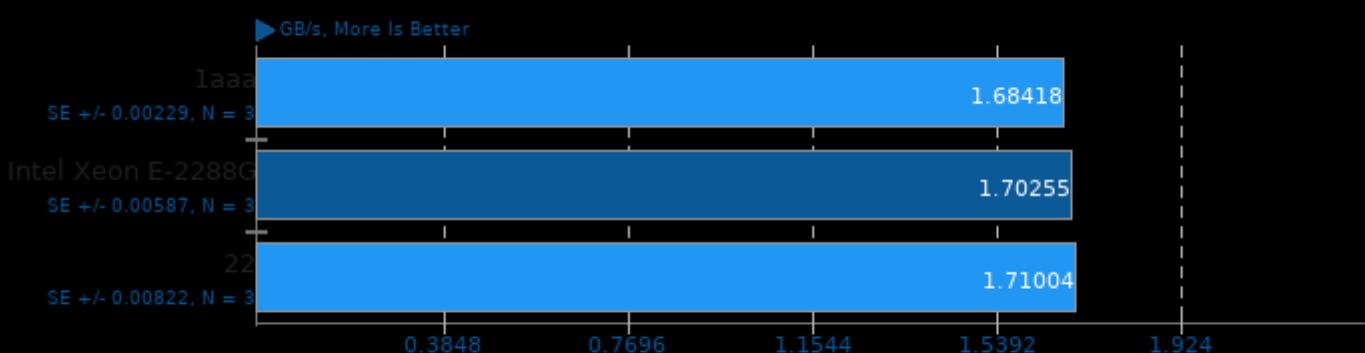


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: Random Ring Bandwidth

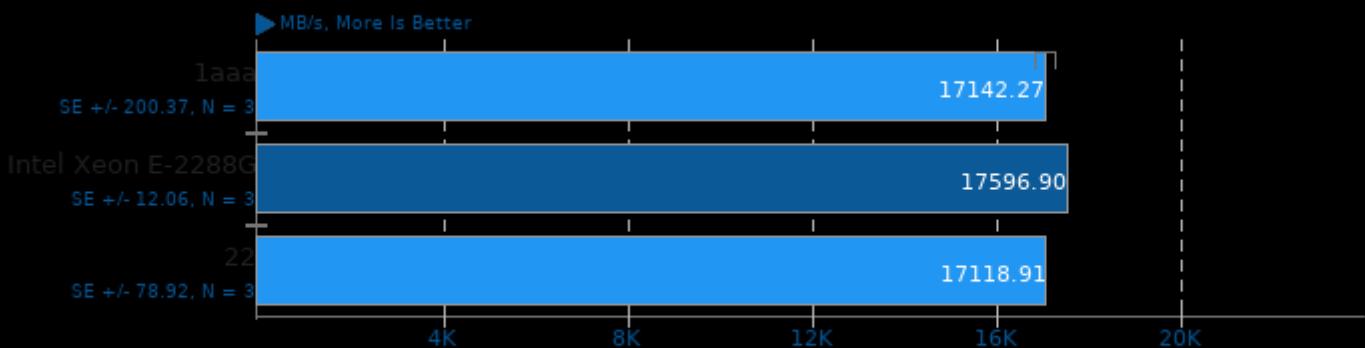


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

HPC Challenge 1.5.0

Test / Class: Max Ping Pong Bandwidth

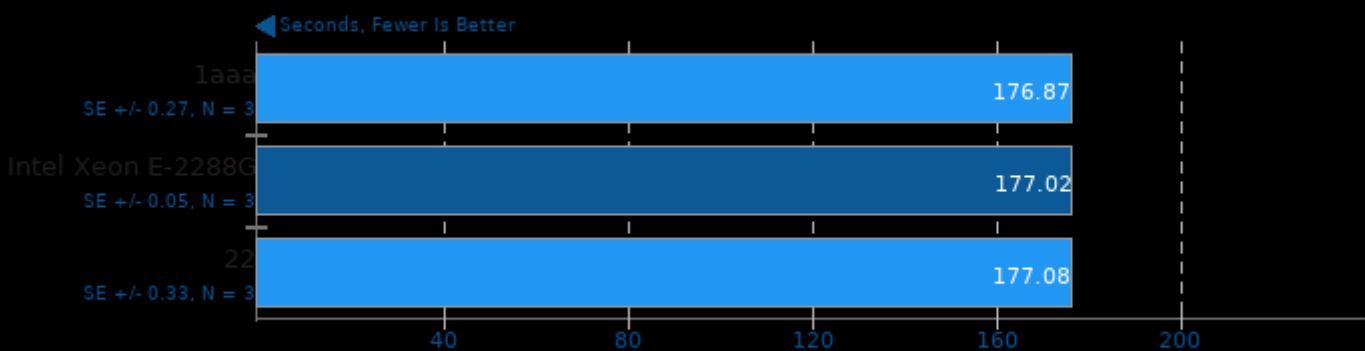


1. (CC) gcc options: -lblas -lm -pthread -lmpi -fomit-frame-pointer -funroll-loops

