



AMD EPYC 7F72 2P Linux 5.11 - Perf Governor

2 x AMD EPYC 7F72 24-Core testing looking at CPU freq invariance on 5.11 with patch. CPU power consumption monitoring via AMD_Energy interface at 1 second polling. Additional data with CPUFreq performance governor included.

Automated Executive Summary

CPUFreq Performance had the most wins, coming in first place for 51% of the tests.

Based on the geometric mean of all complete results, the fastest (CPUFreq Performance) was 1.021x the speed of the slowest (CPUFreq Schedutil).

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

Cpuminer-Opt (Algorithm: LBC, LBRY Credits) at 1.396x

dav1d (Video Input: Chimera 1080p 10-bit) at 1.364x

OSPray (Demo: Magnetic Reconnection - Renderer: Path Tracer) at 1.333x

x265 (Video Input: Bosphorus 1080p) at 1.26x

DaCapo Benchmark (Java Test: Tradebeans) at 1.197x

InfluxDB (Concurrent Streams: 4 - Batch Size: 10000 - Tags: 2,5000,1 - Points Per Series: 10000) at 1.177x

dav1d (Video Input: Summer Nature 4K) at 1.145x

DaCapo Benchmark (Java Test: Tradesoap) at 1.114x

Timed GDB GNU Debugger Compilation (Time To Compile) at 1.09x

IOR (Block Size: 2MB - Disk Target: Default Test Directory) at 1.089x.

Test Systems:

CPUFreq Schedutil

Processor: 2 x AMD EPYC 7F72 24-Core @ 3.20GHz (48 Cores / 96 Threads), Motherboard: Supermicro H11DSi-NT v2.00 (2.1 BIOS), Chipset: AMD Starship/Matisse, Memory: 16 x 8192 MB DDR4-3200MT/s HMA81GR7CJR8N-XN, Disk: 1000GB Western Digital WD_BLACK SN850 1TB, Graphics: ASPEED, Monitor: VE228, Network: 2 x Intel 10G X550T

OS: Ubuntu 20.10, Kernel: 5.11.0-rc4-max-boost-inv-patch (x86_64) 20210121, Desktop: GNOME Shell 3.38.1, Display Server: X Server 1.20.9, Display Driver: modesetting 1.20.9, 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,amdgc-n-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,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
Disk Notes: NONE / errors=remount-ro,relatime,rw / Block Size: 4096
Processor Notes: Scaling Governor: acpi-cpufreq schedutil (Boost: Enabled) - CPU Microcode: 0x8301034
Java Notes: OpenJDK Runtime Environment (build 11.0.9.1+1-Ubuntu-0ubuntu1.20.10)
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swaps barriers and __user pointer sanitization + spectre_v2: Mitigation of Full AMD retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

CPUFreq Performance

Processor: 2 x AMD EPYC 7F72 24-Core @ 3.20GHz (48 Cores / 96 Threads), Motherboard: Supermicro H11DSi-NT v2.00 (2.1 BIOS), Chipset: AMD Starship/Matisse, Memory: 16 x 8192 MB DDR4-3200MT/s HMA81GR7CJR8N-XN, Disk: 1000GB Western Digital WD_BLACK SN850 1TB, Graphics: ASPEED, Network: 2 x Intel 10G X550T

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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,amdgc-n-amdhsa=/build/gcc-10-JvwpWM/gcc-10-10.2.0/debian/tmp-gcn/usr,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
Disk Notes: NONE / errors=remount-ro,relatime,rw / Block Size: 4096
Processor Notes: Scaling Governor: acpi-cpufreq performance (Boost: Enabled) - CPU Microcode: 0x8301034
Java Notes: OpenJDK Runtime Environment (build 11.0.9.1+1-Ubuntu-0ubuntu1.20.10)
Python Notes: Python 3.8.6
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swaps barriers and __user pointer sanitization + spectre_v2: Mitigation of Full AMD retpoline IBPB: conditional IBRS_FW STIBP: conditional RSB filling + srbds: Not affected + tsx_async_abort: Not affected

	CPUFreq Schedutil	CPUFreq Performance
Algebraic Multi-Grid Benchmark (Figure Of Merit)	1448718333	1444174667
Normalized	100%	99.69%
Standard Deviation	0.1%	0.5%
Algebraic Multi-Grid Benchmark (Figure Of Merit/Watt)	4631995	4634187
Normalized	99.95%	100%
Timed Godot Game Engine Compilation - Time To Compile (sec)	59.177	58.746
Normalized	99.27%	100%
Standard Deviation	0.5%	0.8%
Timed GDB GNU Debugger Compilation - Time To Compile (sec)	92.916	85.277
Normalized	91.78%	100%
Standard Deviation	0.8%	0.3%
Timed Linux Kernel Compilation - Time To Compile	25.752	25.414
Normalized	98.69%	100%
Standard Deviation	2.4%	2.4%
Timed LLVM Compilation - Time To Compile (sec)	208.786	208.043
Normalized	99.64%	100%
Standard Deviation	0.7%	2.3%
Cpuminer-Opt - Q.S.2.P (kH/s)	296995	420231
Normalized	70.67%	100%
Standard Deviation	6.2%	15.7%
Cpuminer-Opt - Q.S.2.P (kH/s/Watt)	2358	2899
Normalized	81.35%	100%
Cpuminer-Opt - x25x (kH/s)	1542	1538
Normalized	100%	99.72%
Standard Deviation	4.5%	2.5%
Cpuminer-Opt - x25x (kH/s/Watt)	6.08	6.04
Normalized	100%	99.34%
Cpuminer-Opt - Garlicoin (kH/s)	9950	9964
Normalized	99.85%	100%
Standard Deviation	3.9%	5.8%
Cpuminer-Opt - Garlicoin (kH/s/Watt)	59.91	57.99
Normalized	100%	96.8%
Cpuminer-Opt - Skeincoin (kH/s)	364017	522948
Normalized	69.61%	100%
Standard Deviation	5.3%	6.4%
Cpuminer-Opt - Skeincoin (kH/s/Watt)	2898	3626
Normalized	79.92%	100%
Cpuminer-Opt - LBC, LBRY Credits (kH/s)	139037	194087
Normalized	71.64%	100%
Standard Deviation	1.7%	0.8%
Cpuminer-Opt - LBC, LBRY Credits (kH/s/Watt)	1092	1315
Normalized	82.98%	100%
Cython Benchmark - N-Queens (sec)	26.604	26.895
Normalized	100%	98.92%
Standard Deviation	1.4%	0.4%
dav1d - Summer Nature 4K (FPS)	317.45	363.33
Normalized	87.37%	100%
Standard Deviation	0.3%	3.8%
dav1d - Summer Nature 4K (FPS/Watt)	1.72	1.84
Normalized	93.48%	100%
dav1d - C.1.1.b (FPS)	133.37	181.95

	Normalized	73.3%	100%
	Standard Deviation	0.2%	0.2%
dav1d - C.1.1.b (FPS/Watt)		0.92	1.21
	Normalized	76.03%	100%
Etcpak - ETC1 (Mpx/s)		267.587	267.136
	Normalized	100%	99.83%
	Standard Deviation	0.2%	0.2%
Etcpak - ETC1 (Mpx/s/Watt)		2.10	2.11
	Normalized	99.53%	100%
Etcpak - ETC1 + Dithering (Mpx/s)		245.595	245.453
	Normalized	100%	99.94%
	Standard Deviation	0.1%	0.1%
Etcpak - ETC1 + Dithering (Mpx/s/Watt)		1.91	1.93
	Normalized	98.96%	100%
Etcpak - ETC2 (Mpx/s)		155.798	155.783
	Normalized	100%	99.99%
	Standard Deviation	0%	0%
Etcpak - ETC2 (Mpx/s/Watt)		1.21	1.22
	Normalized	99.18%	100%
FinanceBench - Bonds OpenMP (ms)		56769	56094
	Normalized	98.81%	100%
	Standard Deviation	1.8%	1.1%
FinanceBench - Repo OpenMP (ms)		39407	39948
	Normalized	100%	98.64%
	Standard Deviation	1.7%	2%
Gcrypt Library (sec)		232.542	232.760
	Normalized	100%	99.91%
	Standard Deviation	0.6%	0.5%
GnuPG - 2.7.S.F.E (sec)		77.179	77.022
	Normalized	99.8%	100%
	Standard Deviation	0.5%	1%
IOR - 2MB (MB/s)		475.25	517.33
	Normalized	91.87%	100%
	Standard Deviation	0.8%	1.8%
IOR - 2MB (MB/s/Watt)		2.43	2.64
	Normalized	92.05%	100%
IOR - 8MB (MB/s)		520.72	539.63
	Normalized	96.5%	100%
	Standard Deviation	0.9%	1.9%
IOR - 8MB (MB/s/Watt)		2.49	2.55
	Normalized	97.65%	100%
LAMMPS Molecular Dynamics Simulator - Rhodopsin Protein (ns/day)		23.787	24.639
	Normalized	96.54%	100%
	Standard Deviation	2.4%	3%
LAMMPS Molecular Dynamics Simulator - Rhodopsin Protein (ns/day/Watt)		0.13	0.14
	Normalized	92.86%	100%
LAMMPS Molecular Dynamics Simulator - 20k Atoms (ns/day)		25.077	25.116
	Normalized	99.84%	100%
	Standard Deviation	0.3%	0.2%

LAMMPS Molecular Dynamics Simulator - 20k Atoms	0.06	0.06
(ns/day/Watt)		
LULESH (z/s)	19771	19335
Normalized	100%	97.79%
Standard Deviation	1.9%	2.1%
LULESH (z/s/Watt)	80.77	78.80
Normalized	100%	97.56%
NAS Parallel Benchmarks - EP.C (Mop/s)	3841	3857
Normalized	99.59%	100%
Standard Deviation	0.4%	0.3%
NAS Parallel Benchmarks - EP.C (Mop/s/Watt)	17.62	17.84
Normalized	98.77%	100%
NAS Parallel Benchmarks - EP.D (Mop/s)	3863	3867
Normalized	99.9%	100%
Standard Deviation	0.1%	0.1%
NAS Parallel Benchmarks - EP.D (Mop/s/Watt)	10.24	10.29
Normalized	99.51%	100%
NAS Parallel Benchmarks - LU.C (Mop/s)	154377	153771
Normalized	100%	99.61%
Standard Deviation	0.7%	0.2%
NAS Parallel Benchmarks - LU.C (Mop/s/Watt)	469.62	466.44
Normalized	100%	99.32%
ONNX Runtime - yolov4 - OpenMP CPU	181	185
Normalized	97.84%	100%
Standard Deviation	1.8%	2.5%
ONNX Runtime - yolov4 - OpenMP CPU	0.69	0.70
(Inferences/min/Watt)		
Normalized	98.57%	100%
ONNX Runtime - super-resolution-10 - OpenMP CPU	4210	4190
(Inferences/min)		
Normalized	100%	99.52%
Standard Deviation	1.8%	5.6%
ONNX Runtime - super-resolution-10 - OpenMP CPU	15.26	15.49
(Inferences/min/Watt)		
Normalized	98.52%	100%
OpenFOAM - Motorbike 30M (sec)	18.30	18.29
Normalized	99.95%	100%
Standard Deviation	0.8%	0.9%
OpenFOAM - Motorbike 60M (sec)	128.28	128.81
Normalized	100%	99.59%
Standard Deviation	0.1%	0.1%
Quantum ESPRESSO - AUSURF112 (sec)	1171	1249
Normalized	100%	93.75%
Standard Deviation	2.1%	4.6%
QMCPACK - simple-H2O (Execution Time - sec)	29.281	28.971
Normalized	98.94%	100%
Standard Deviation	0.5%	0.4%
QuantLib (MFLOPS)	2157	2156
Normalized	100%	99.96%
Standard Deviation	0.7%	1.3%
QuantLib (MFLOPS/Watt)	16.34	16.49
Normalized	99.09%	100%
rav1e - 10 (FPS)	3.054	3.177
Normalized	96.13%	100%

Standard Deviation	0.5%	1%
rav1e - 10 (FPS/Watt)	0.02	0.02
rav1e - 6 (FPS)	1.408	1.446
Normalized	97.37%	100%
Standard Deviation	0.4%	0.1%
rav1e - 6 (FPS/Watt)	0.01	0.01
rav1e - 5 (FPS)	1.068	1.095
Normalized	97.53%	100%
Standard Deviation	0.1%	0.5%
rav1e - 5 (FPS/Watt)	0.01	0.01
rav1e - 1 (FPS)	0.372	0.375
Normalized	99.2%	100%
Standard Deviation	0.5%	0%
Redis - SET (Reqs/sec)	1427348	1454741
Normalized	98.12%	100%
Standard Deviation	3.6%	2.5%
Redis - SET (Reqs/sec/Watt)	11501	11684
Normalized	98.43%	100%
Redis - GET (Reqs/sec)	1711622	1782756
Normalized	96.01%	100%
Standard Deviation	2.5%	6.3%
Redis - GET (Reqs/sec/Watt)	13846	14376
Normalized	96.31%	100%
Redis - LPUSH (Reqs/sec)	1217219	1251006
Normalized	97.3%	100%
Standard Deviation	2%	1.6%
Redis - LPUSH (Reqs/sec/Watt)	9780	10016
Normalized	97.64%	100%
Redis - SADD (Reqs/sec)	1611164	1610485
Normalized	100%	99.96%
Standard Deviation	1.9%	4.3%
Redis - SADD (Reqs/sec/Watt)	13036	12967
Normalized	100%	99.47%
RELION - Basic - CPU (sec)	348.294	348.338
Normalized	100%	99.99%
Standard Deviation	2.6%	2.7%
Google SynthMark - VoiceMark_100 (Voices)	714.914	714.181
Normalized	100%	99.9%
Standard Deviation	0%	0.3%
Google SynthMark - VoiceMark_100 (Voices/Watt)	5.54	5.57
Normalized	99.46%	100%
TNN - CPU - MobileNet v2 (ms)	289.764	297.132
Normalized	100%	97.52%
Standard Deviation	1.7%	0%
TNN - CPU - SqueezeNet v1.1 (ms)	274.869	274.097
Normalized	99.72%	100%
Standard Deviation	0.4%	0%
AI Benchmark Alpha - D.I.S (Score)	1720	1775
Normalized	96.9%	100%
AI Benchmark Alpha - D.T.S (Score)	1067	1133
Normalized	94.17%	100%
AI Benchmark Alpha - Device AI Score (Score)	2787	2908
Normalized	95.84%	100%
AI Benchmark Alpha - Device AI Score (Score/Watt)	12.98	11.59

	Normalized	100%	89.29%
ASKAP - tConvolve MPI - Gridding (Million Grid Points/sec)		7454	7442
	Normalized	100%	99.84%
	Standard Deviation	0.1%	0.2%
ASKAP - tConvolve MPI - Degridding (Million Grid Points/sec)		11944	11493
	Normalized	100%	96.22%
	Standard Deviation	0.1%	2.1%
ASKAP - tConvolve MPI - Degridding (Million Grid Points/sec/Watt)		40.51	33.50
	Normalized	100%	82.7%
asmFish - 1.H.M.2.D (Nodes/s)		117632955	117370871
	Normalized	100%	99.78%
	Standard Deviation	0.5%	2.4%
asmFish - 1.H.M.2.D (Nodes/s/Watt)		259519	251626
	Normalized	100%	96.96%
ASTC Encoder - Thorough (sec)		5.65	5.67
	Normalized	100%	99.65%
	Standard Deviation	0.2%	0.2%
ASTC Encoder - Exhaustive (sec)		40.97	41.07
	Normalized	100%	99.76%
	Standard Deviation	0.1%	0.2%
Blender - Barbershop - CPU-Only (sec)		156.83	158.07
	Normalized	100%	99.22%
	Standard Deviation	0.1%	1%
BlogBench - Read (Final Score)		1103118	1086347
	Normalized	100%	98.48%
	Standard Deviation	0.3%	2.2%
BlogBench - Read (Final Score/Watt)		4753	4639
	Normalized	100%	97.61%
BRL-CAD - V.P.M (VGR Performance Metric)		636521	635725
	Normalized	100%	99.87%
BRL-CAD - V.P.M (VGR Performance Metric/Watt)		1370	1355
	Normalized	100%	98.95%
Build2 - Time To Compile (sec)		67.322	67.334
	Normalized	100%	99.98%
	Standard Deviation	1.3%	0.8%
BYTE Unix Benchmark - Dhrystone 2 (LPS)		38319340	38656226
	Normalized	99.13%	100%
	Standard Deviation	1.5%	2.2%
BYTE Unix Benchmark - Dhrystone 2 (LPS/Watt)		306193	307169
	Normalized	99.68%	100%
Zstd Compression - 3 (MB/s)		8271	7770
	Normalized	100%	93.95%
	Standard Deviation	1.4%	28.9%
Zstd Compression - 3 (MB/s/Watt)		54.88	50.56
	Normalized	100%	92.13%
LZ4 Compression - 1 - Compression Speed (MB/s)		9757	9652
	Normalized	100%	98.92%
	Standard Deviation	0.3%	1.3%
LZ4 Compression - 1 - D.S (MB/s)		11305	11151
	Normalized	100%	98.63%
	Standard Deviation	0.4%	1.7%

LZ4 Compression - 1 - D.S (MB/s/Watt)	81.34	81.46
Normalized	99.85%	100%
LZ4 Compression - 3 - Compression Speed (MB/s)	48.95	49.29
Normalized	99.31%	100%
Standard Deviation	0.4%	2.3%
LZ4 Compression - 3 - D.S (MB/s)	10666	10410
Normalized	100%	97.6%
Standard Deviation	1%	1.3%
LZ4 Compression - 3 - D.S (MB/s/Watt)	80.07	79.05
Normalized	100%	98.73%
LZ4 Compression - 9 - Compression Speed (MB/s)	47.76	48.02
Normalized	99.46%	100%
Standard Deviation	0.5%	0.9%
LZ4 Compression - 9 - D.S (MB/s)	10490	10555
Normalized	99.38%	100%
Standard Deviation	0.5%	1.6%
LZ4 Compression - 9 - D.S (MB/s/Watt)	78.46	80.12
Normalized	97.93%	100%
DaCapo Benchmark - H2 (msec)	5217	4570
Normalized	87.6%	100%
Standard Deviation	6.3%	6.9%
DaCapo Benchmark - Jython (msec)	4778	4740
Normalized	99.2%	100%
Standard Deviation	2.3%	1.1%
DaCapo Benchmark - Tradebeans (msec)	5591	4671
Normalized	83.54%	100%
Standard Deviation	5.3%	5%
DaCapo Benchmark - Tradesoap (msec)	5148	4621
Normalized	89.76%	100%
Standard Deviation	2.4%	2.1%
Dolfyn - C.F.D (sec)	18.652	18.635
Normalized	99.91%	100%
Standard Deviation	0.3%	0.3%
OSPray - M.R - SciVis (FPS)	32.62	32.80
Normalized	99.45%	100%
Standard Deviation	1.7%	1.8%
OSPray - M.R - SciVis (FPS/Watt)	0.11	0.10
Normalized	100%	90.91%
OSPray - M.R - Path Tracer (FPS)	250	333.33
Normalized	75%	100%
Standard Deviation		0%
OSPray - M.R - Path Tracer (FPS/Watt)	1.65	1.99
Normalized	82.91%	100%
OSPray - XFrog Forest - SciVis (FPS)	11.19	11.19
Standard Deviation	0.6%	0.6%
OSPray - XFrog Forest - SciVis (FPS/Watt)	0.03	0.03
OSPray - XFrog Forest - Path Tracer (FPS)	5.95	5.95
Standard Deviation	0%	0%
OSPray - XFrog Forest - Path Tracer (FPS/Watt)	0.01	0.01
OSPray - NASA Streamlines - SciVis (FPS)	71.43	71.43
Standard Deviation	0%	0%
OSPray - NASA Streamlines - SciVis (FPS/Watt)	0.30	0.30
OSPray - NASA Streamlines - Path Tracer (FPS)	16.39	16.39
Standard Deviation	0%	0%

OSPray - NASA Streamlines - Path Tracer (FPS/Watt)	0.05	0.05
OSPray - San Miguel - SciVis (FPS)	54.97	55.56
Normalized	98.94%	100%
Standard Deviation	2.4%	0%
OSPray - San Miguel - SciVis (FPS/Watt)	0.32	0.33
Normalized	96.97%	100%
OSPray - San Miguel - Path Tracer (FPS)	4.32	4.33
Normalized	99.77%	100%
Standard Deviation	0.2%	0%
OSPray - San Miguel - Path Tracer (FPS/Watt)	0.01	0.01
POV-Ray - Trace Time (sec)	11.305	11.427
Normalized	100%	98.93%
Standard Deviation	1%	0.2%
YafaRay - T.T.F.S.S (sec)	87.143	87.331
Normalized	100%	99.78%
Standard Deviation	3.8%	3.1%
FFTE - N.2.3.C.F.R (MFLOPS)	178738	180038
Normalized	99.28%	100%
Standard Deviation	3.8%	3.5%
FFTE - N.2.3.C.F.R (MFLOPS/Watt)	656.40	664.85
Normalized	98.73%	100%
FFTW - Float + SSE - 2D FFT Size 4096 (Mflops)	17015	17335
Normalized	98.15%	100%
Standard Deviation	2.2%	3.5%
FFTW - Float + SSE - 2D FFT Size 4096 (Mflops/Watt)	127.83	131.21
Normalized	97.42%	100%
CLOMP - Static OMP Speedup (Speedup)	47.8	47.4
Normalized	100%	99.16%
Standard Deviation	1.7%	2%
CLOMP - Static OMP Speedup (Speedup/Watt)	0.31	0.31
GPAW - Carbon Nanotube (sec)	59.851	59.757
Normalized	99.84%	100%
Standard Deviation	1.1%	0.9%
GROMACS - Water Benchmark (Ns/Day)	5.261	5.255
Normalized	100%	99.89%
Standard Deviation	0.7%	0.7%
GROMACS - Water Benchmark (Ns/Day/Watt)	0.01	0.01
NAMD - ATPase Simulation - 327,506 Atoms (days/ns)	0.44472	0.44469
Normalized	99.99%	100%
Standard Deviation	0%	0.3%
Himeno Benchmark - P.P.S (MFLOPS)	4287	4136
Normalized	100%	96.47%
Standard Deviation	1%	1.1%
Himeno Benchmark - P.P.S (MFLOPS/Watt)	31.94	31.13
Normalized	100%	97.46%
Hierarchical INTegration - FLOAT (QUIPs)	323144417	322775284
Normalized	100%	99.89%
Standard Deviation	0.1%	0.1%
Hierarchical INTegration - FLOAT (QUIPs/Watt)	2496421	2527557
Normalized	98.77%	100%
High Performance Conjugate Gradient (GFLOP/s)	30.8262	30.9260
Normalized	99.68%	100%
Standard Deviation	0.7%	0.1%
High Performance Conjugate Gradient (GFLOP/s/Watt)	0.08	0.09

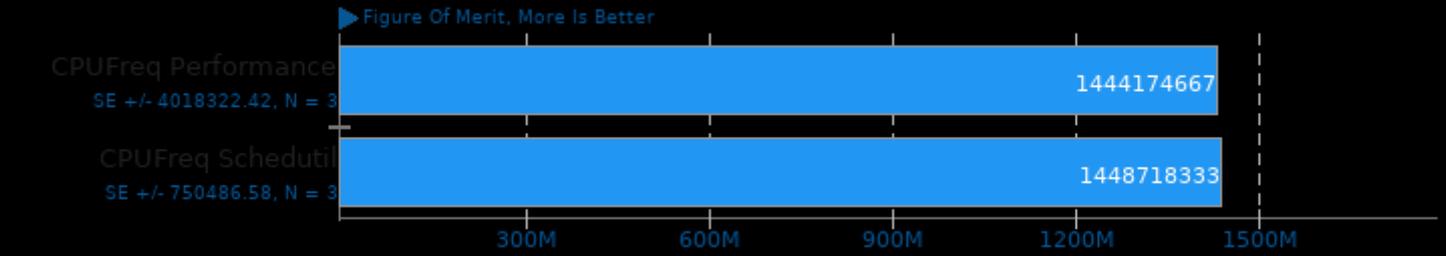
	Normalized	88.89%	100%
John The Ripper - MD5 (Real C/S)		4612308	4762000
	Normalized	96.86%	100%
	Standard Deviation	4.2%	0.3%
John The Ripper - MD5 (Real C/S/Watt)		10085	10378
	Normalized	97.17%	100%
John The Ripper - Blowfish (Real C/S)		72636	71757
	Normalized	100%	98.79%
	Standard Deviation	0.2%	1.2%
John The Ripper - Blowfish (Real C/S/Watt)		185.47	183.88
	Normalized	100%	99.14%
KeyDB (Ops/sec)		294214	303171
	Normalized	97.05%	100%
	Standard Deviation	4%	6.6%
KeyDB (Ops/sec/Watt)		1865	1762
	Normalized	100%	94.44%
InfluxDB - 4 - 10000 - 2,5000,1 - 10000 (val/sec)		812194	956189
	Normalized	84.94%	100%
	Standard Deviation	0.3%	0.4%
InfluxDB - 4 - 10000 - 2,5000,1 - 10000 (val/sec/Watt)		4857	4964
	Normalized	97.86%	100%
InfluxDB - 64 - 10000 - 2,5000,1 - 10000 (val/sec)		1256112	1360163
	Normalized	92.35%	100%
	Standard Deviation	0.4%	1.2%
InfluxDB - 64 - 10000 - 2,5000,1 - 10000 (val/sec/Watt)		6672	6626
	Normalized	100%	99.31%
LeelaChessZero - BLAS (Nodes/s)		4061	4147
	Normalized	97.93%	100%
	Standard Deviation	3.7%	0.7%
LeelaChessZero - BLAS (Nodes/s/Watt)		9.72	9.72
LeelaChessZero - Eigen (Nodes/s)		4433	4450
	Normalized	99.62%	100%
	Standard Deviation	1.4%	1%
LeelaChessZero - Eigen (Nodes/s/Watt)		10.45	10.39
	Normalized	100%	99.43%
LuxCoreRender - DLSC (M samples/sec)		7.80	7.89
	Normalized	98.86%	100%
	Standard Deviation	2.2%	2%
LuxCoreRender - DLSC (M samples/sec/Watt)		0.02	0.02
LuxCoreRender - R.C.a.P (M samples/sec)		8.76	8.76
	Standard Deviation	1.8%	0.9%
LuxCoreRender - R.C.a.P (M samples/sec/Watt)		0.02	0.02
oneDNN - C.B.S.A - f32 - CPU (ms)		0.863782	0.867545
	Normalized	100%	99.57%
	Standard Deviation	0.5%	0.5%
oneDNN - D.B.s - f32 - CPU (ms)		2.33290	2.30467
	Normalized	98.79%	100%
	Standard Deviation	1.2%	4.3%
oneDNN - IP Shapes 1D - f32 - CPU (ms)		1.55447	1.57963
	Normalized	100%	98.41%
	Standard Deviation	1.7%	1.7%
oneDNN - IP Shapes 3D - f32 - CPU (ms)		0.849248	0.813628
	Normalized	95.81%	100%
	Standard Deviation	1.1%	1.5%

oneDNN - M.M.B.S.T - f32 - CPU (ms)	0.521968	0.514604
Normalized	98.59%	100%
Standard Deviation	1.8%	2.3%
oneDNN - R.N.N.T - f32 - CPU (ms)	1123	1247
Normalized	100%	90.05%
Standard Deviation	0.5%	11%
Timed MrBayes Analysis - P.P.A (sec)	82.042	82.261
Normalized	100%	99.73%
Standard Deviation	0.6%	0.6%
Nebular Empirical Analysis Tool (sec)	24.633	25.037
Normalized	100%	98.39%
Standard Deviation	7.8%	9.3%
Numpy Benchmark (Score)	323.00	324.48
Normalized	99.54%	100%
Standard Deviation	0.1%	0.1%
Numpy Benchmark (Score/Watt)	2.43	2.46
Normalized	98.78%	100%
Intel Open Image Denoise - Memorial (Images / Sec)	28.39	28.33
Normalized	100%	99.79%
Standard Deviation	0.3%	1.4%
Intel Open Image Denoise - Memorial (Images /	0.08	0.08
PlaidML - No - Inference - ResNet 50 - CPU (FPS)	4.63	4.66
Normalized	99.36%	100%
Standard Deviation	1%	1.5%
PlaidML - No - Inference - ResNet 50 - CPU (FPS/Watt)	0.03	0.03
PlaidML - No - Inference - VGG16 - CPU (FPS)	25.42	25.22
Normalized	100%	99.21%
Standard Deviation	4.6%	3.6%
PlaidML - No - Inference - VGG16 - CPU (FPS/Watt)	0.09	0.09
PlaidML - No - Inference - VGG19 - CPU (FPS)	22.49	22.43
Normalized	100%	99.73%
Standard Deviation	2.7%	3.5%
PlaidML - No - Inference - VGG19 - CPU (FPS/Watt)	0.08	0.08
Primesieve - 1.P.N.G (sec)	4.535	4.489
Normalized	98.99%	100%
Standard Deviation	1%	0.5%
TTSIOD 3D Renderer - P.R.W.S.S.M (FPS)	655.225	665.448
Normalized	98.46%	100%
Standard Deviation	0.9%	3.4%
TTSIOD 3D Renderer - P.R.W.S.S.M (FPS/Watt)	2.70	2.74
Normalized	98.54%	100%
Rodinia - OpenMP CFD Solver (sec)	8.882	8.510
Normalized	95.81%	100%
Standard Deviation	6.2%	1.4%
Rodinia - OpenMP LavaMD (sec)	52.092	52.360
Normalized	100%	99.49%
Standard Deviation	0.4%	0%
Rodinia - OpenMP Leukocyte (sec)	52.684	51.290
Normalized	97.35%	100%
Standard Deviation	2.3%	0.6%
Rodinia - O.S (sec)	10.338	10.432
Normalized	100%	99.1%
Standard Deviation	0.7%	0.8%
Rodinia - OpenMP HotSpot3D (sec)	96.603	96.885

	Normalized	100%	99.71%
	Standard Deviation	1%	1%
simdjson - PartialTweets (GB/s)		0.63	0.63
	Standard Deviation	0%	0%
simdjson - LargeRand (GB/s)		0.36	0.37
	Normalized	97.3%	100%
	Standard Deviation	1.6%	0%
simdjson - Kostya (GB/s)		0.57	0.57
	Standard Deviation	0%	1%
simdjson - DistinctUserID (GB/s)		0.65	0.65
	Standard Deviation	0%	0.9%
simdjson - DistinctUserID (GB/s/Watt)		0.01	0.01
SQLite Speedtest - Timed Time - Size 1,000 (sec)		70.540	69.883
	Normalized	99.07%	100%
	Standard Deviation	0.3%	0.5%
Stockfish - Total Time (Nodes/s)		97042601	96082114
	Normalized	100%	99.01%
	Standard Deviation	1.4%	2.4%
Stockfish - Total Time (Nodes/s/Watt)		220990	218753
	Normalized	100%	98.99%
SVT-AV1 - Enc Mode 8 - 1080p (FPS)		68.231	68.465
	Normalized	99.66%	100%
	Standard Deviation	6%	3.7%
SVT-AV1 - Enc Mode 8 - 1080p (FPS/Watt)		0.33	0.33
SVT-AV1 - Enc Mode 4 - 1080p (FPS)		7.648	7.488
	Normalized	100%	97.91%
	Standard Deviation	0.7%	0.8%
SVT-AV1 - Enc Mode 4 - 1080p (FPS/Watt)		0.03	0.03
SVT-AV1 - Enc Mode 0 - 1080p (FPS)		0.091	0.091
	Standard Deviation	2.4%	0.6%
SVT-VP9 - V.Q.O - Bosphorus 1080p (FPS)		323.81	309.61
	Normalized	100%	95.61%
	Standard Deviation	5%	19.1%
SVT-VP9 - V.Q.O - Bosphorus 1080p (FPS/Watt)		1.74	1.68
	Normalized	100%	96.55%
SVT-VP9 - P.S.O - Bosphorus 1080p (FPS)		371.48	363.18
	Normalized	100%	97.77%
	Standard Deviation	1.4%	1.5%
SVT-VP9 - P.S.O - Bosphorus 1080p (FPS/Watt)		2.11	2.07
	Normalized	100%	98.1%
SVT-VP9 - VMAF Optimized - Bosphorus 1080p (FPS)		364.81	346.71
	Normalized	100%	95.04%
	Standard Deviation	0.8%	2.9%
SVT-VP9 - VMAF Optimized - Bosphorus 1080p (FPS/Watt)		2.08	1.97
	Normalized	100%	94.71%
Swet - Average (Operations/sec)		687480262	686132109
	Normalized	100%	99.8%
	Standard Deviation	0.4%	0.9%
Swet - Average (Operations/sec/Watt)		5408273	5450164
	Normalized	99.23%	100%
Tachyon - Total Time (sec)		18.0565	18.2004
	Normalized	100%	99.21%
	Standard Deviation	0.6%	1.4%

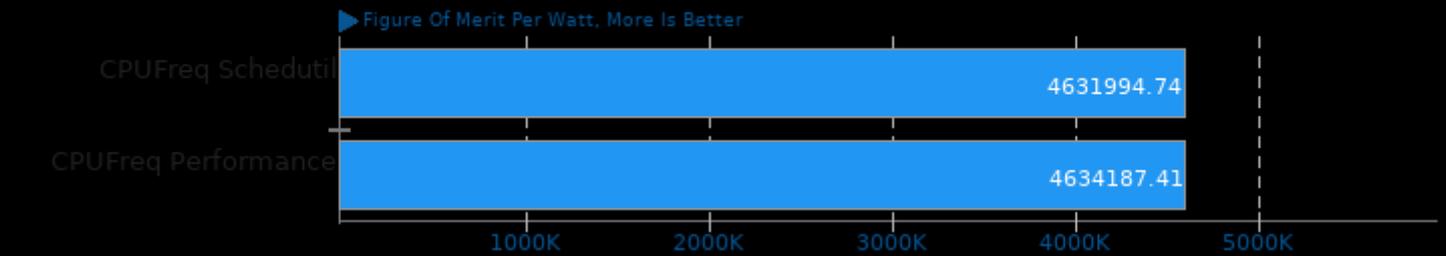
TensorFlow Lite - Mobilenet Float (us)	39524	39982
Normalized	100%	98.85%
Standard Deviation	1.7%	2%
TensorFlow Lite - Mobilenet Quant (us)	41034	41180
Normalized	100%	99.65%
Standard Deviation	2.4%	0.9%
TensorFlow Lite - NASNet Mobile (us)	134044	132844
Normalized	99.1%	100%
Standard Deviation	6.9%	6.3%
TensorFlow Lite - SqueezeNet (us)	62195	61347
Normalized	98.64%	100%
Standard Deviation	2.6%	2.3%
TensorFlow Lite - I.R.V (us)	736285	737993
Normalized	100%	99.77%
Standard Deviation	2.4%	0.5%
TensorFlow Lite - Inception V4 (us)	810750	818887
Normalized	100%	99.01%
Standard Deviation	0.2%	1%
TSCP - A.C.P (Nodes/s)	1114562	1116255
Normalized	99.85%	100%
Standard Deviation	0.2%	0.2%
TSCP - A.C.P (Nodes/s/Watt)	8993	9017
Normalized	99.73%	100%
Tungsten Renderer - Hair (sec)	6.69036	6.69505
Normalized	100%	99.93%
Standard Deviation	0.5%	2.2%
Tungsten Renderer - Water Caustic (sec)	21.3329	21.4652
Normalized	100%	99.38%
Standard Deviation	3.8%	2.1%
Tungsten Renderer - Volumetric Caustic (sec)	5.26235	5.31183
Normalized	100%	99.07%
Standard Deviation	1.8%	2.5%
Chaos Group V-RAY - CPU (Ksamples)	53460	55014
Normalized	97.18%	100%
Standard Deviation	6.9%	1.6%
Chaos Group V-RAY - CPU (Ksamples/Watt)	127.59	130.65
Normalized	97.66%	100%
x265 - Bosphorus 1080p (FPS)	49.45	62.29
Normalized	79.39%	100%
Standard Deviation	2.1%	4.6%
x265 - Bosphorus 1080p (FPS/Watt)	0.29	0.31
Normalized	93.55%	100%
x265 - Bosphorus 4K (FPS)	19.74	20.75
Normalized	95.13%	100%
Standard Deviation	1.2%	0.7%
x265 - Bosphorus 4K (FPS/Watt)	0.08	0.08

Algebraic Multi-Grid Benchmark 1.2



1. (CC) gcc options: -lparcsr_ls -lparcsr_mv -lseq_mv -llj_mv -lkrylov -lhypre_utilities -lm -fopenmp -pthread -lmpi

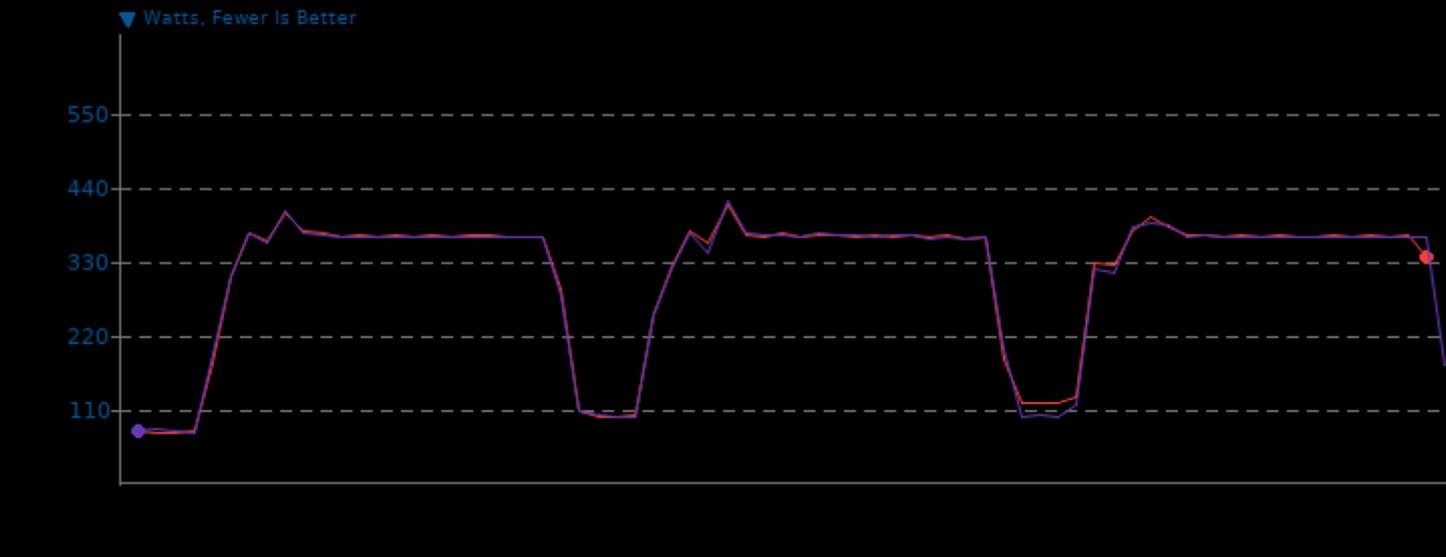
Algebraic Multi-Grid Benchmark 1.2



Algebraic Multi-Grid Benchmark 1.2

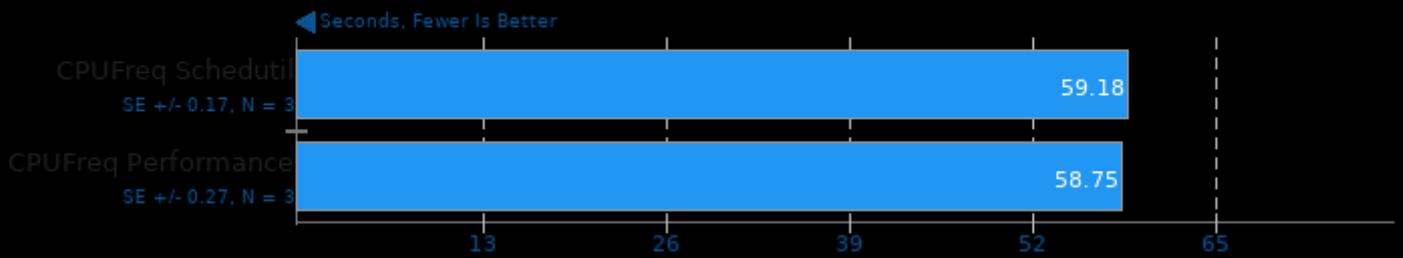
CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Scheduling	76.7	312.8	412.3
CPUFreq Performance	77.8	309.8	419.8