2. ATLAS + Open MPI 4.0.3

CloverLeaf

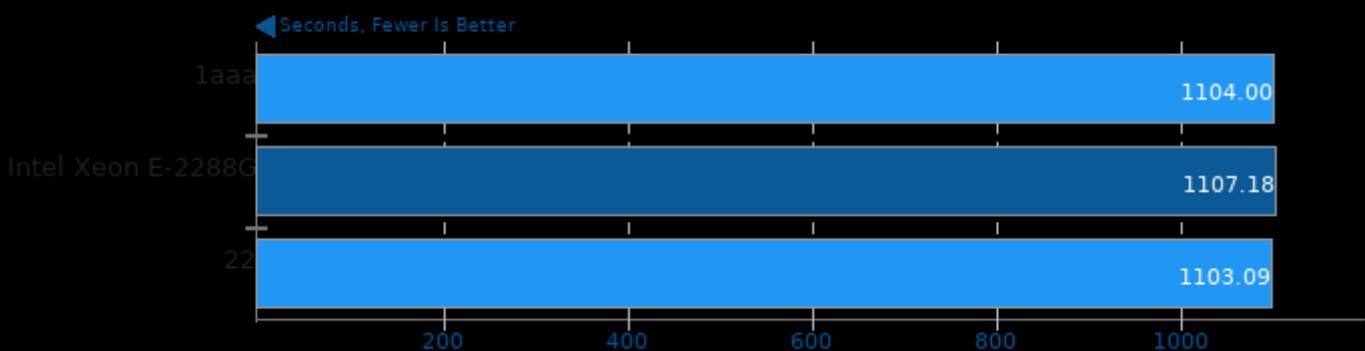
Lagrangian-Eulerian Hydrodynamics



1. (F9X) gfortran options: -O3 -march=native -funroll-loops -fopenmp

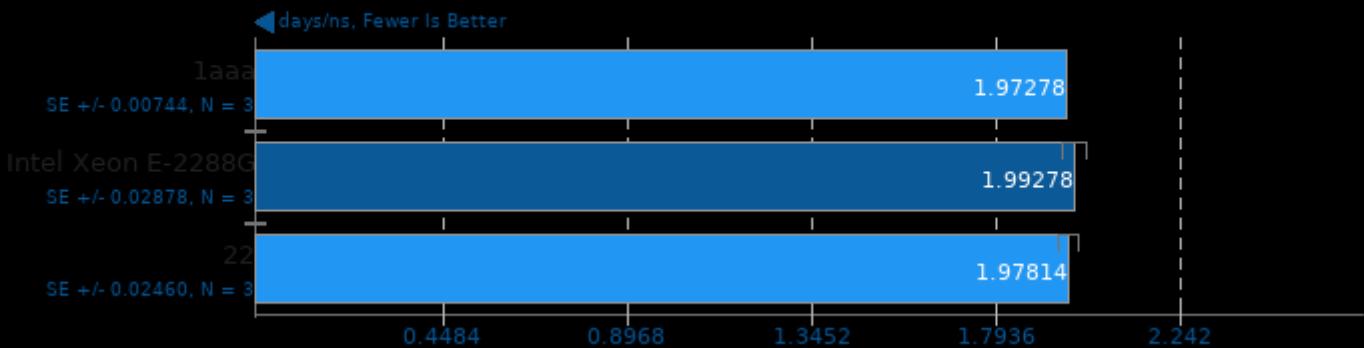
CP2K Molecular Dynamics 8.1

Fayalite-FIST Data



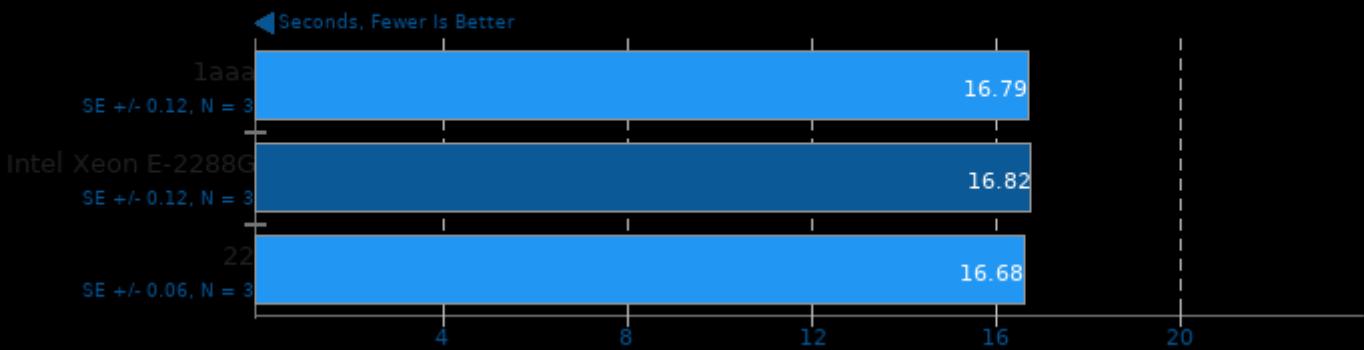
NAMD 2.14

ATPase Simulation - 327,506 Atoms



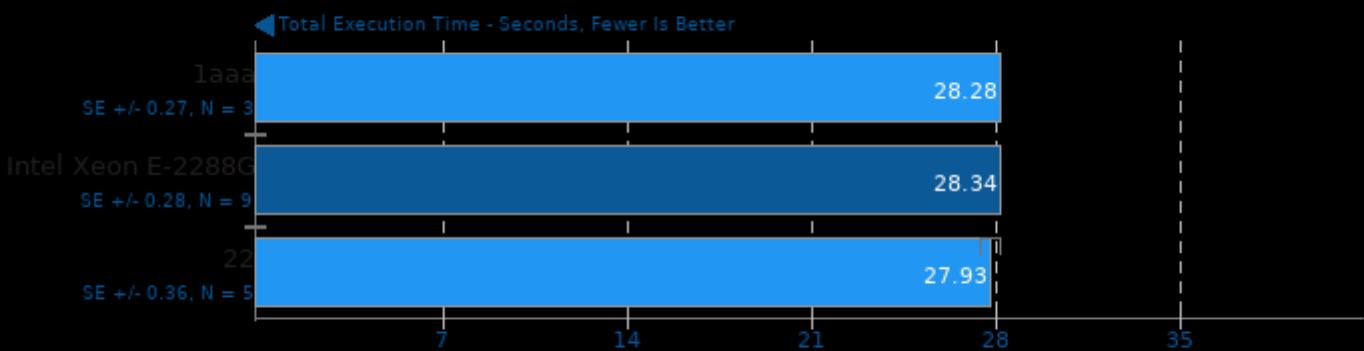
Dolfyn 0.527

Computational Fluid Dynamics



QMCPACK 3.10

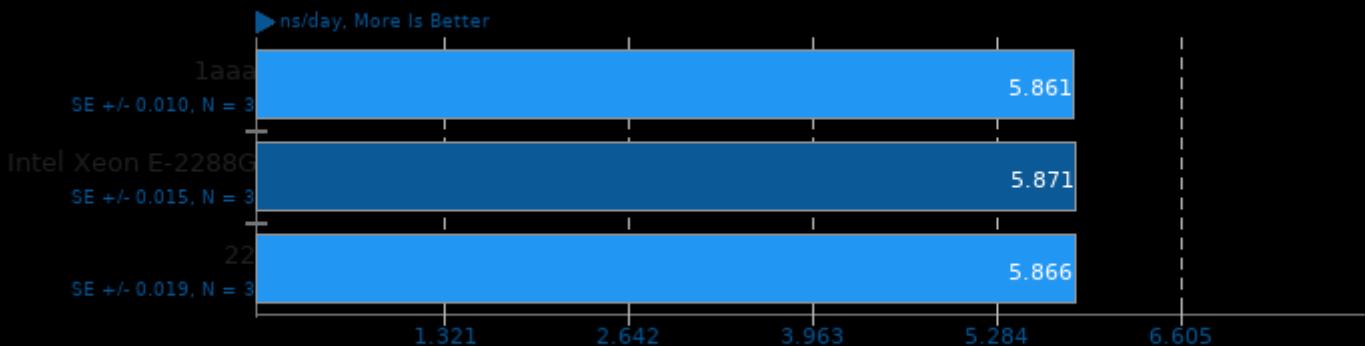
Input: simple-H2O



1. (CXX) g++ options: -fopenmp -finline-limit=1000 -fstrict-aliasing -funroll-all-loops -march=native -O3 -fomit-frame-pointer -ffast-math -pthread -lm

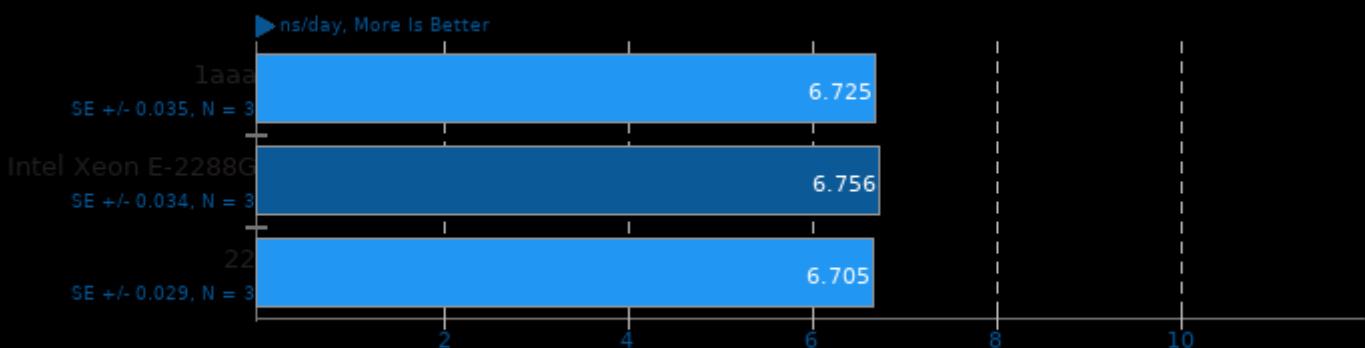
LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: 20k Atoms

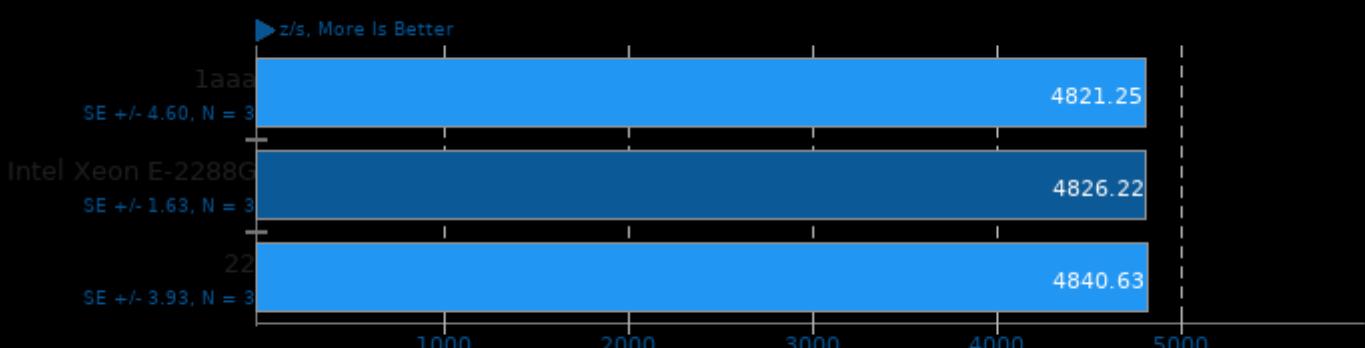


LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: Rhodopsin Protein

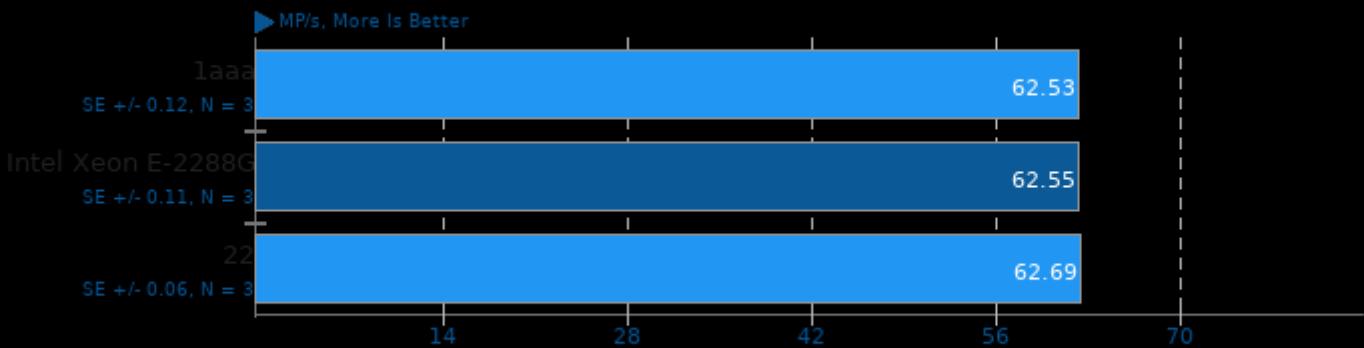


LULESH 2.0.3



JPEG XL 0.3.1

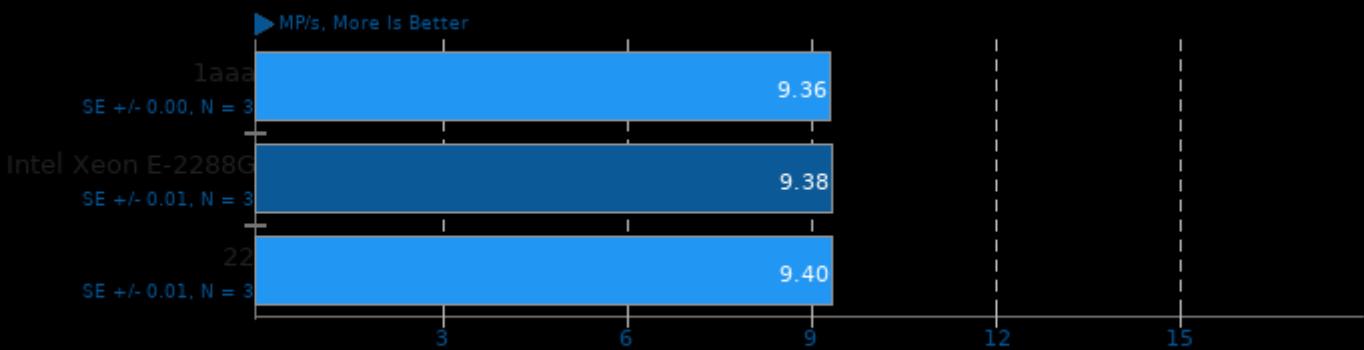
Input: PNG - Encode Speed: 5



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

JPEG XL 0.3.1

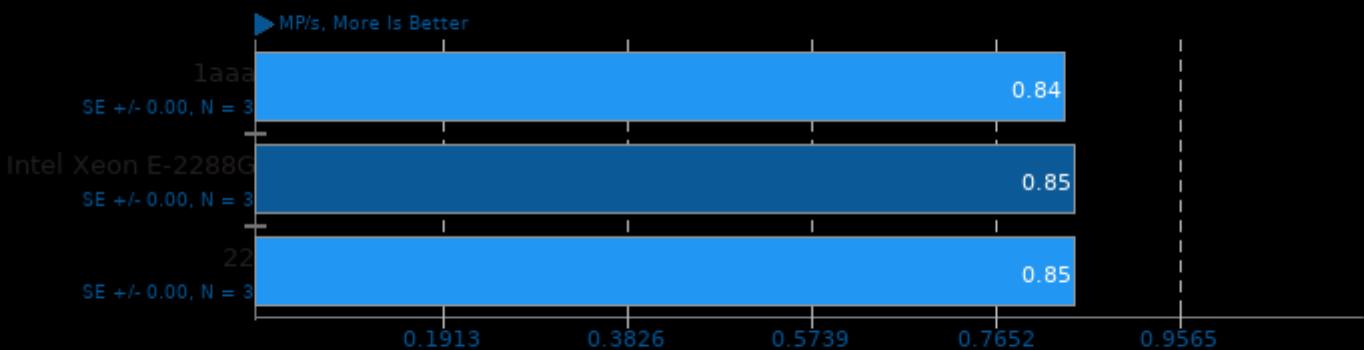
Input: PNG - Encode Speed: 7



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

JPEG XL 0.3.1

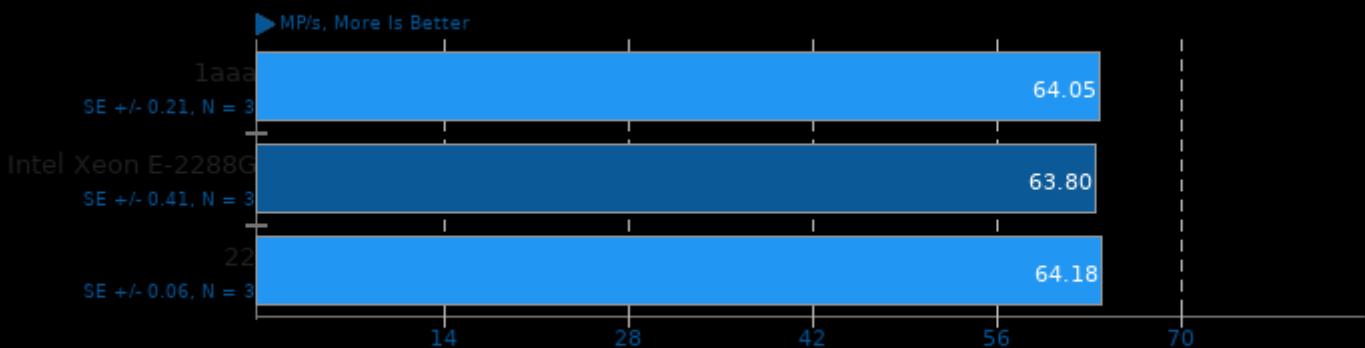
Input: PNG - Encode Speed: 8



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

JPEG XL 0.3.1

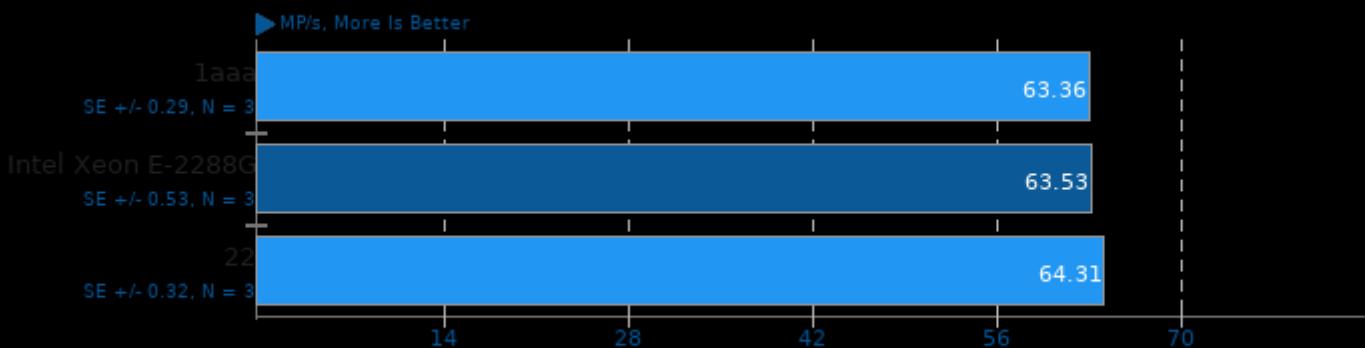
Input: JPEG - Encode Speed: 5



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

JPEG XL 0.3.1

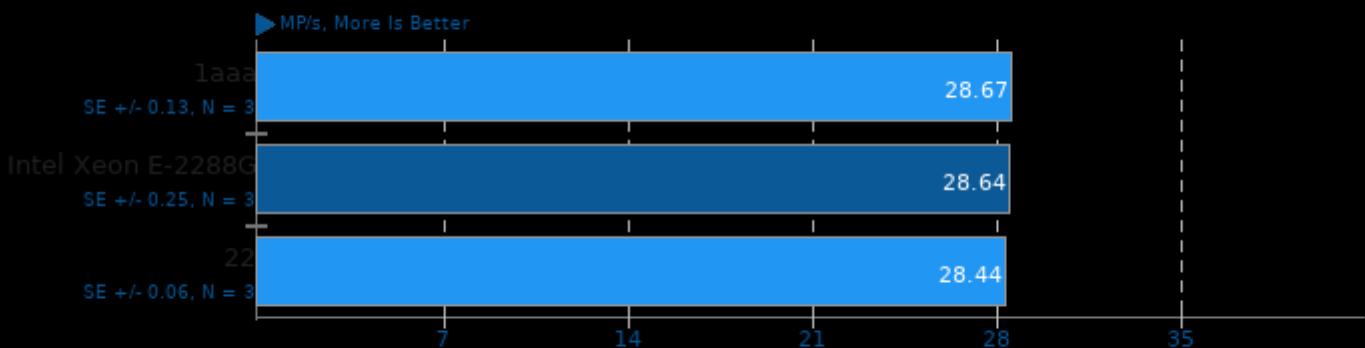
Input: JPEG - Encode Speed: 7



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

JPEG XL 0.3.1

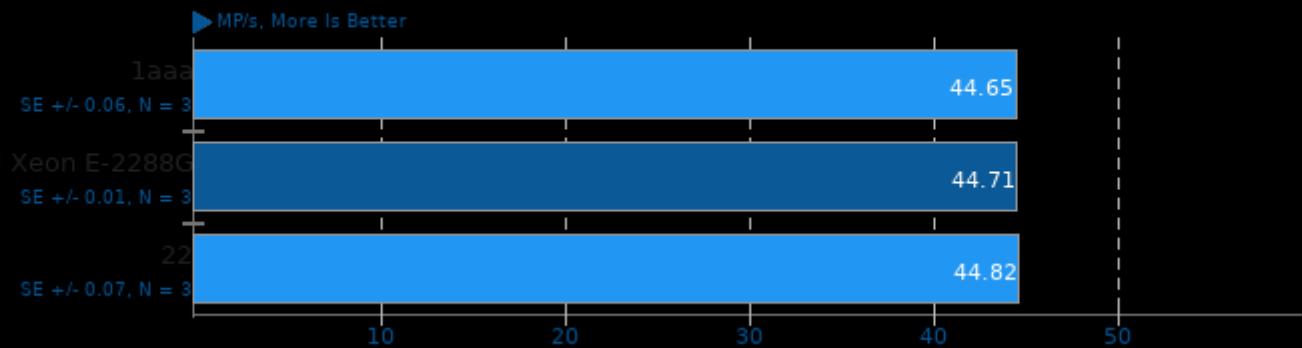
Input: JPEG - Encode Speed: 8