Timed Godot Game Engine Compilation 3.2.3

Time To Compile

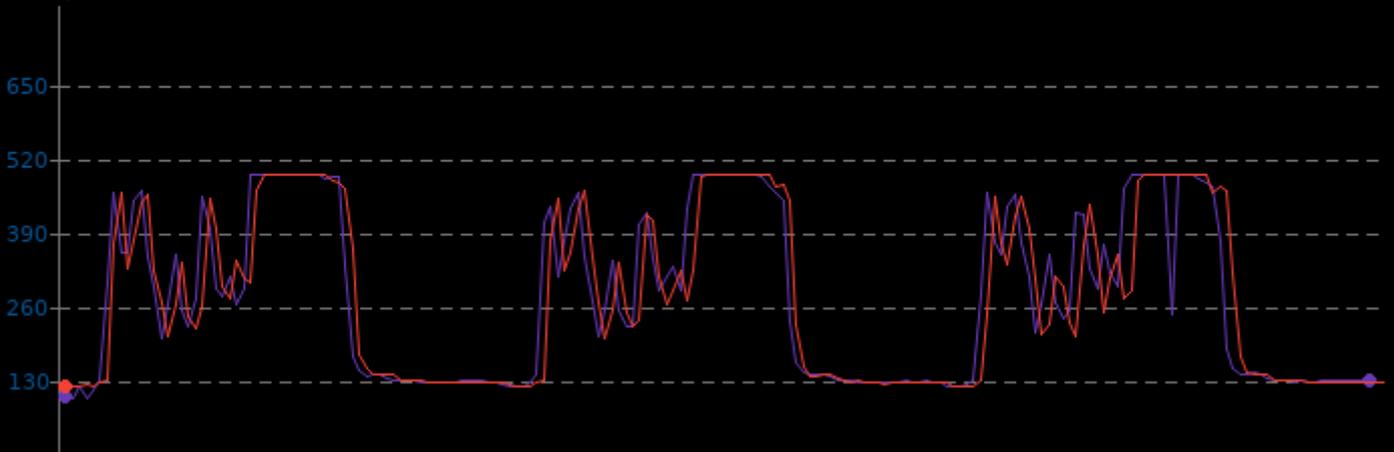


Timed Godot Game Engine Compilation 3.2.3

CPU Power Consumption Monitor

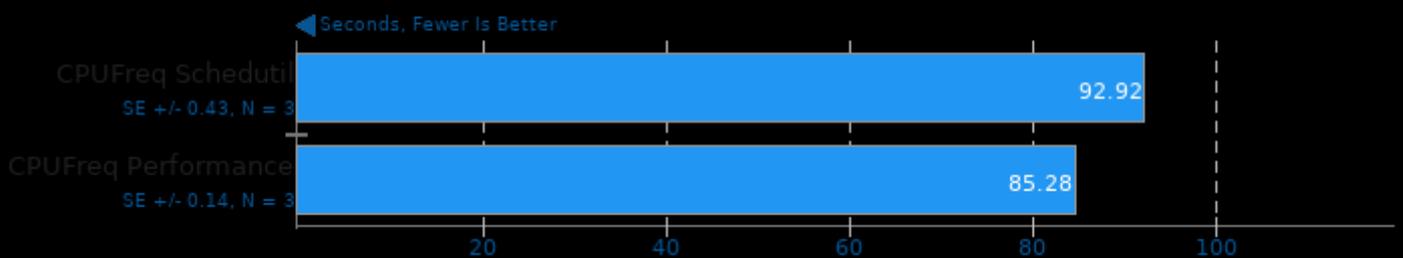
	Min	Avg	Max
CPUFreq Performance	99.7	278.9	492.2
CPUFreq Scheduling	120.6	276.3	492.2

▼ Watts, Fewer Is Better



Timed GDB GNU Debugger Compilation 9.1

Time To Compile

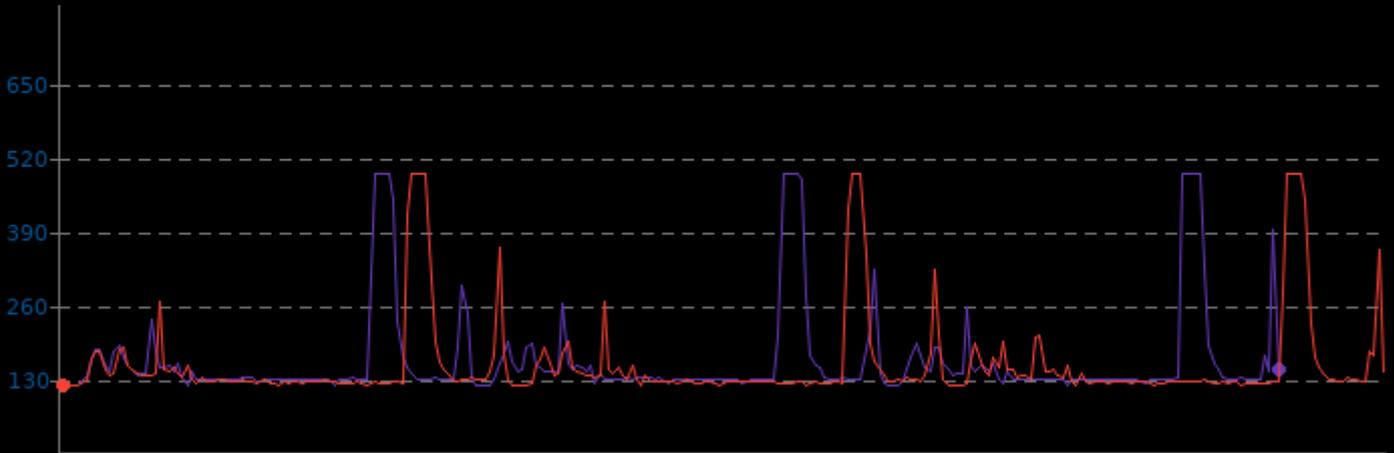


Timed GDB GNU Debugger Compilation 9.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.7	167.0	492.1
CPUFreq Schedutil	120.6	159.2	492.3

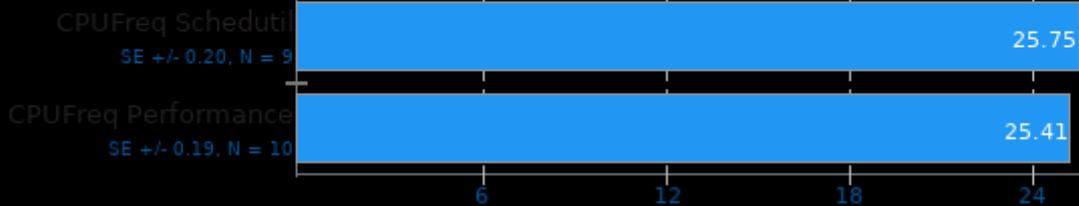
▼ Watts, Fewer Is Better



Timed Linux Kernel Compilation 5.4

Time To Compile

◀ Seconds, Fewer Is Better

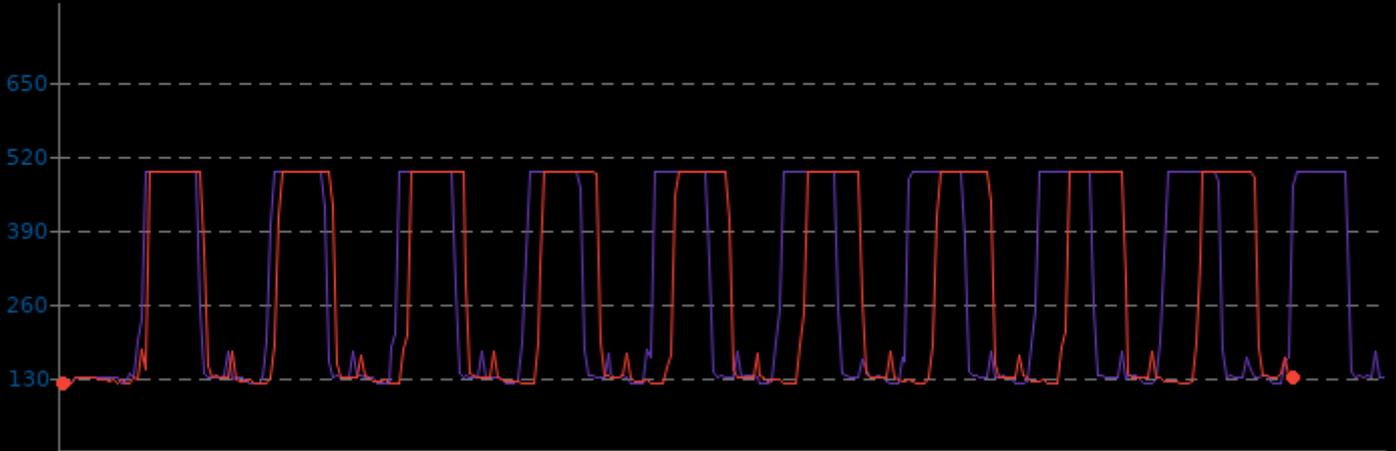


Timed Linux Kernel Compilation 5.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.3	290.5	492.2
CPUFreq Schedutil	120.0	284.2	492.3

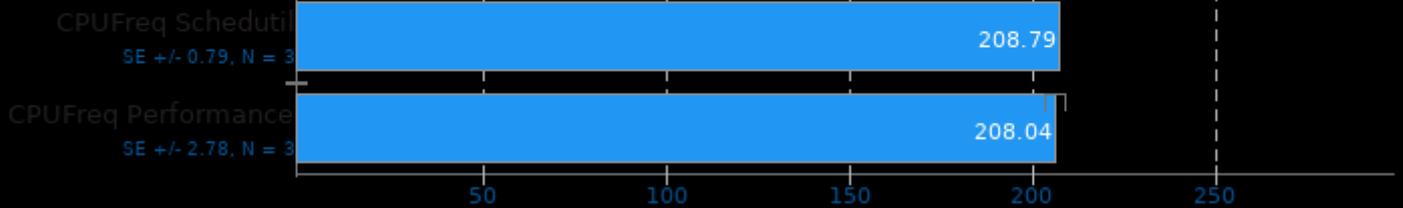
▼ Watts, Fewer Is Better



Timed LLVM Compilation 10.0

Time To Compile

◀ Seconds, Fewer Is Better

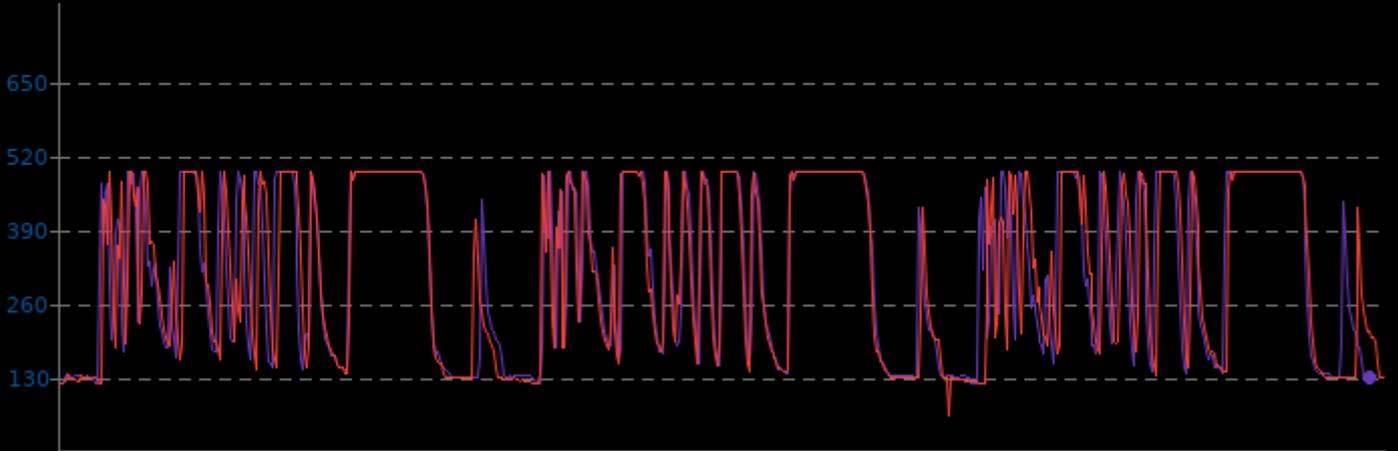


Timed LLVM Compilation 10.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.1	322.9	492.3
CPUFreq Schedutil	64.9	318.0	492.4

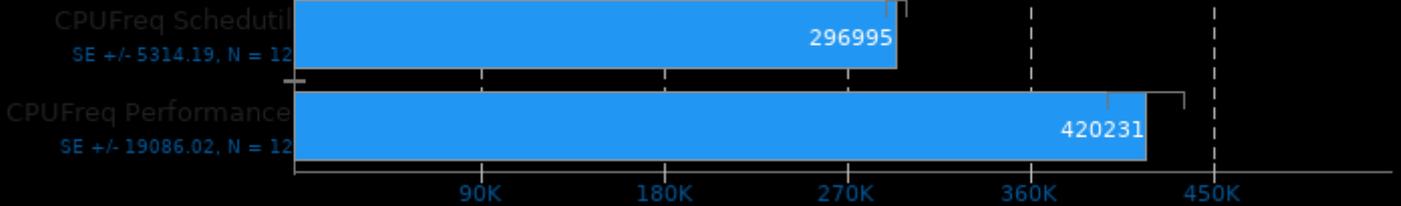
Watts, Fewer Is Better



Cpuminer-Opt 3.15.5

Algorithm: Quad SHA-256, Pyrite

kH/s, More Is Better

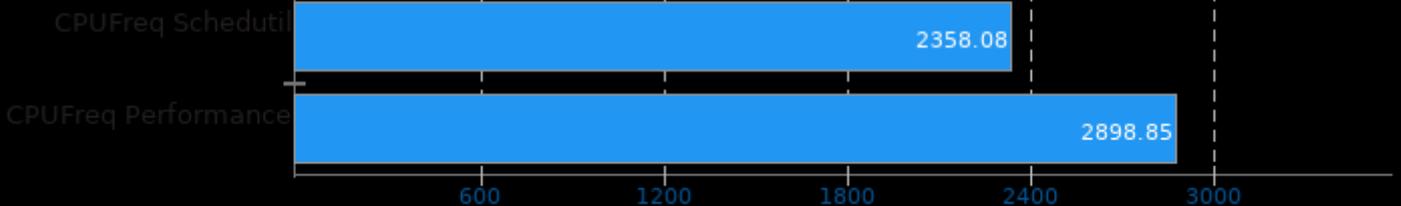


1. (CXX) g++ options: -O2 -fcurl -lz -lpthread -lssl -lcrypto -lgmp

Cpuminer-Opt 3.15.5

Algorithm: Quad SHA-256, Pyrite

kH/s Per Watt, More Is Better

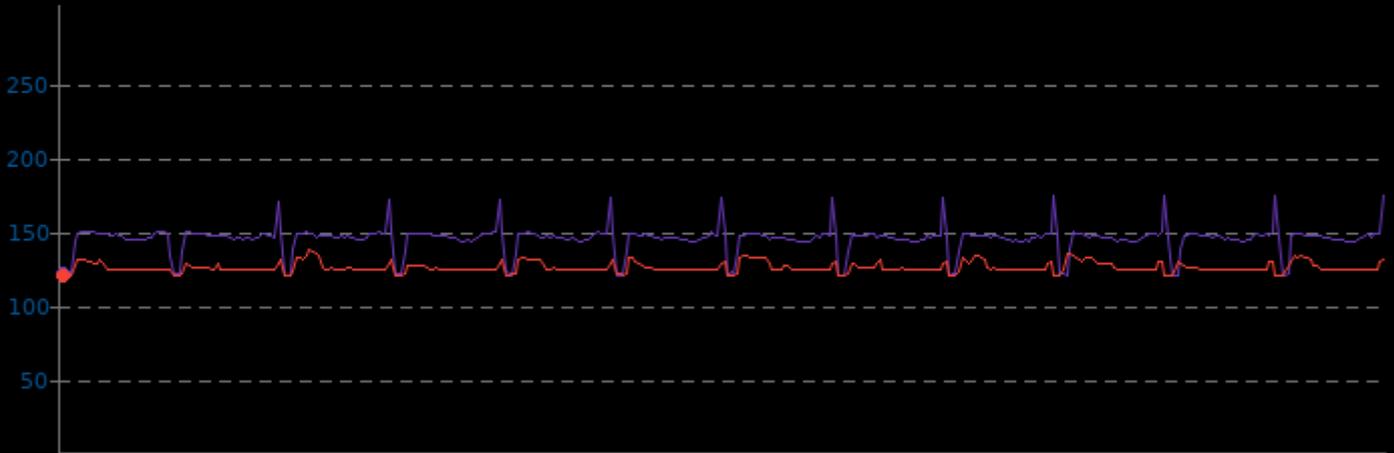


Cpuminer-Opt 3.15.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.9	145.0	174.3
CPUFreq Schedutil	120.1	125.9	138.6

Watts, Fewer Is Better



Cpuminer-Opt 3.15.5

Algorithm: x25x

kH/s, More Is Better

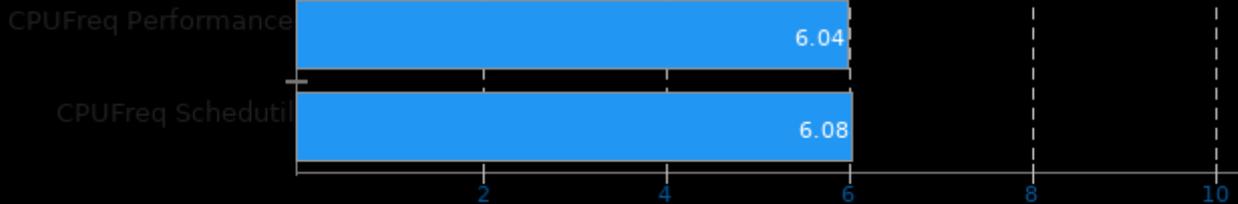


1. (CXX) g++ options: -O2 -fcurl -lz -lpthread -lssl -lcrypto -lgmp

Cpuminer-Opt 3.15.5

Algorithm: x25x

kH/s Per Watt, More Is Better

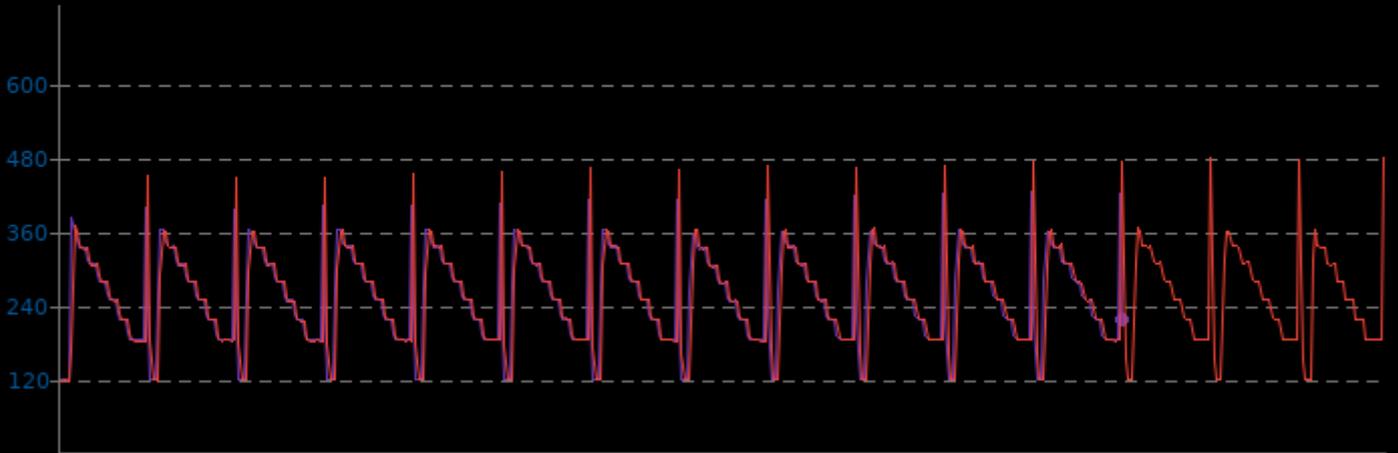


Cpuminer-Opt 3.15.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.5	254.4	424.5
CPUFreq Schedutil	119.9	253.8	480.5

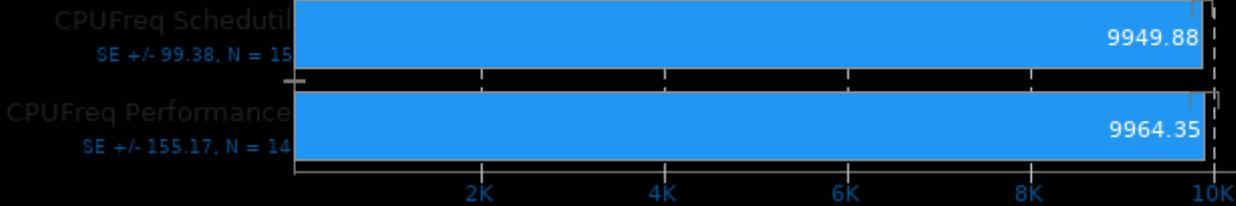
Watts, Fewer Is Better



Cpuminer-Opt 3.15.5

Algorithm: Garlicoin

kH/s, More Is Better

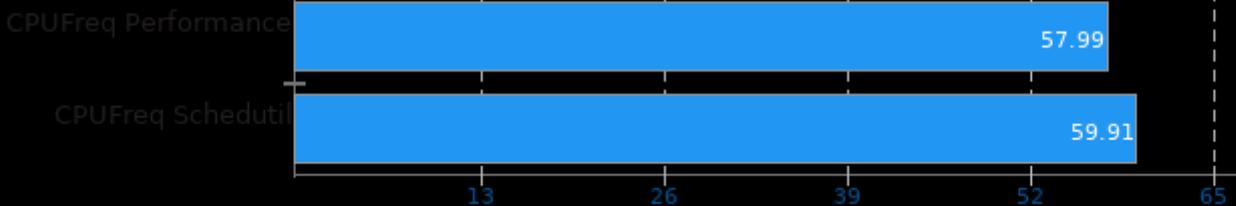


1. (CXX) g++ options: -O2 -fcurl -lz -pthread -lssl -lcrypto -lgmp

Cpuminer-Opt 3.15.5

Algorithm: Garlicoin

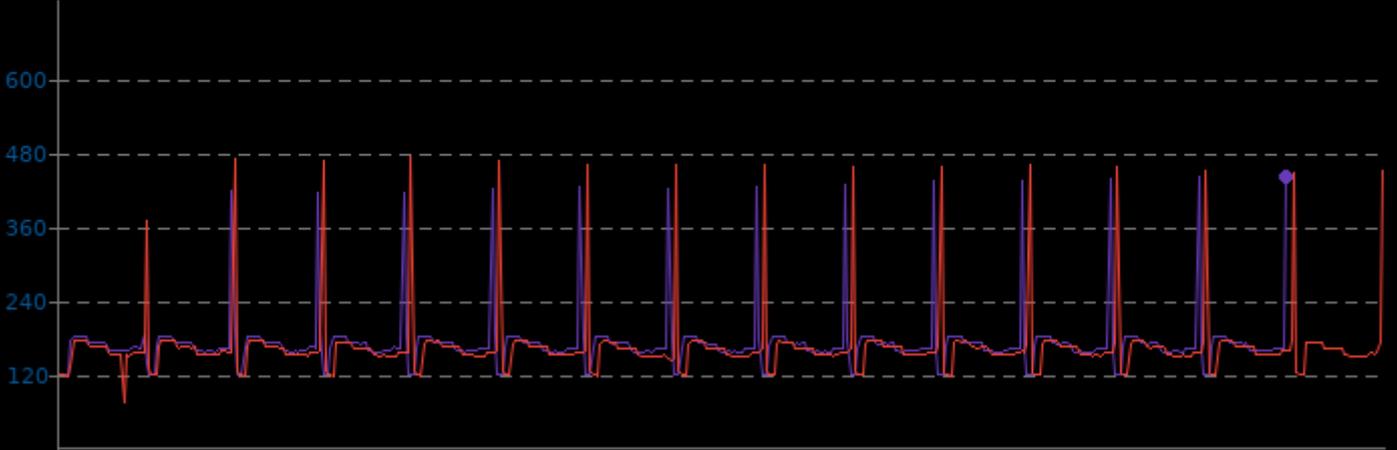
kH/s Per Watt, More Is Better



Cpuminer-Opt 3.15.5
CPU Power Consumption Monitor

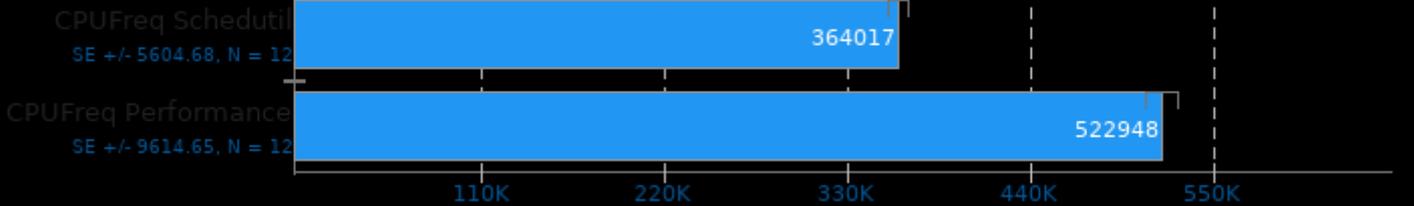
	Min	Avg	Max
CPUFreq Performance	120.5	171.8	441.1
CPUFreq Schedutil	75.9	166.1	473.3

Watts, Fewer Is Better



Cpuminer-Opt 3.15.5
Algorithm: Skeincoin

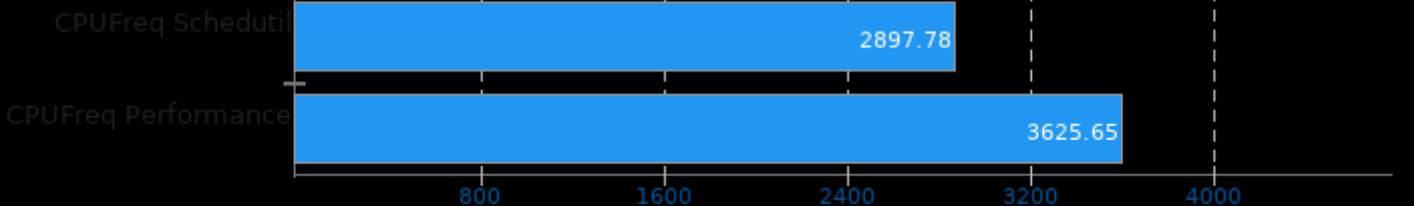
kH/s, More Is Better



1. (CXX) g++ options: -O2 -fcurl -lz -pthread -lssl -lcrypto -lgmp

Cpuminer-Opt 3.15.5
Algorithm: Skeincoin

kH/s Per Watt, More Is Better

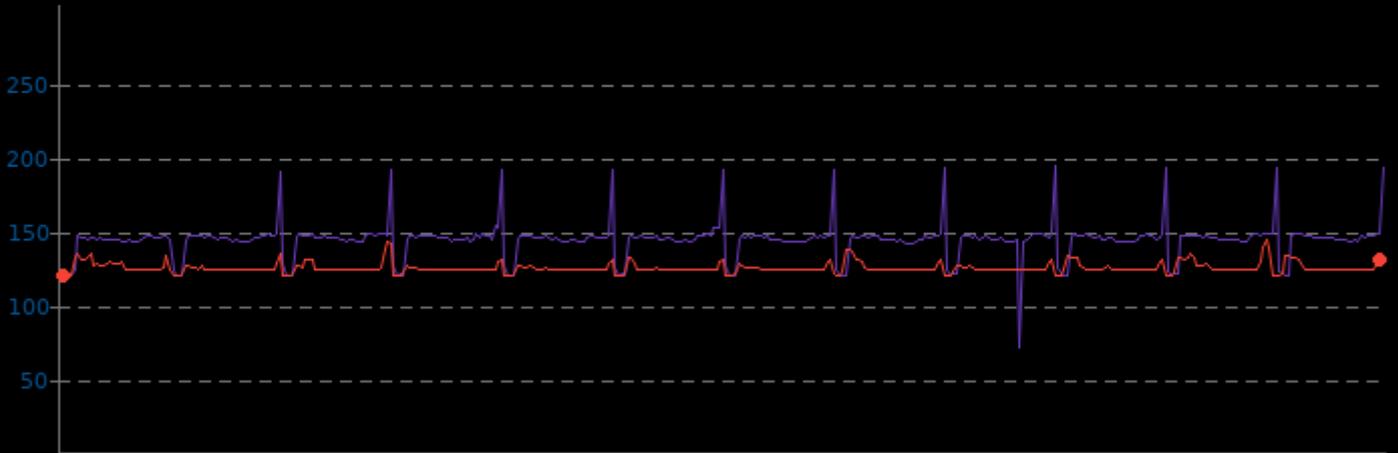


Cpuminer-Opt 3.15.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	72.0	144.2	193.5
CPUFreq Schedutil	120.0	125.6	144.4

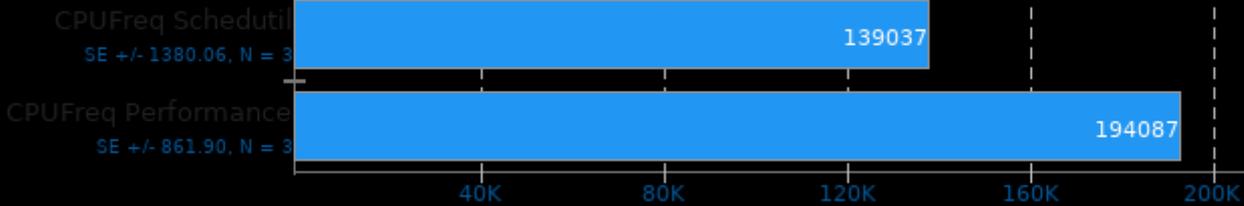
Watts, Fewer Is Better



Cpuminer-Opt 3.15.5

Algorithm: LBC, LBRY Credits

kH/s, More Is Better

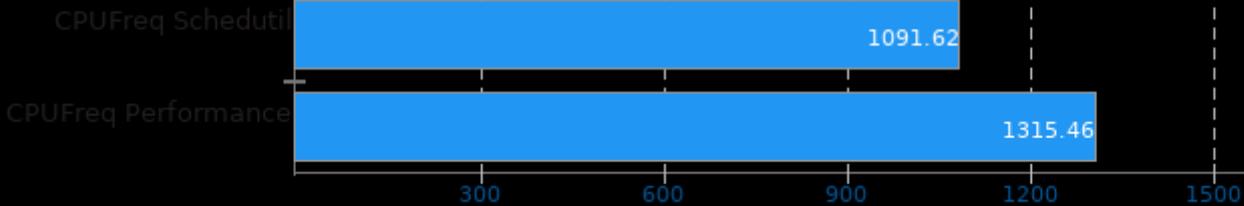


1. (CXX) g++ options: -O2 -fcurl -lz -pthread -lssl -lcrypto -lgmp

Cpuminer-Opt 3.15.5

Algorithm: LBC, LBRY Credits

kH/s Per Watt, More Is Better

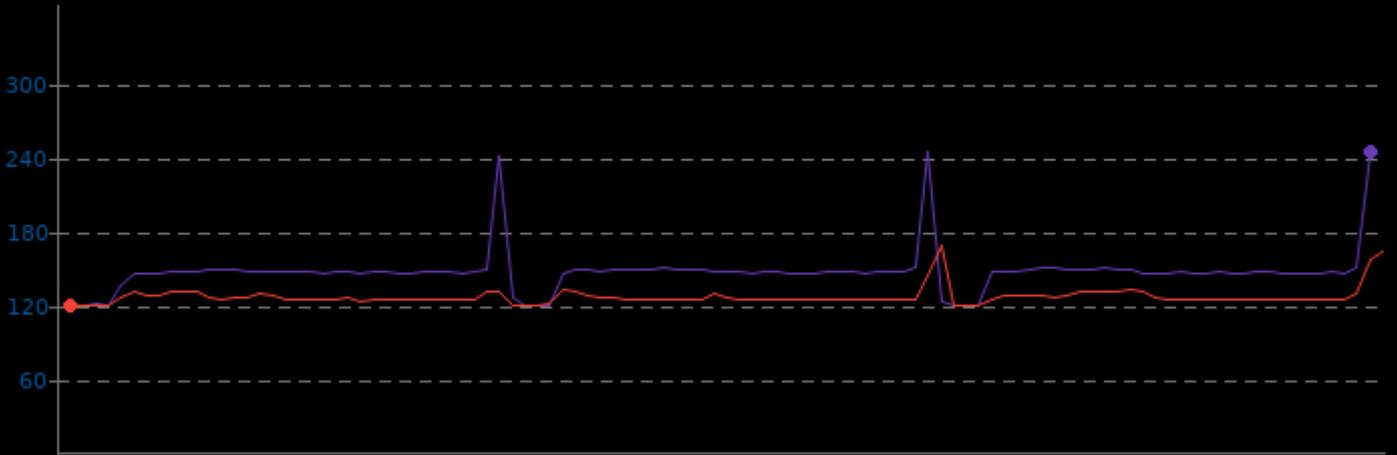


Cpuminer-Opt 3.15.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.6	147.5	245.0
CPUFreq Schedutil	119.9	127.4	169.1

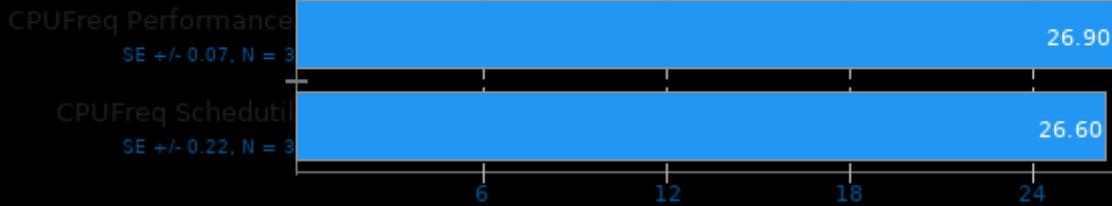
Watts, Fewer Is Better



Cython Benchmark 0.29.21

Test: N-Queens

Seconds, Fewer Is Better

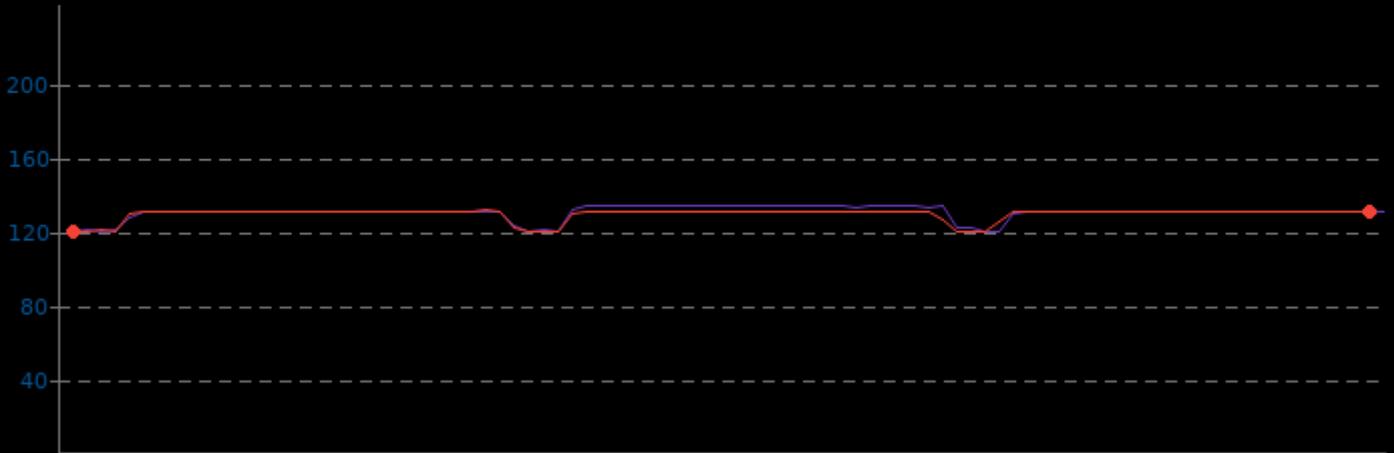


Cython Benchmark 0.29.21

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.3	130.1	133.8
CPUFreq Schedutil	119.9	129.5	131.5

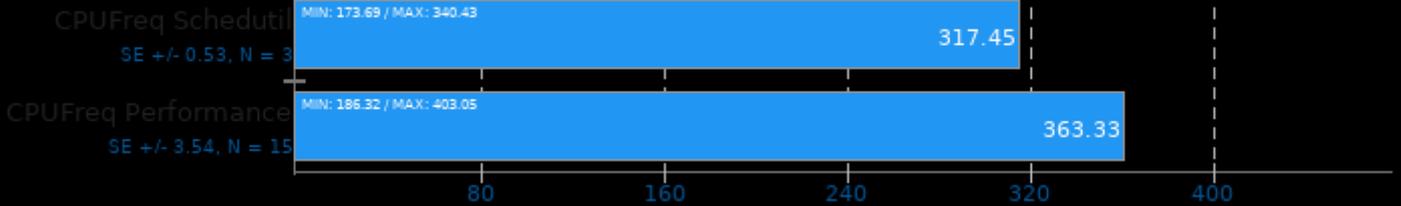
Watts, Fewer Is Better



dav1d 0.8.1

Video Input: Summer Nature 4K

FPS, More Is Better

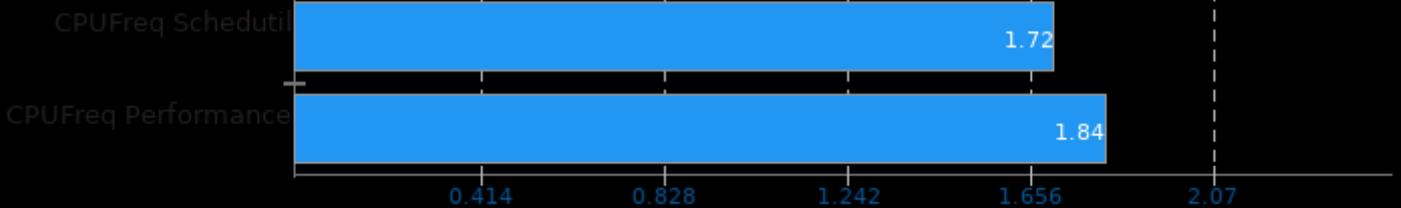


1. (CC) gcc options: -pthread

dav1d 0.8.1

Video Input: Summer Nature 4K

FPS Per Watt, More Is Better

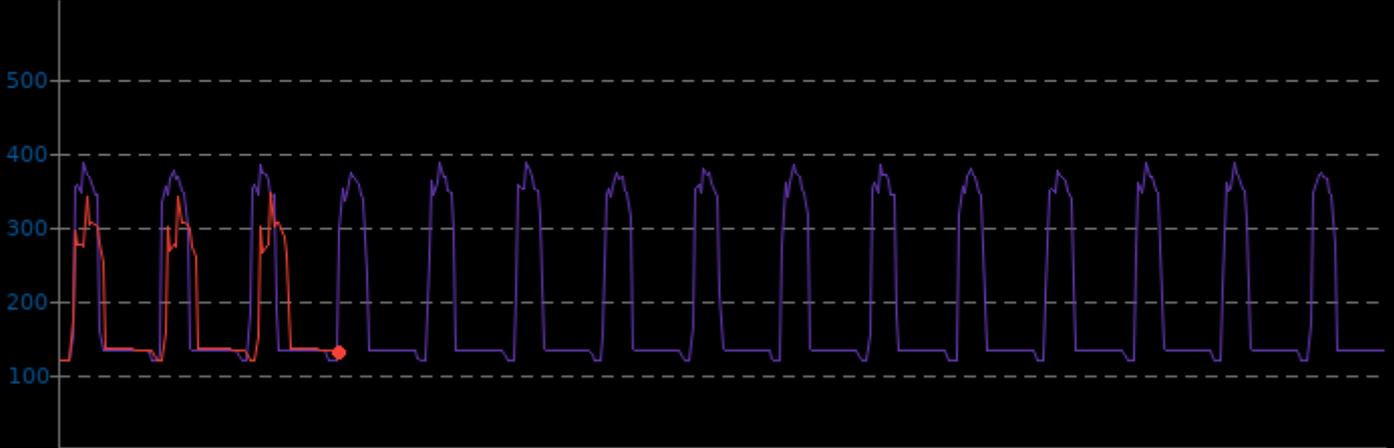


dav1d 0.8.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.9	197.5	386.9
CPUFreq Schedutil	119.8	184.4	344.4

Watts, Fewer Is Better



dav1d 0.8.1

Video Input: Chimera 1080p 10-bit

FPS, More Is Better

CPUFreq Schedutil
SE +/- 0.14, N = 3



CPUFreq Performance
SE +/- 0.23, N = 3



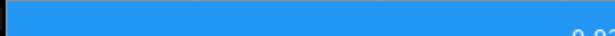
1. (CO) gcc options: -pthread

dav1d 0.8.1

Video Input: Chimera 1080p 10-bit

FPS Per Watt, More Is Better

CPUFreq Schedutil



CPUFreq Performance

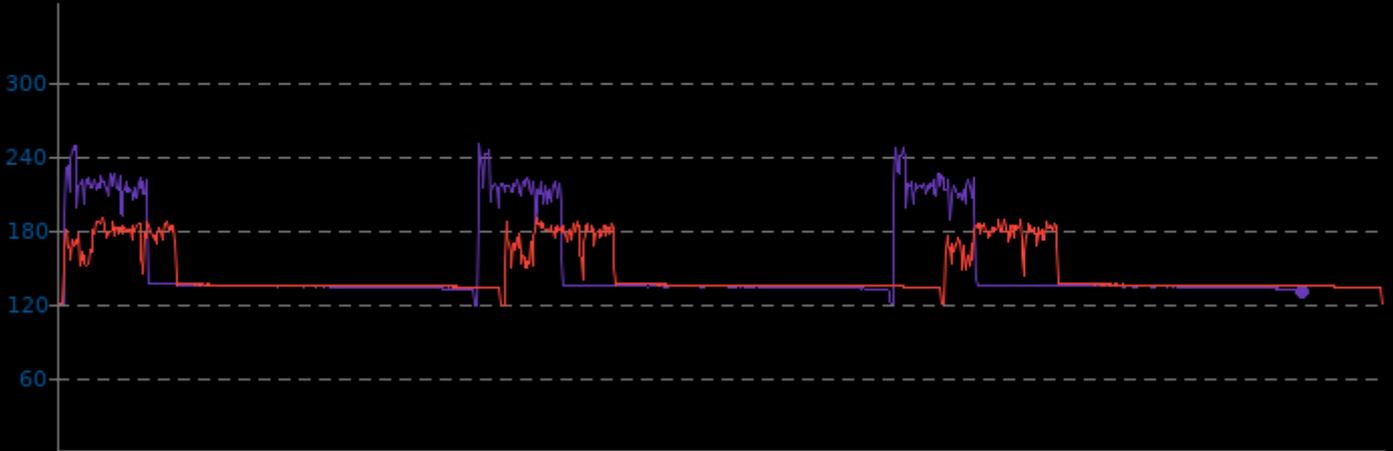


dav1d 0.8.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.6	150.2	248.8
CPUFreq Schedutil	119.7	144.8	190.2