1. (CXX) g++ options: -funwind-tables -O3 -O2 -pthread -fPIE -pie -ldl

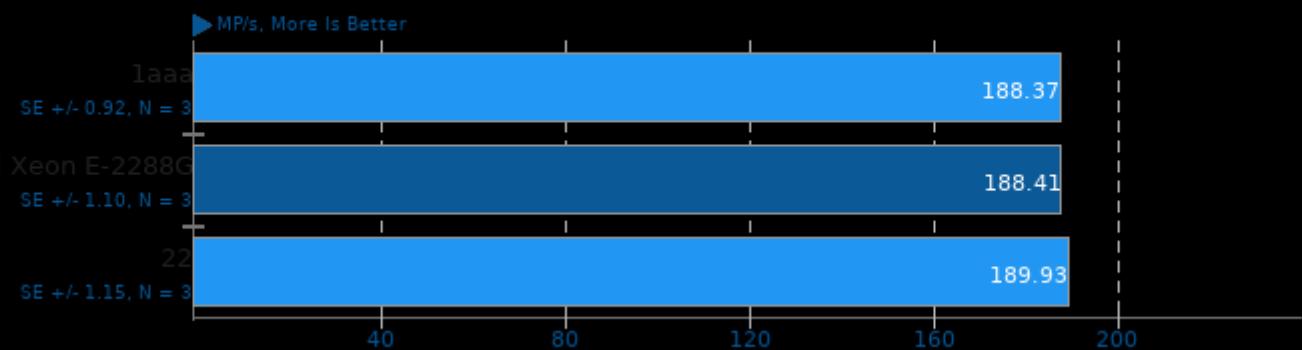
JPEG XL Decoding 0.3.1

CPU Threads: 1



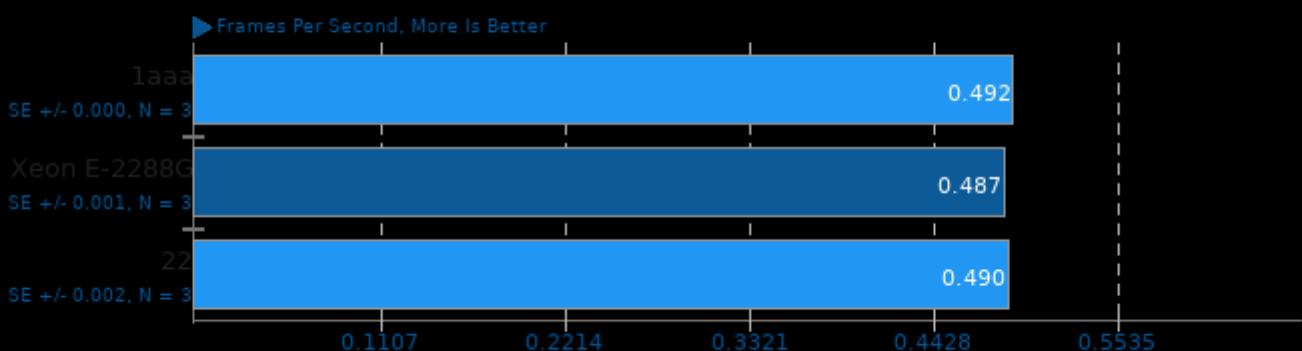
JPEG XL Decoding 0.3.1

CPU Threads: All



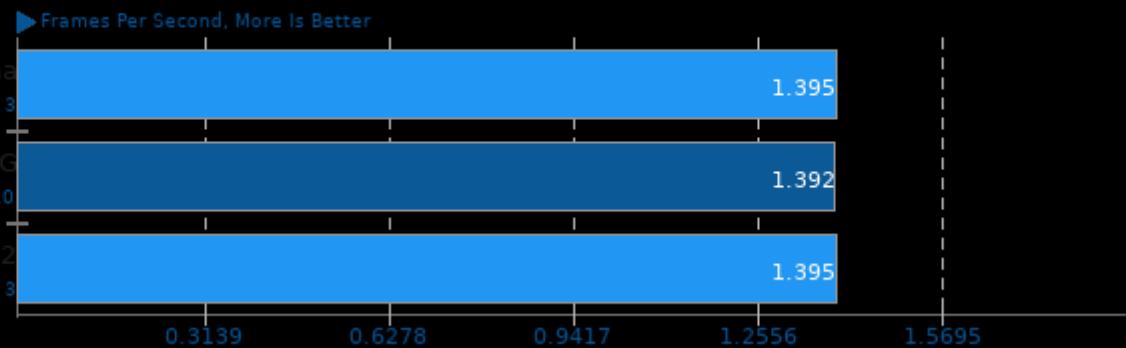
rav1e 0.4

Speed: 1

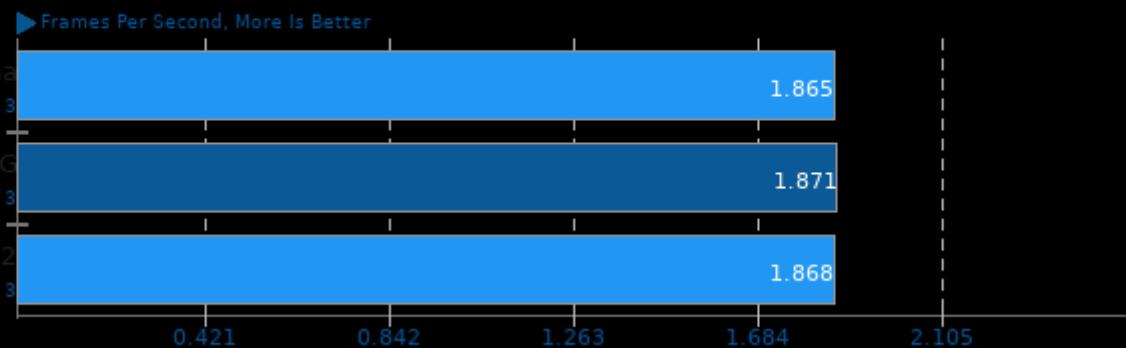


rav1e 0.4

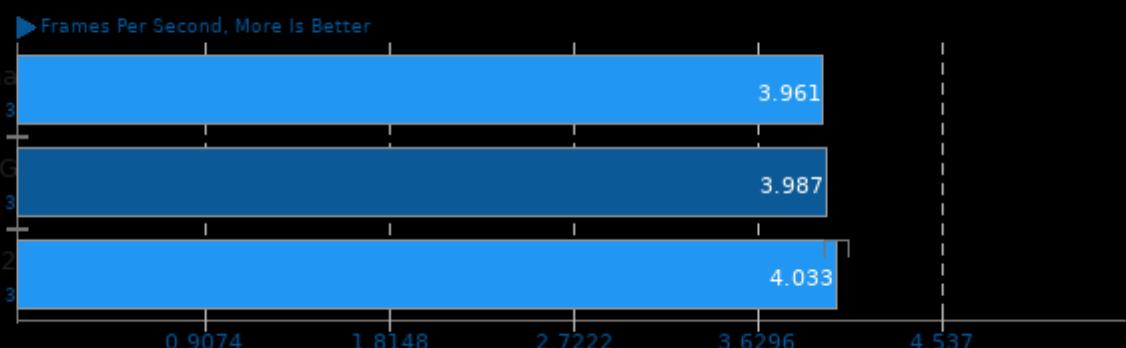
Speed: 5

**rav1e 0.4**

Speed: 6

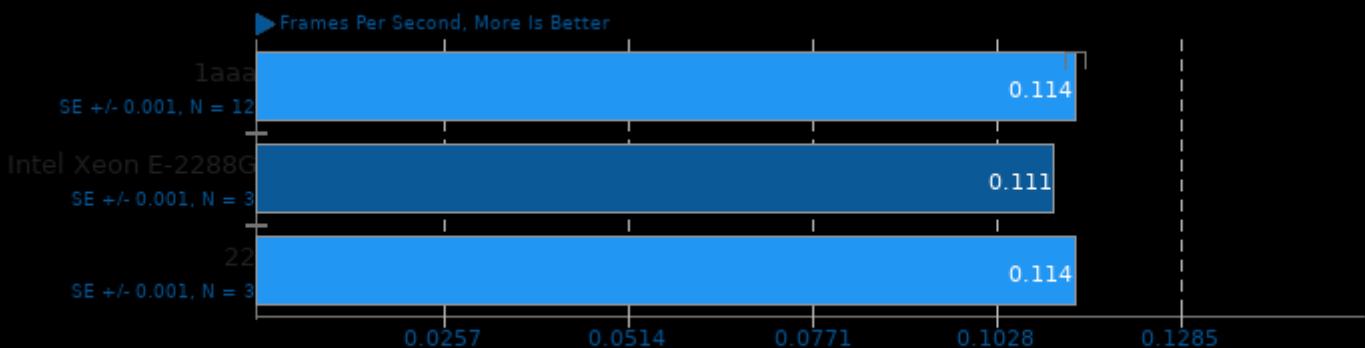
**rav1e 0.4**

Speed: 10



SVT-AV1 0.8

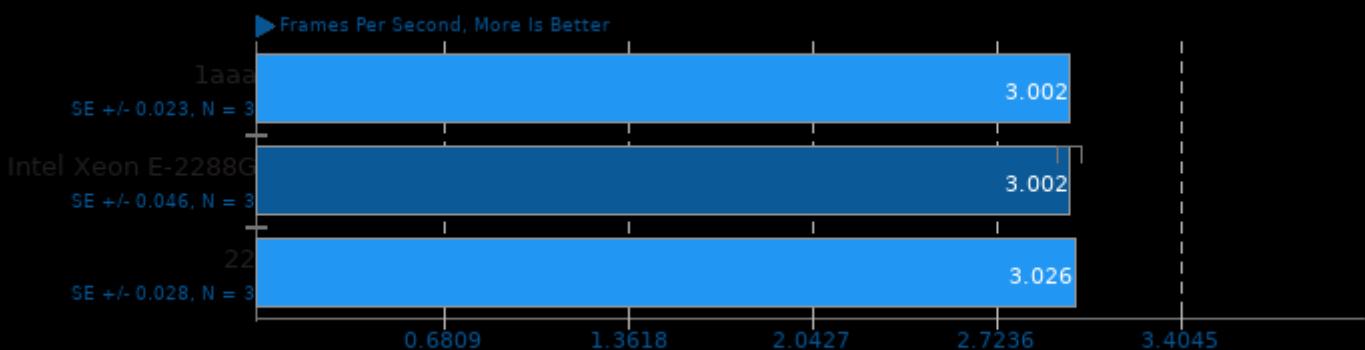
Encoder Mode: Enc Mode 0 - Input: 1080p



1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-AV1 0.8

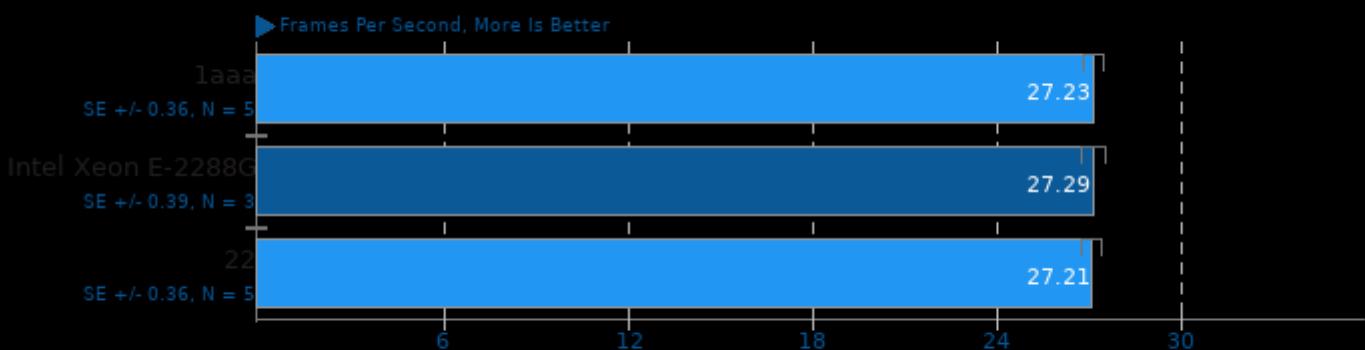
Encoder Mode: Enc Mode 4 - Input: 1080p



1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-AV1 0.8

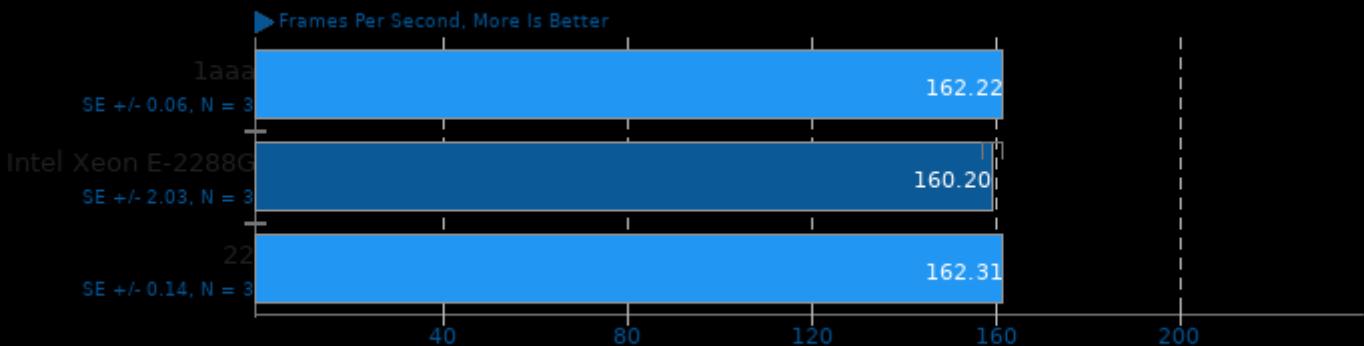
Encoder Mode: Enc Mode 8 - Input: 1080p



1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-VP9 0.1

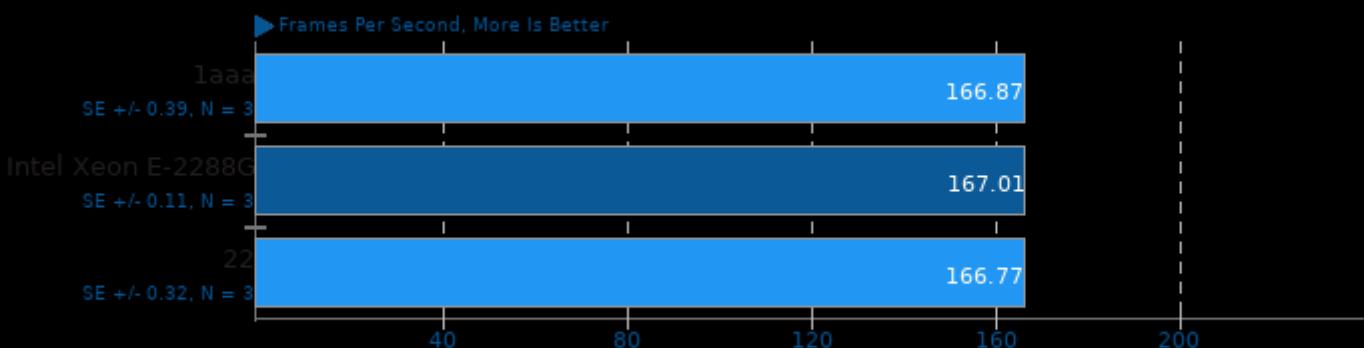
Tuning: VMAF Optimized - Input: Bosphorus 1080p



1. (CC) gcc options: -O3 -fcommon -fPIE -fPIC -fvisibility=hidden -pie -rdynamic -lpthread -lrt -lm

SVT-VP9 0.1

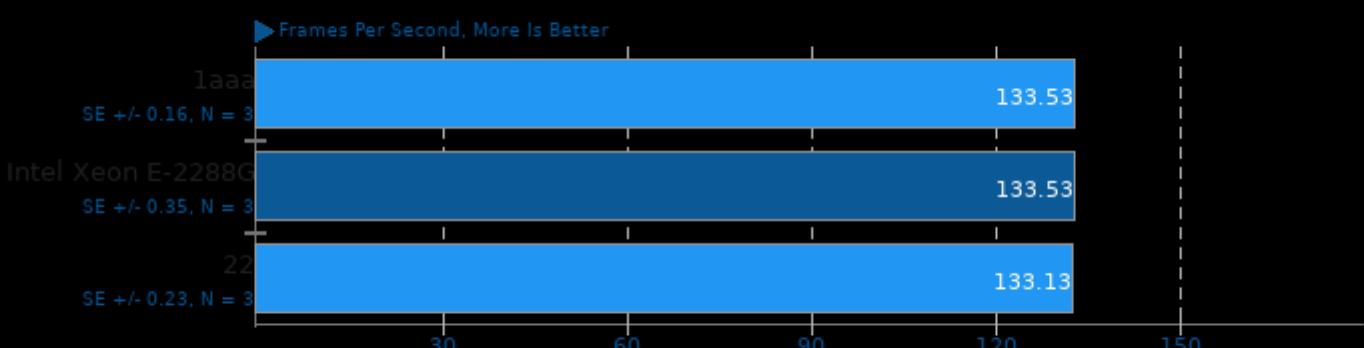
Tuning: PSNR/SSIM Optimized - Input: Bosphorus 1080p



1. (CC) gcc options: -O3 -fcommon -fPIE -fPIC -fvisibility=hidden -pie -rdynamic -lpthread -lrt -lm

SVT-VP9 0.1

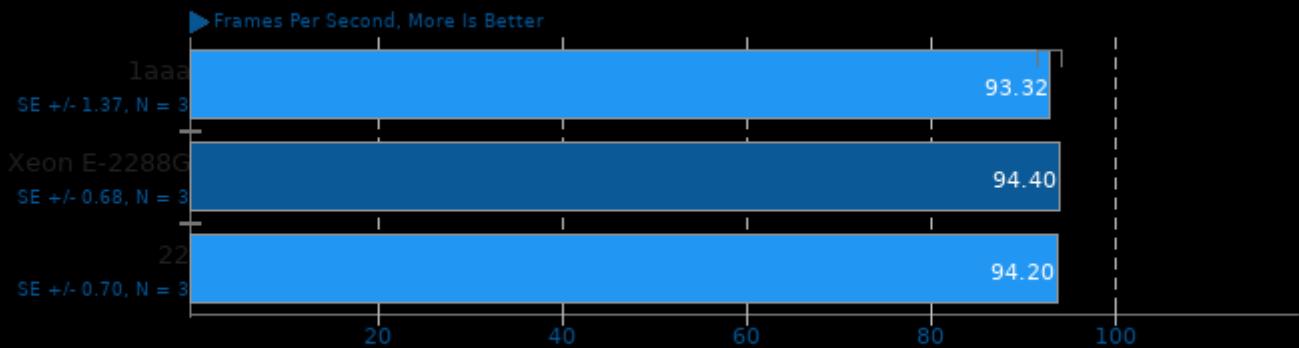
Tuning: Visual Quality Optimized - Input: Bosphorus 1080p



1. (CC) gcc options: -O3 -fcommon -fPIE -fPIC -fvisibility=hidden -pie -rdynamic -lpthread -lrt -lm

x264 2019-12-17

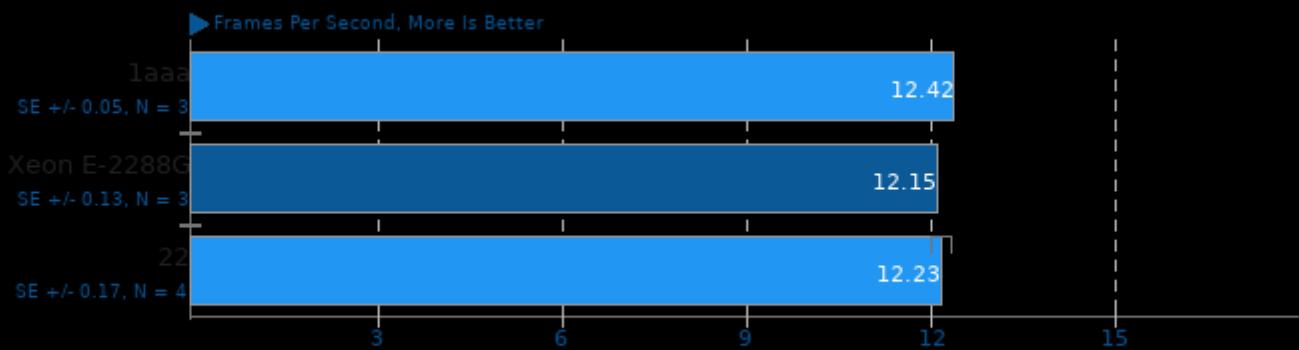
H.264 Video Encoding



1. (CC) gcc options: -ldl -lavformat -lavcodec -lavutil -lswscale -m64 -lpthread -O3 -ffast-math -std=gnu99 -fPIC -fomit-frame-pointer -fno-tree-vectorize