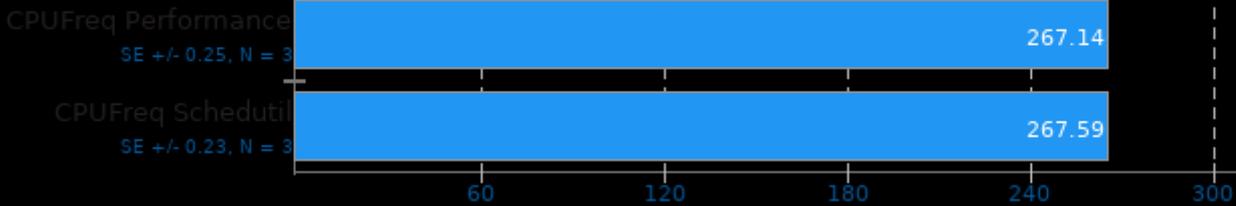
Watts, Fewer Is Better



Etcpak 0.7

Configuration: ETC1

Mpx/s, More Is Better

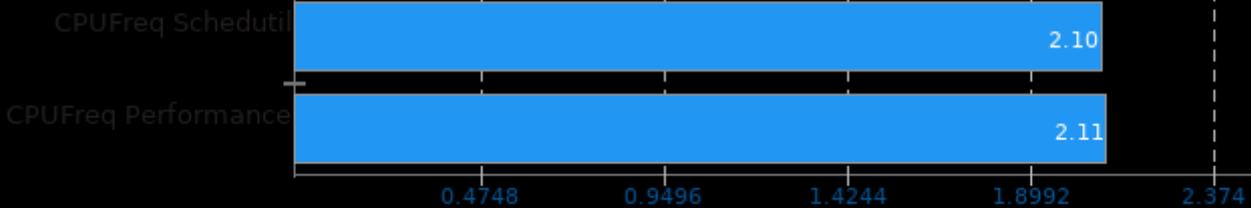


1. (CXX) g++ options: -O3 -march=native -std=c++11 -pthread

Etcpak 0.7

Configuration: ETC1

Mpx/s Per Watt, More Is Better

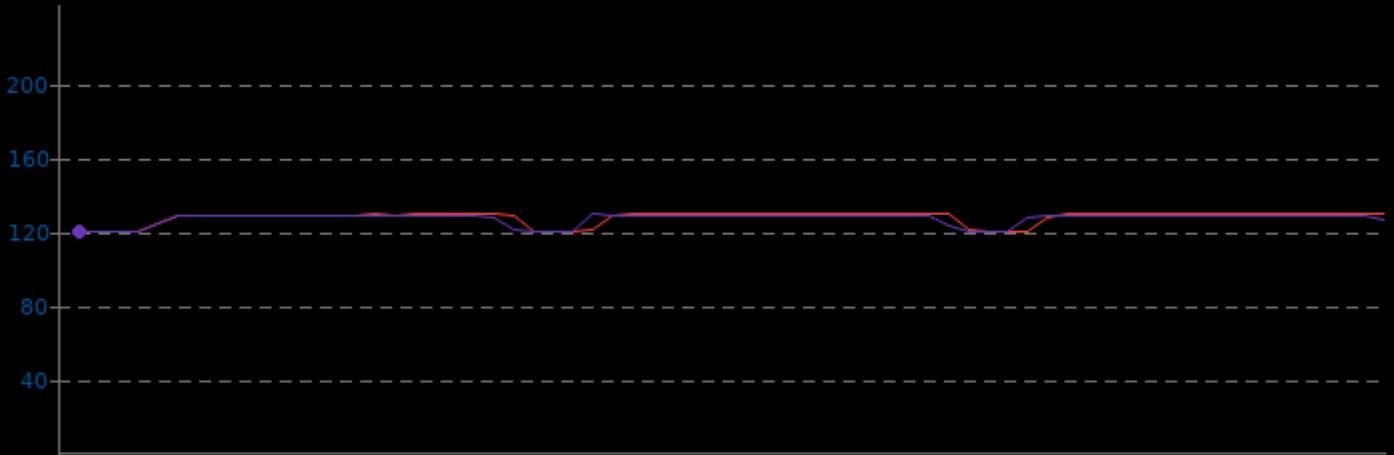


Etcpak 0.7

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.5	127.5	129.7
CPUFreq Performance	119.7	126.8	129.3

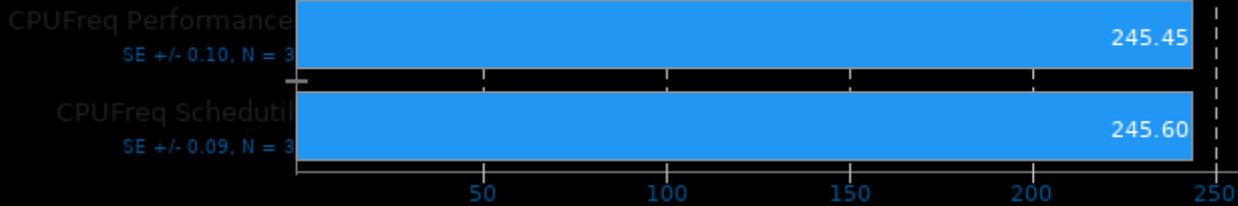
Watts, Fewer Is Better



Etcpak 0.7

Configuration: ETC1 + Dithering

Mpx/s, More Is Better

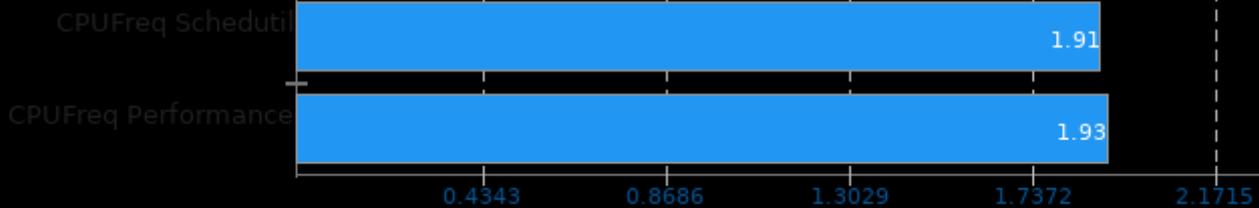


1. (CXX) g++ options: -O3 -march=native -std=c++11 -pthread

Etcpak 0.7

Configuration: ETC1 + Dithering

Mpx/s Per Watt, More Is Better

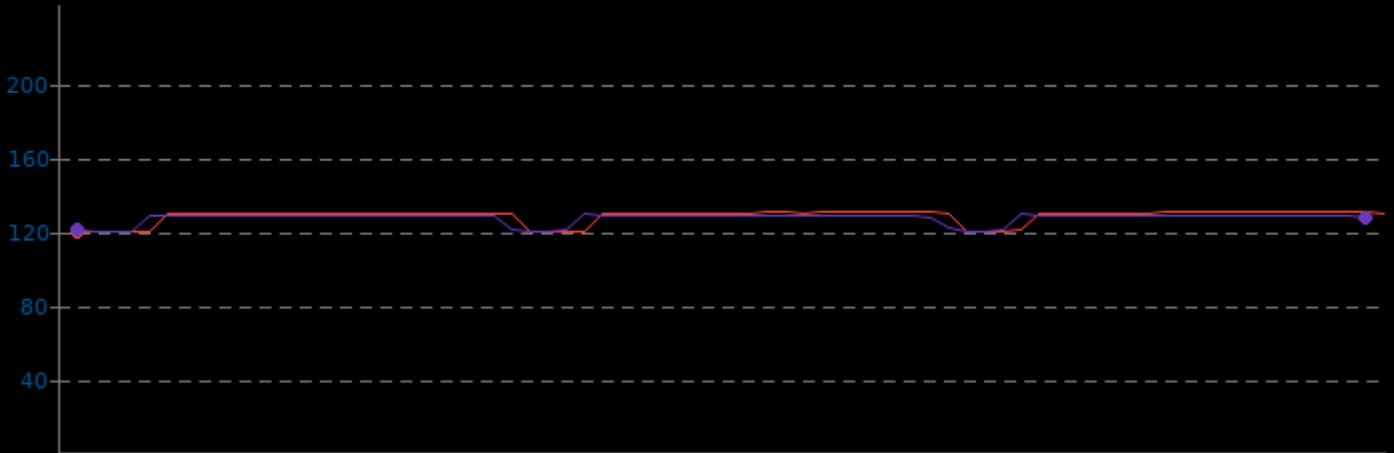


Etcpak 0.7

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.6	128.2	130.3
CPUFreq Performance	119.8	127.0	129.7

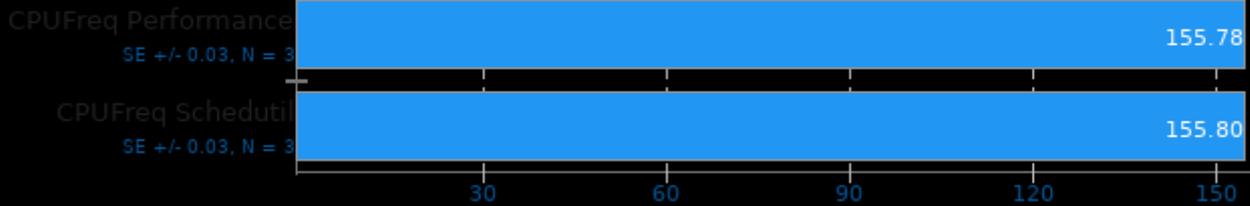
Watts, Fewer Is Better



Etcpak 0.7

Configuration: ETC2

Mpx/s, More Is Better

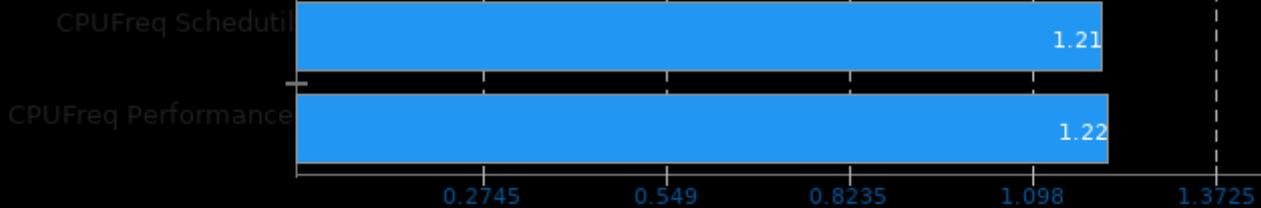


1. (CXX) g++ options: -O3 -march=native -std=c++11 -pthread

Etcpak 0.7

Configuration: ETC2

Mpx/s Per Watt, More Is Better

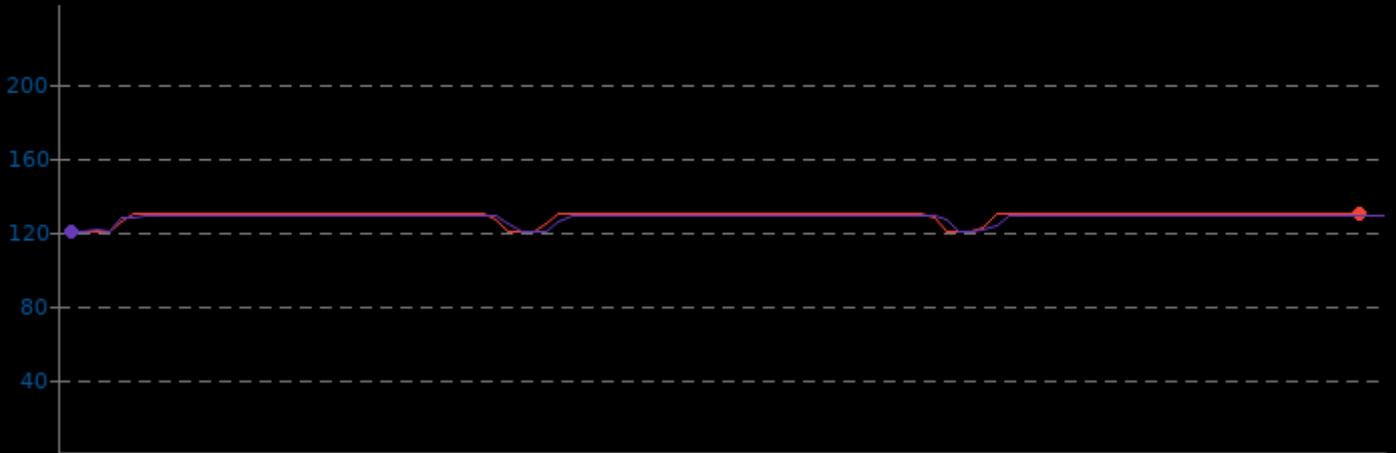


Etcpak 0.7

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.7	128.7	130.1
CPUFreq Performance	119.9	127.4	128.6

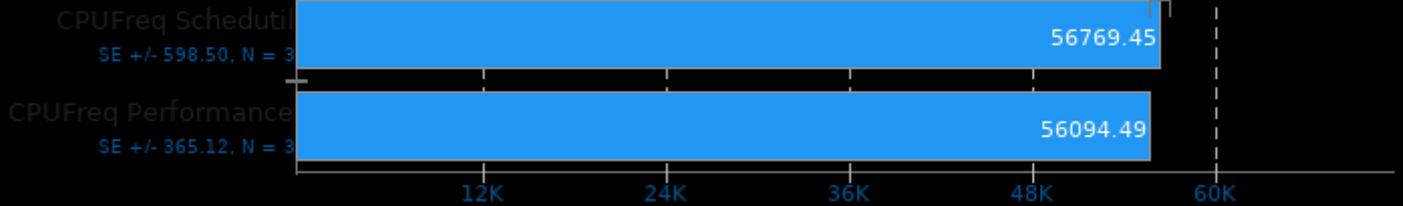
Watts, Fewer Is Better



FinanceBench 2016-07-25

Benchmark: Bonds OpenMP

ms, Fewer Is Better



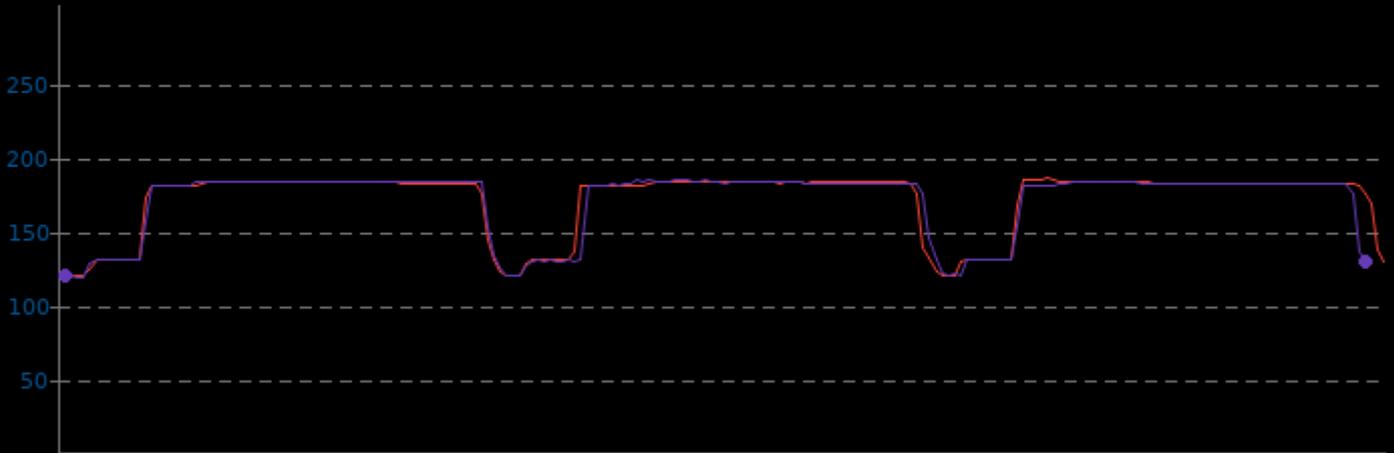
1. (CXX) g++ options: -O3 -march=native -fopenmp

FinanceBench 2016-07-25

CPU Power Consumption Monitor

	Min	Avg	Max
■ CPUFreq Schedutil	120.0	171.1	185.9
■ CPUFreq Performance	119.8	171.0	184.5

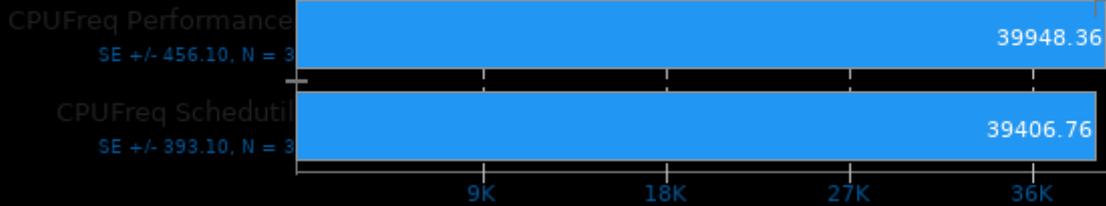
▼ Watts, Fewer Is Better



FinanceBench 2016-07-25

Benchmark: Repo OpenMP

← ms, Fewer Is Better



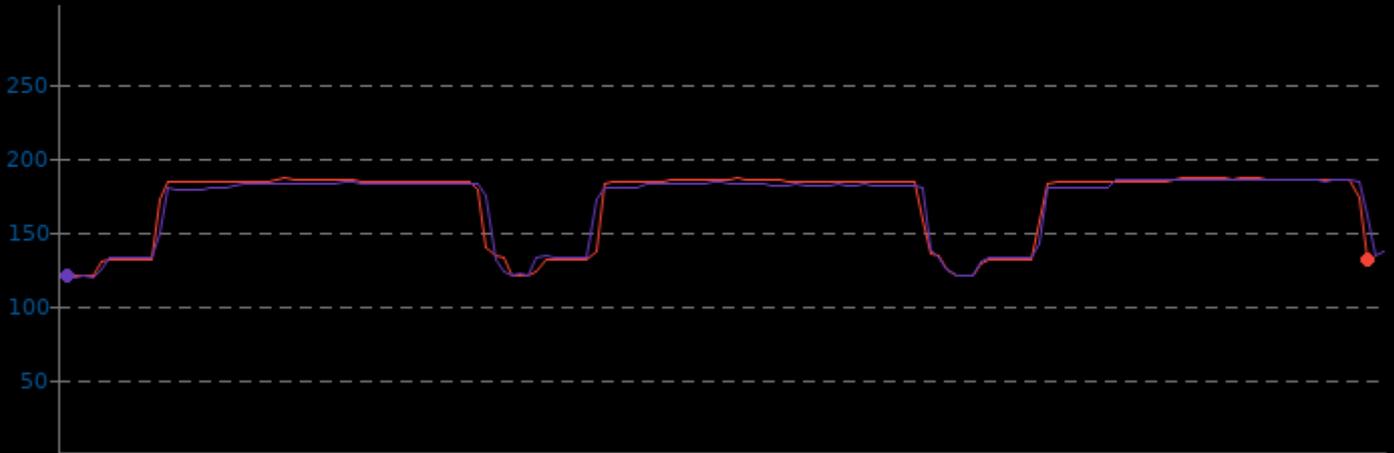
1. (CXX) g++ options: -O3 -march=native -fopenmp

FinanceBench 2016-07-25

CPU Power Consumption Monitor

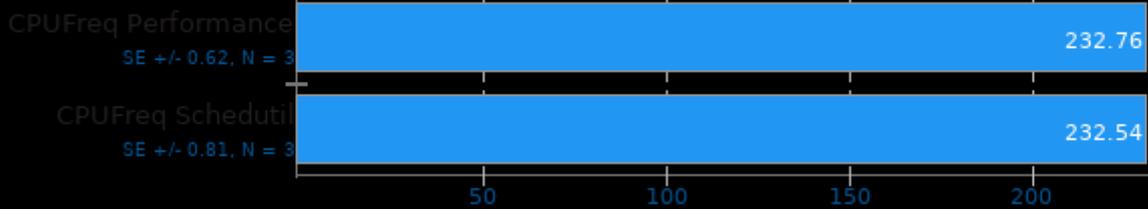
	Min	Avg	Max
■ CPUFreq Schedutil	120.0	169.8	186.4
■ CPUFreq Performance	119.8	168.6	185.1

▼ Watts, Fewer Is Better



Gcrypt Library 1.9

← Seconds, Fewer Is Better



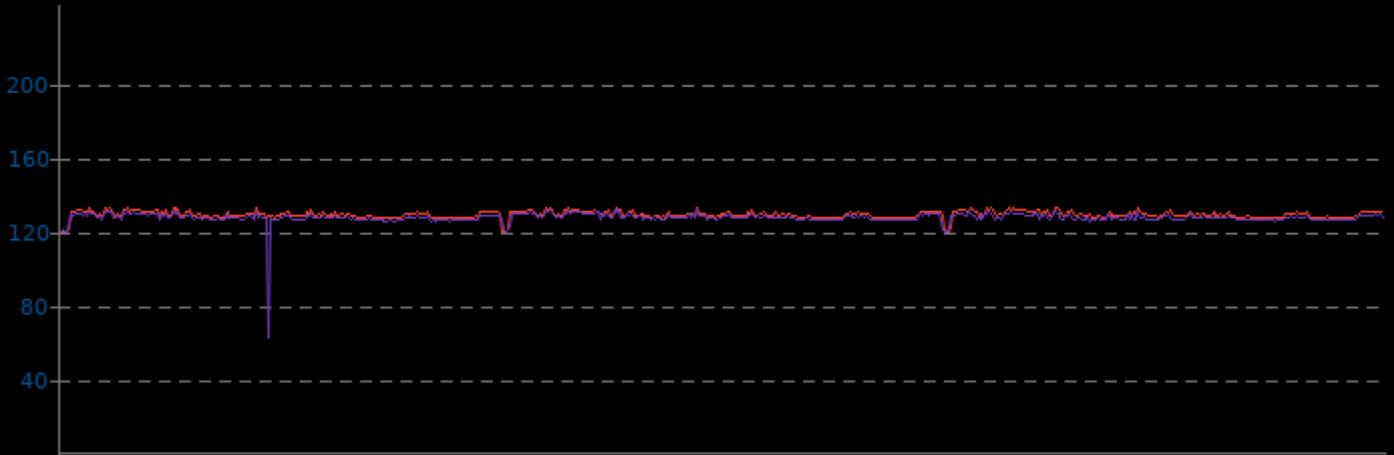
1. (CC) gcc options: -O2 -fvisibility=hidden -lgpg-error

Gcrypt Library 1.9

CPU Power Consumption Monitor

	Min	Avg	Max
■ CPUFreq Schedutil	119.8	129.2	133.1
■ CPUFreq Performance	63.3	127.6	131.6

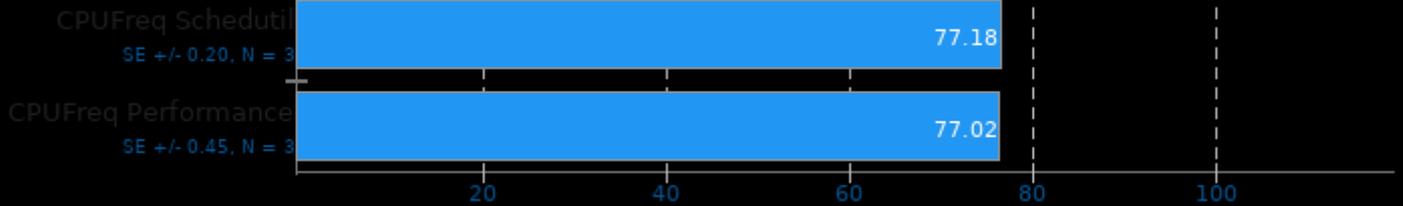
▼ Watts, Fewer Is Better



GnuPG 2.2.27

2.7GB Sample File Encryption

◀ Seconds, Fewer Is Better



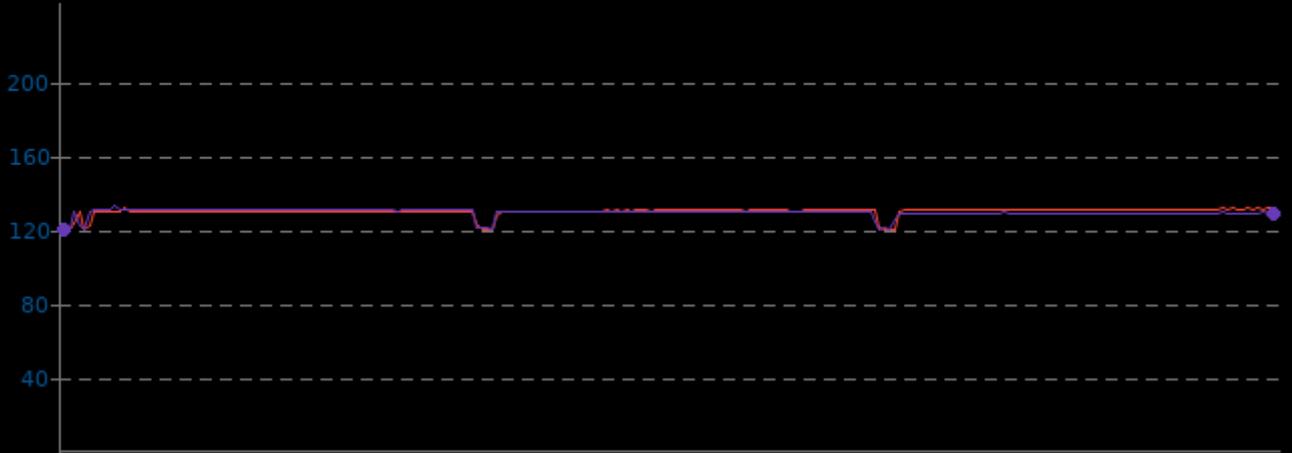
1. (CC) gcc options: -O2

GnuPG 2.2.27

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.9	129.8	131.4
CPUFreq Performance	119.8	129.3	132.4

Watts, Fewer Is Better



IOR 3.3.0

Block Size: 2MB - Disk Target: Default Test Directory

MB/s, More Is Better

CPUFreq Schedutil

SE +/- 2.06, N = 3



CPUFreq Performance

SE +/- 5.48, N = 3



1. (CO) gcc options: -O2 -lm -pthread -mpi

IOR 3.3.0

Block Size: 2MB - Disk Target: Default Test Directory

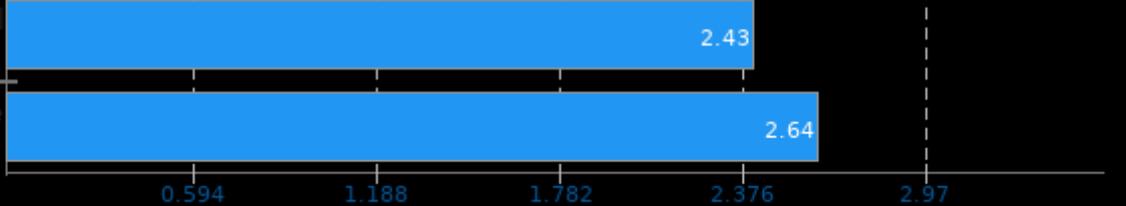
MB/s Per Watt, More Is Better

CPUFreq Schedutil

2.43

CPUFreq Performance

2.64

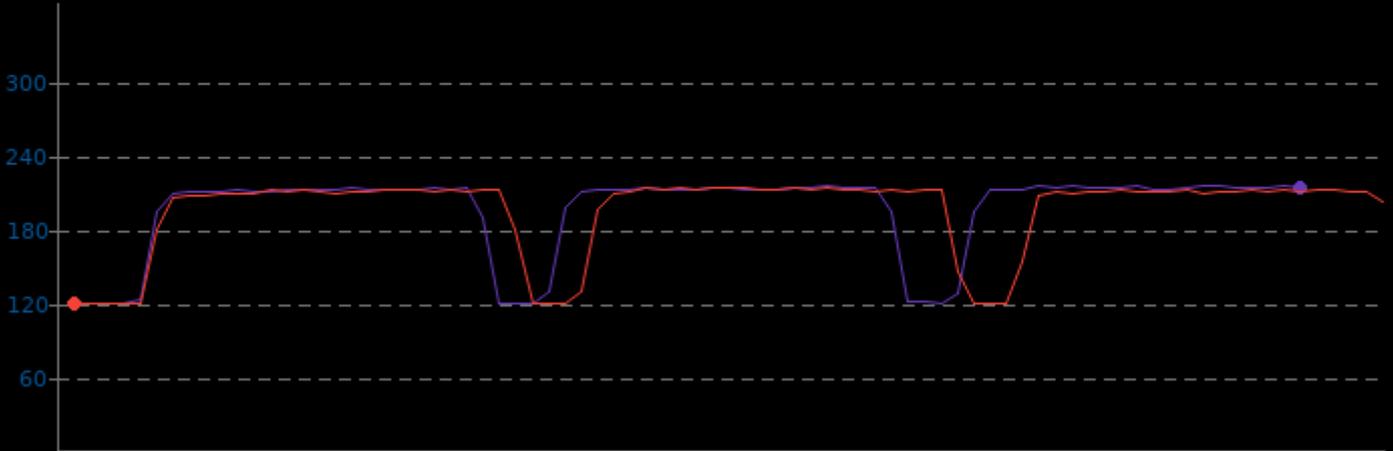


IOR 3.3.0

CPU Power Consumption Monitor

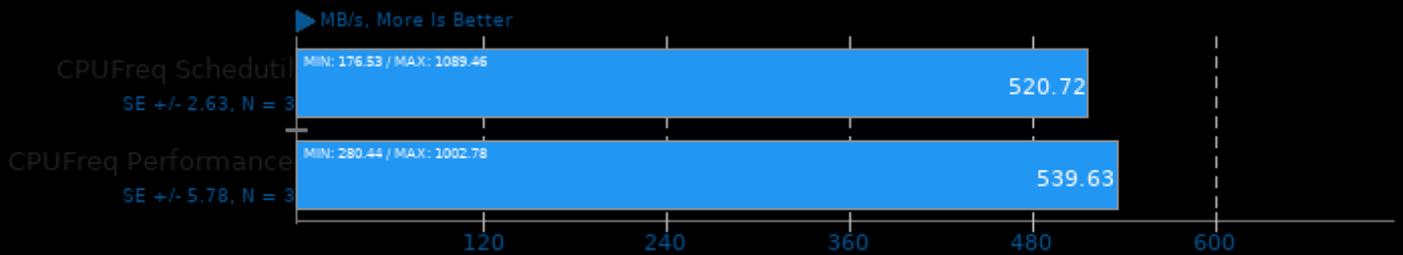
	Min	Avg	Max
CPUFreq Performance	119.8	196.2	215.2
CPUFreq Schedutil	119.9	195.2	214.2

Watts, Fewer Is Better



IOR 3.3.0

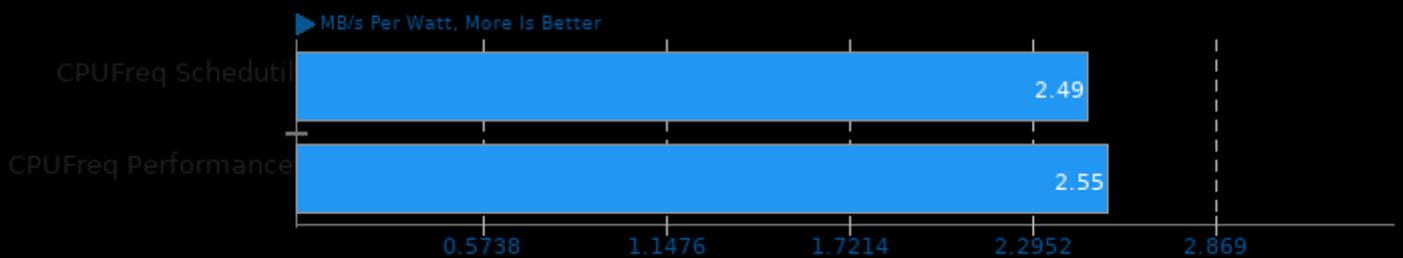
Block Size: 8MB - Disk Target: Default Test Directory



1. (CO) gcc options: -O2 -lm -pthread -lmpi

IOR 3.3.0

Block Size: 8MB - Disk Target: Default Test Directory

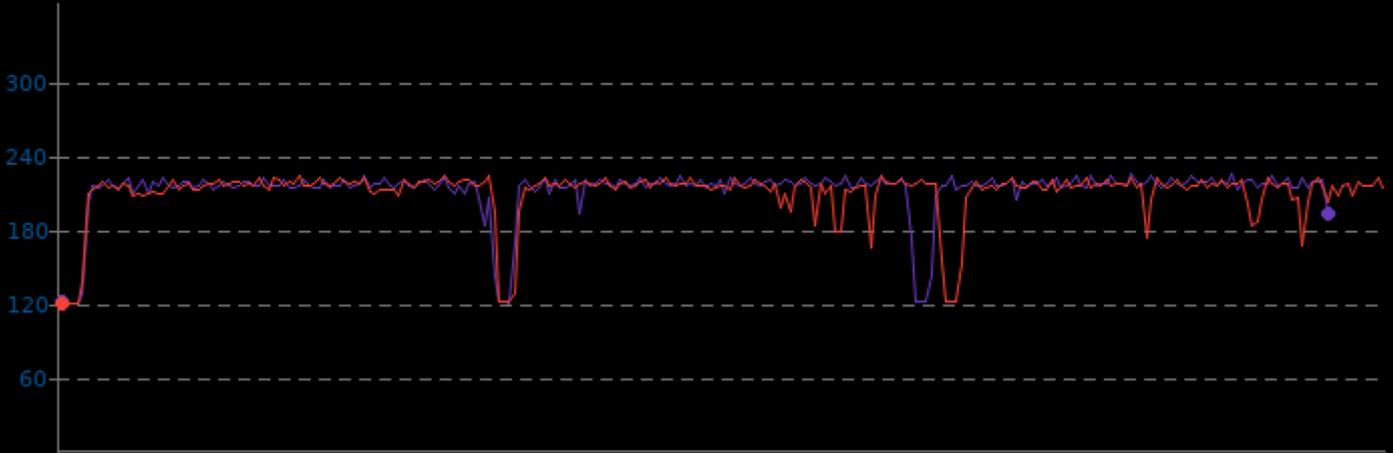


IOR 3.3.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.4	211.4	225.0
CPUFreq Schedutil	120.5	209.5	223.9

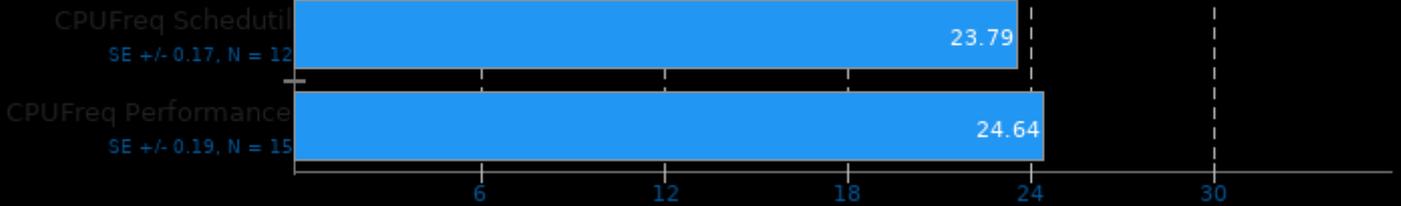
Watts, Fewer Is Better



LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: Rhodopsin Protein

ns/day, More Is Better

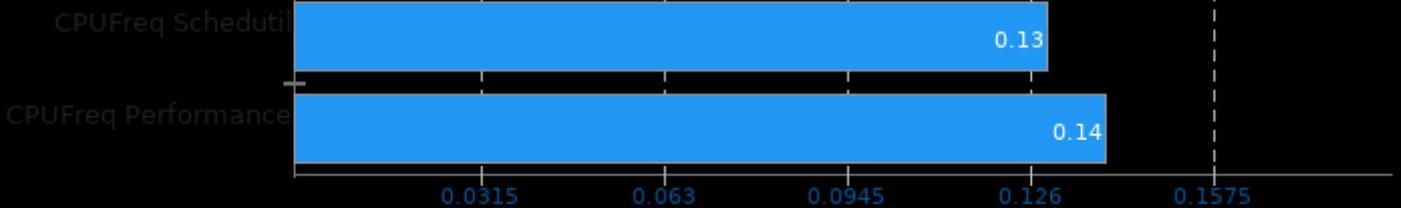


1. (CXX) g++ options: -O3 -pthread -lm

LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: Rhodopsin Protein

ns/day Per Watt, More Is Better

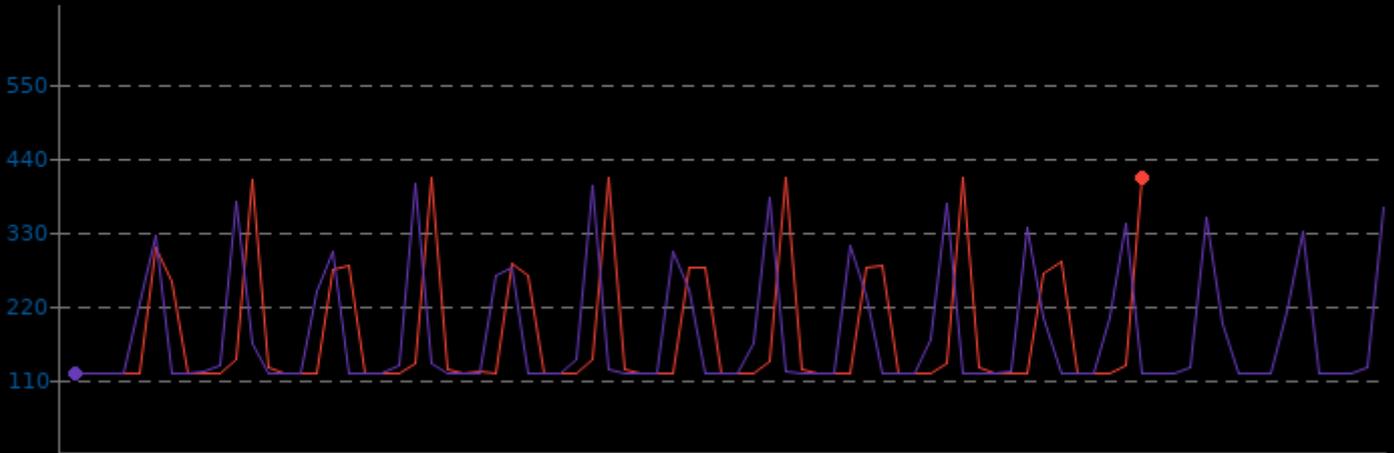


LAMMPS Molecular Dynamics Simulator 29Oct2020

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.4	176.6	409.0
CPUFreq Performance	120.5	176.0	401.4

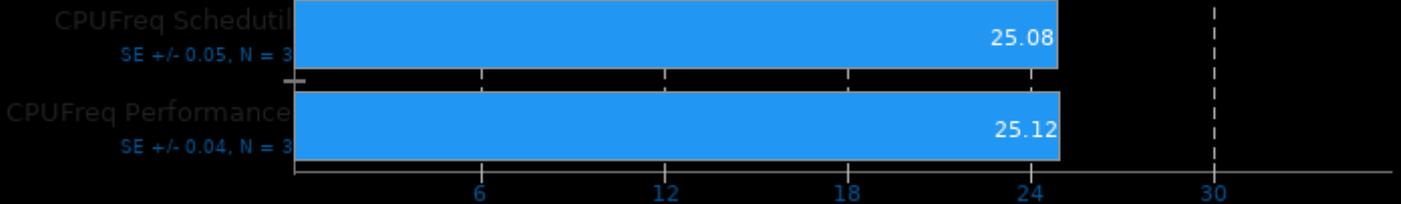
Watts, Fewer Is Better



LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: 20k Atoms

ns/day, More Is Better

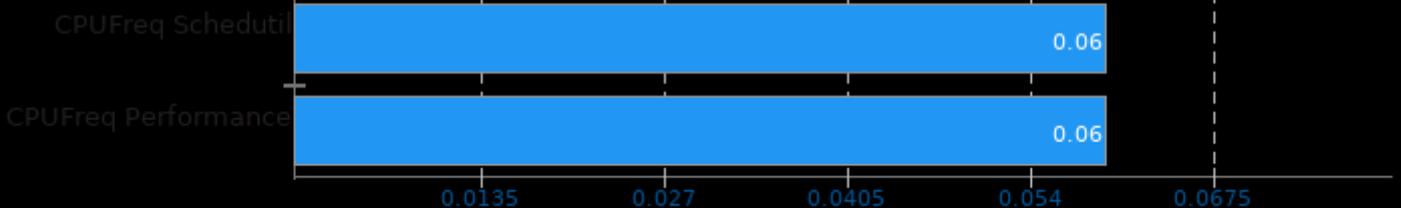


1. (CXX) g++ options: -O3 -pthread -lm

LAMMPS Molecular Dynamics Simulator 29Oct2020

Model: 20k Atoms

ns/day Per Watt, More Is Better

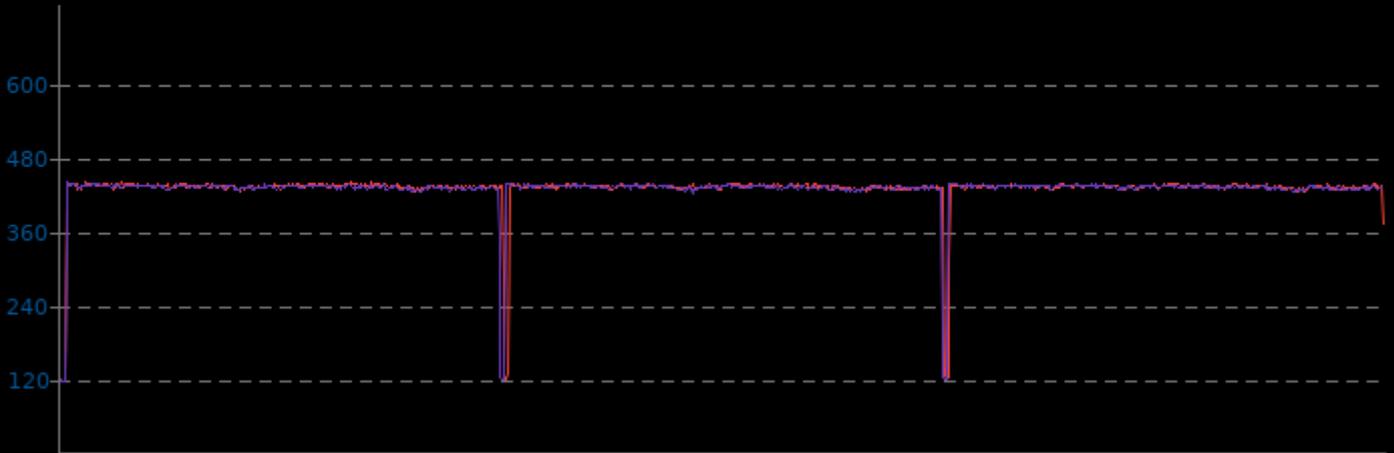


LAMMPS Molecular Dynamics Simulator 29Oct2020

CPU Power Consumption Monitor

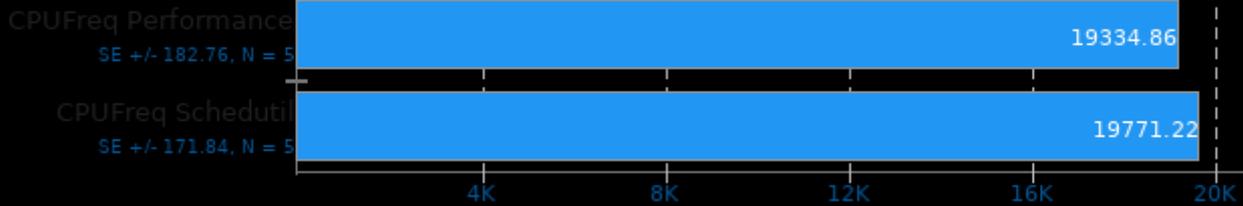
	Min	Avg	Max
CPUFreq Schedutil	119.9	428.6	441.7
CPUFreq Performance	120.0	427.6	439.3

▼ Watts, Fewer Is Better



LULESH 2.0.3

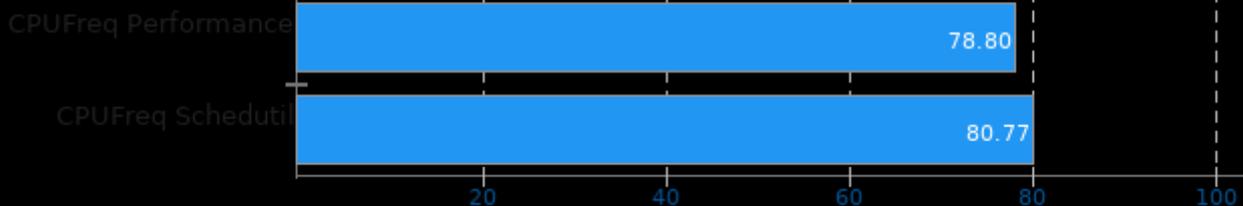
► z/s, More Is Better



1. (CXX) g++ options: -O3 -fopenmp -lm -pthread -lmpi_cxx -lmpi

LULESH 2.0.3

► z/s Per Watt, More Is Better

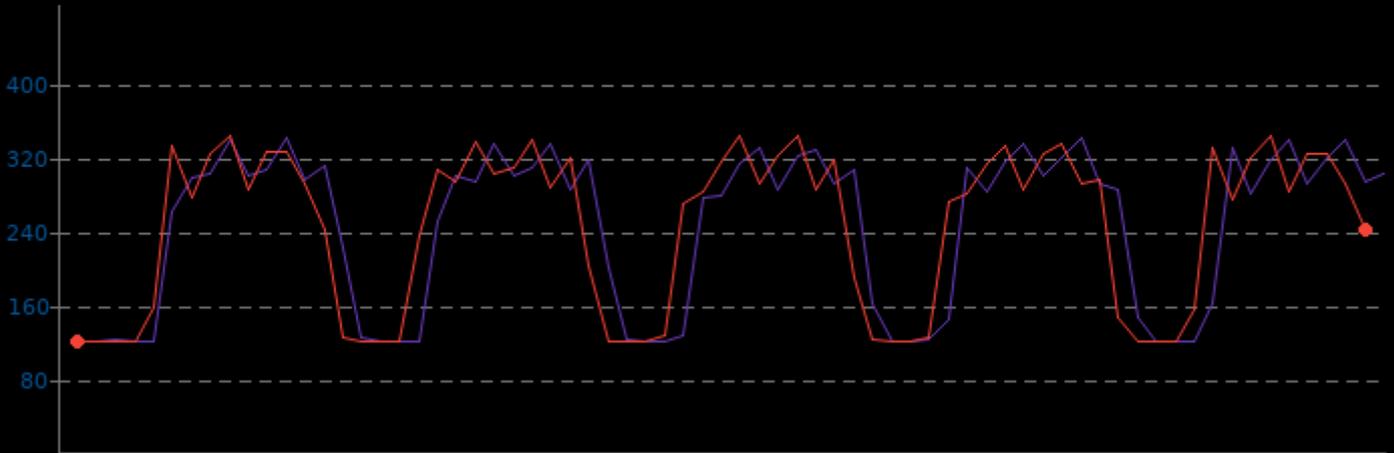


LULESH 2.0.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.7	245.4	341.7
CPUFreq Schedutil	121.6	244.8	342.9

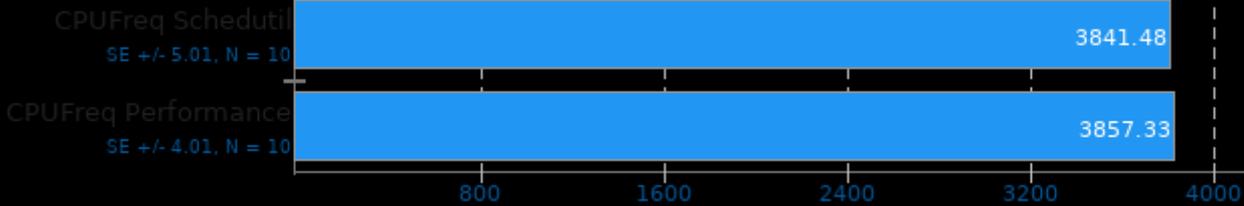
Watts, Fewer Is Better



NAS Parallel Benchmarks 3.4

Test / Class: EP.C

Total Mop/s, More Is Better

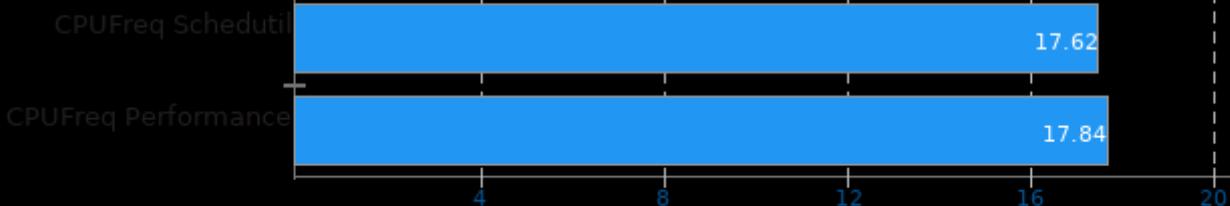


1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpi fh -lmpi -lopen-rte -lopen-pal -lhwloc -ldl -levent -levent_pthreads -luti
2. Open MPI 4.0.3

NAS Parallel Benchmarks 3.4

Test / Class: EP.C

Total Mop/s Per Watt, More Is Better

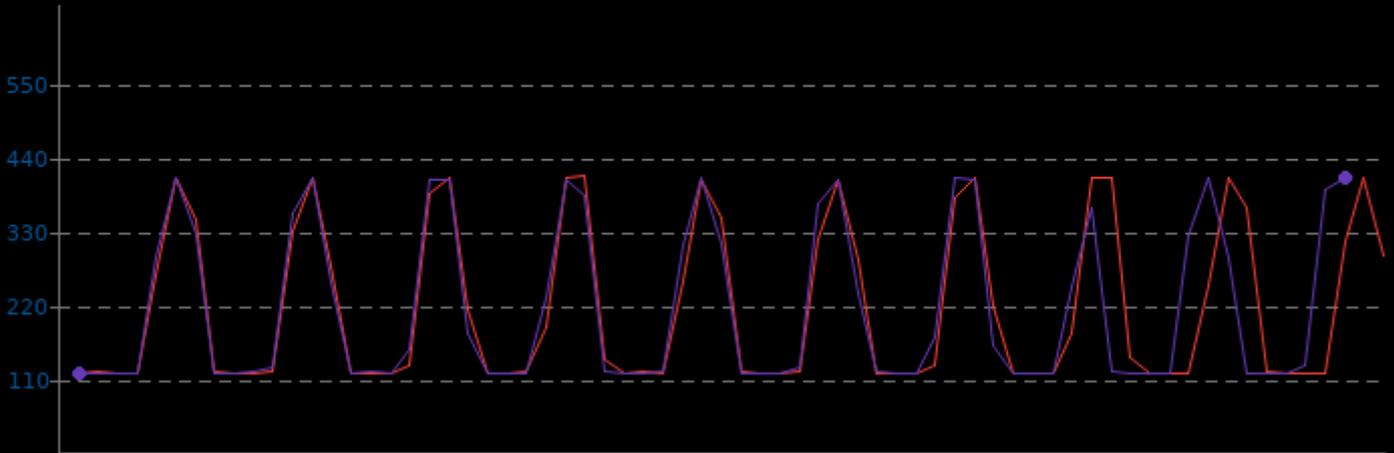


NAS Parallel Benchmarks 3.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.6	218.1	411.3
CPUFreq Performance	120.8	216.2	410.0

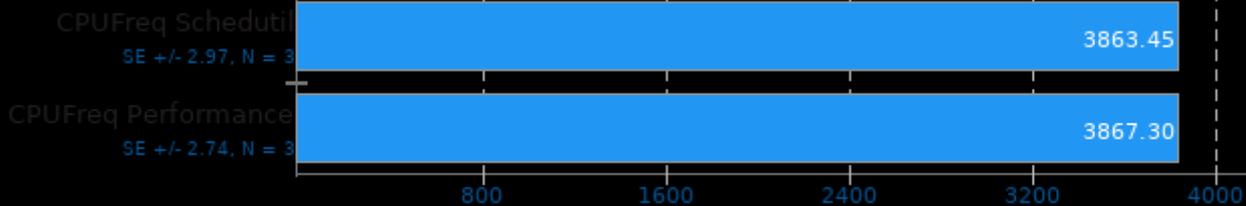
Watts, Fewer Is Better



NAS Parallel Benchmarks 3.4

Test / Class: EP.D

Total Mop/s, More Is Better

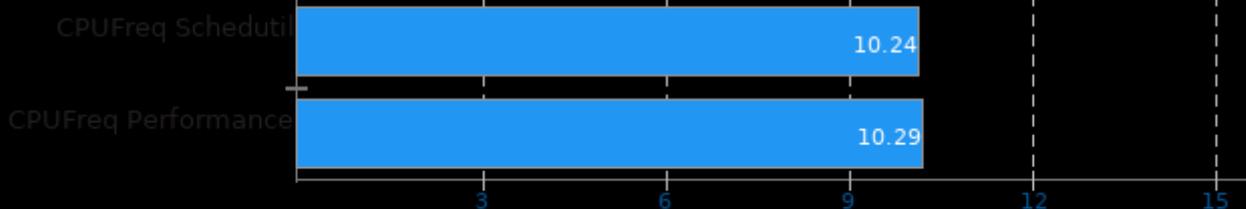


1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi -lopen-rte -lopen-pal -lhwloc -ldl -levent -levent_pthreads -luti
2. Open MPI 4.0.3

NAS Parallel Benchmarks 3.4

Test / Class: EP.D

Total Mop/s Per Watt, More Is Better

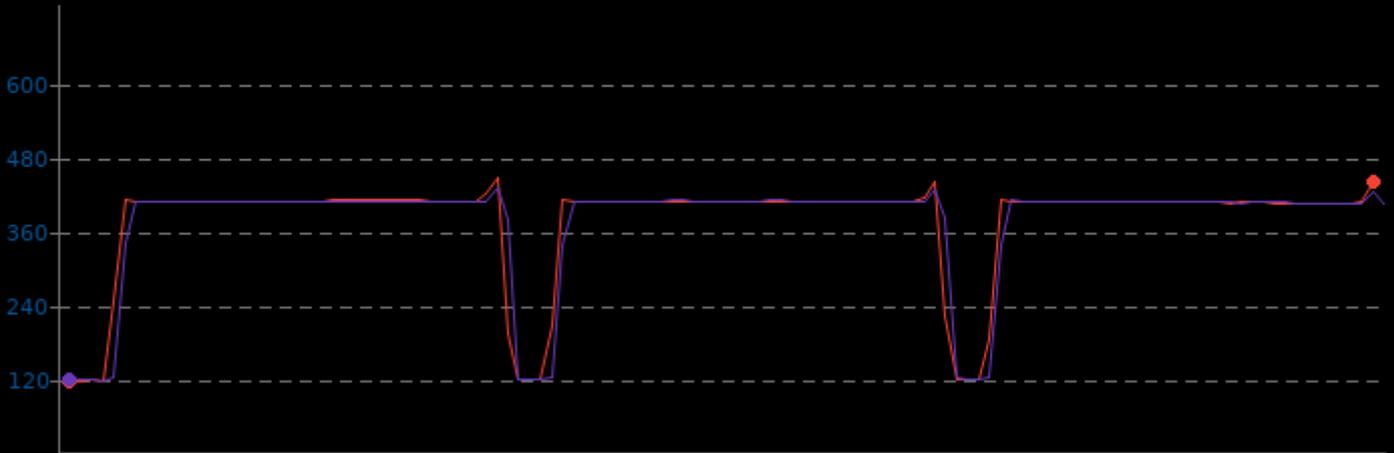


NAS Parallel Benchmarks 3.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.1	377.2	446.9
CPUFreq Performance	120.4	375.8	430.9

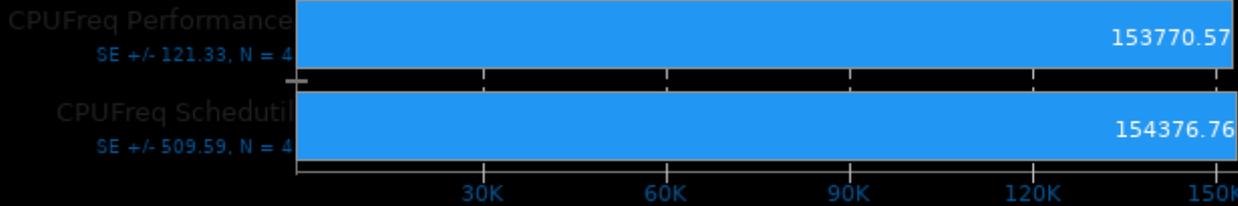
Watts, Fewer Is Better



NAS Parallel Benchmarks 3.4

Test / Class: LU.C

Total Mop/s, More Is Better

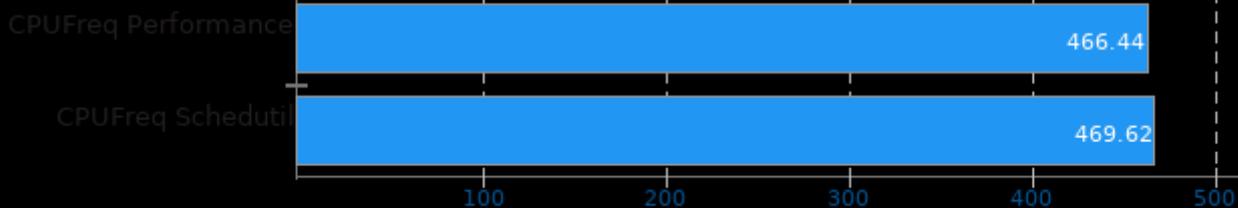


1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi -lopen-rte -lopen-pal -lhwloc -ldl -levent -levent_threads -luti
2. Open MPI 4.0.3

NAS Parallel Benchmarks 3.4

Test / Class: LU.C

Total Mop/s Per Watt, More Is Better

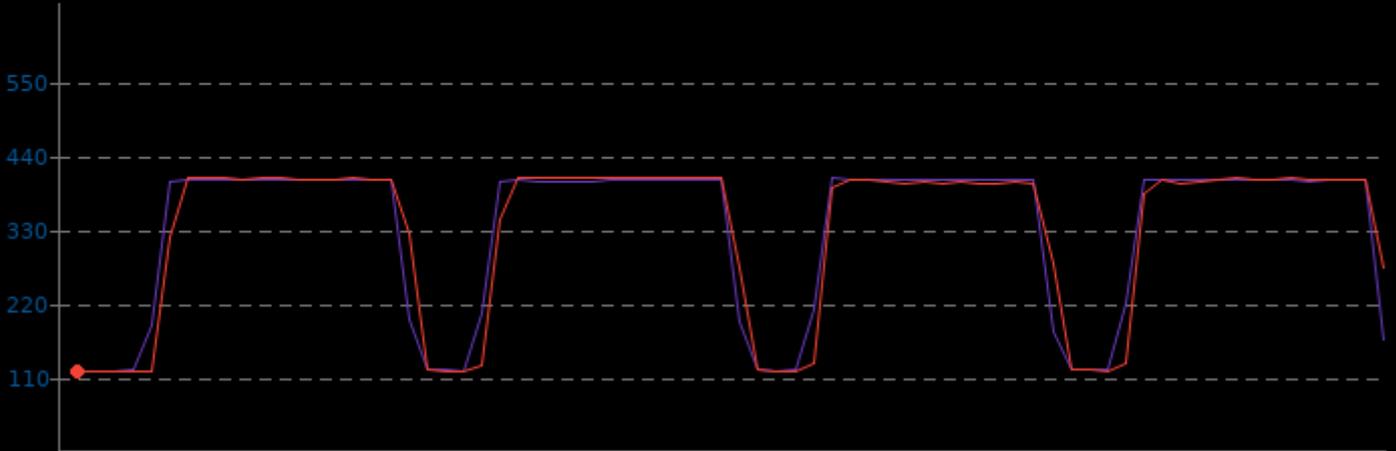


NAS Parallel Benchmarks 3.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.1	329.7	405.5
CPUFreq Schedutil	121.0	328.7	407.9

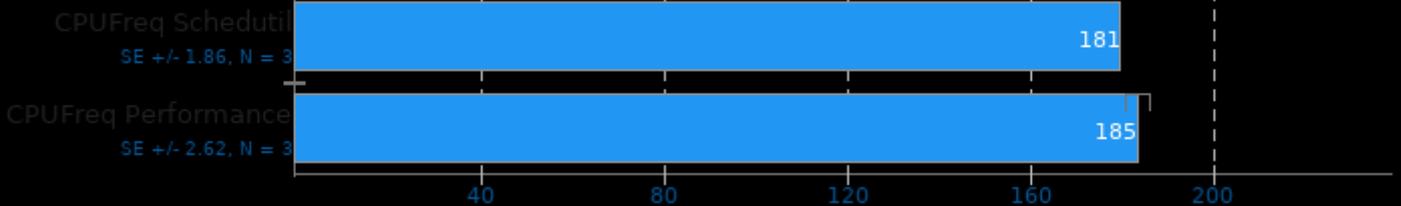
Watts, Fewer Is Better



ONNX Runtime 1.6

Model: yolov4 - Device: OpenMP CPU

Inferences Per Minute, More Is Better

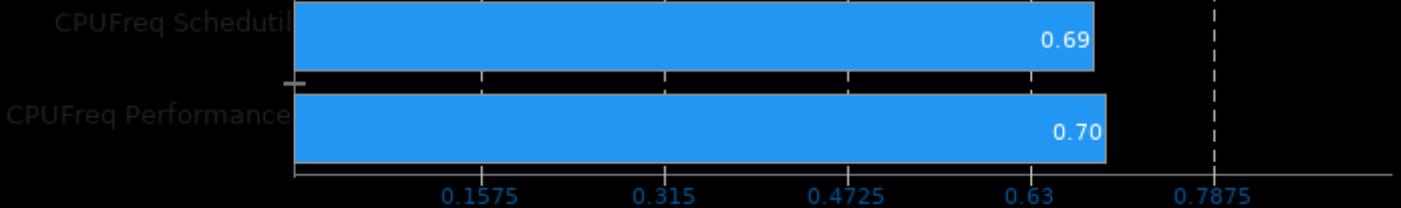


1. (CXX) g++ options: -fopenmp -function-sections -fdata-sections -O3 -ldl -lrt

ONNX Runtime 1.6

Model: yolov4 - Device: OpenMP CPU

Inferences Per Minute Per Watt, More Is Better

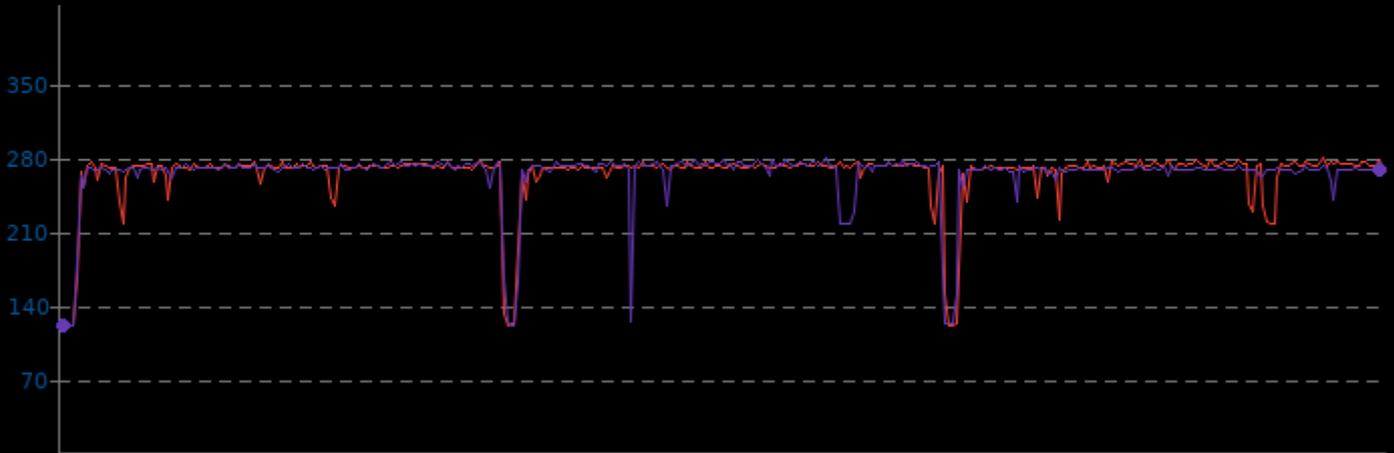


ONNX Runtime 1.6

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.1	263.9	279.9
CPUFreq Performance	121.3	263.5	278.7

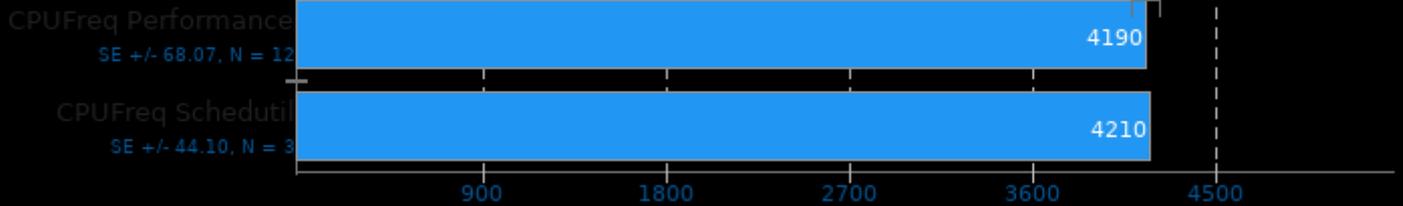
Watts, Fewer Is Better



ONNX Runtime 1.6

Model: super-resolution-10 - Device: OpenMP CPU

Inferences Per Minute, More Is Better

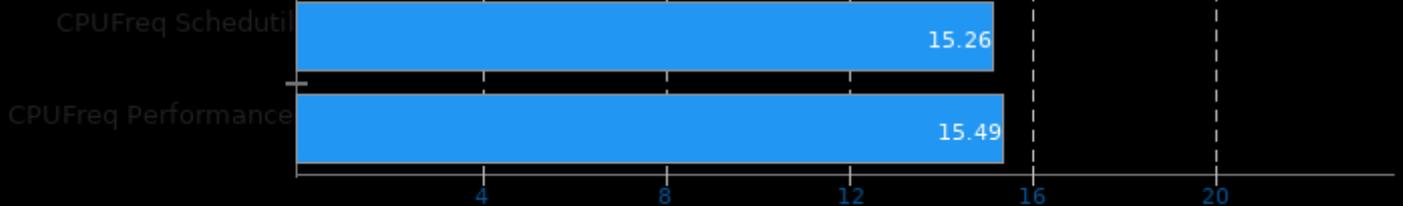


1. (CXX) g++ options: -fopenmp -function-sections -fdata-sections -O3 -ldl -lrt

ONNX Runtime 1.6

Model: super-resolution-10 - Device: OpenMP CPU

Inferences Per Minute Per Watt, More Is Better



ONNX Runtime 1.6

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.2	275.8	301.5
CPUFreq Performance	121.3	270.4	293.8

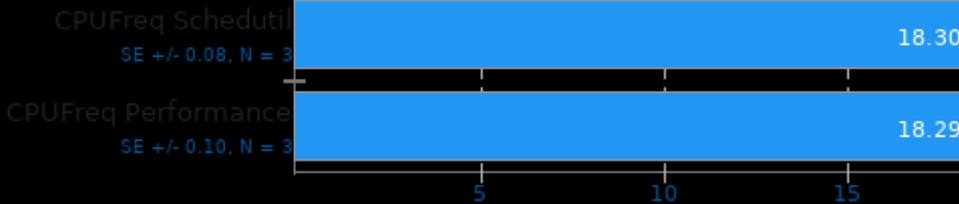
▼ Watts, Fewer Is Better



OpenFOAM 8

Input: Motorbike 30M

◀ Seconds, Fewer Is Better



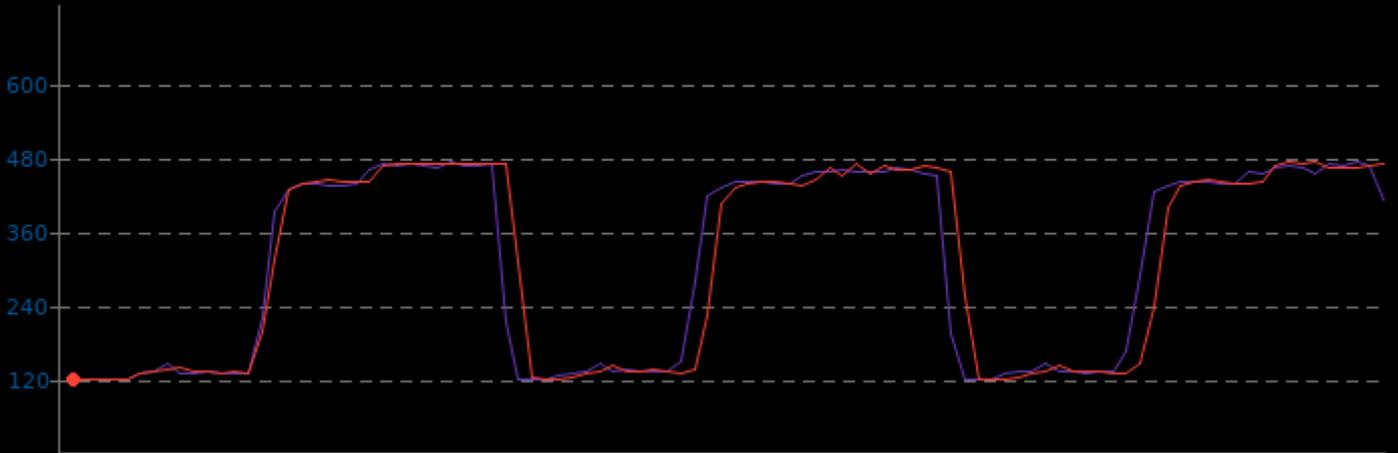
1. (CXX) g++ options: -std=c++11 -m64 -O3 -ftemplate-depth-100 -fPIC -fuse-ld=bfd -Xlinker --add-needed --no-as-needed -lfoamToVTK -ldynamicMesh -

OpenFOAM 8

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.9	309.6	472.6
CPUFreq Schedutil	121.2	309.5	472.2

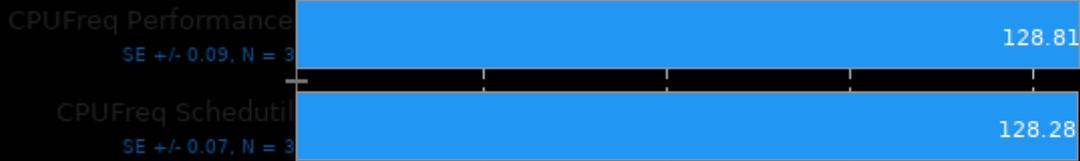
Watts, Fewer Is Better



OpenFOAM 8

Input: Motorbike 60M

Seconds, Fewer Is Better



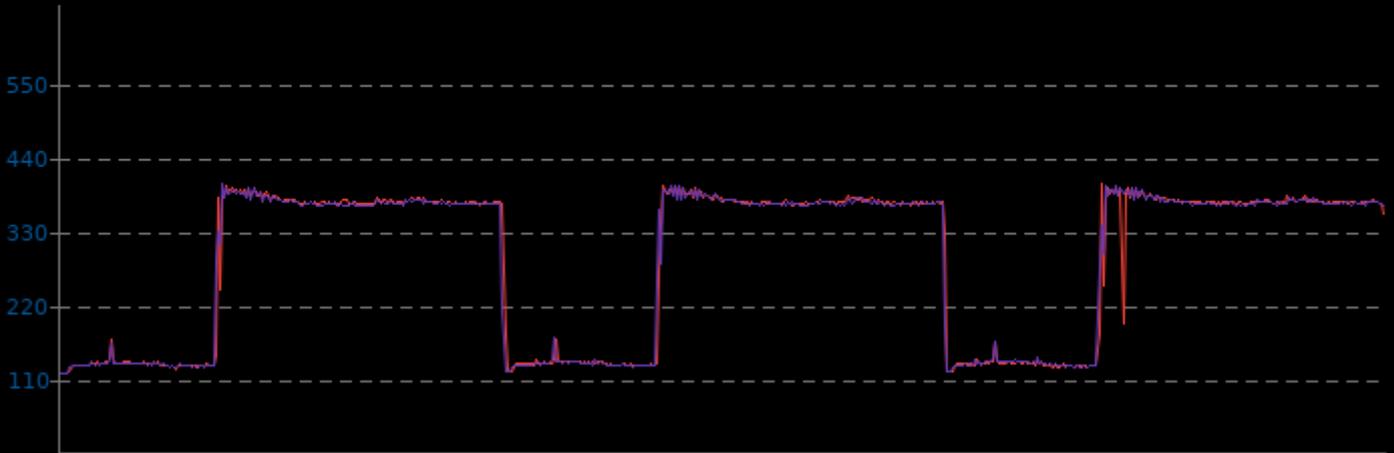
1. (CXX) g++ options: -std=c++11 -m64 -O3 -ftemplate-depth-100 -fPIC -fuse-ld=bfd -Xlinker --add-needed --no-as-needed -lfoamToVTK -ldynamicMesh -

OpenFOAM 8

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.0	290.6	400.9
CPUFreq Performance	121.1	290.0	399.7

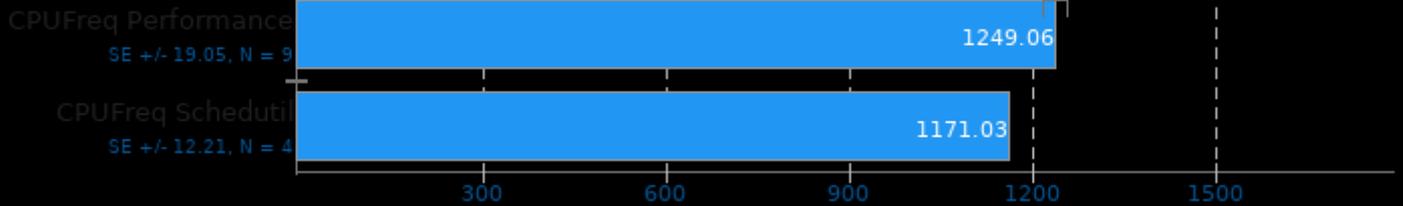
Watts, Fewer Is Better



Quantum ESPRESSO 6.7

Input: AUSURF112

Seconds, Fewer Is Better

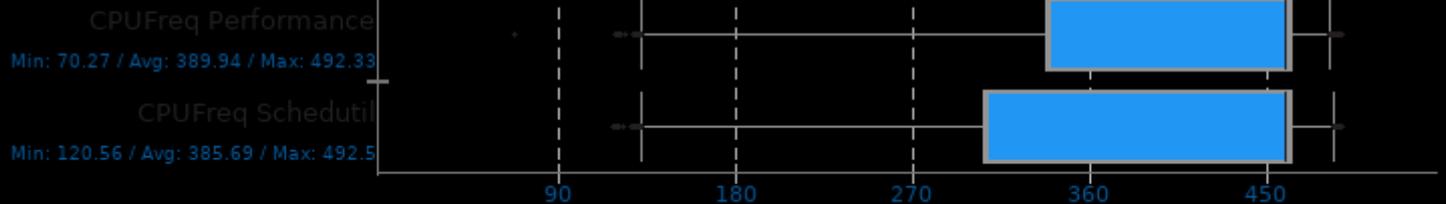


1. (F9X) gfortran options: -lopenblas -lFoX_dom -lFoX_sax -lFoX_wxml -lFoX_common -lFoX_utils -lFoX_fsys -lfftw3 -pthread -lmpi_usempif08 -lmpi_mpifh

Quantum ESPRESSO 6.7

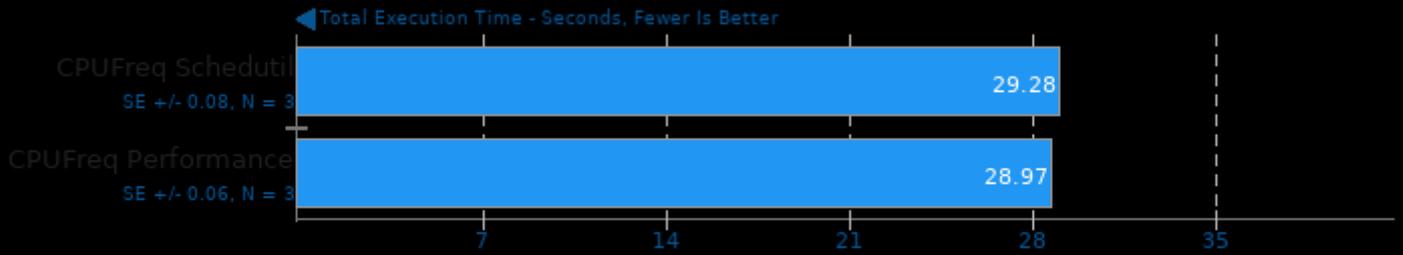
CPU Power Consumption Monitor

Watts, Fewer Is Better



QMCPACK 3.10

Input: simple-H2O



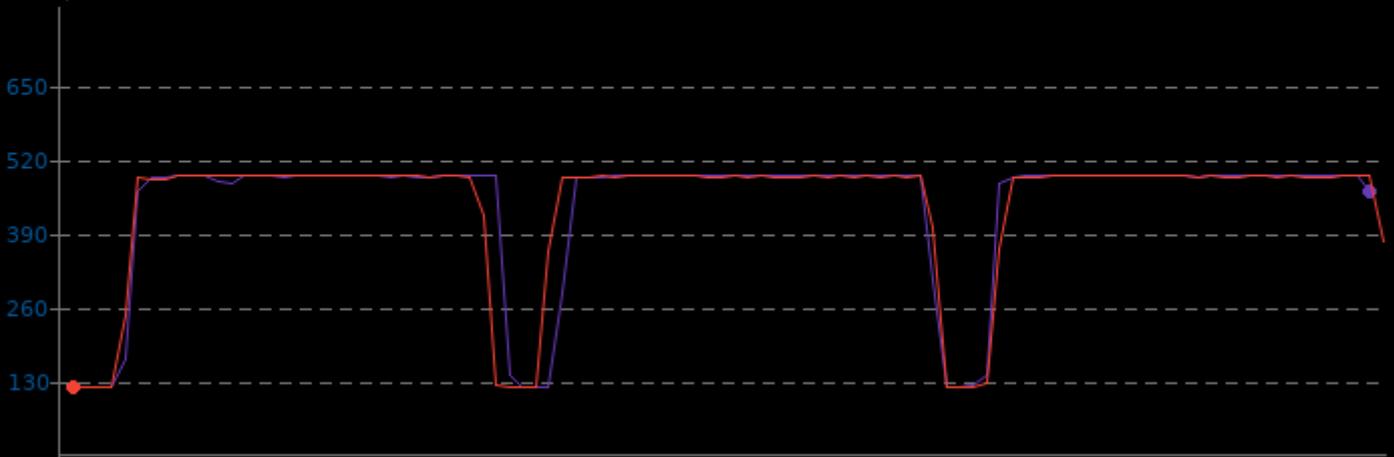
1. (CXX) g++ options: -fopenmp -finline-limit=1000 -fstrict-aliasing -funroll-all-loops -march=native -O3 -fomit-frame-pointer -ffast-math -pthread -lm

QMCPACK 3.10

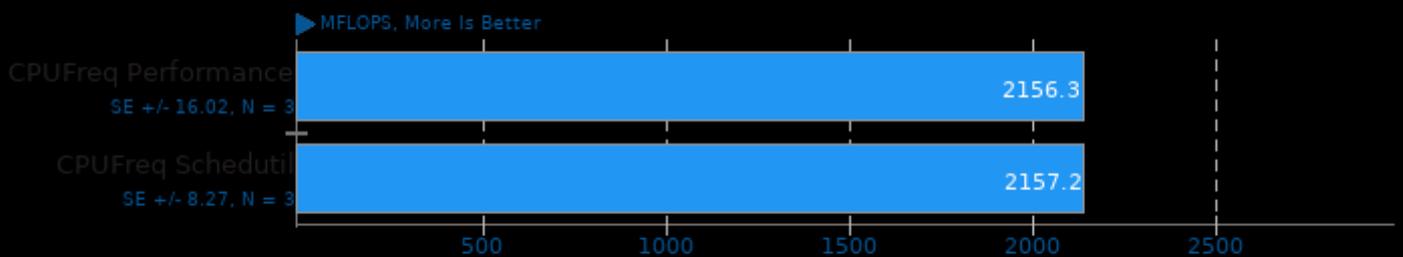
CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.6	438.1	491.9
CPUFreq Scheduling	120.3	437.6	491.3

▼ Watts, Fewer Is Better

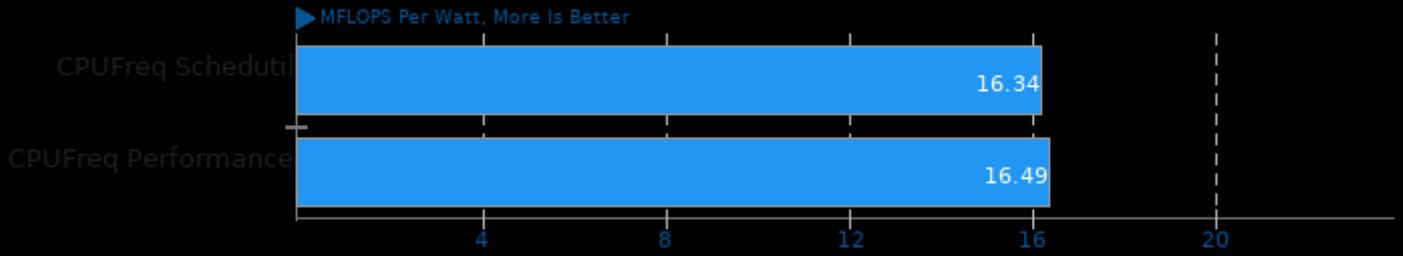


QuantLib 1.21



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

QuantLib 1.21

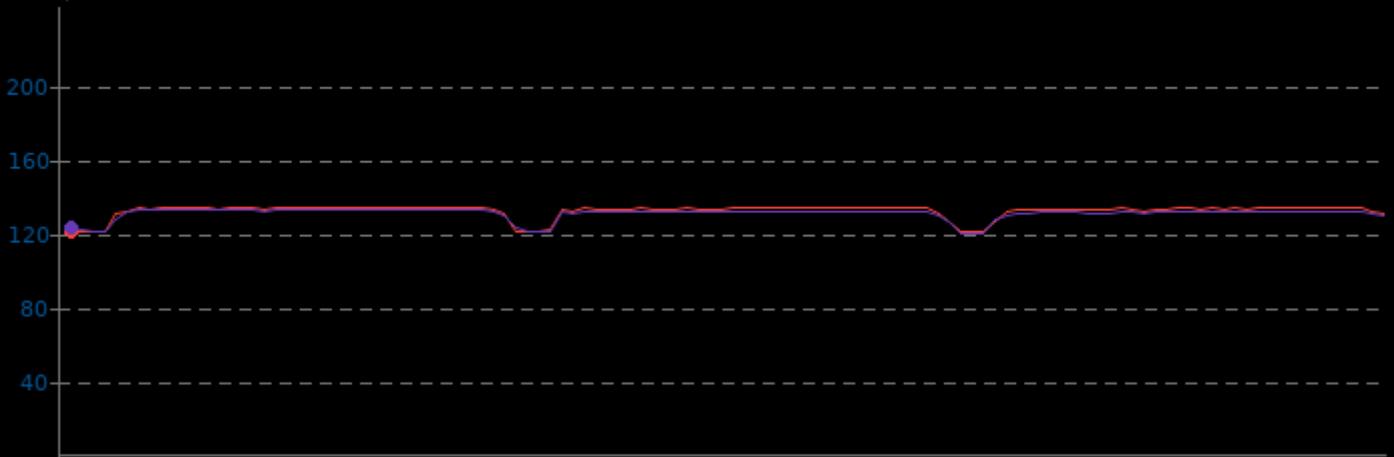


QuantLib 1.21

CPU Power Consumption Monitor

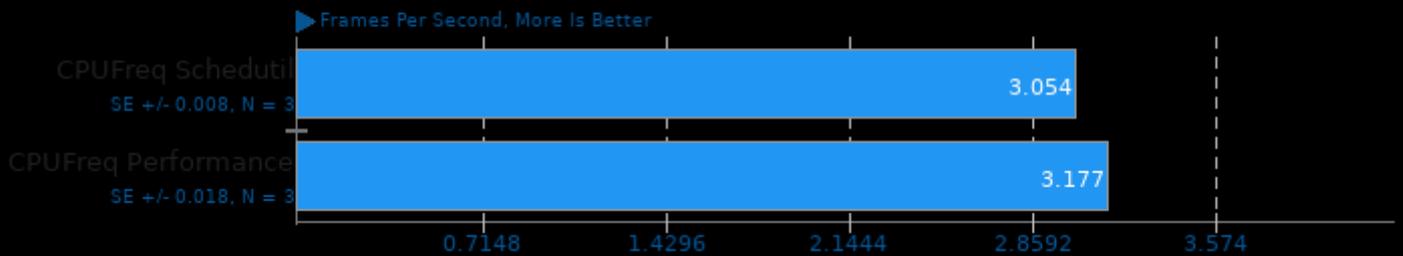
	Min	Avg	Max
CPUFreq Scheduling	120.6	132.0	134.5
CPUFreq Performance	120.3	130.8	133.1