x265 3.4

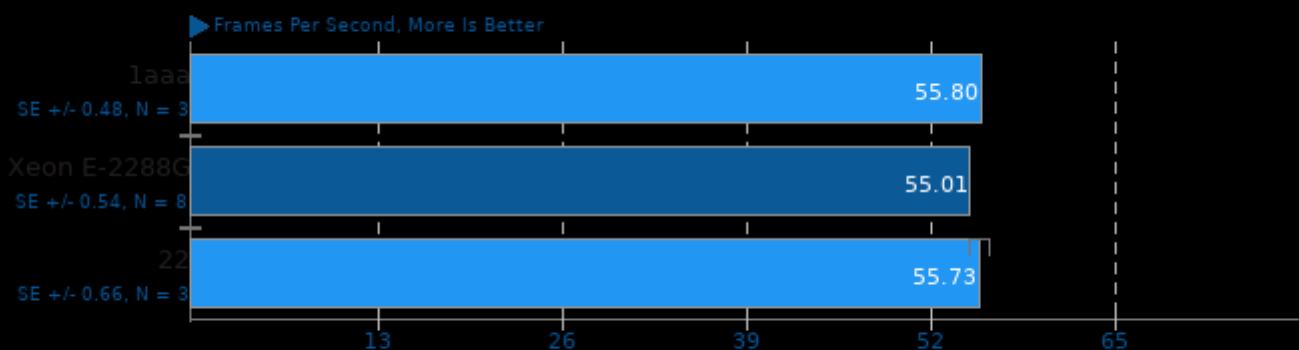
Video Input: Bosphorus 4K



1. (CXX) g++ options: -O3 -rdynamic -lpthread -lrt -ldl -lnuma

x265 3.4

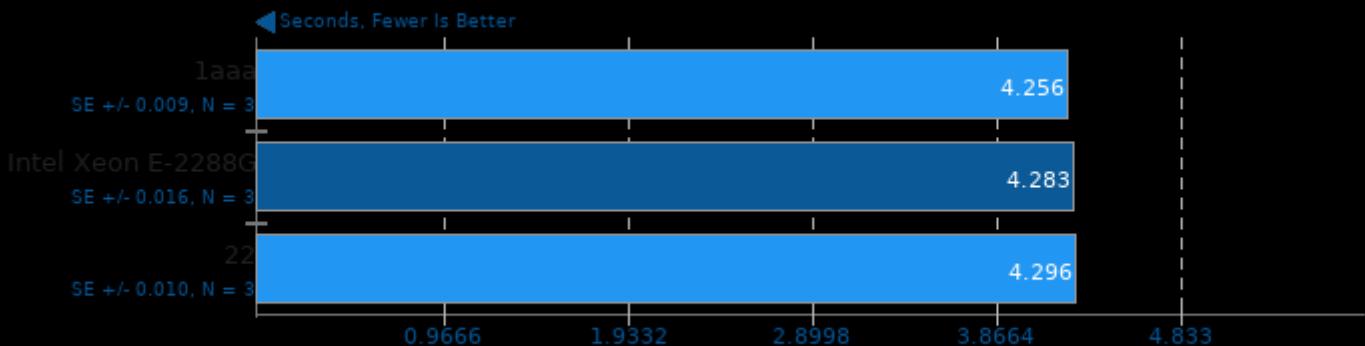
Video Input: Bosphorus 1080p



1. (CXX) g++ options: -O3 -rdynamic -lpthread -lrt -ldl -lnuma

WebP2 Image Encode 20210126

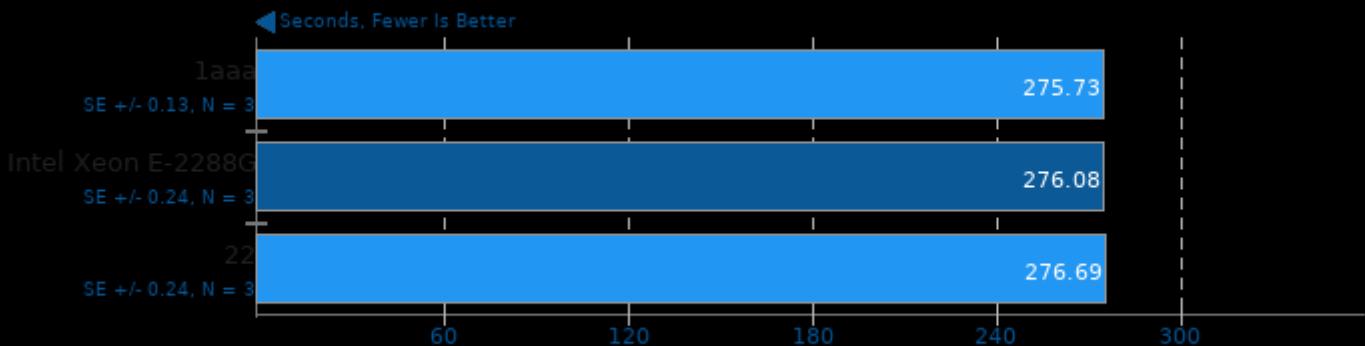
Encode Settings: Default



1. (CXX) g++ options: -msse4.2 -fno-rtti -O3 -rdynamic -lpthread -ljpeg -lgif

WebP2 Image Encode 20210126

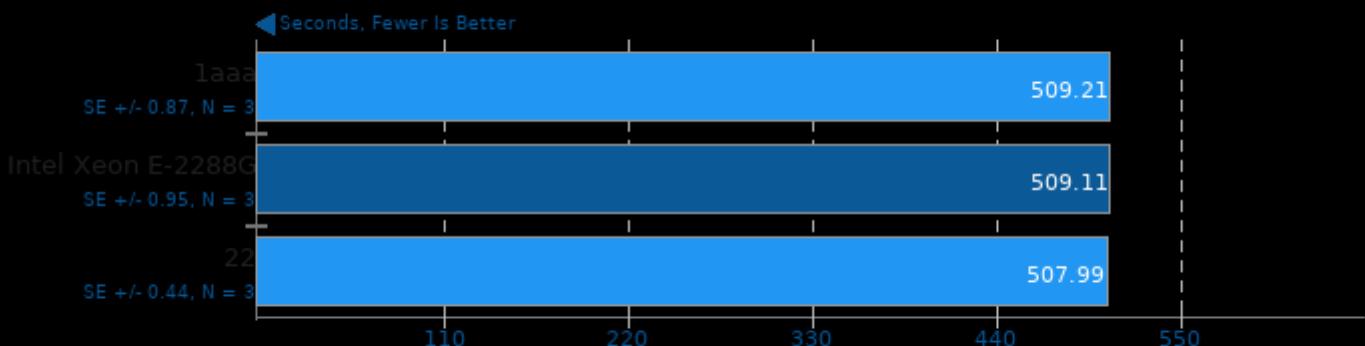
Encode Settings: Quality 75, Compression Effort 7



1. (CXX) g++ options: -msse4.2 -fno-rtti -O3 -rdynamic -lpthread -ljpeg -lgif

WebP2 Image Encode 20210126

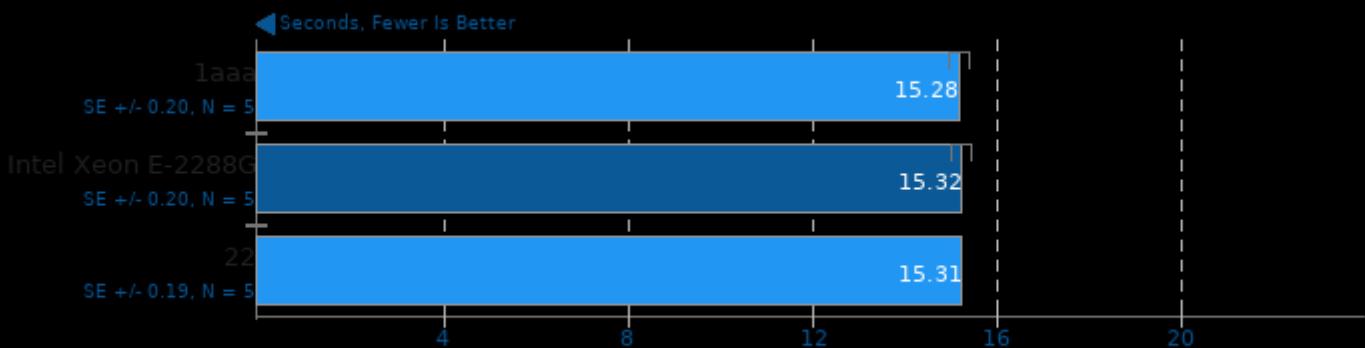
Encode Settings: Quality 95, Compression Effort 7



1. (CXX) g++ options: -msse4.2 -fno-rtti -O3 -rdynamic -lpthread -ljpeg -lgif

WebP2 Image Encode 20210126

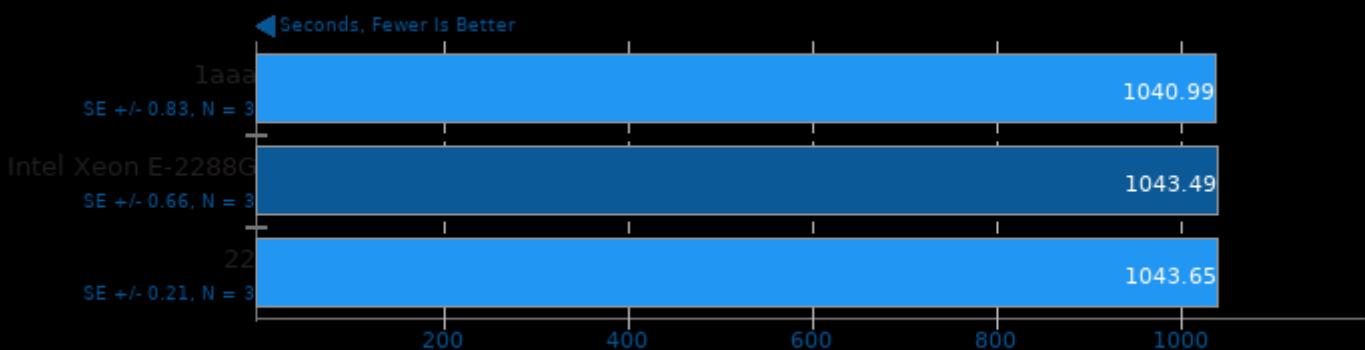
Encode Settings: Quality 100, Compression Effort 5



1. (CXX) g++ options: -msse4.2 -fno-rtti -O3 -rdynamic -lpthread -ljpeg -lgif

WebP2 Image Encode 20210126

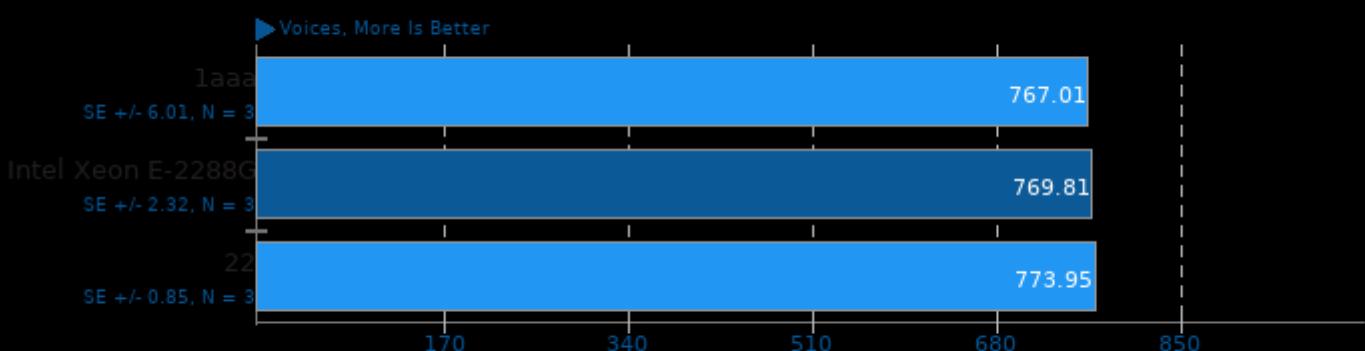
Encode Settings: Quality 100, Lossless Compression