▼ Watts, Fewer Is Better



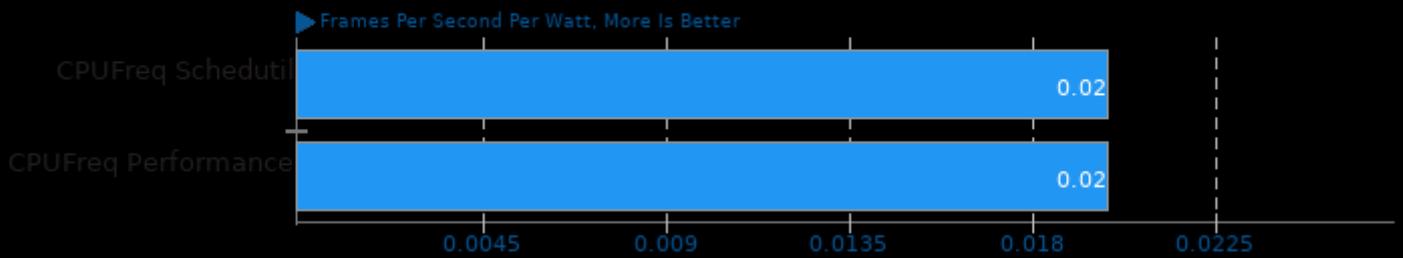
rav1e 0.4

Speed: 10



rav1e 0.4

Speed: 10

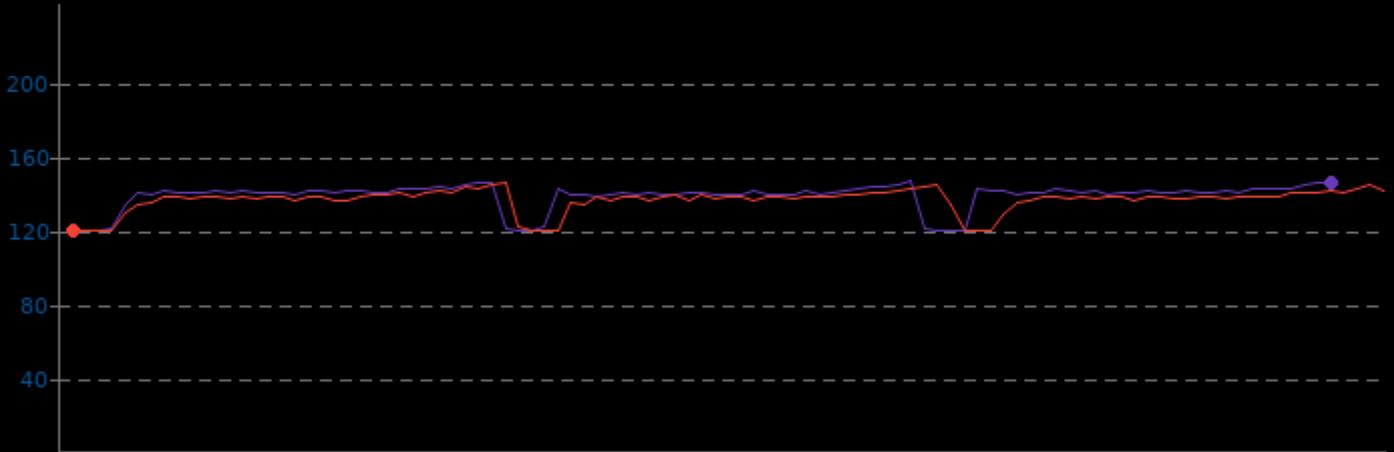


rav1e 0.4

CPU Power Consumption Monitor

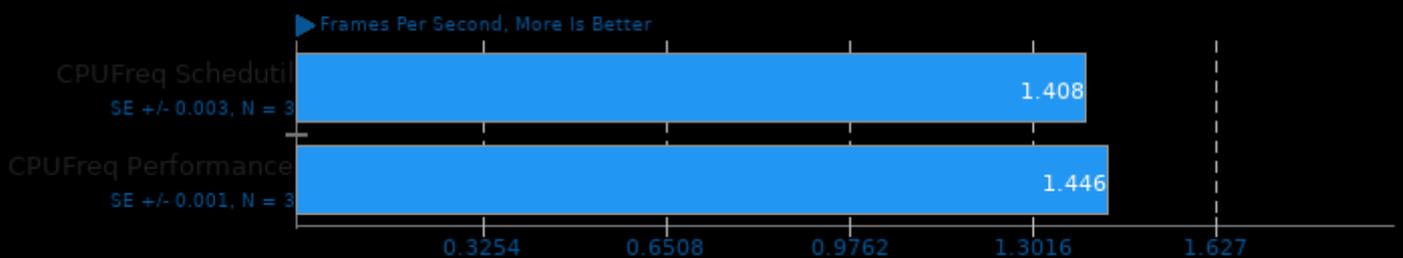
	Min	Avg	Max
CPUFreq Performance	119.9	138.6	146.5
CPUFreq Scheduling	120.2	136.5	145.8

▼ Watts, Fewer Is Better



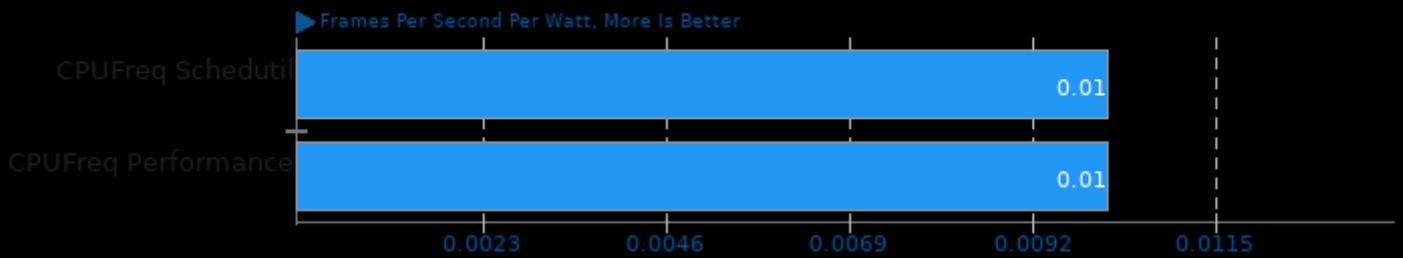
rav1e 0.4

Speed: 6



rav1e 0.4

Speed: 6

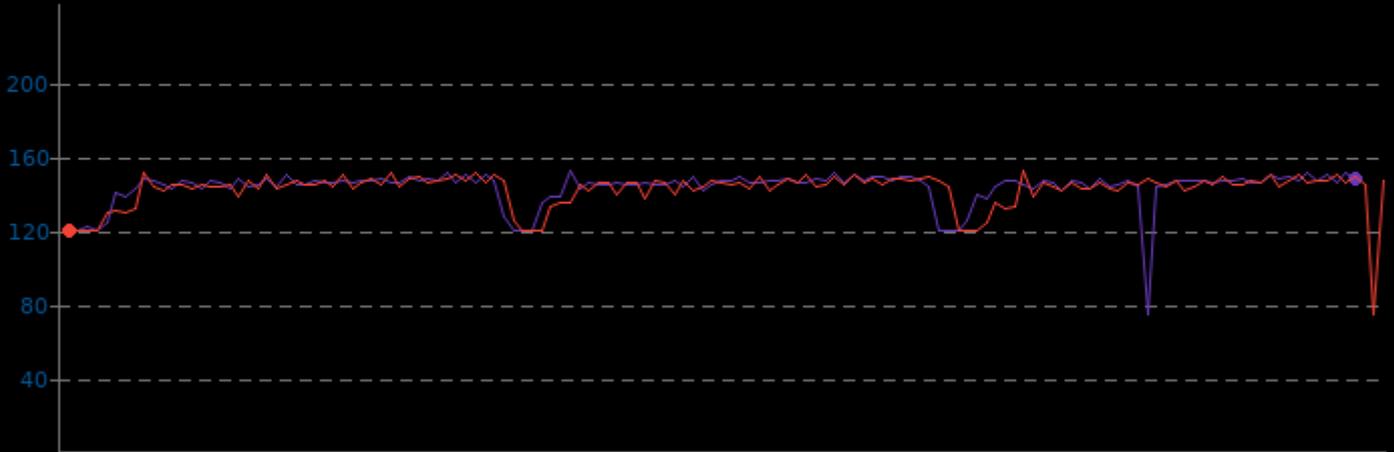


rav1e 0.4

CPU Power Consumption Monitor

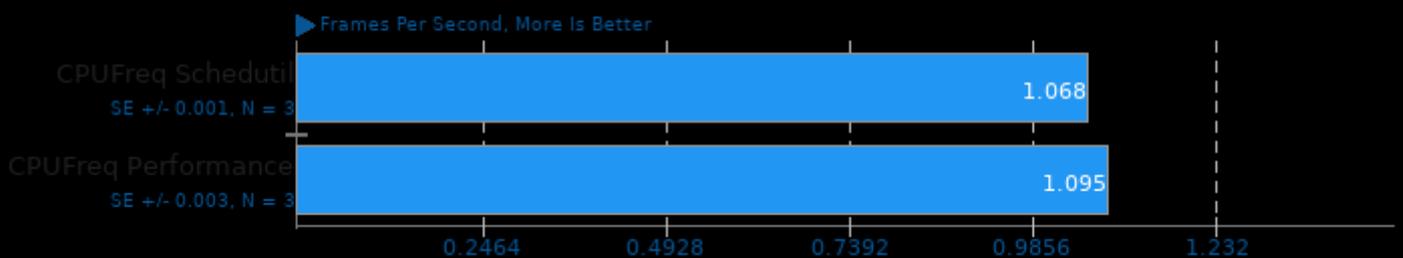
	Min	Avg	Max
CPUFreq Performance	74.7	143.0	152.2
CPUFreq Scheduling	74.9	142.0	151.6

▼ Watts, Fewer Is Better



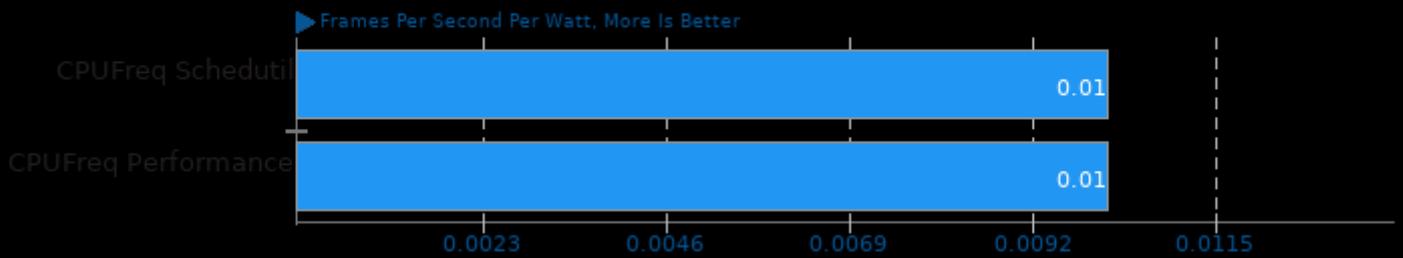
rav1e 0.4

Speed: 5



rav1e 0.4

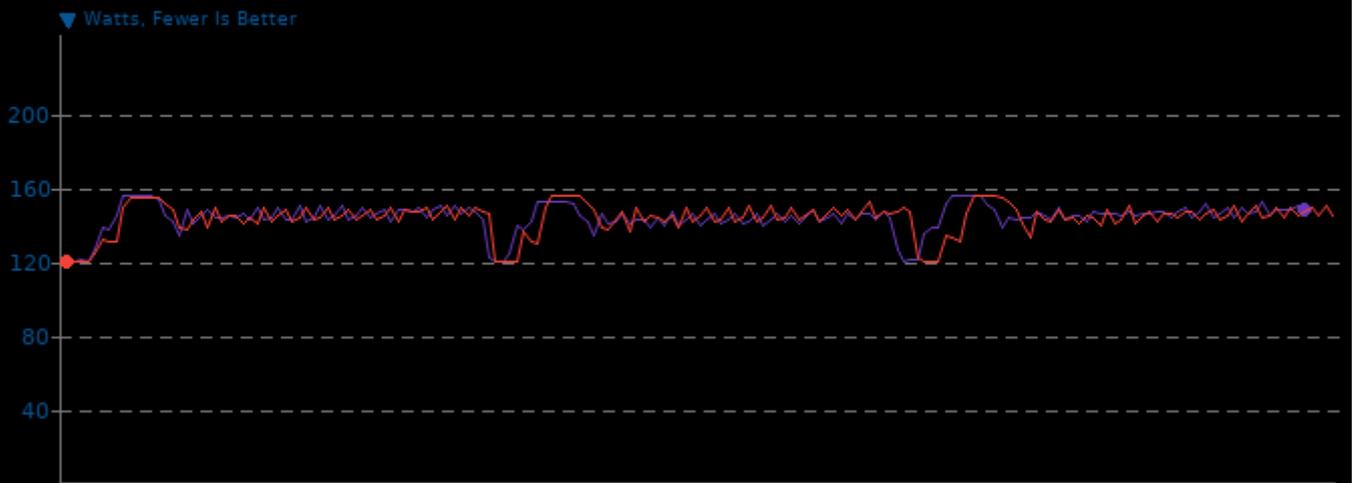
Speed: 5



rav1e 0.4

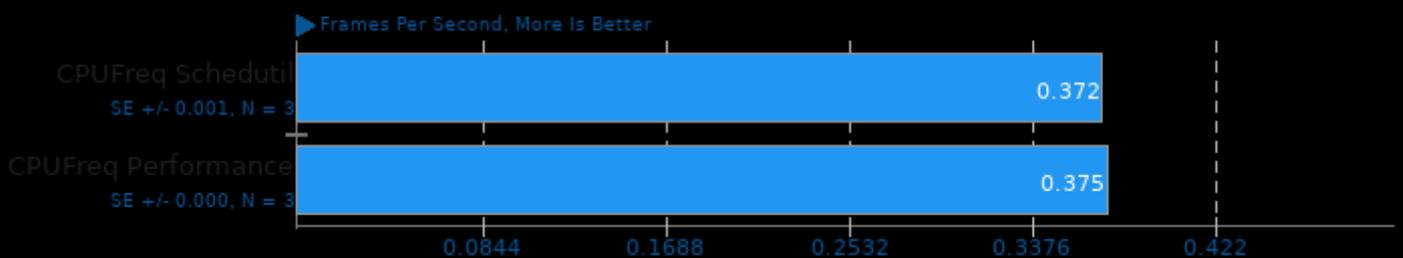
CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.8	143.6	155.6
CPUFreq Scheduling	120.0	143.3	155.2



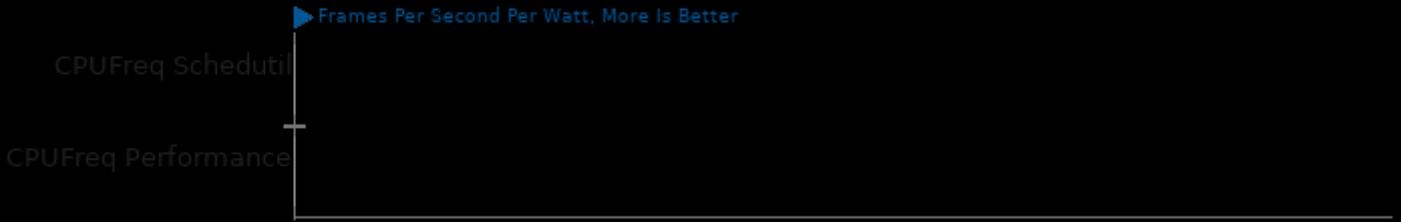
rav1e 0.4

Speed: 1



rav1e 0.4

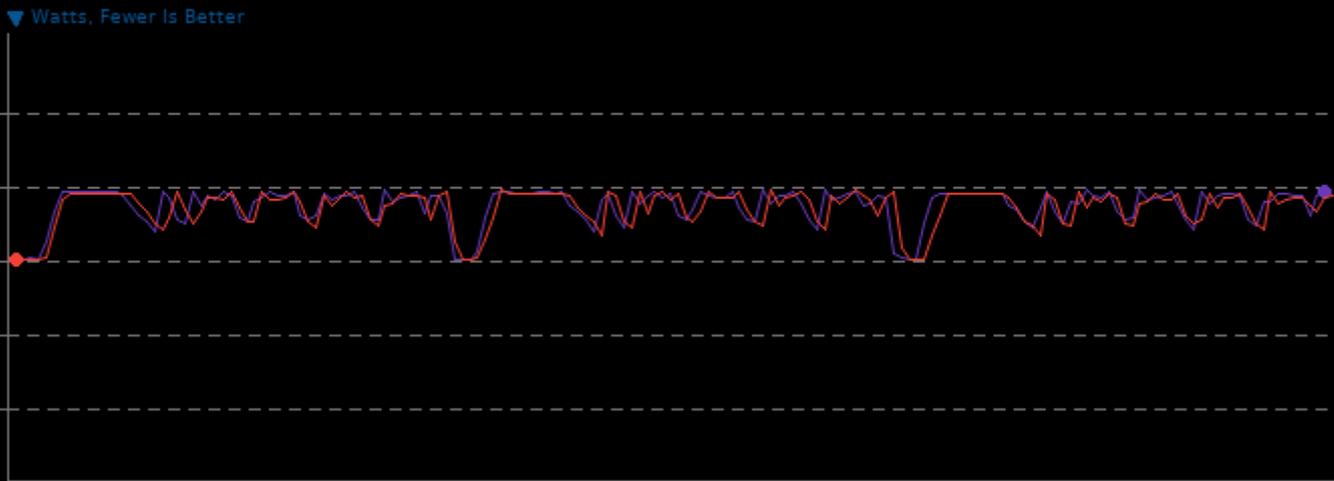
Speed: 1



rav1e 0.4

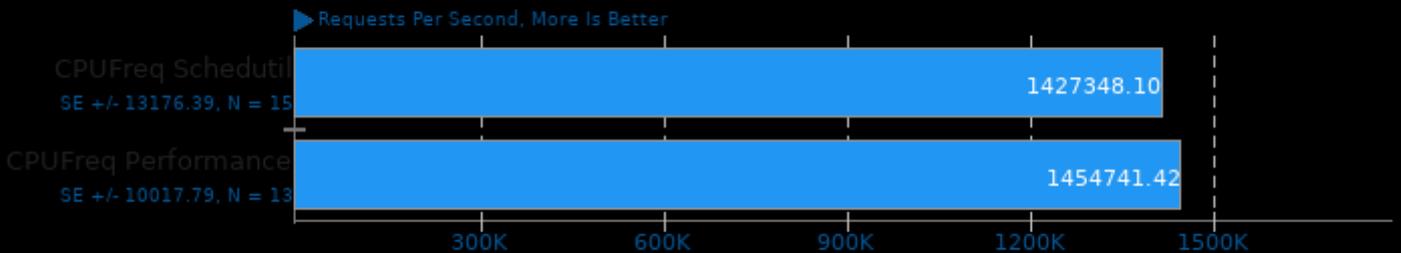
CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.7	148.6	157.3
CPUFreq Scheduling	119.9	147.6	157.1



Redis 6.0.9

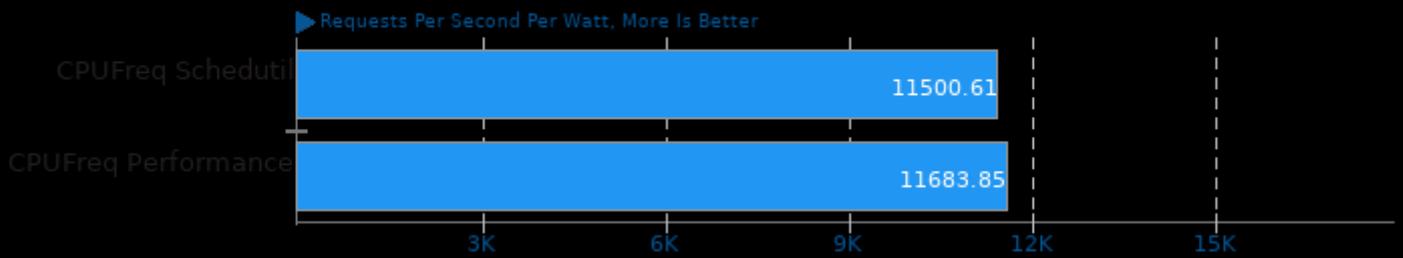
Test: SET



1. (CXX) g++ options: -MM -MT -g3 -fvisibility=hidden -O3

Redis 6.0.9

Test: SET

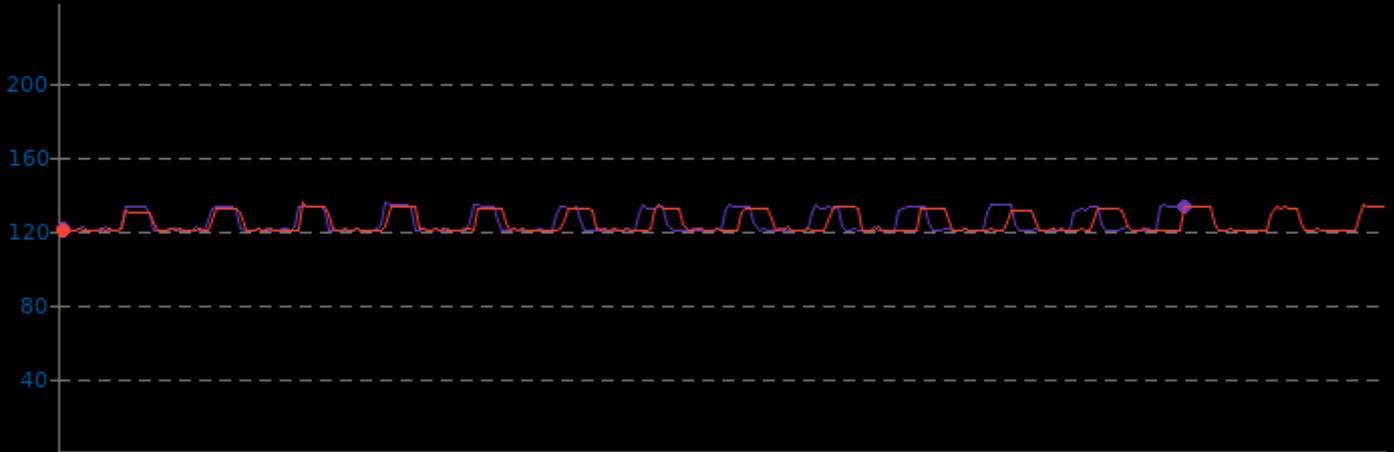


Redis 6.0.9

CPU Power Consumption Monitor

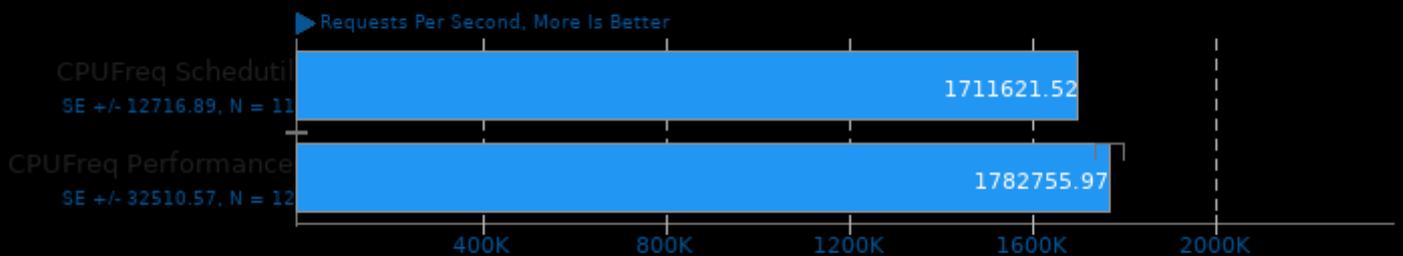
	Min	Avg	Max
CPUFreq Performance	119.7	124.5	135.4
CPUFreq Scheduling	119.7	124.1	134.6

Watts, Fewer Is Better



Redis 6.0.9

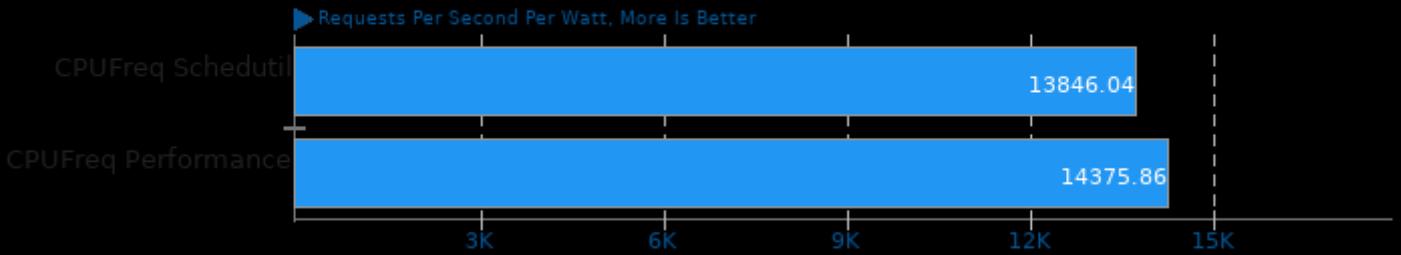
Test: GET



1. (CXX) g++ options: -MM -MT -g3 -fvisibility=hidden -O3

Redis 6.0.9

Test: GET

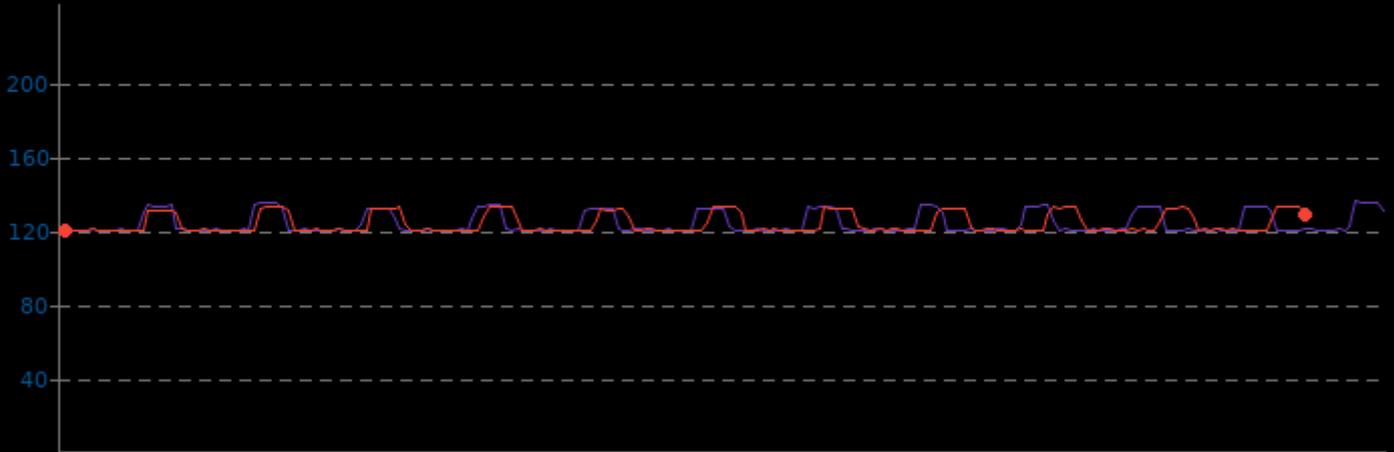


Redis 6.0.9

CPU Power Consumption Monitor

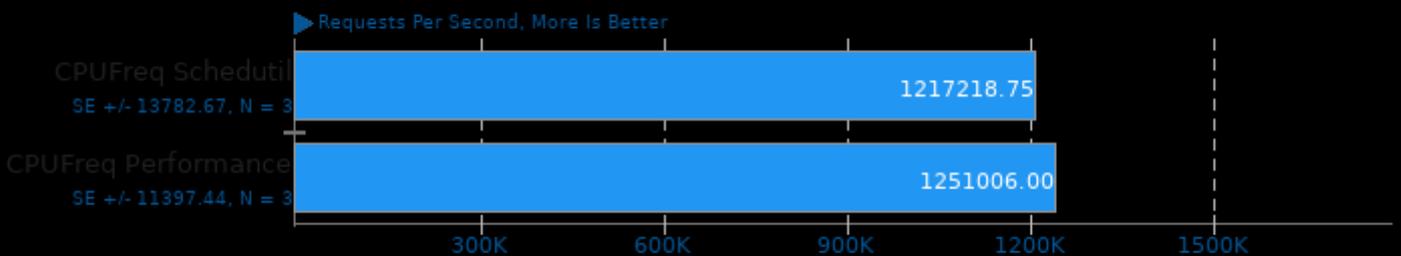
	Min	Avg	Max
CPUFreq Performance	119.8	124.0	135.9
CPUFreq Scheduling	119.7	123.6	133.0

Watts, Fewer Is Better



Redis 6.0.9

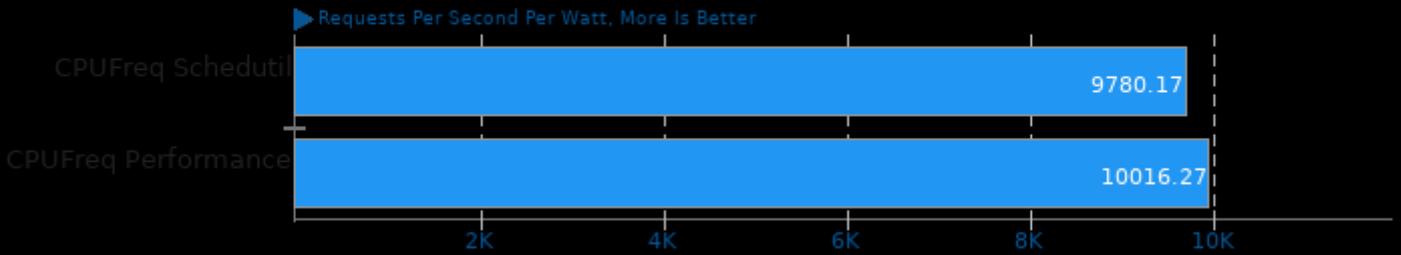
Test: LPUSE



1. (CXX) g++ options: -MM -MT -g3 -fvisibility=hidden -O3

Redis 6.0.9

Test: LPUSH

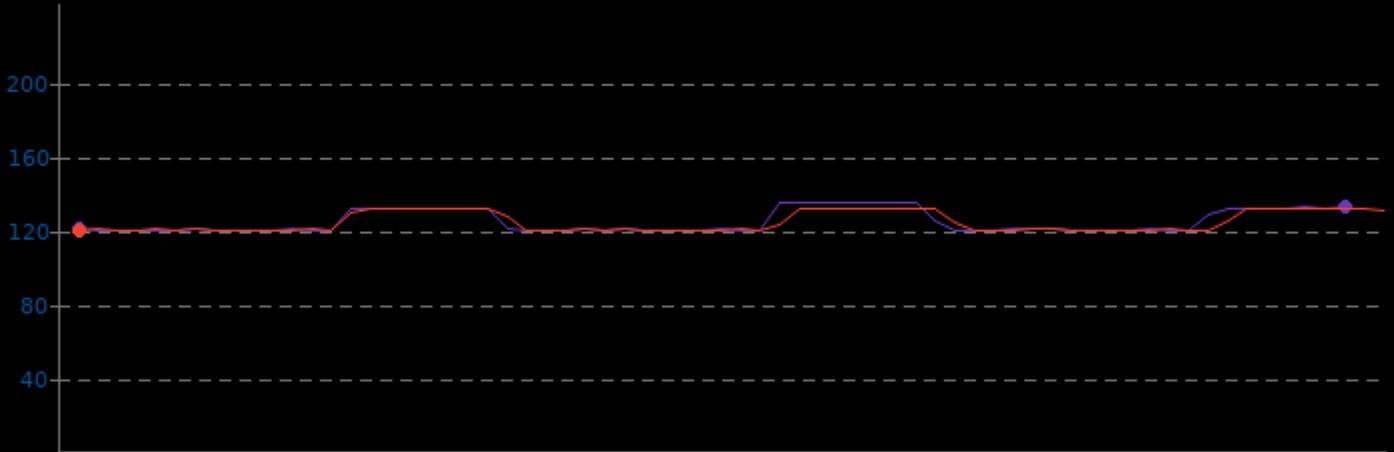


Redis 6.0.9

CPU Power Consumption Monitor

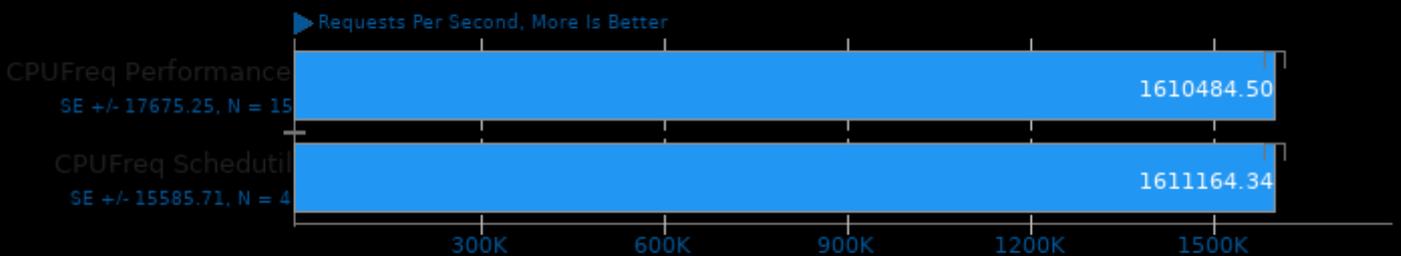
	Min	Avg	Max
CPUFreq Performance	119.8	124.9	134.8
CPUFreq Scheduling	119.7	124.5	132.3

Watts, Fewer Is Better



Redis 6.0.9

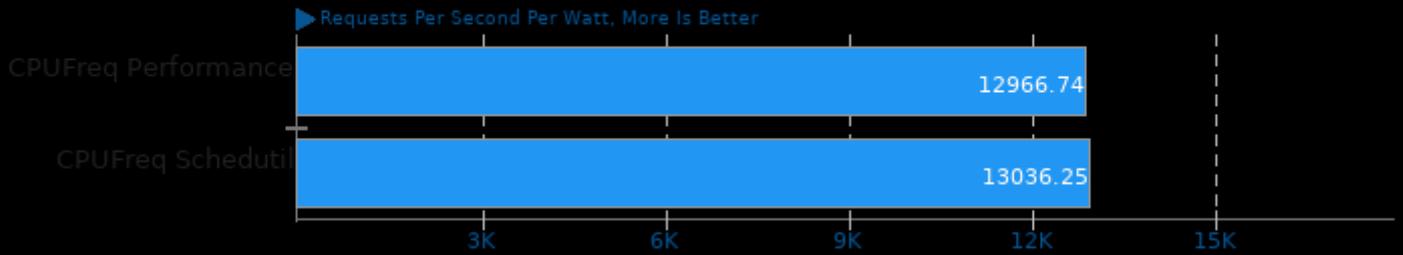
Test: SADD



1. (CXX) g++ options: -MM -MT -g3 -fvisibility=hidden -O3

Redis 6.0.9

Test: SADD



Redis 6.0.9

CPU Power Consumption Monitor

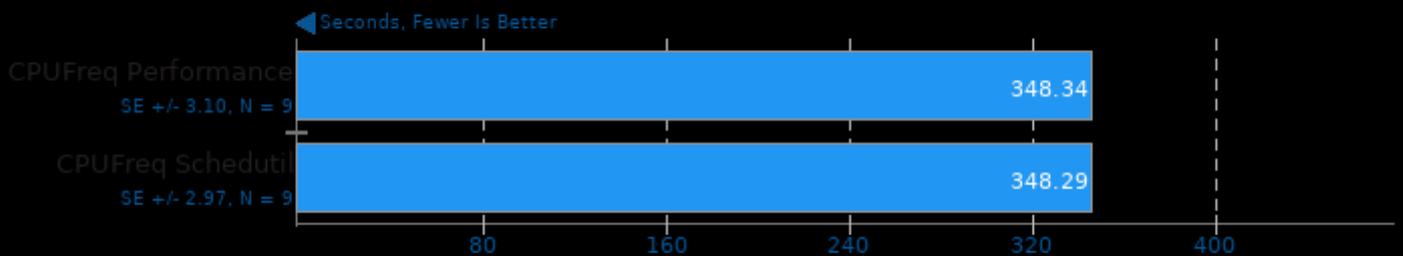
	Min	Avg	Max
CPUFreq Performance	119.7	124.2	136.0
CPUFreq Scheduling	119.6	123.6	132.8

Watts, Fewer Is Better



RELION 3.1.1

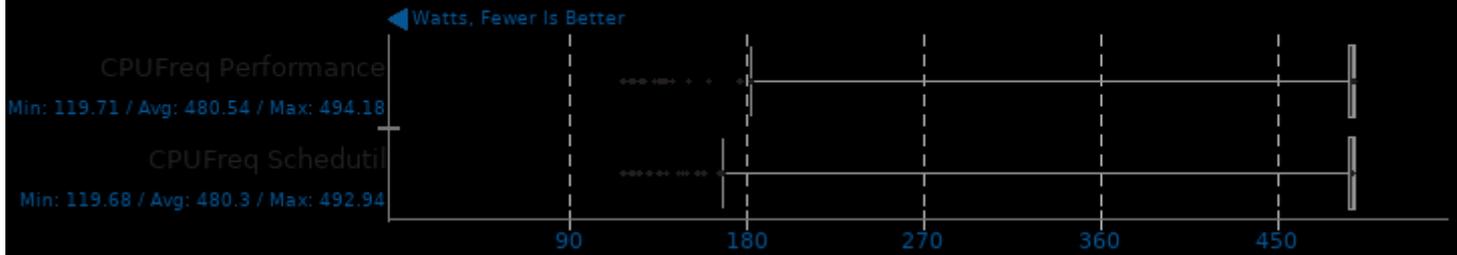
Test: Basic - Device: CPU



1. (CXX) g++ options: -fopenmp -std=c++0x -O3 -rdynamic -ldl -ltiff -lfftw3f -lfftw3 -lpng -pthread -lmpi_cxx -lmpi

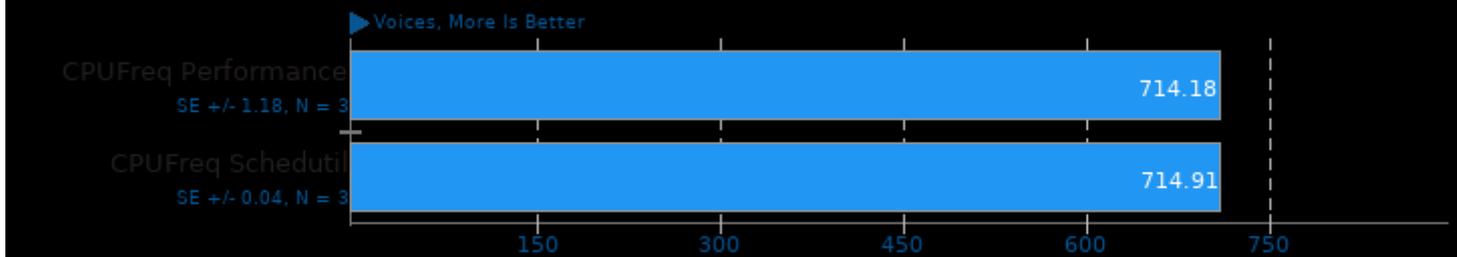
RELION 3.1.1

CPU Power Consumption Monitor



Google SynthMark 20201109

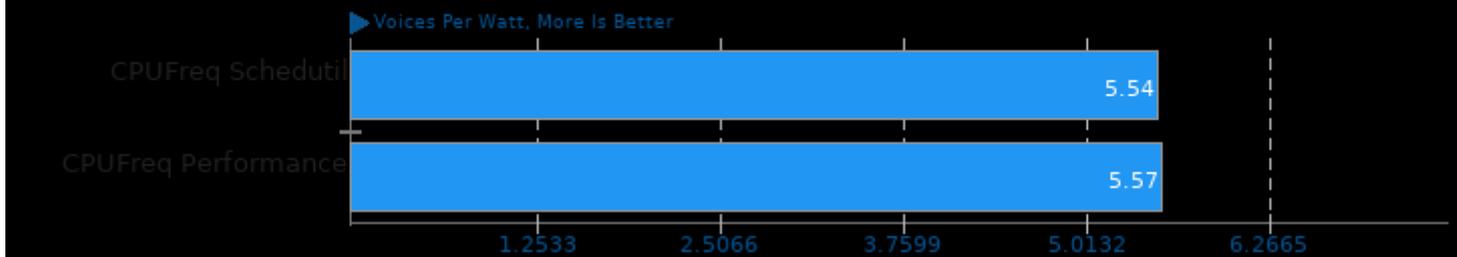
Test: VoiceMark_100



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

Google SynthMark 20201109

Test: VoiceMark_100

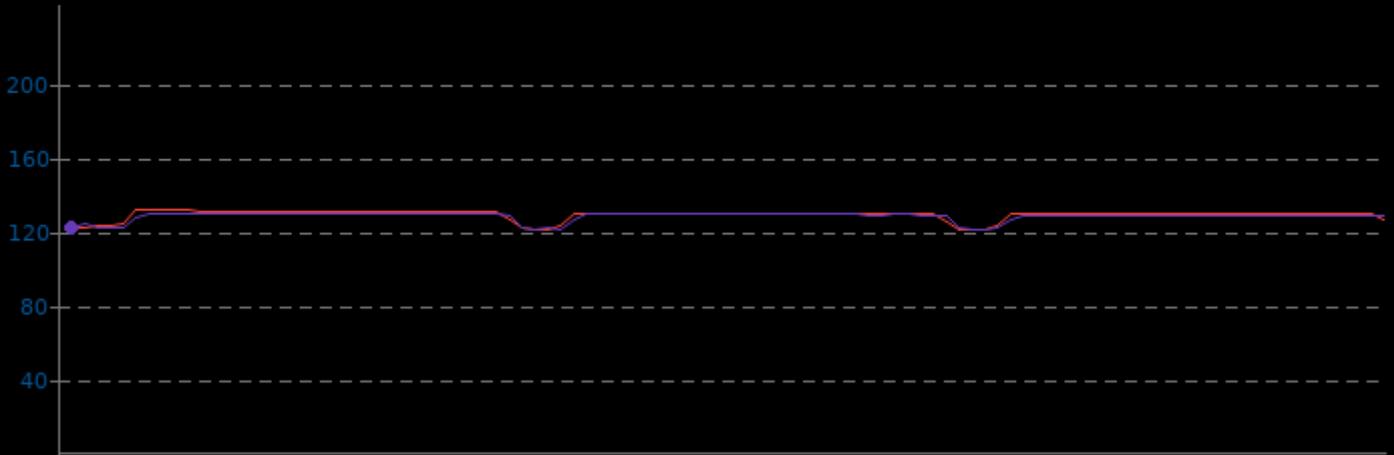


Google SynthMark 20201109

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.8	129.0	131.4
CPUFreq Performance	121.0	128.2	130.1

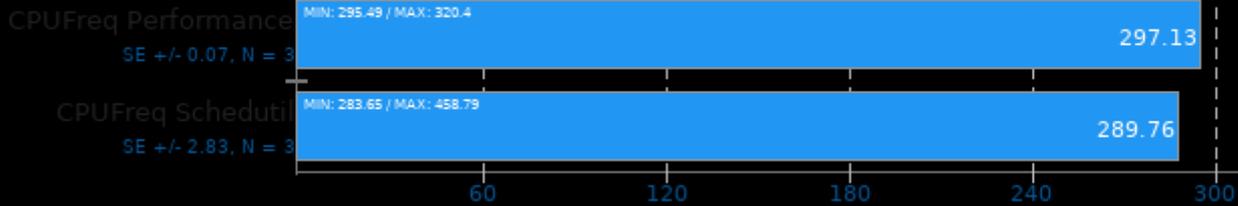
Watts, Fewer Is Better



TNN 0.2.3

Target: CPU - Model: MobileNet v2

ms, Fewer Is Better



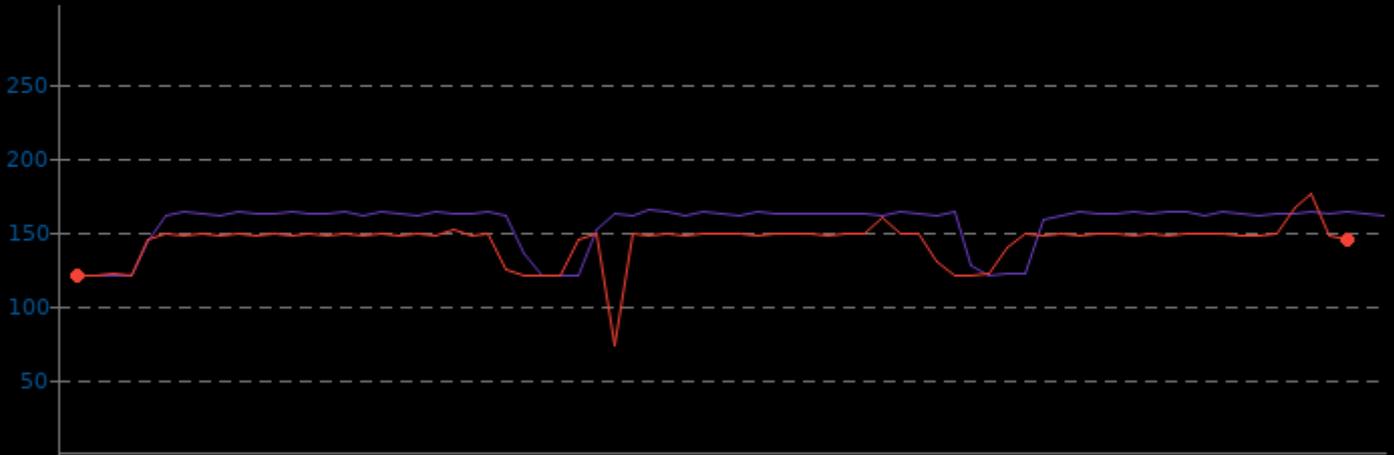
1. (CXX) g++ options: -fopenmp -pthread -fvisibility=hidden -O3 -rdynamic -ldl

TNN 0.2.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.6	155.3	165.0
CPUFreq Schedutil	73.7	143.3	175.3

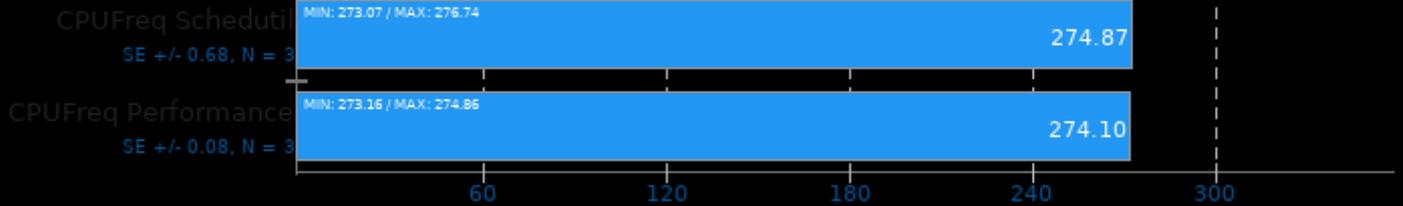
Watts, Fewer Is Better



TNN 0.2.3

Target: CPU - Model: SqueezeNet v1.1

ms, Fewer Is Better



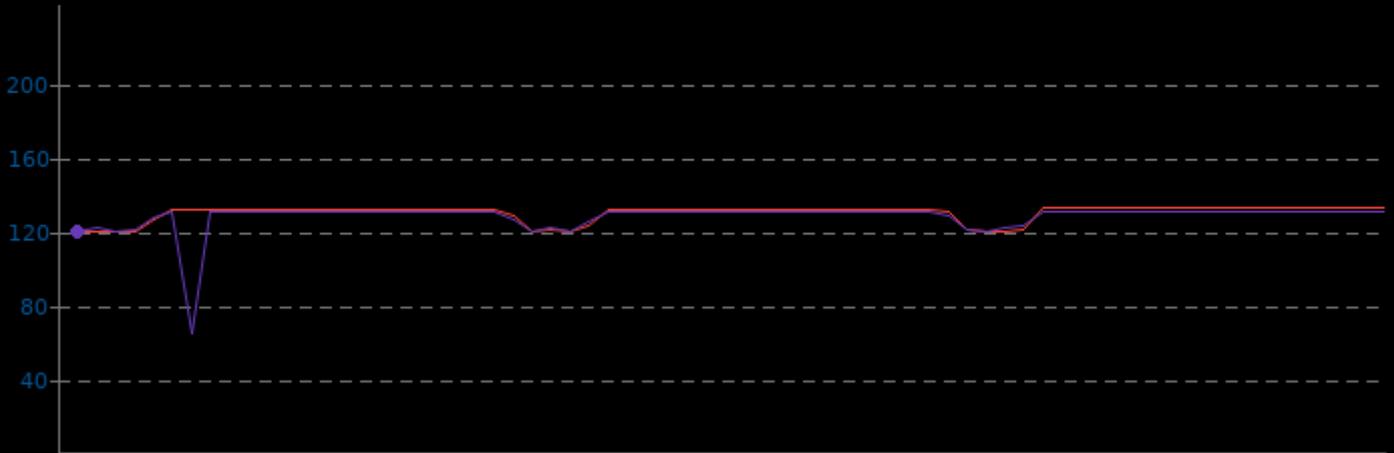
1. (CXX) g++ options: -fopenmp -pthread -fvisibility=hidden -O3 -rdynamic -ldl

TNN 0.2.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.3	129.8	132.8
CPUFreq Performance	65.3	127.9	130.9

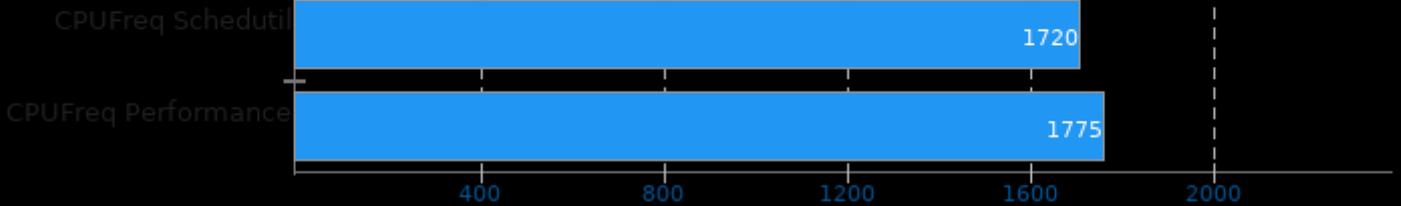
Watts, Fewer Is Better



AI Benchmark Alpha 0.1.2

Device Inference Score

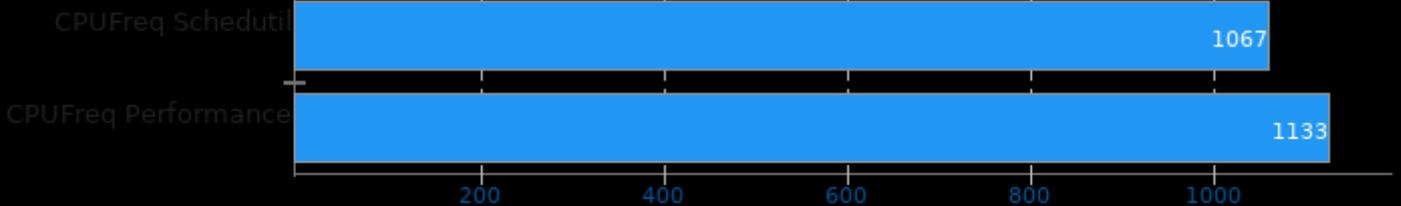
Score, More Is Better



AI Benchmark Alpha 0.1.2

Device Training Score

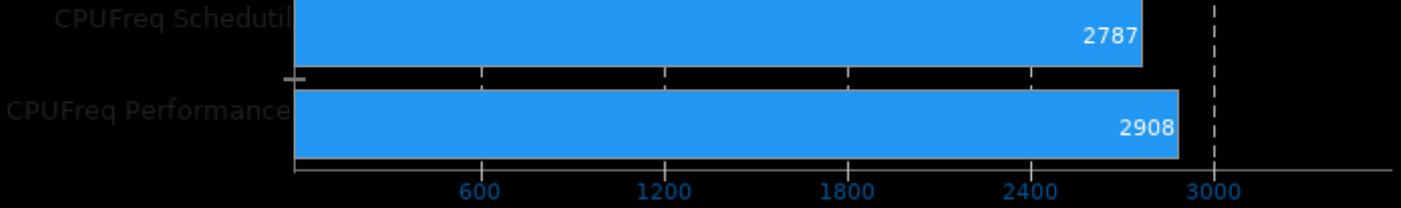
Score, More Is Better



AI Benchmark Alpha 0.1.2

Device AI Score

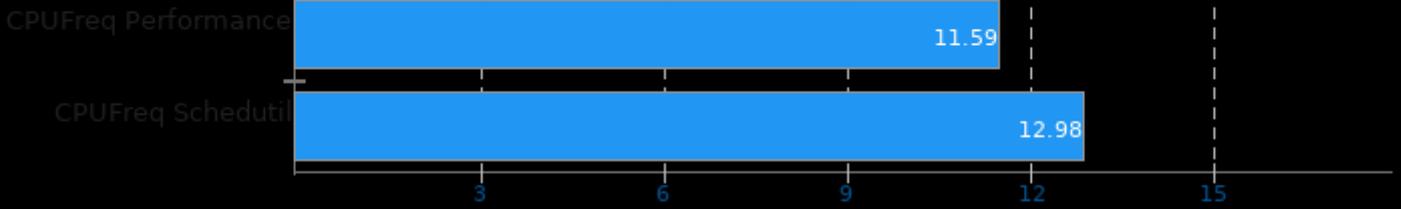
▶ Score, More Is Better



AI Benchmark Alpha 0.1.2

Device AI Score

▶ Score Per Watt, More Is Better



AI Benchmark Alpha 0.1.2

CPU Power Consumption Monitor

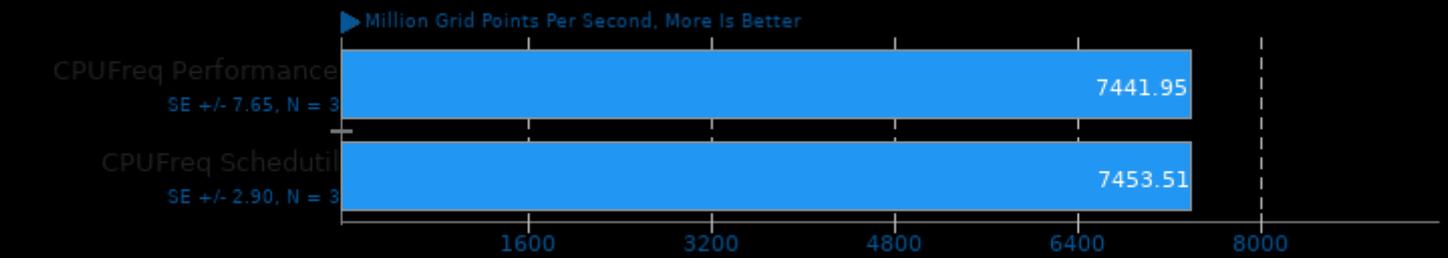
	Min	Avg	Max
CPUFreq Performance	119.8	250.8	388.9
CPUFreq Scheduling	119.9	214.7	378.2

▼ Watts, Fewer Is Better



ASKAP 2018-11-10

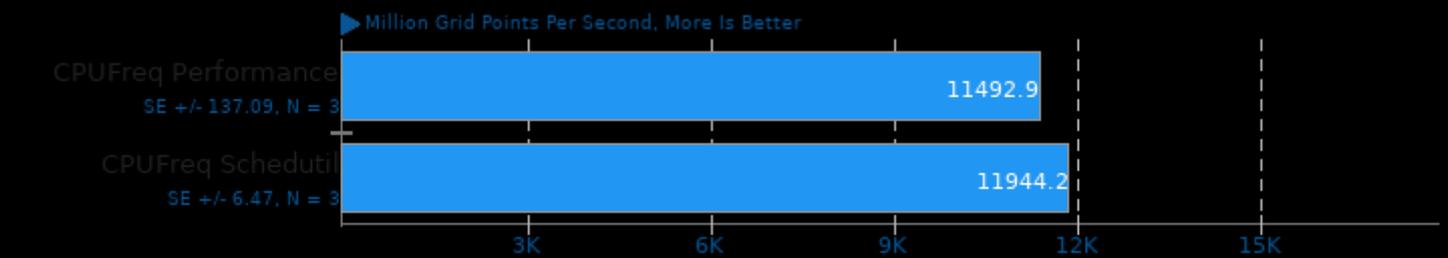
Test: tConvolve MPI - Gridding



1. (CXX) g++ options: -lpthread

ASKAP 2018-11-10

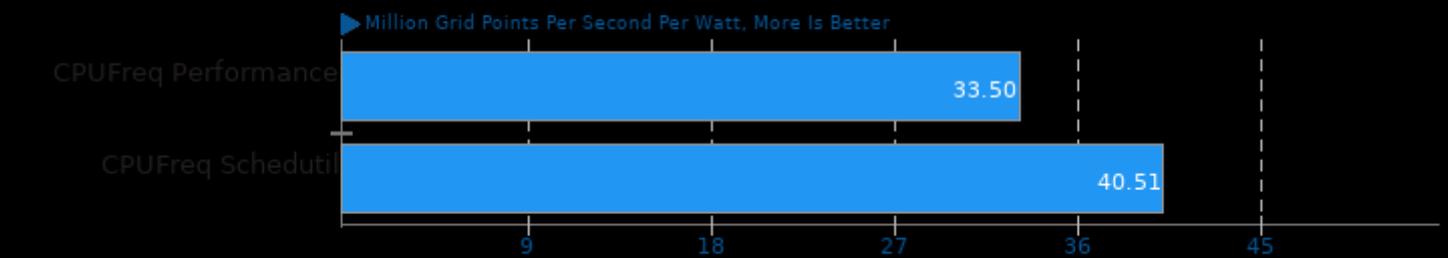
Test: tConvolve MPI - Degridding



1. (CXX) g++ options: -lpthread

ASKAP 2018-11-10

Test: tConvolve MPI - Degridding

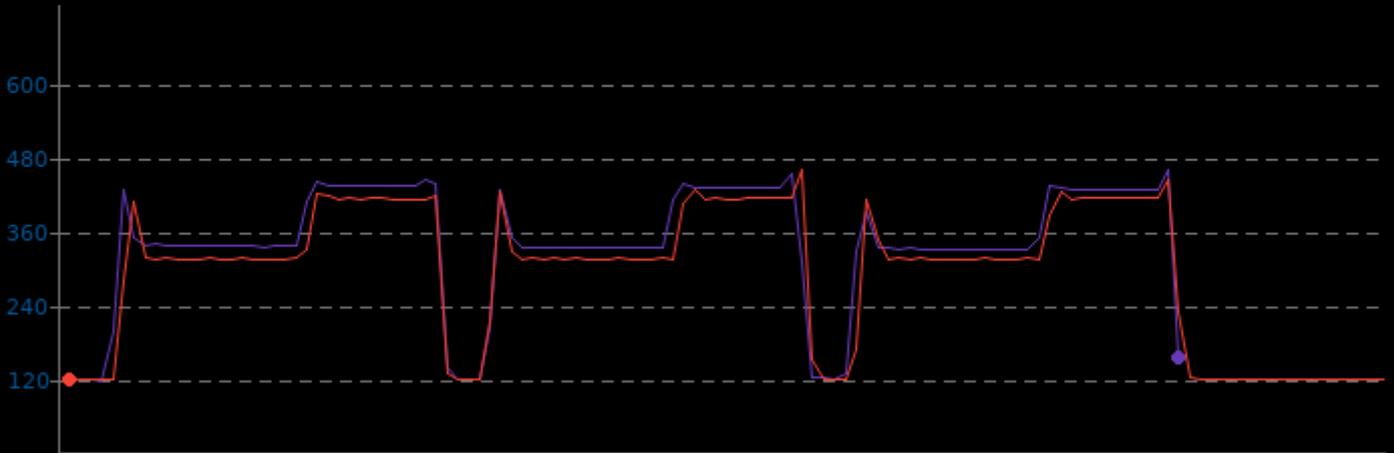


ASKAP 2018-11-10

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.5	343.1	458.5
CPUFreq Schedutil	120.8	294.9	460.5

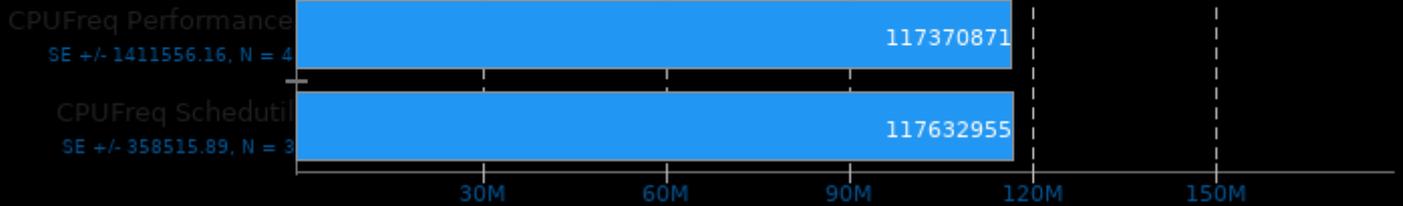
Watts, Fewer Is Better



asmFish 2018-07-23

1024 Hash Memory, 26 Depth

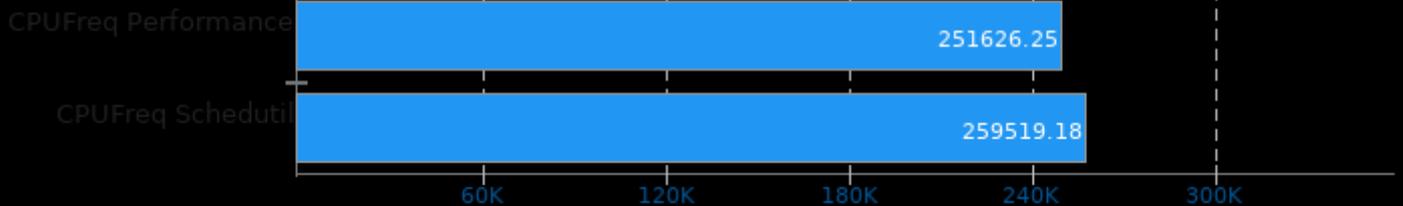
Nodes/second, More Is Better



asmFish 2018-07-23

1024 Hash Memory, 26 Depth

Nodes/second Per Watt, More Is Better

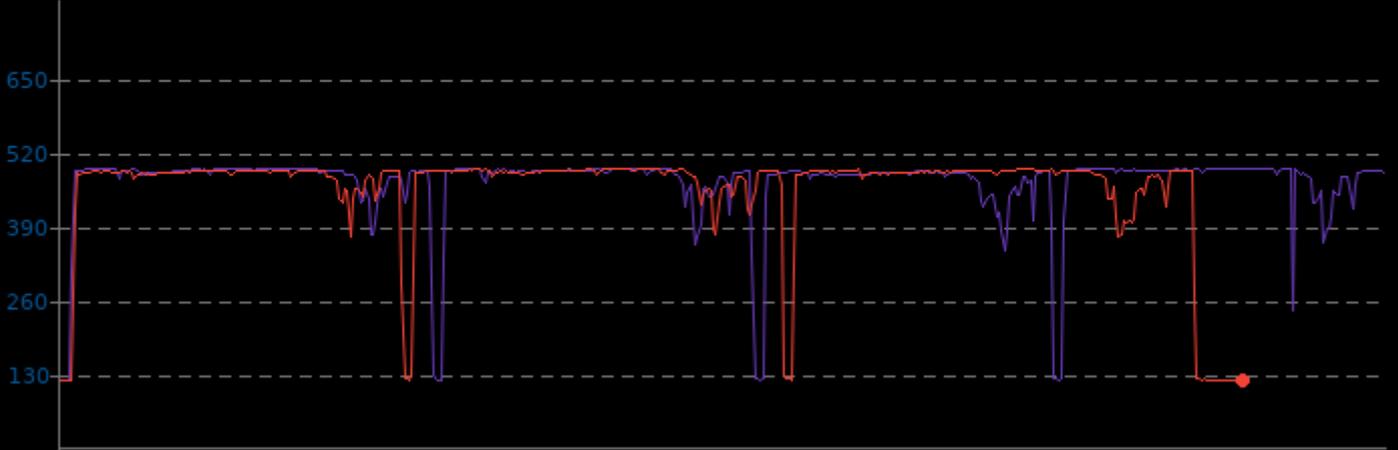


asmFish 2018-07-23

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.2	466.4	492.0
CPUFreq Schedutil	120.7	453.3	491.9

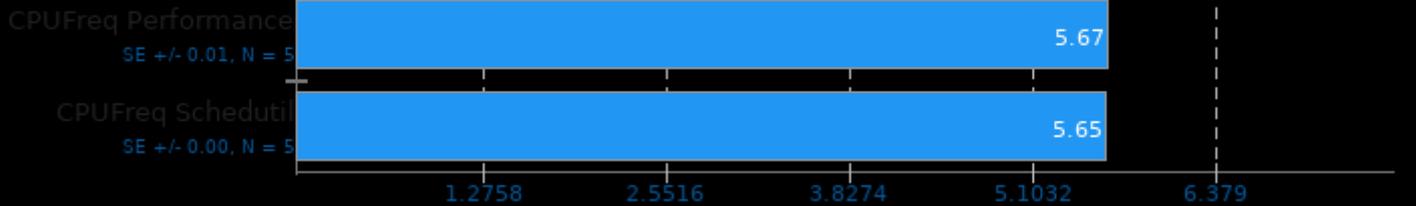
Watts, Fewer Is Better



ASTC Encoder 2.0

Preset: Thorough

Seconds, Fewer Is Better



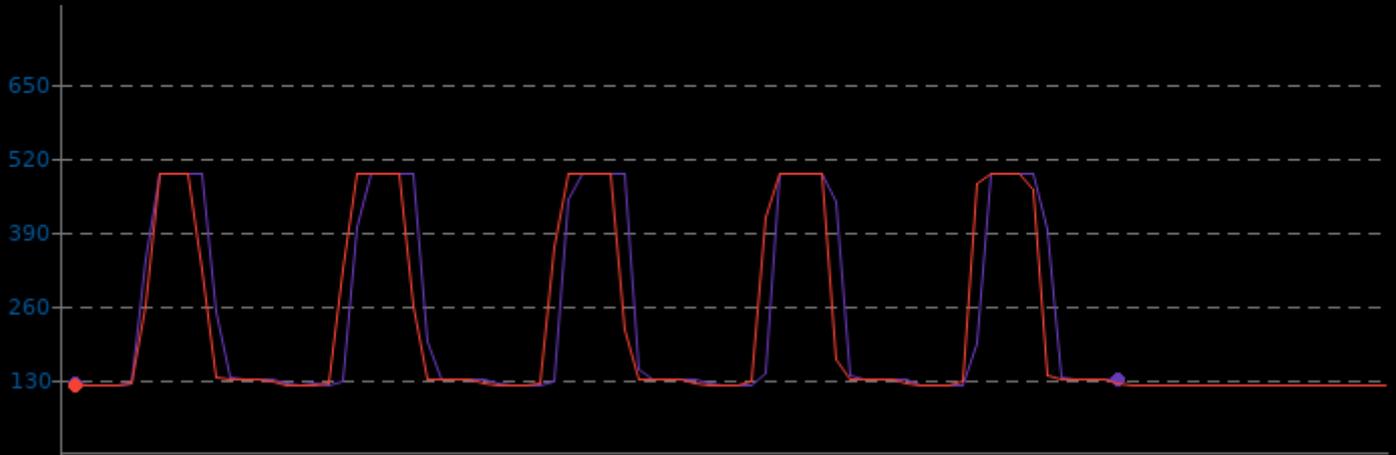
1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno-math-errno -mavx2 -mpopcnt -lpthread

ASTC Encoder 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.3	247.5	492.0
CPUFreq Schedutil	120.4	217.2	492.0

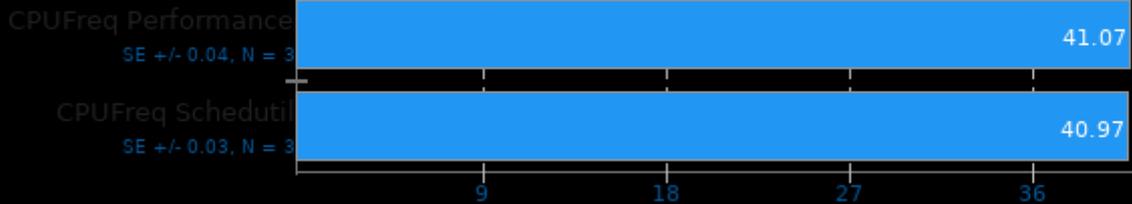
Watts, Fewer Is Better



ASTC Encoder 2.0

Preset: Exhaustive

Seconds, Fewer Is Better



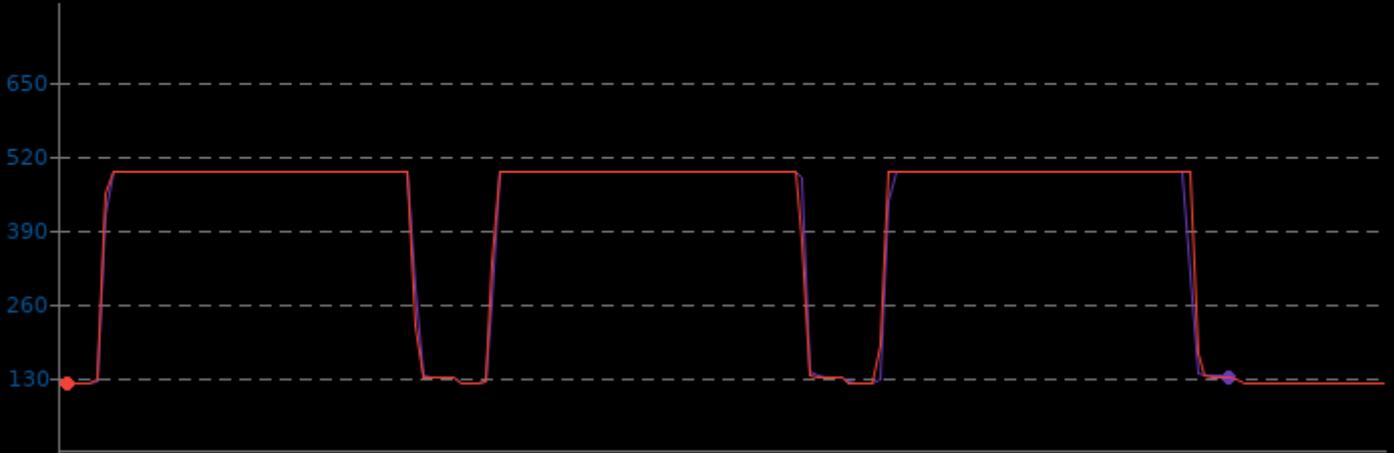
1. (CXX) g++ options: -std=c++14 -fvisibility=hidden -O3 -fno-math-errno -mavx2 -mpopcnt -lpthread

ASTC Encoder 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.8	417.1	492.0
CPUFreq Schedutil	120.2	383.9	492.0

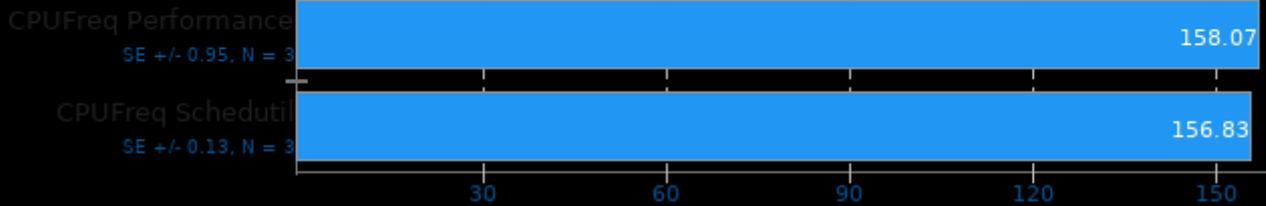
▼ Watts, Fewer Is Better



Blender 2.90

Blend File: Barbershop - Compute: CPU-Only

◀ Seconds, Fewer Is Better

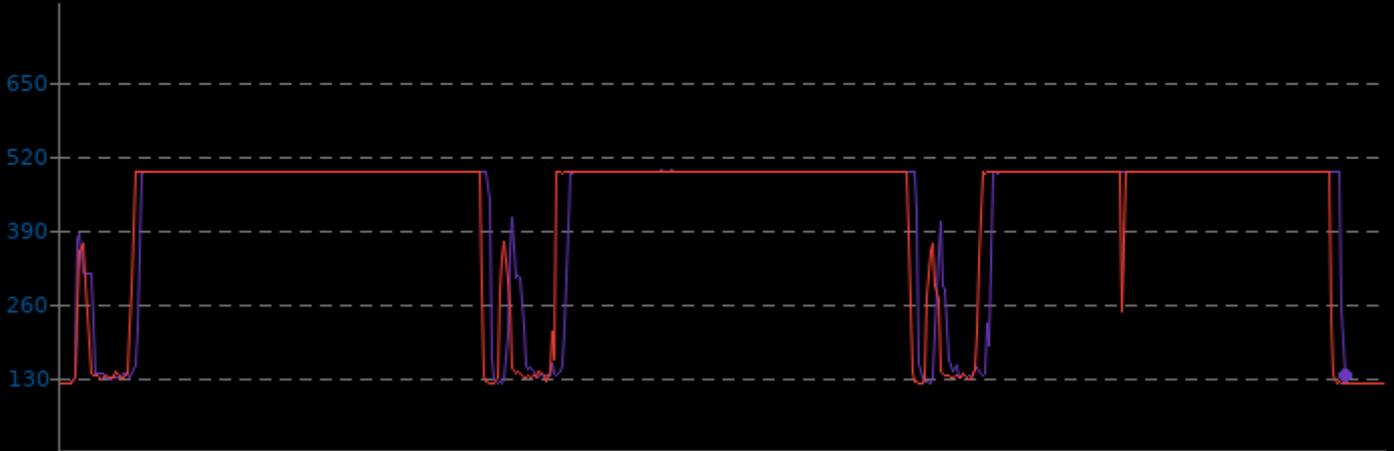


Blender 2.90

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.2	434.6	494.0
CPUFreq Schedutil	120.6	423.5	492.3

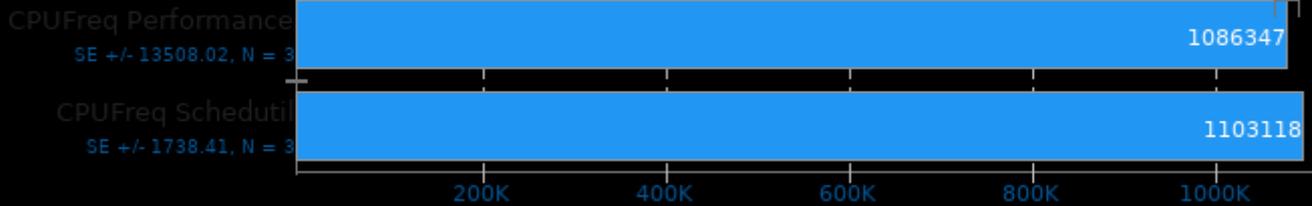
Watts, Fewer Is Better



BlogBench 1.1

Test: Read

Final Score, More Is Better

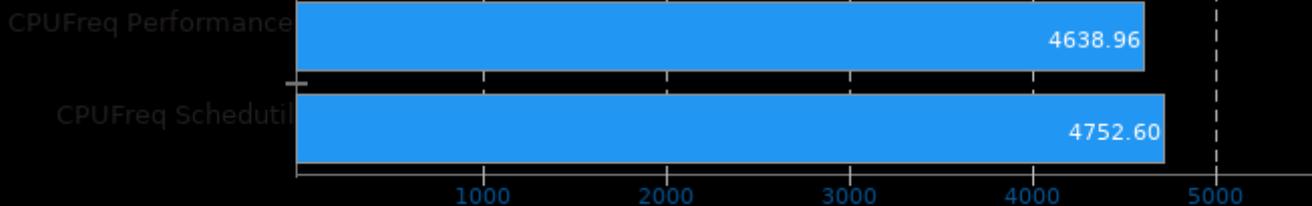


1. (C) gcc options: -O2 -pthread

BlogBench 1.1

Test: Read

Final Score Per Watt, More Is Better



BlogBench 1.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.8	234.2	328.6
CPUFreq Schedutil	120.0	232.1	341.5

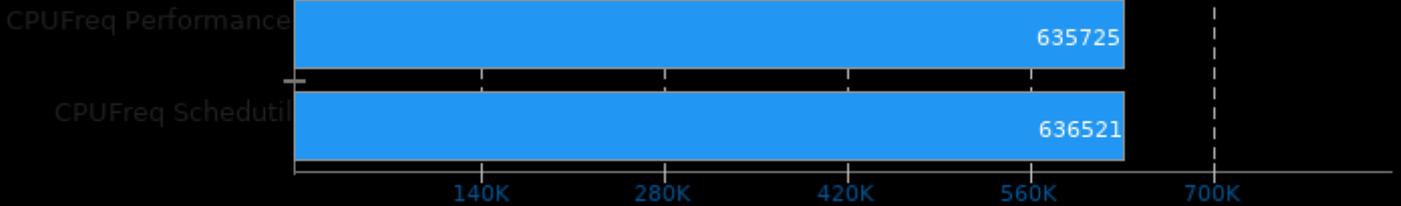
▼ Watts, Fewer Is Better



BRL-CAD 7.30.8

VGR Performance Metric

▶ VGR Performance Metric, More Is Better

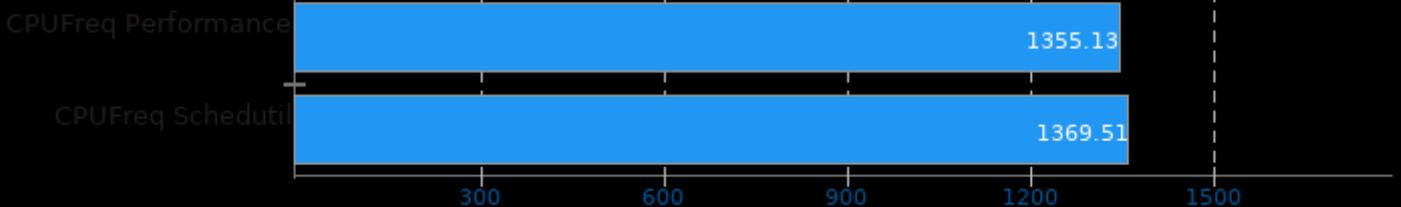


1. (CXX) g++ options: -std=c++11 -pipe -fno-strict-aliasing -fno-common -fexceptions -ftemplate-depth-128 -m64 -ggdb3 -O3 -fipa-pta -fstrength-reduce

BRL-CAD 7.30.8

VGR Performance Metric

▶ VGR Performance Metric Per Watt, More Is Better

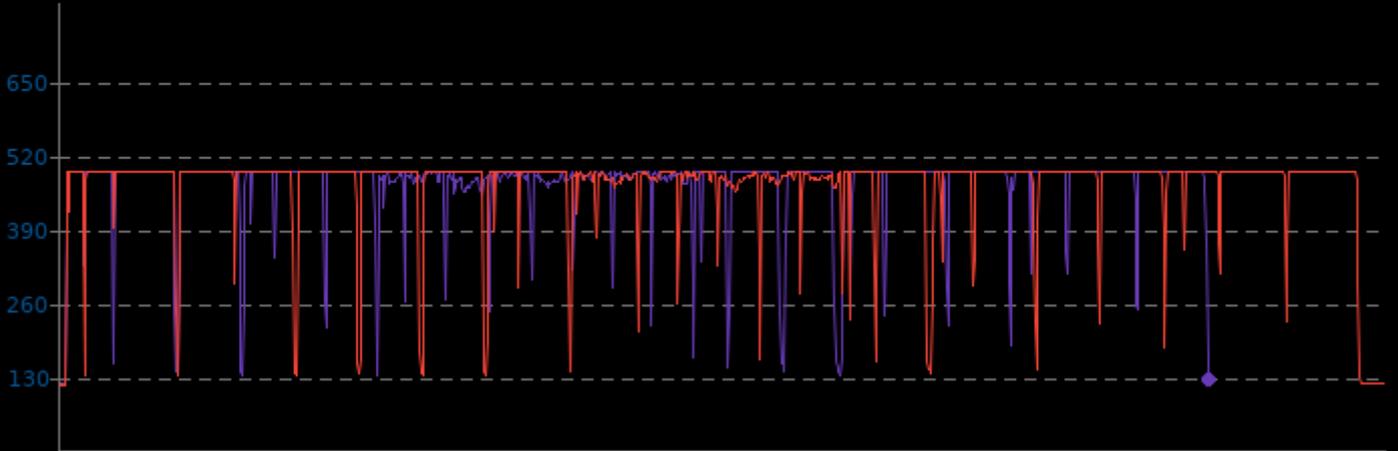


BRL-CAD 7.30.8

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.4	469.1	492.3
CPUFreq Schedutil	119.9	464.8	492.3

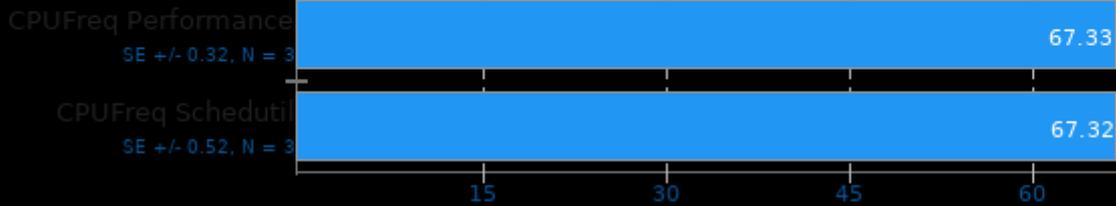
▼ Watts, Fewer Is Better



Build2 0.13

Time To Compile

◀ Seconds, Fewer Is Better

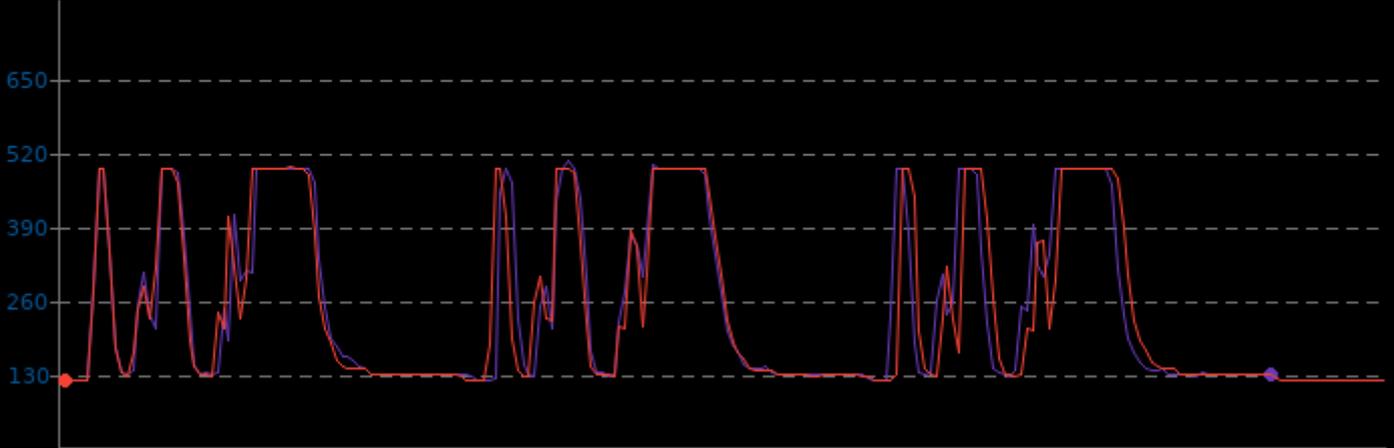


Build2 0.13

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.9	256.5	506.4
CPUFreq Schedutil	120.4	244.2	493.2