1. (CXX) g++ options: -msse4.2 -fno-rtti -O3 -rdynamic -lpthread -ljpeg -lgif

Google SynthMark 20201109

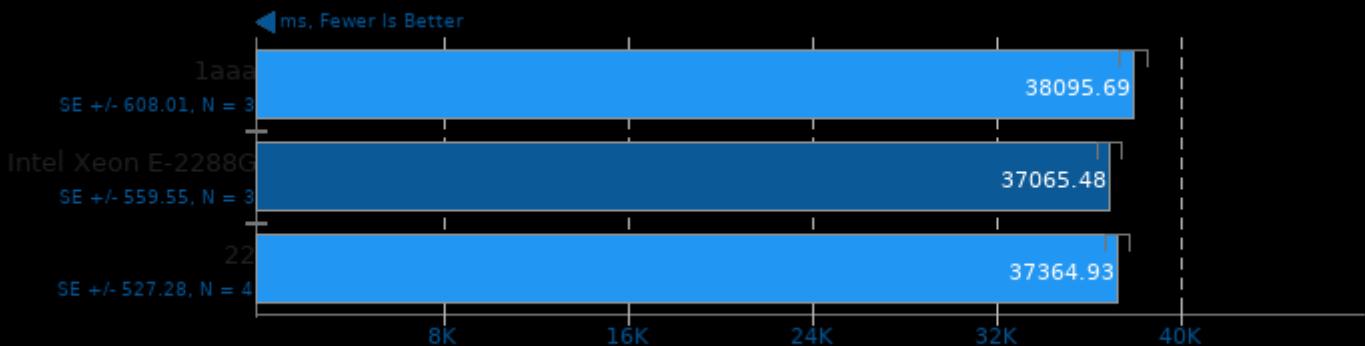
Test: VoiceMark_100



1. (CXX) g++ options: -lm -lpthread -std=c++11 -Ofast

FinanceBench 2016-07-25

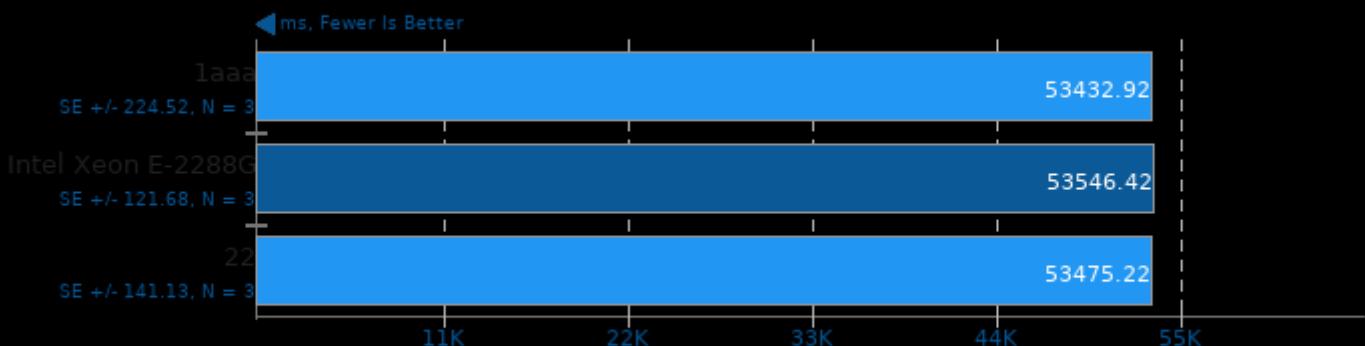
Benchmark: Repo OpenMP



1. (CXX) g++ options: -O3 -march=native -fopenmp

FinanceBench 2016-07-25

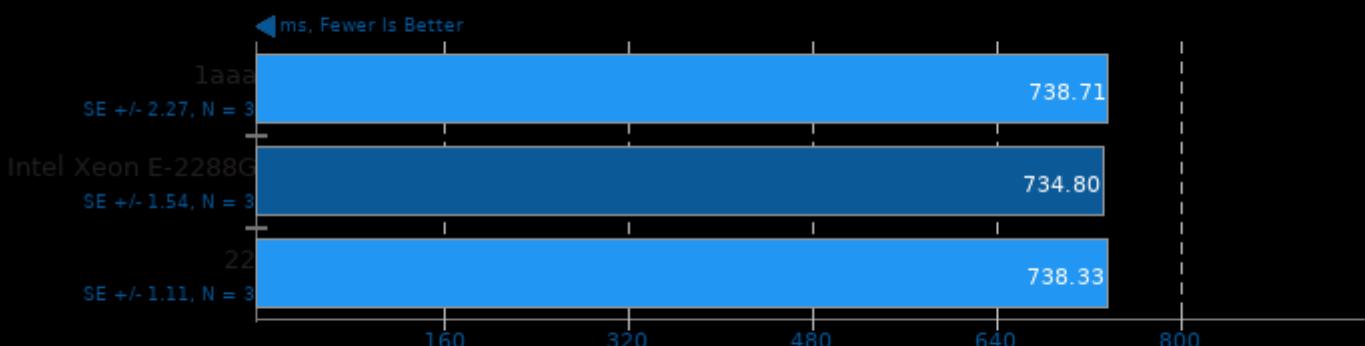
Benchmark: Bonds OpenMP



1. (CXX) g++ options: -O3 -march=native -fopenmp

FinanceBench 2016-07-25

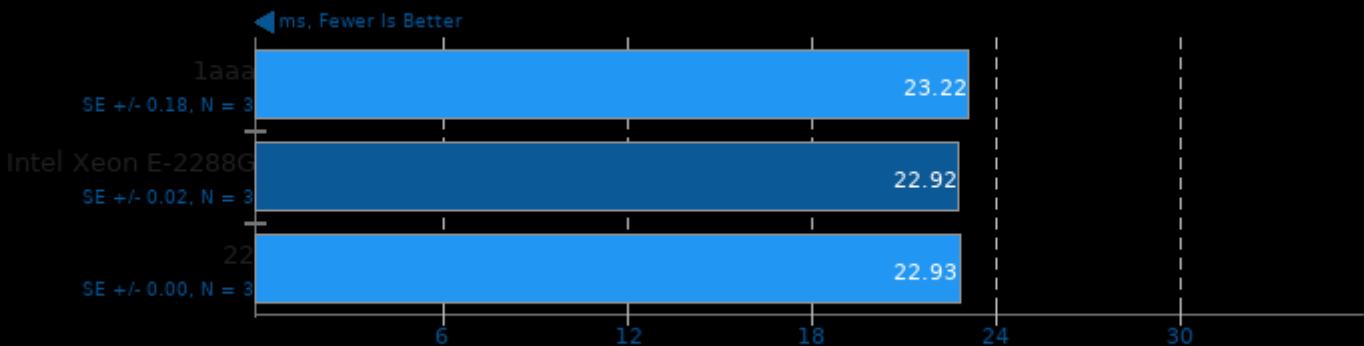
Benchmark: Monte-Carlo OpenCL



1. (CXX) g++ options: -O3 -march=native -fopenmp

FinanceBench 2016-07-25

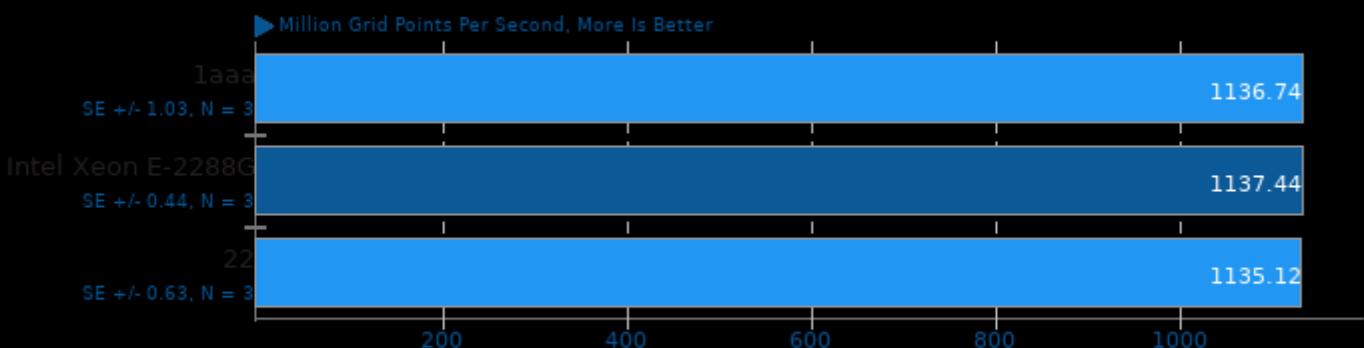
Benchmark: Black-Scholes OpenCL



1. (CXX) g++ options: -O3 -march=native -fopenmp

ASKAP 1.0

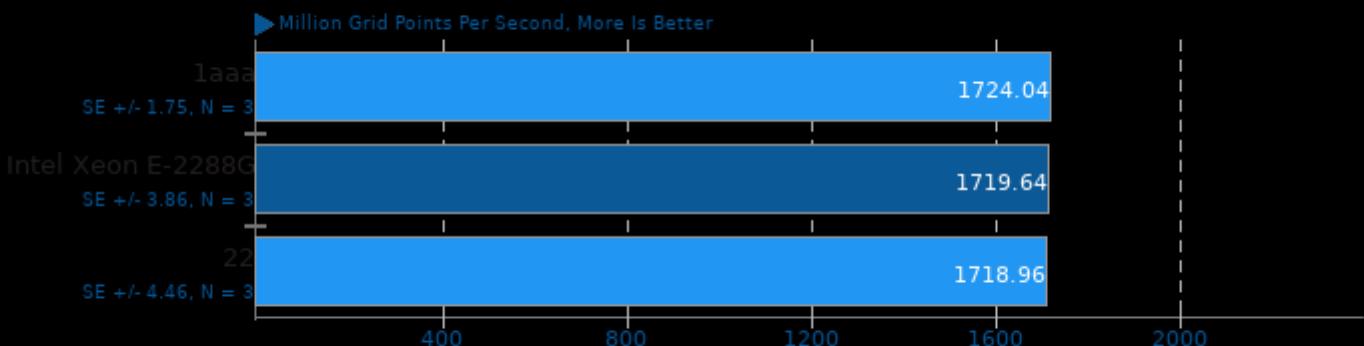
Test: tConvolve MT - Gridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

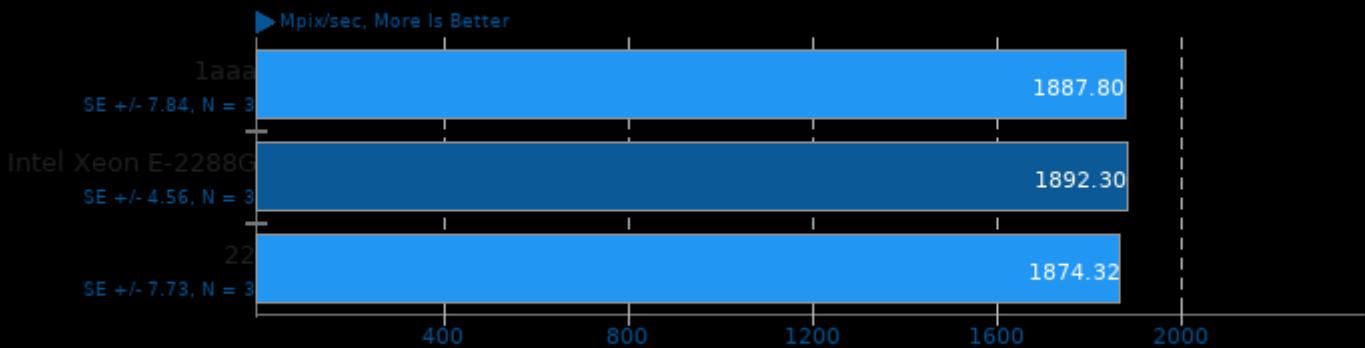
Test: tConvolve MT - Degridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

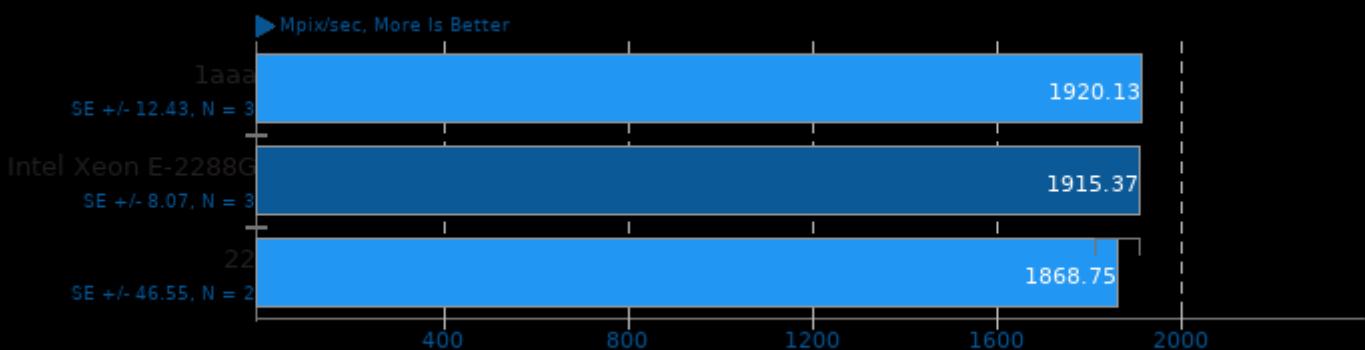
Test: tConvolve MPI - Degridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