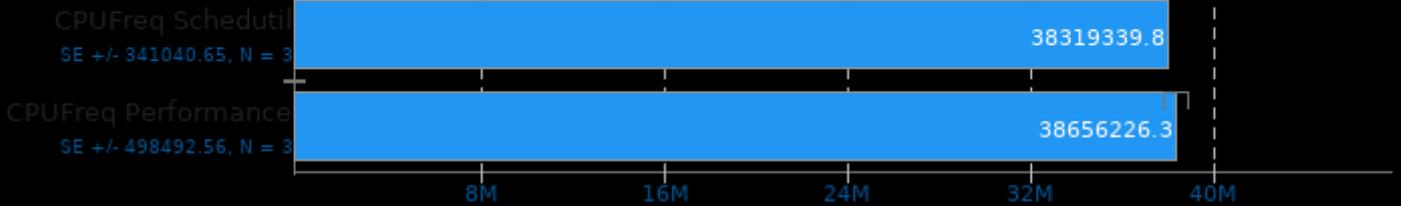
Watts, Fewer Is Better



BYTE Unix Benchmark 3.6

Computational Test: Dhrystone 2

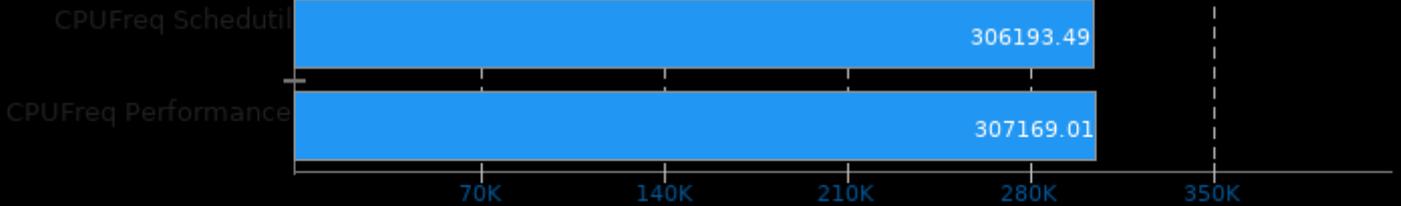
LPS, More Is Better



BYTE Unix Benchmark 3.6

Computational Test: Dhrystone 2

LPS Per Watt, More Is Better

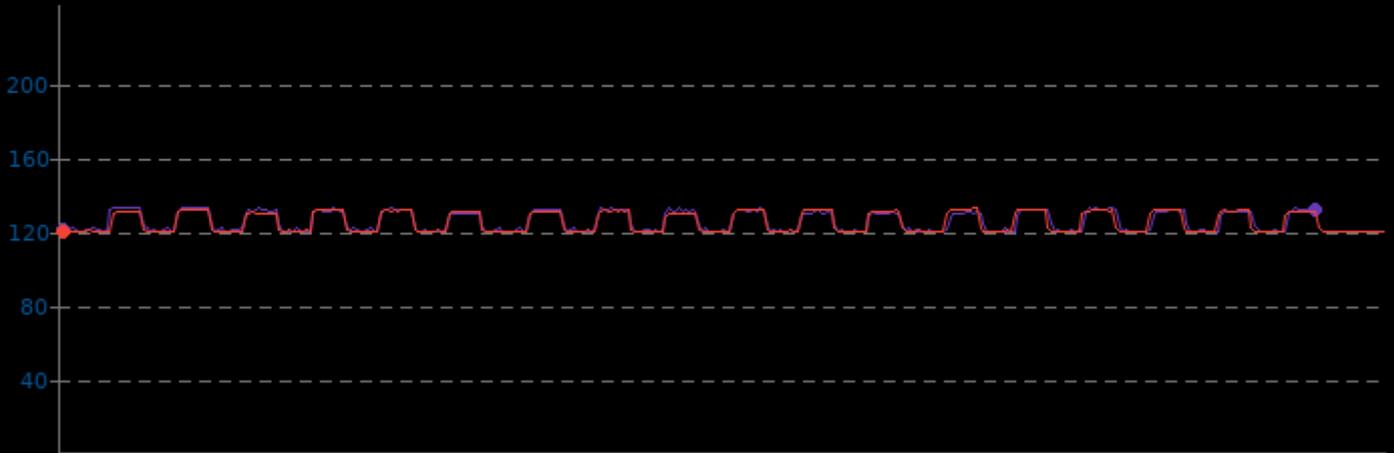


BYTE Unix Benchmark 3.6

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.0	125.8	133.3
CPUFreq Schedutil	119.7	125.1	132.4

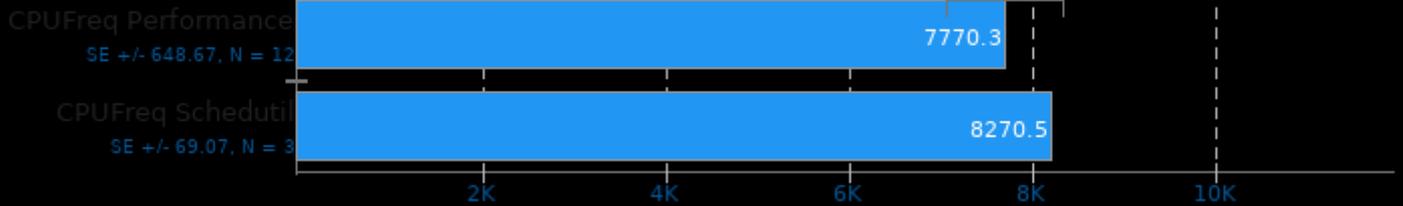
Watts, Fewer Is Better



Zstd Compression 1.4.5

Compression Level: 3

MB/s, More Is Better

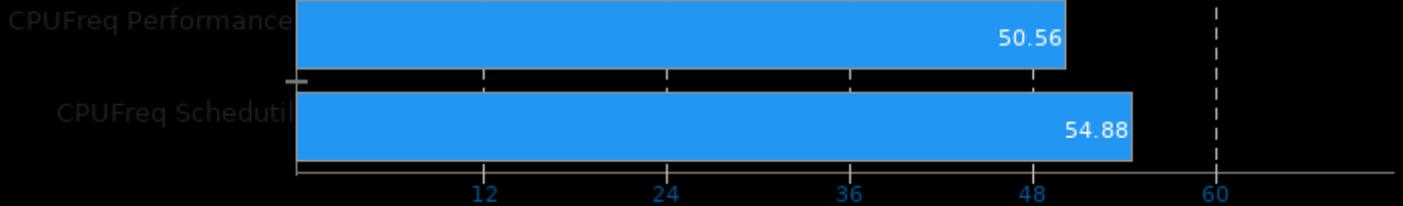


1. (CO) gcc options: -O3 -pthread -lz -lzma

Zstd Compression 1.4.5

Compression Level: 3

MB/s Per Watt, More Is Better



Zstd Compression 1.4.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.0	153.7	222.8
CPUFreq Schedutil	120.7	150.7	214.6

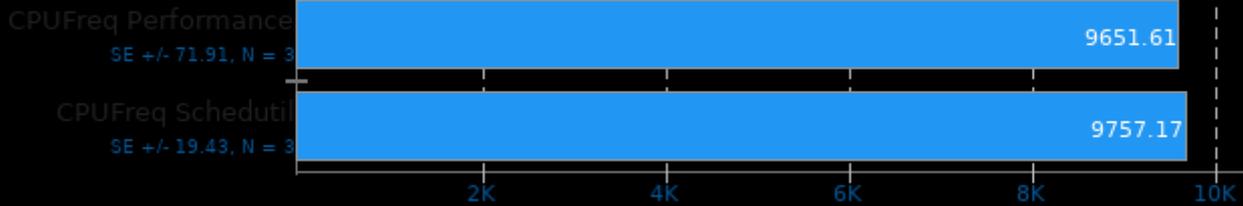
▼ Watts, Fewer Is Better



LZ4 Compression 1.9.3

Compression Level: 1 - Compression Speed

► MB/s, More Is Better

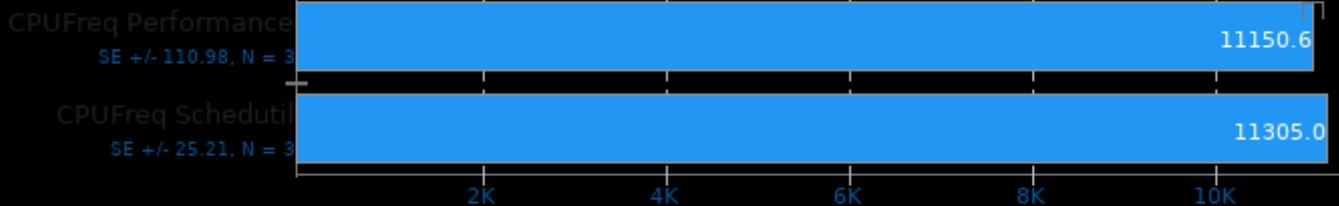


1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

Compression Level: 1 - Decompression Speed

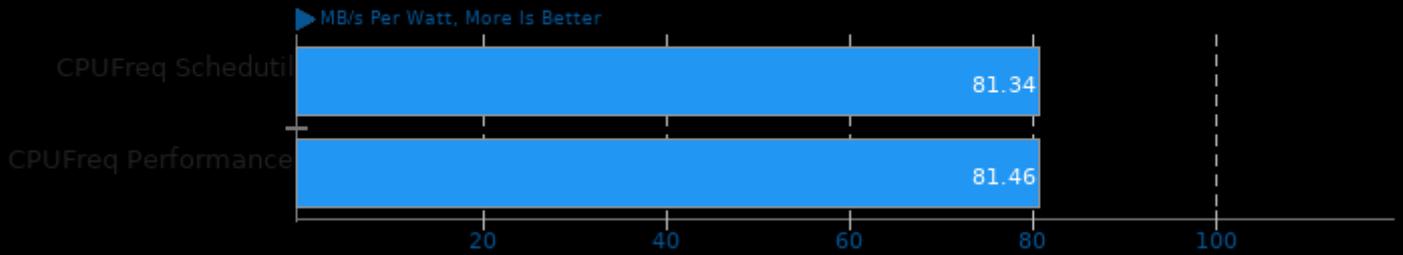
► MB/s, More Is Better



1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

Compression Level: 1 - Decompression Speed

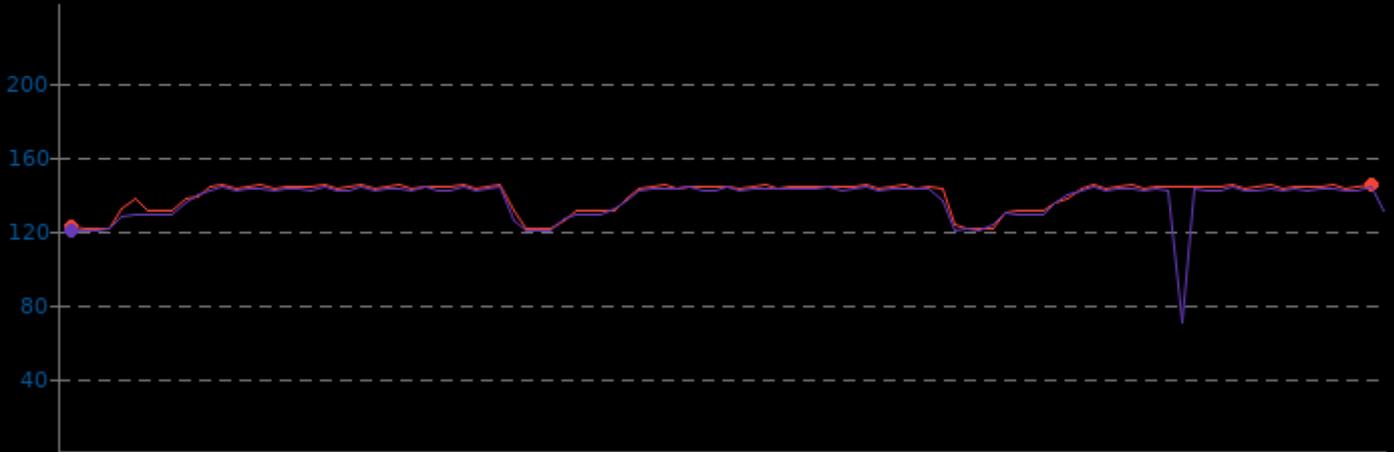


LZ4 Compression 1.9.3

CPU Power Consumption Monitor

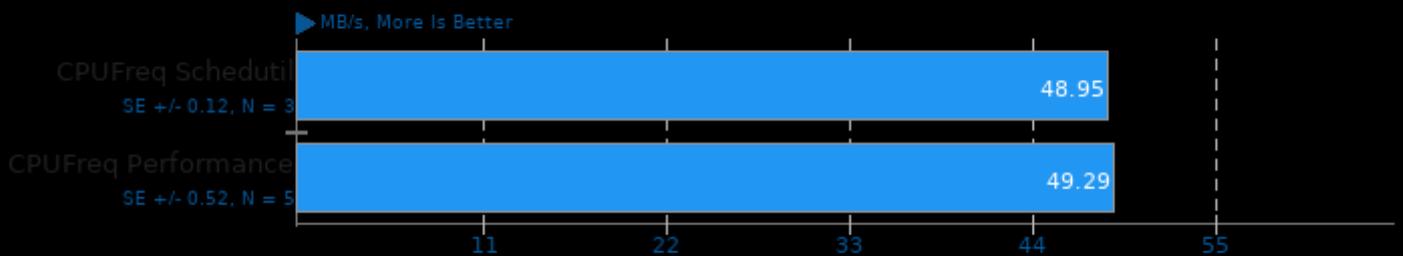
	Min	Avg	Max
CPUFreq Schedutil	120.7	139.0	145.1
CPUFreq Performance	71.1	136.9	143.9

Watts, Fewer Is Better



LZ4 Compression 1.9.3

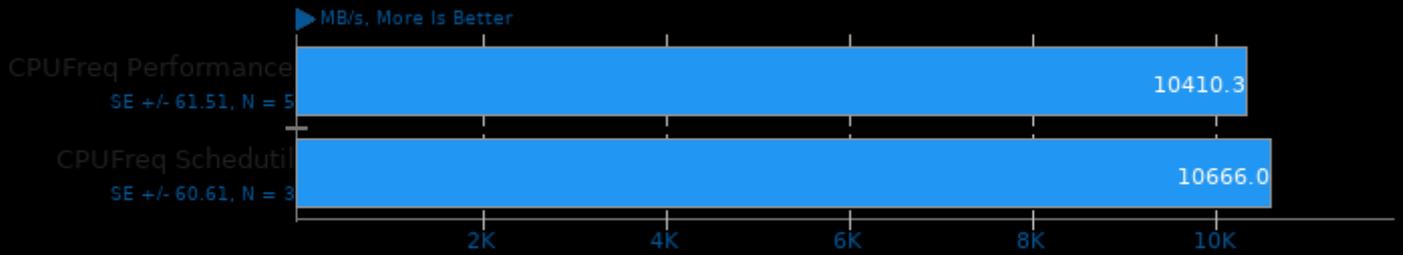
Compression Level: 3 - Compression Speed



1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

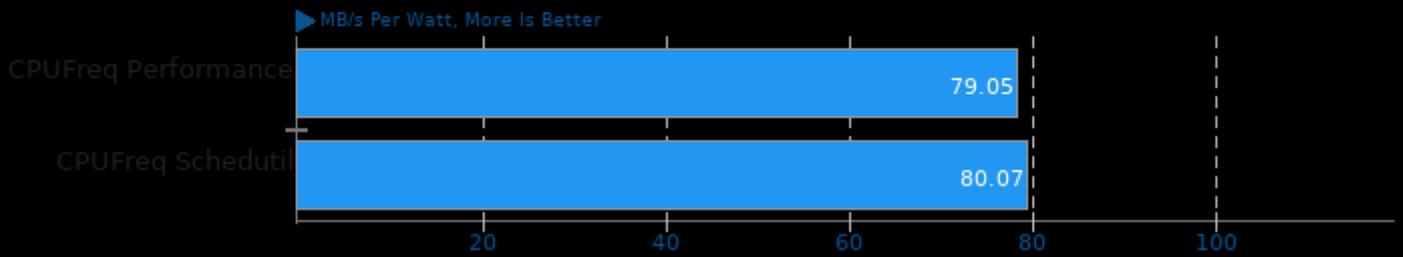
Compression Level: 3 - Decompression Speed



1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

Compression Level: 3 - Decompression Speed

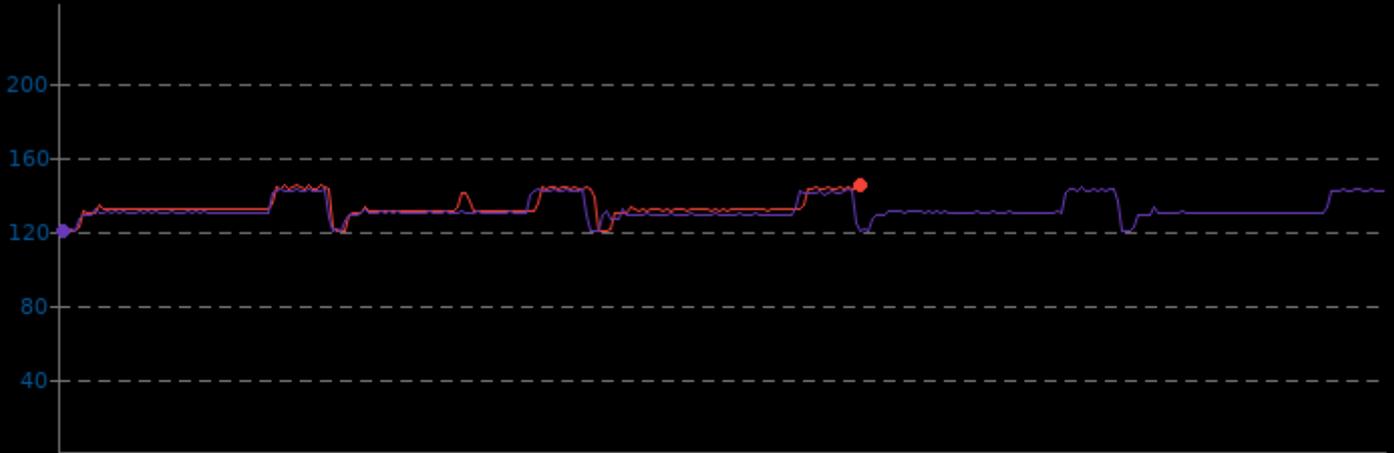


LZ4 Compression 1.9.3

CPU Power Consumption Monitor

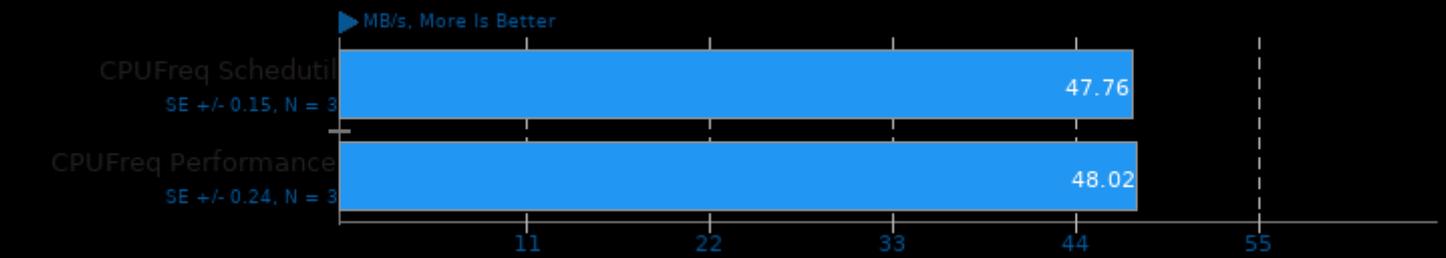
	Min	Avg	Max
CPUFreq Scheduling	120.3	133.2	144.5
CPUFreq Performance	119.7	131.7	143.1

Watts, Fewer Is Better



LZ4 Compression 1.9.3

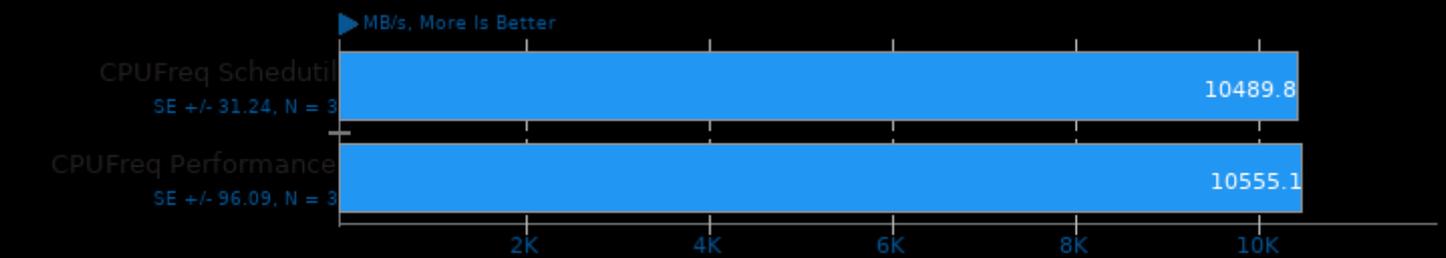
Compression Level: 9 - Compression Speed



1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

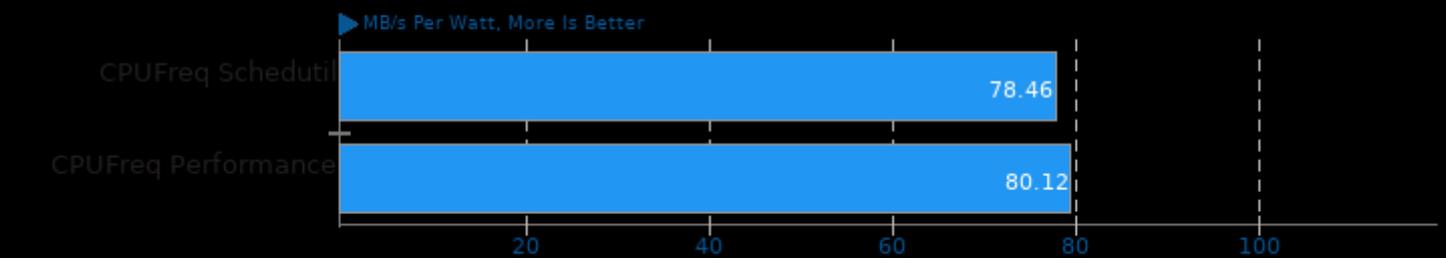
Compression Level: 9 - Decompression Speed



1. (CC) gcc options: -O3

LZ4 Compression 1.9.3

Compression Level: 9 - Decompression Speed

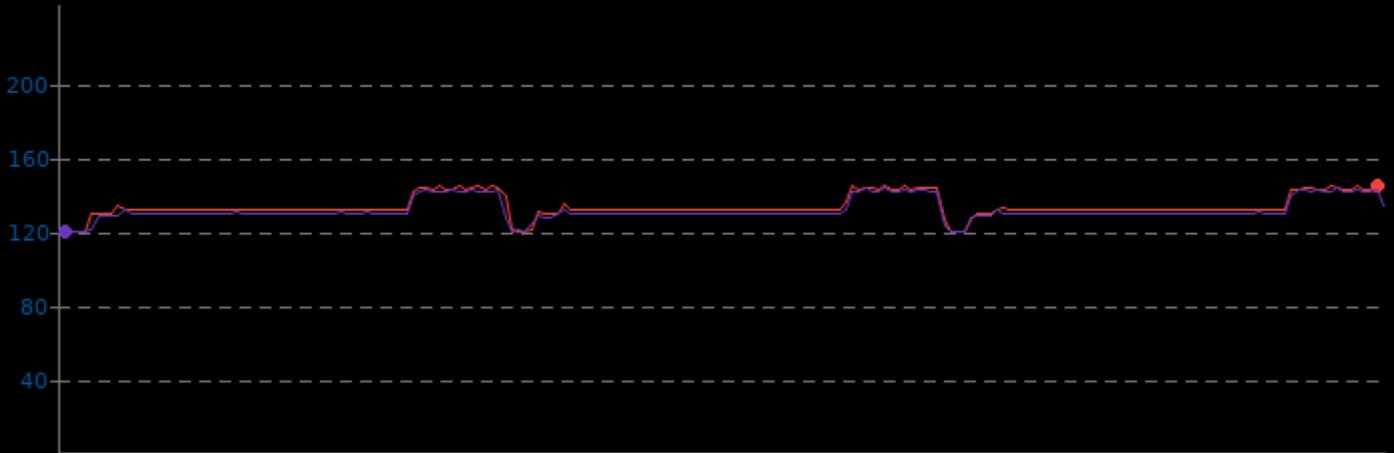


LZ4 Compression 1.9.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.1	133.7	144.7
CPUFreq Performance	119.7	131.7	143.1

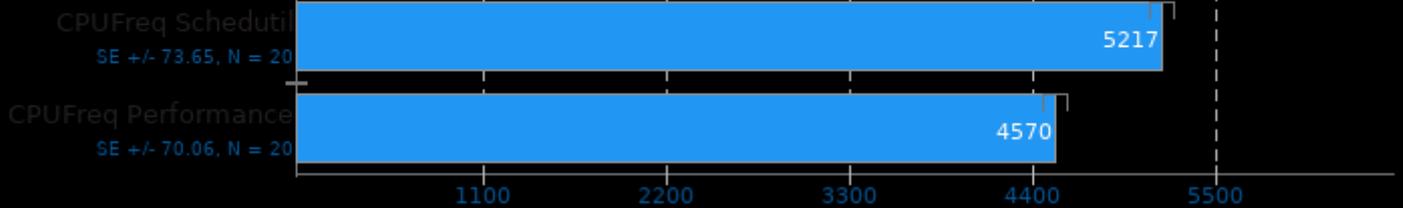
Watts, Fewer Is Better



DaCapo Benchmark 9.12-MR1

Java Test: H2

msec, Fewer Is Better

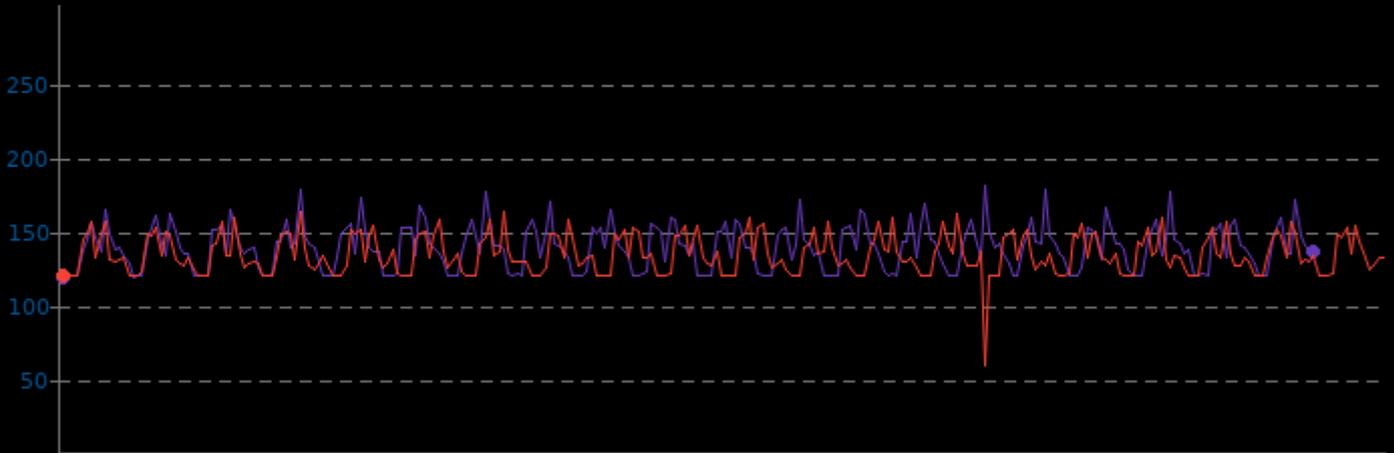


DaCapo Benchmark 9.12-MR1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.8	139.4	180.3
CPUFreq Schedutil	60.6	134.4	163.7

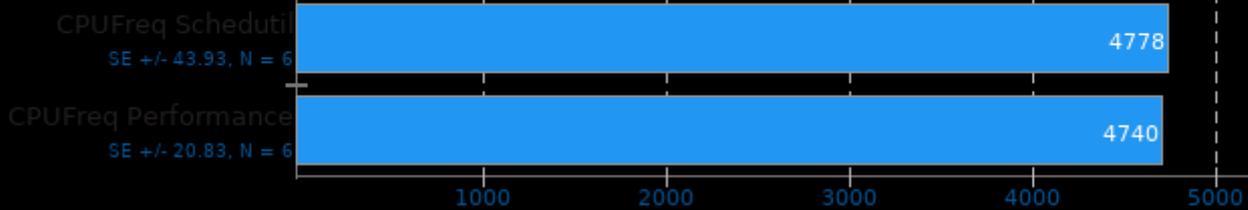
Watts, Fewer Is Better



DaCapo Benchmark 9.12-MR1

Java Test: jython

msec, Fewer Is Better

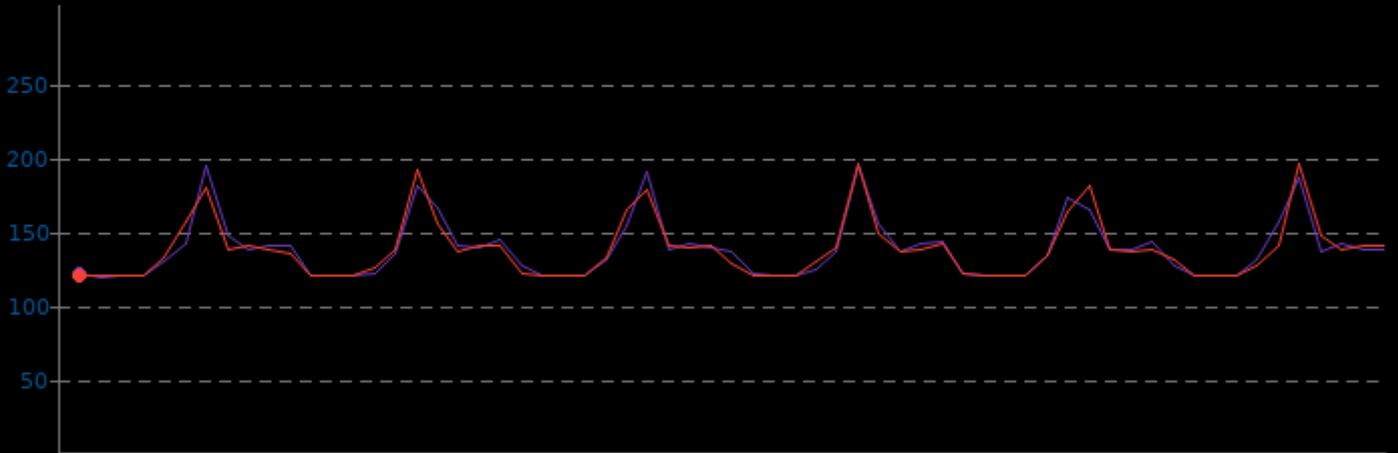


DaCapo Benchmark 9.12-MR1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.9	138.2	194.4
CPUFreq Schedutil	120.0	137.8	195.6

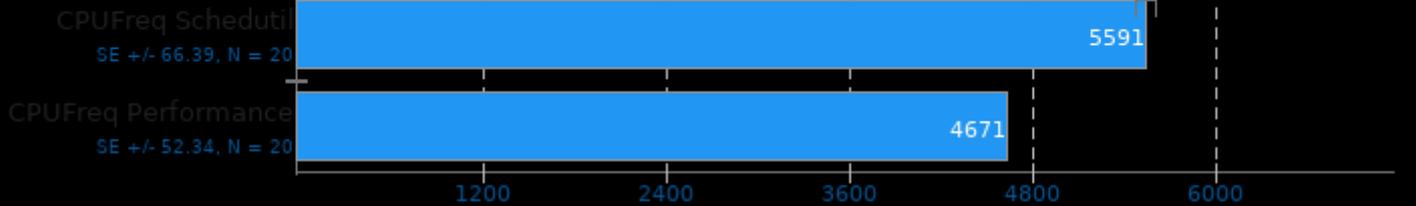
Watts, Fewer Is Better



DaCapo Benchmark 9.12-MR1

Java Test: Tradebeans

msec, Fewer Is Better

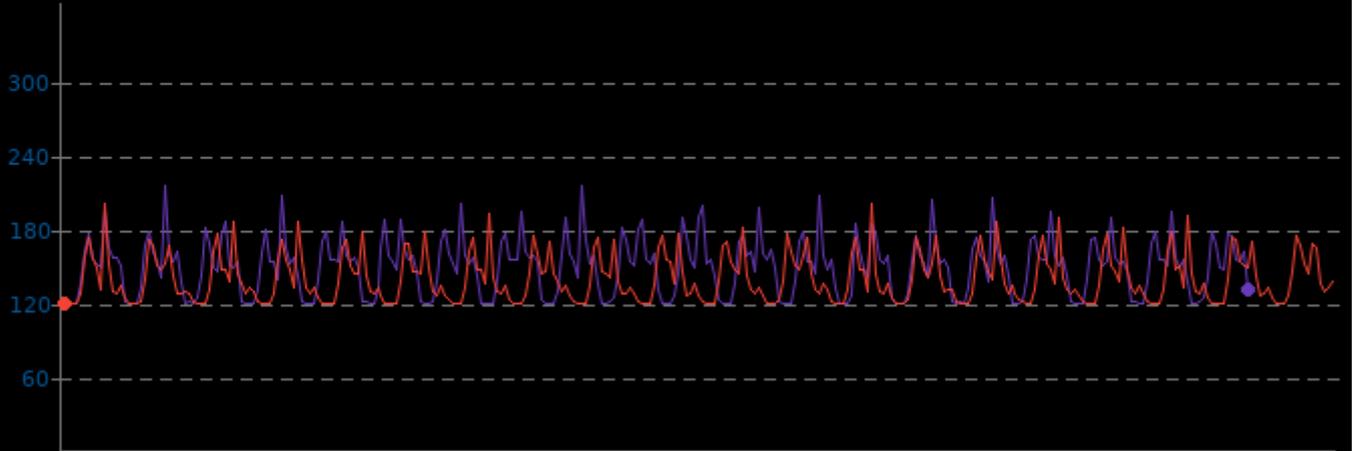


DaCapo Benchmark 9.12-MR1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.8	149.7	216.0
CPUFreq Schedutil	119.9	140.5	200.9

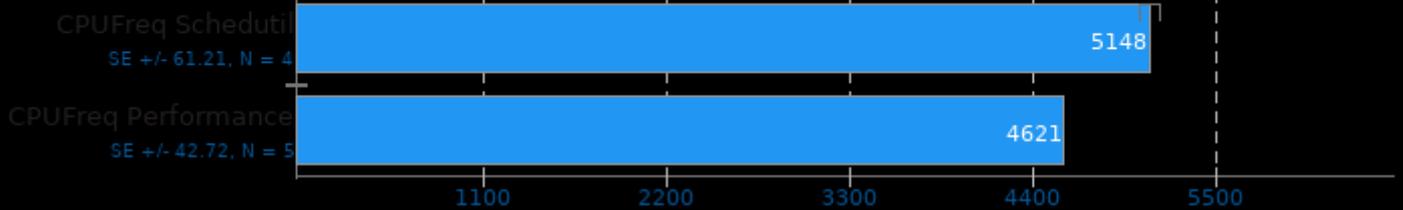
▼ Watts, Fewer Is Better



DaCapo Benchmark 9.12-MR1

Java Test: Tradesoap

◀ msec, Fewer Is Better

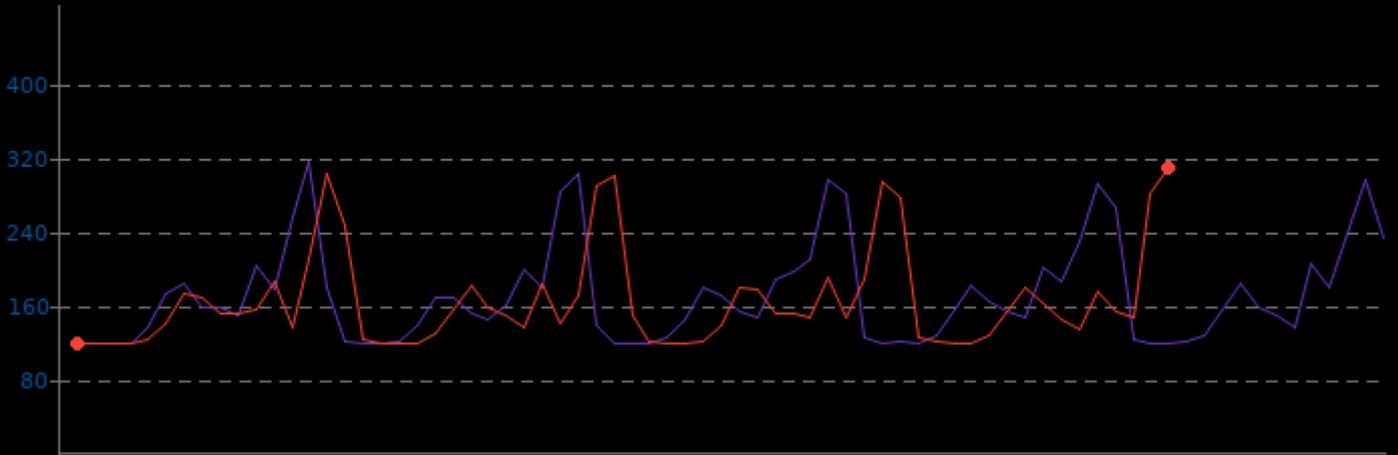


DaCapo Benchmark 9.12-MR1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.2	171.7	314.7
CPUFreq Schedutil	120.1	165.5	309.0

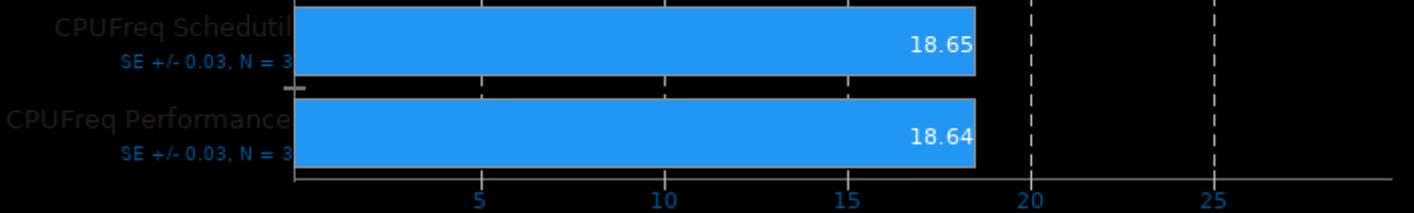
▼ Watts, Fewer Is Better



Dolfyn 0.527

Computational Fluid Dynamics

◀ Seconds, Fewer Is Better

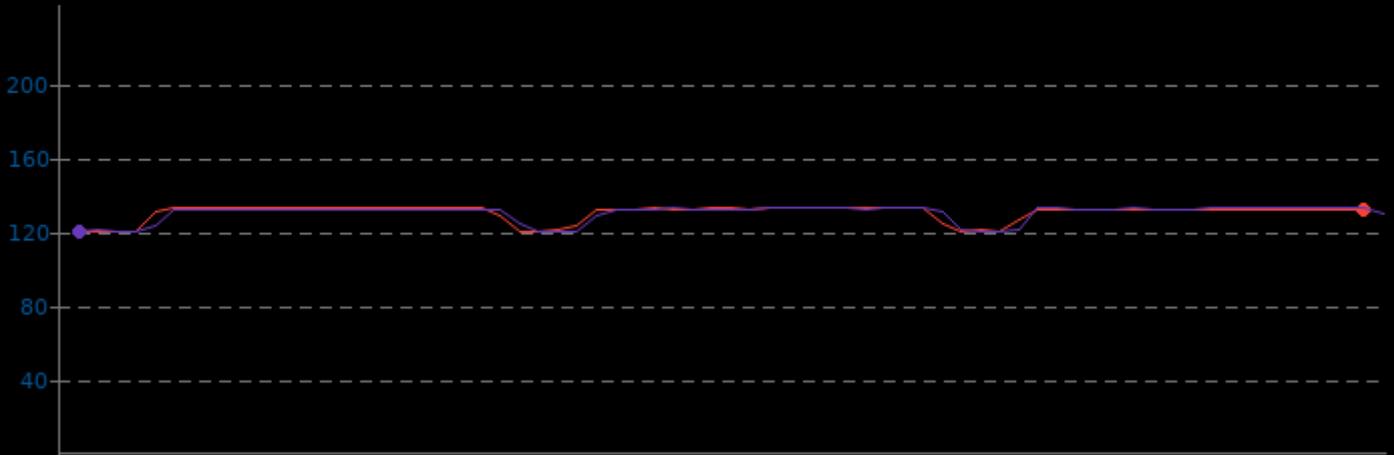


Dolfyn 0.527

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.8	130.2	133.2
CPUFreq Performance	119.9	129.9	132.6

Watts, Fewer Is Better



OSPray 1.8.5

Demo: Magnetic Reconnection - Renderer: SciVis

FPS, More Is Better

CPUFreq Schedutil
SE +/- 0.23, N = 6



CPUFreq Performance
SE +/- 0.24, N = 6



OSPray 1.8.5

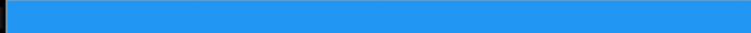
Demo: Magnetic Reconnection - Renderer: SciVis