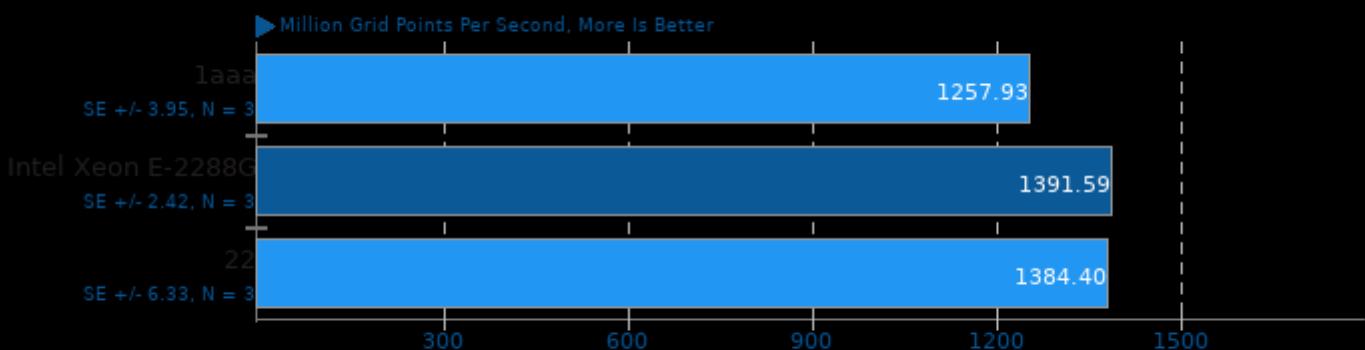
Test: tConvolve MPI - Gridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

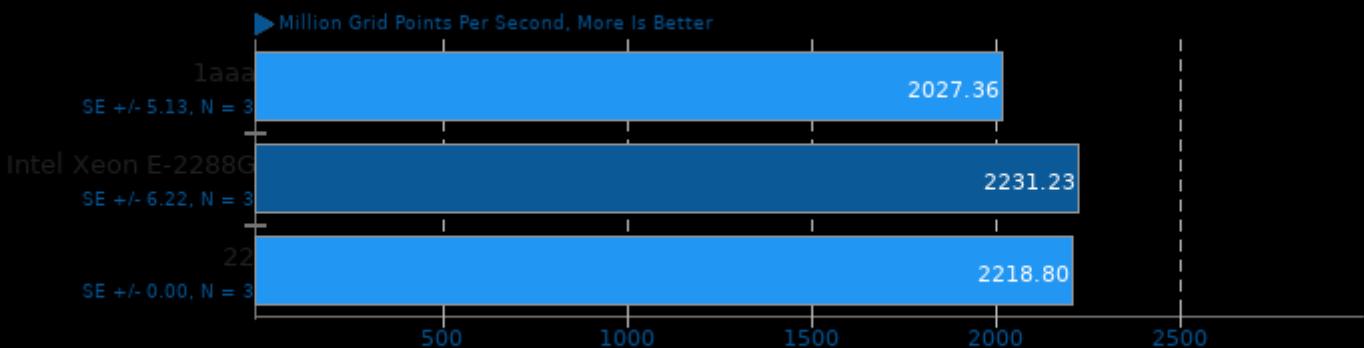
Test: tConvolve OpenMP - Gridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

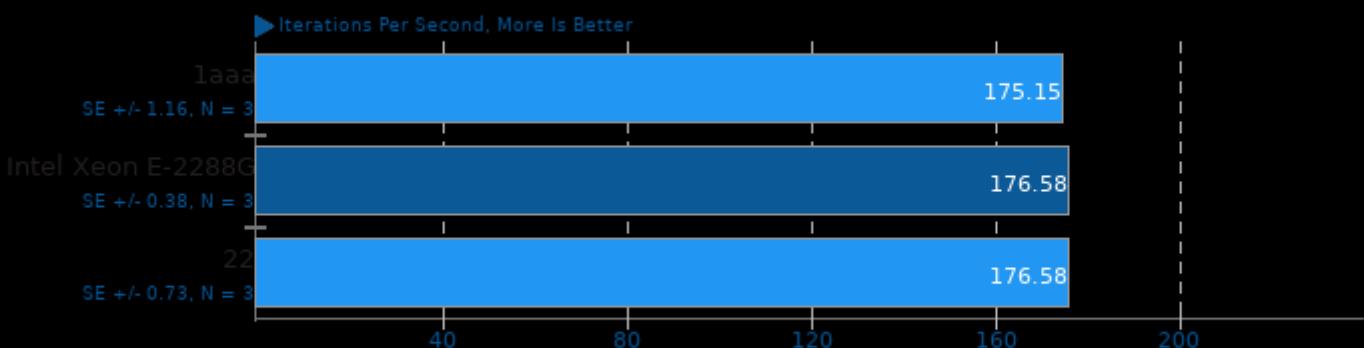
Test: tConvolve OpenMP - Degridding



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

ASKAP 1.0

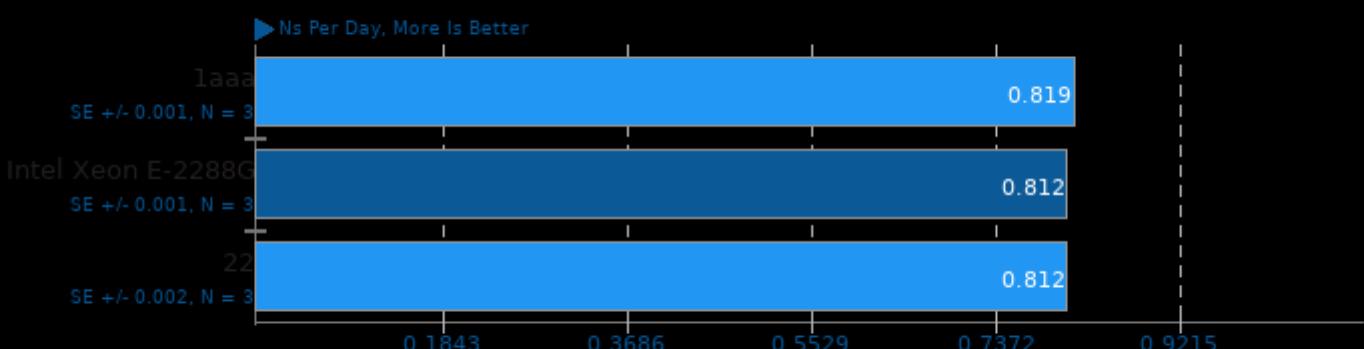
Test: Hogbom Clean OpenMP



1. (CXX) g++ options: -O3 -fstrict-aliasing -fopenmp

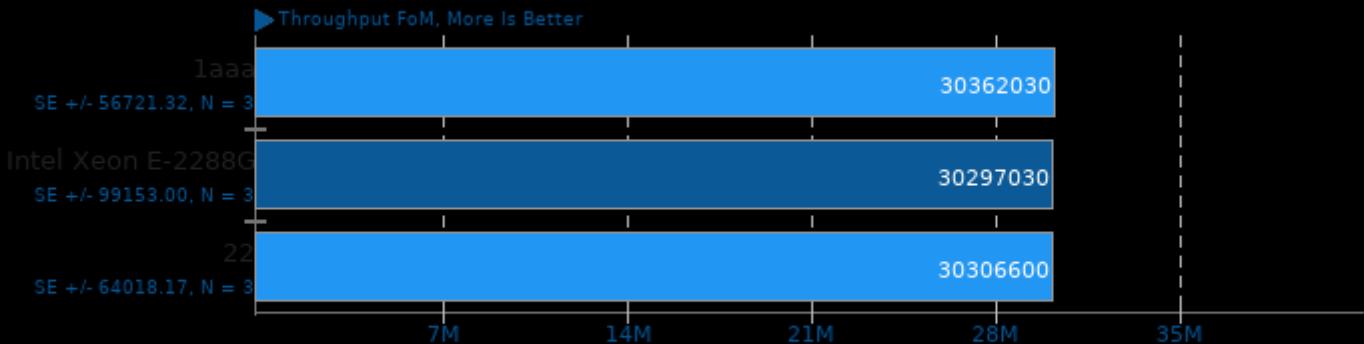
GROMACS 2021

Input: water_GMX50_bare



1. (CXX) g++ options: -O3 -pthread

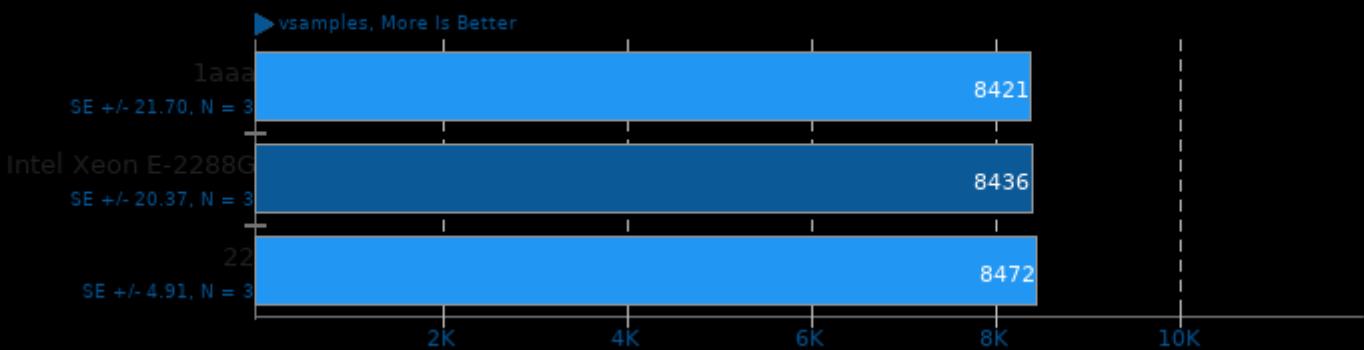
Kripke 1.2.4



1. (CXX) g++ options: -O3 -fopenmp

Chaos Group V-RAY 5

Mode: CPU



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