FPS Per Watt, More Is Better

CPUFreq Performance



CPUFreq Schedutil

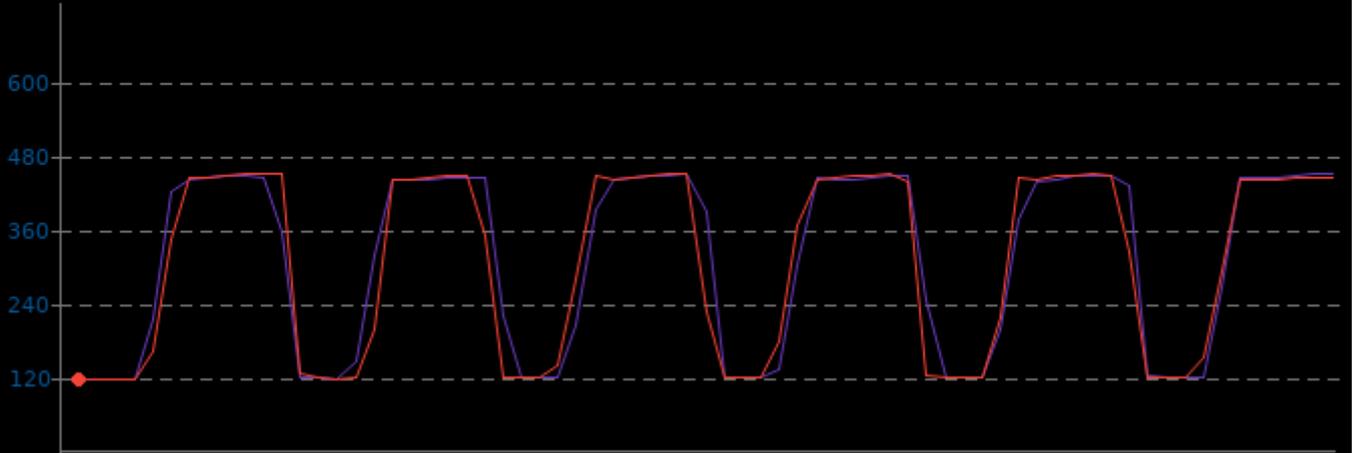


OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.7	314.6	450.2
CPUFreq Schedutil	119.6	309.6	449.8

▼ Watts, Fewer Is Better



OSPray 1.8.5

Demo: Magnetic Reconnection - Renderer: Path Tracer

► FPS, More Is Better

CPUFreq Schedutil

MIN: 90.91 / MAX: 333.33

250.00

CPUFreq Performance

MIN: 100 / MAX: 500

333.33

SE +/- 0.00, N = 11

70 140 210 280 350

OSPray 1.8.5

Demo: Magnetic Reconnection - Renderer: Path Tracer

► FPS Per Watt, More Is Better

CPUFreq Schedutil

1.65

CPUFreq Performance

1.99

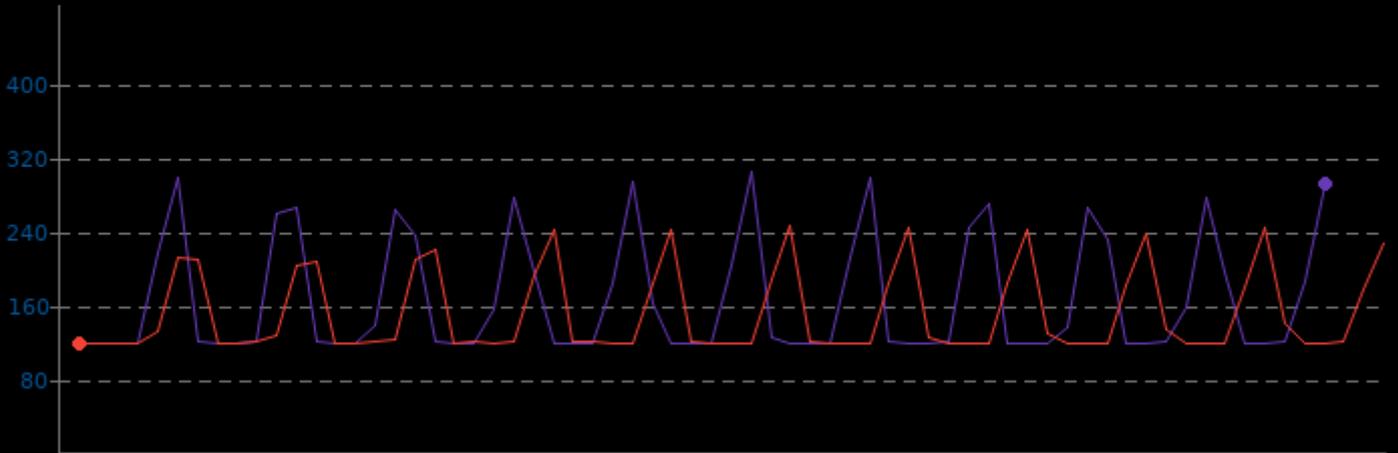
0.4478 0.8956 1.3434 1.7912 2.239

OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.4	167.3	303.3
CPUFreq Schedutil	120.2	151.8	245.9

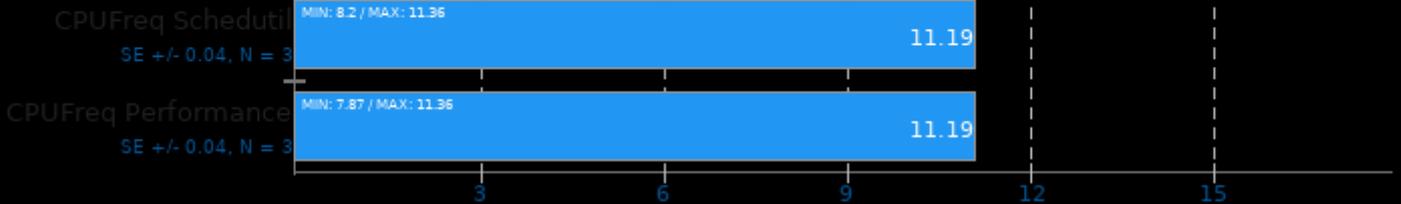
Watts, Fewer Is Better



OSPray 1.8.5

Demo: XFrog Forest - Renderer: SciVis

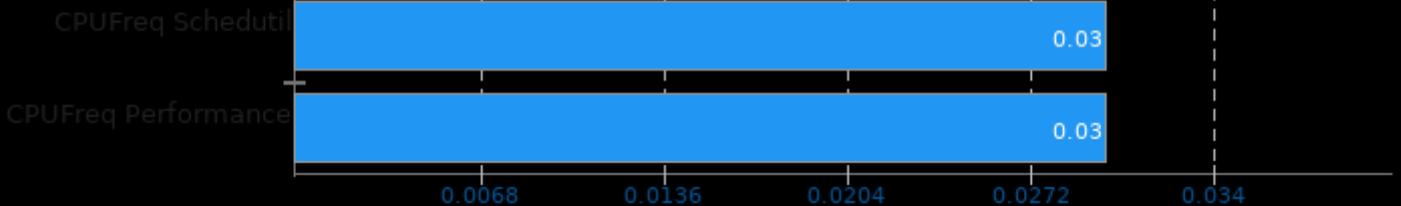
FPS, More Is Better



OSPray 1.8.5

Demo: XFrog Forest - Renderer: SciVis

FPS Per Watt, More Is Better

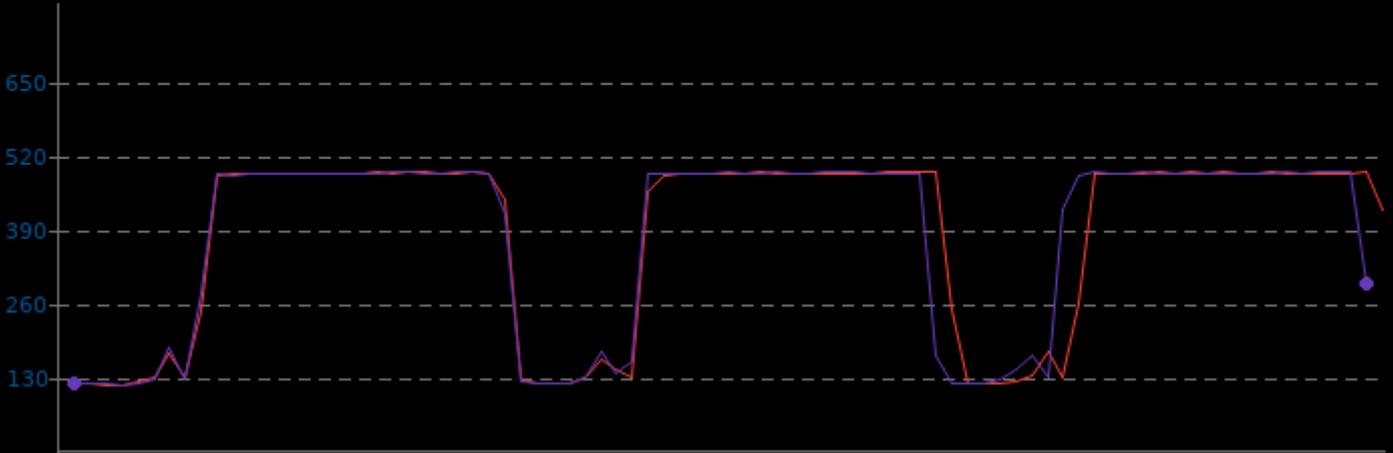


OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Scheduling	120.0	379.8	489.7
CPUFreq Performance	120.1	378.9	489.6

Watts, Fewer Is Better



OSPray 1.8.5

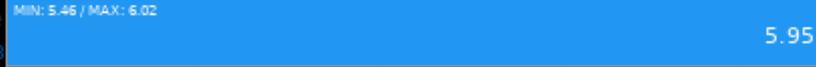
Demo: XFrog Forest - Renderer: Path Tracer

FPS, More Is Better

CPUFreq Scheduling
SE +/- 0.00, N = 3



CPUFreq Performance
SE +/- 0.00, N = 3



1.3388 2.6776 4.0164 5.3552 6.694

OSPray 1.8.5

Demo: XFrog Forest - Renderer: Path Tracer

FPS Per Watt, More Is Better

CPUFreq Scheduling



CPUFreq Performance



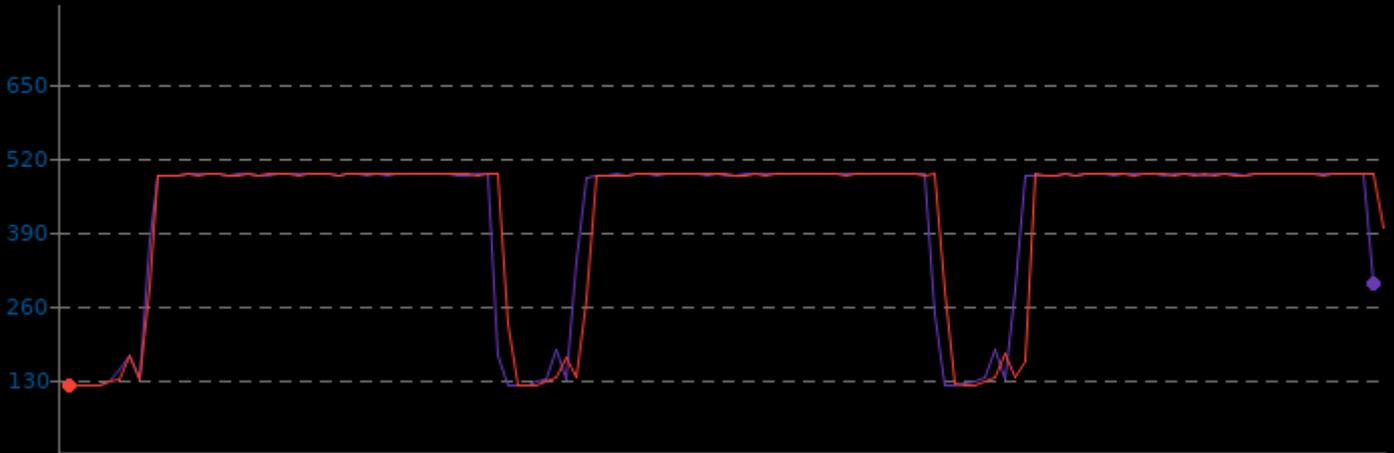
0.0023 0.0046 0.0069 0.0092 0.0115

OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.9	421.1	490.5
CPUFreq Schedutil	121.0	420.8	490.6

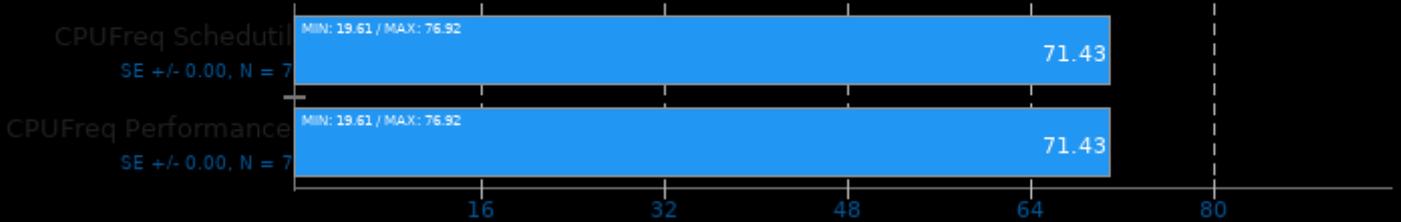
Watts, Fewer Is Better



OSPray 1.8.5

Demo: NASA Streamlines - Renderer: SciVis

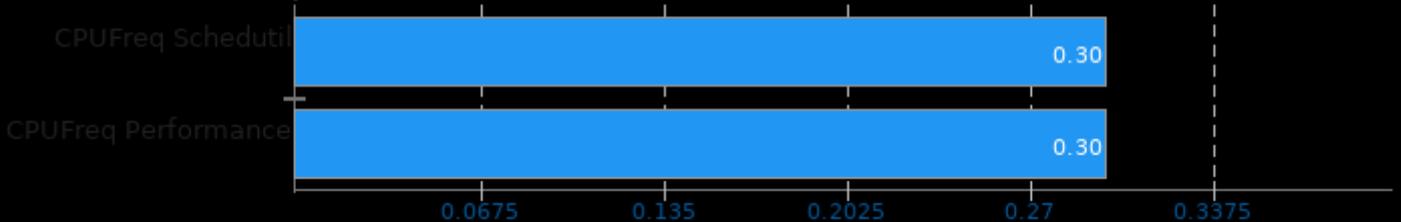
FPS, More Is Better



OSPray 1.8.5

Demo: NASA Streamlines - Renderer: SciVis

FPS Per Watt, More Is Better

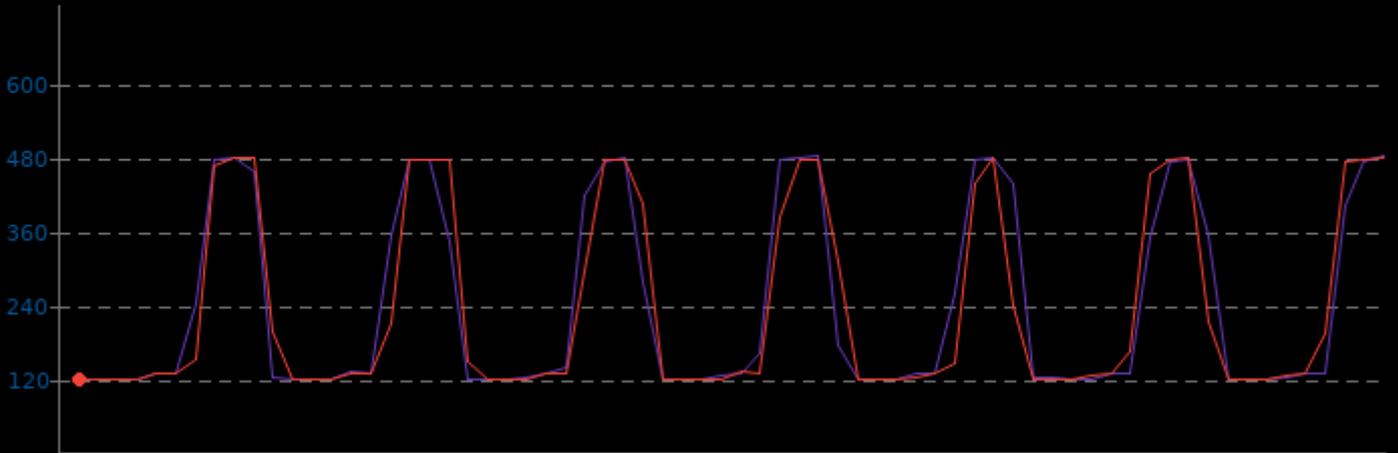


OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.3	241.6	481.2
CPUFreq Schedutil	121.4	238.8	480.3

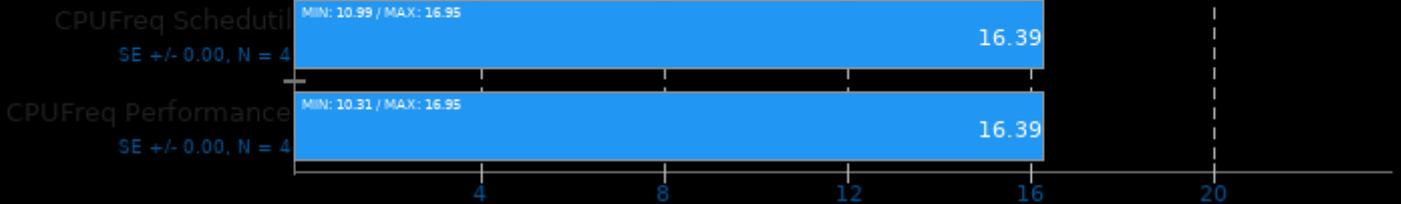
Watts, Fewer Is Better



OSPray 1.8.5

Demo: NASA Streamlines - Renderer: Path Tracer

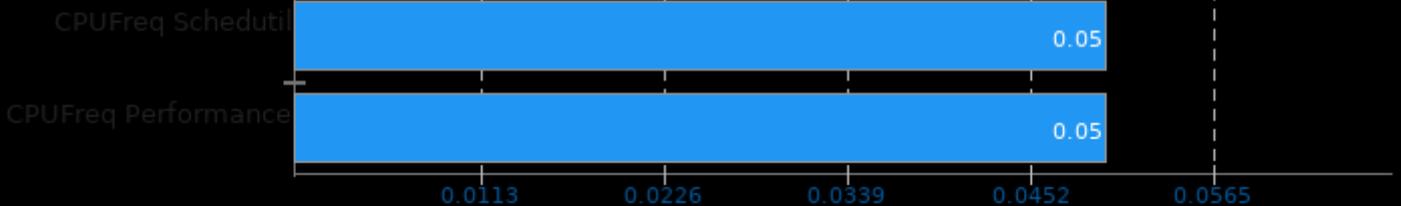
FPS, More Is Better



OSPray 1.8.5

Demo: NASA Streamlines - Renderer: Path Tracer

FPS Per Watt, More Is Better

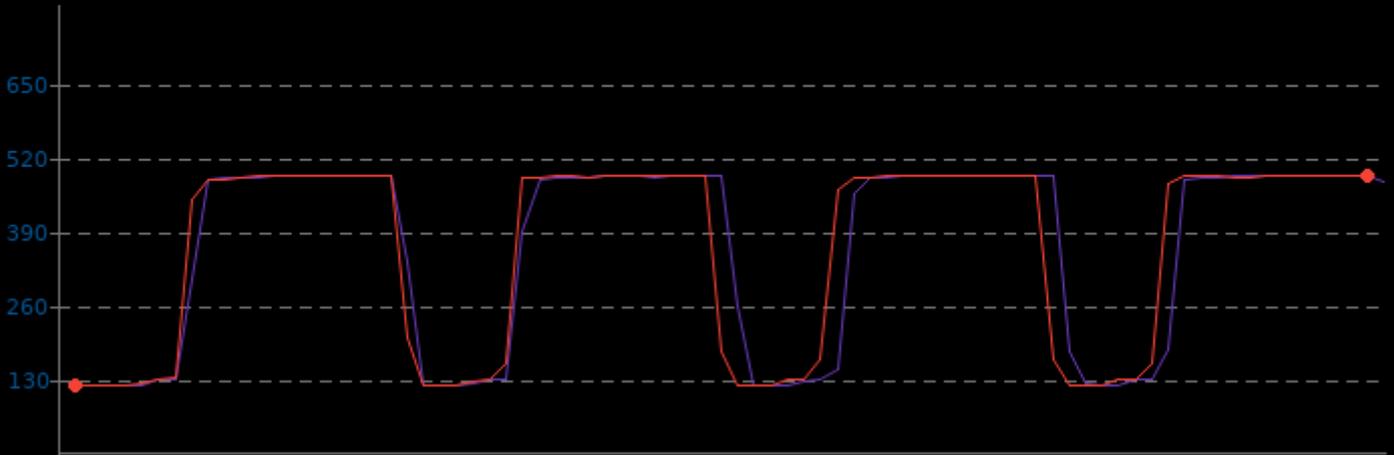


OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.7	362.0	487.7
CPUFreq Schedutil	120.6	361.1	488.0

Watts, Fewer Is Better



OSPray 1.8.5

Demo: San Miguel - Renderer: SciVis

FPS, More Is Better

CPUFreq Schedutil

SE +/- 0.58, N = 5



CPUFreq Performance

SE +/- 0.00, N = 3



OSPray 1.8.5

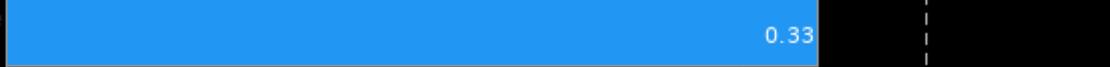
Demo: San Miguel - Renderer: SciVis

FPS Per Watt, More Is Better

CPUFreq Schedutil



CPUFreq Performance

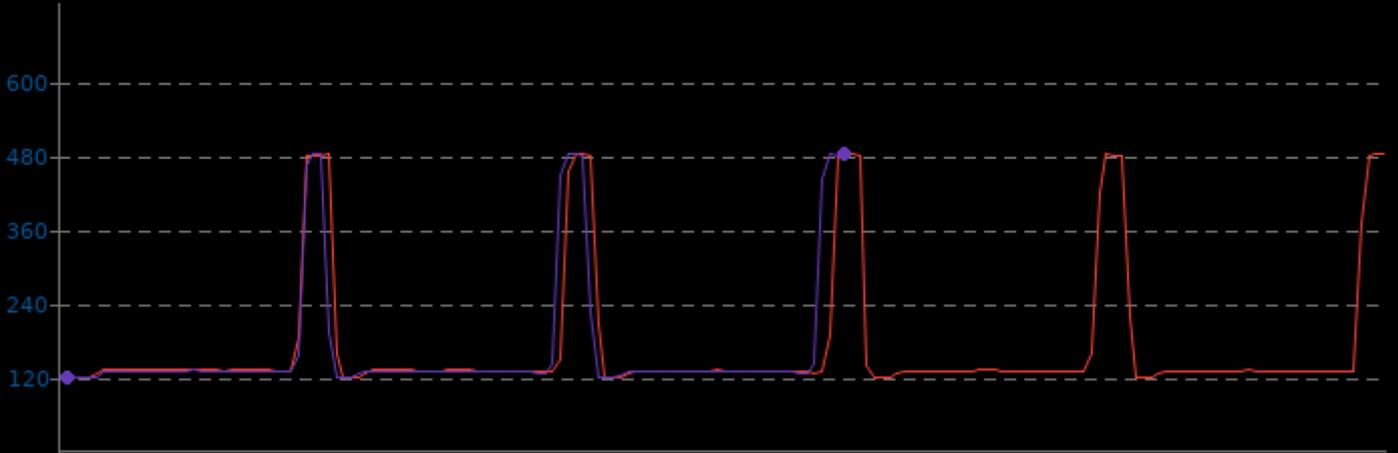


OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.7	171.8	482.2
CPUFreq Performance	120.6	168.2	482.0

Watts, Fewer Is Better



OSPray 1.8.5

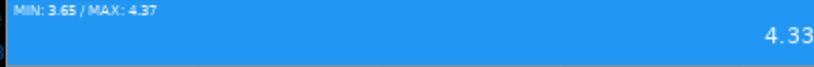
Demo: San Miguel - Renderer: Path Tracer

FPS, More Is Better

CPUFreq Schedutil
SE +/- 0.01, N = 3



CPUFreq Performance
SE +/- 0.00, N = 3



0.9743 1.9486 2.9229 3.8972 4.8715

OSPray 1.8.5

Demo: San Miguel - Renderer: Path Tracer

FPS Per Watt, More Is Better

CPUFreq Schedutil



CPUFreq Performance



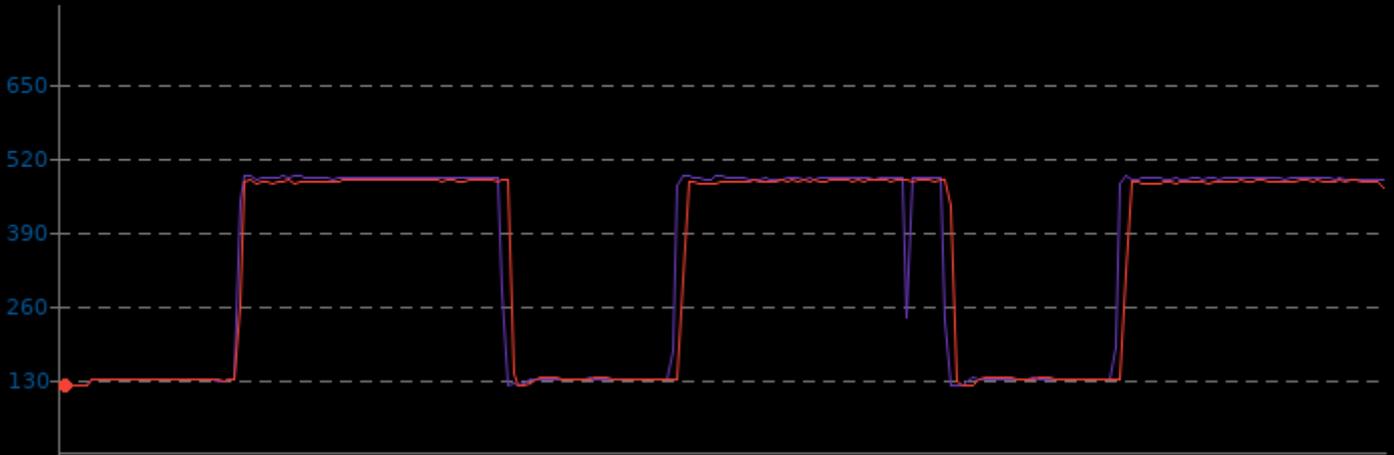
0.0023 0.0046 0.0069 0.0092 0.0115

OSPray 1.8.5

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.1	343.6	488.9
CPUFreq Schedutil	120.2	341.0	480.2

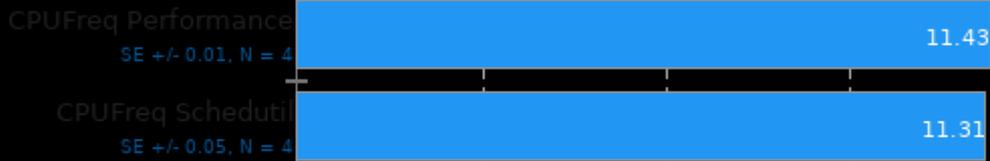
▼ Watts, Fewer Is Better



POV-Ray 3.7.0.7

Trace Time

◀ Seconds, Fewer Is Better



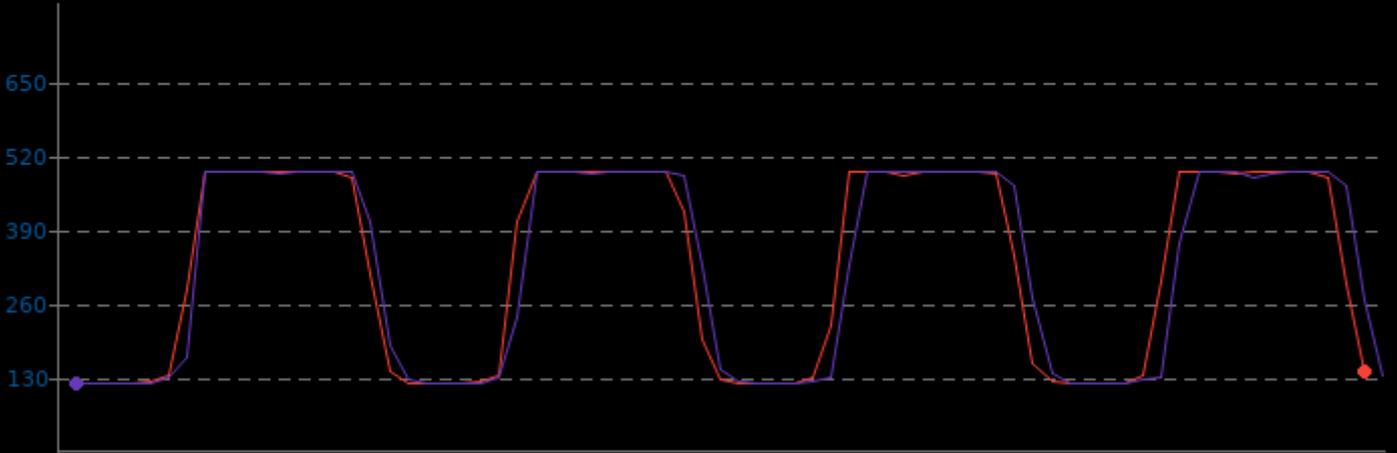
1. (CXX) g++ options: -pipe -O3 -fast-math -march=native -pthread -fSDI -fSM -fICE -fX11 -fllm1mf -fllm1mf-2_5 -fllmath-2_5 -fHalf-2_5 -fllx-2_5 -fllxMath-

POV-Ray 3.7.0.7

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.5	329.6	492.1
CPUFreq Performance	121.6	327.6	492.1

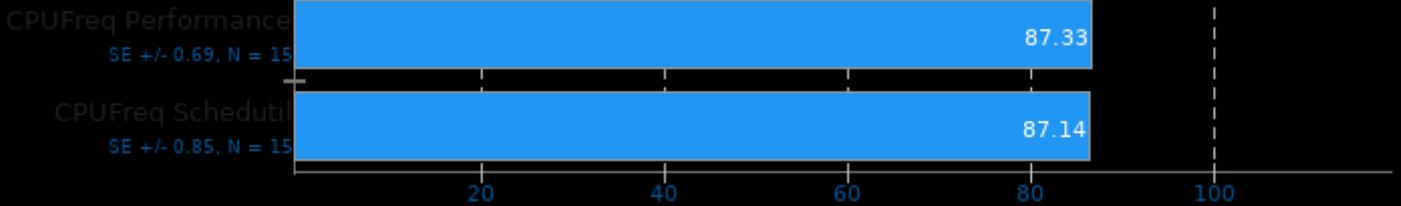
Watts, Fewer Is Better



YafaRay 3.4.1

Total Time For Sample Scene

Seconds, Fewer Is Better

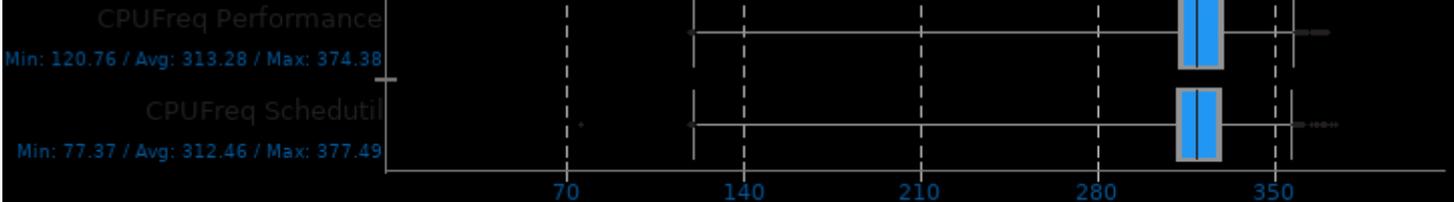


1. (CXX) g++ options: -std=c++11 -O3 -ffast-math -rdynamic -ldl -lmath -llm1mf -llex -lHalf -lz -llmThread -lxml2 -lfreetype -lpthread

YafaRay 3.4.1

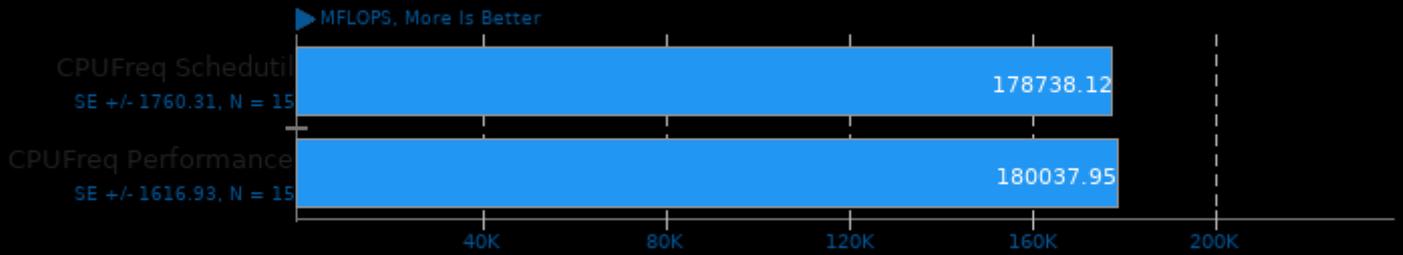
CPU Power Consumption Monitor

Watts, Fewer Is Better



FFTE 7.0

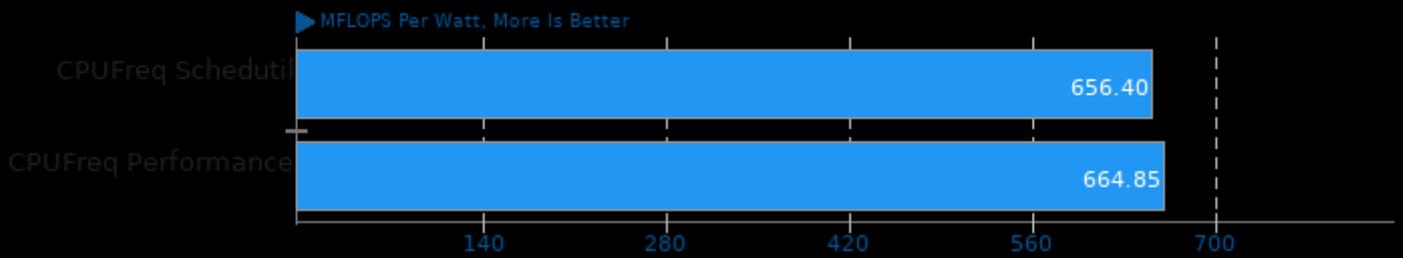
N=256, 3D Complex FFT Routine



1. (F9X) gfortran options: -O3 -fomit-frame-pointer -fopenmp

FFTE 7.0

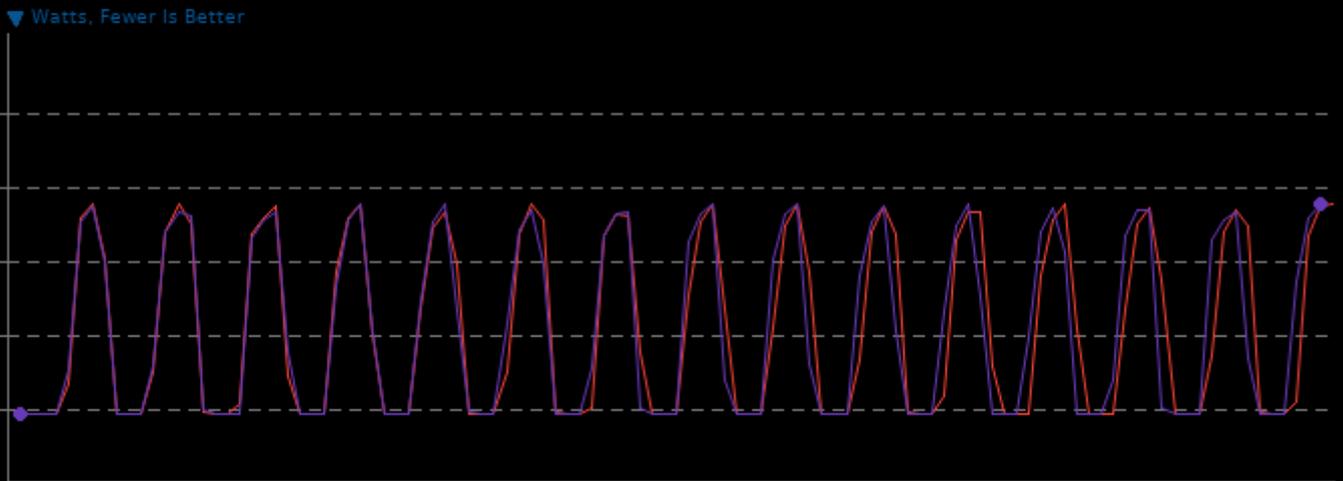
N=256, 3D Complex FFT Routine



FFTE 7.0

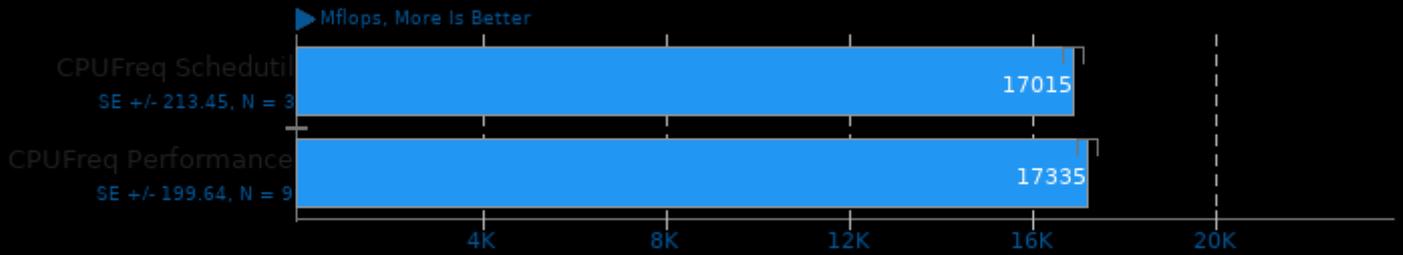
CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.3	272.3	488.9
CPUFreq Performance	121.3	270.8	488.6



FFTW 3.3.6

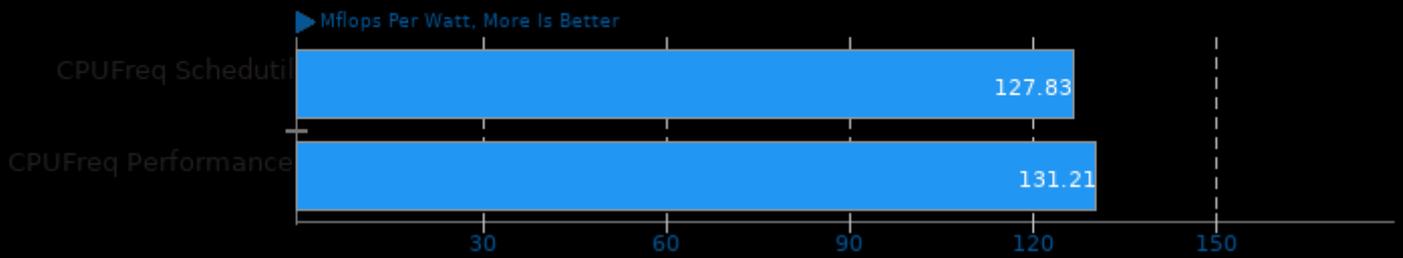
Build: Float + SSE - Size: 2D FFT Size 4096



1. (CC) gcc options: -pthread -O3 -fomit-frame-pointer -mtune=native -malign-double -fstrict-aliasing -fno-schedule-insns -ffast-math -lm

FFTW 3.3.6

Build: Float + SSE - Size: 2D FFT Size 4096



FFTW 3.3.6

CPU Power Consumption Monitor

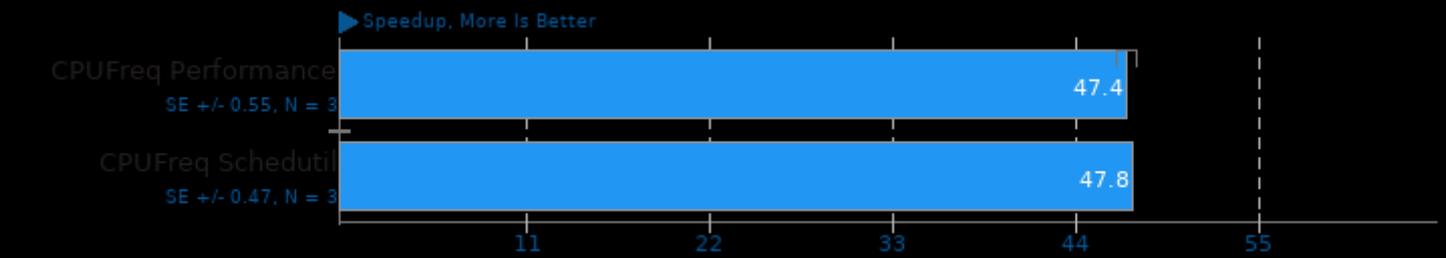
	Min	Avg	Max
CPUFreq Scheduling	120.1	133.1	142.8
CPUFreq Performance	65.2	132.1	150.1

▼ Watts, Fewer Is Better



CLOMP 1.2

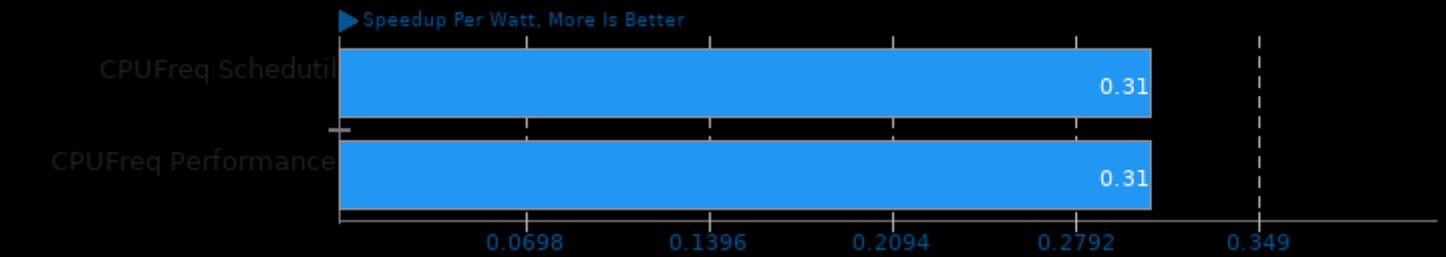
Static OMP Speedup



1. (CC) gcc options: -fopenmp -O3 -lm

CLOMP 1.2

Static OMP Speedup

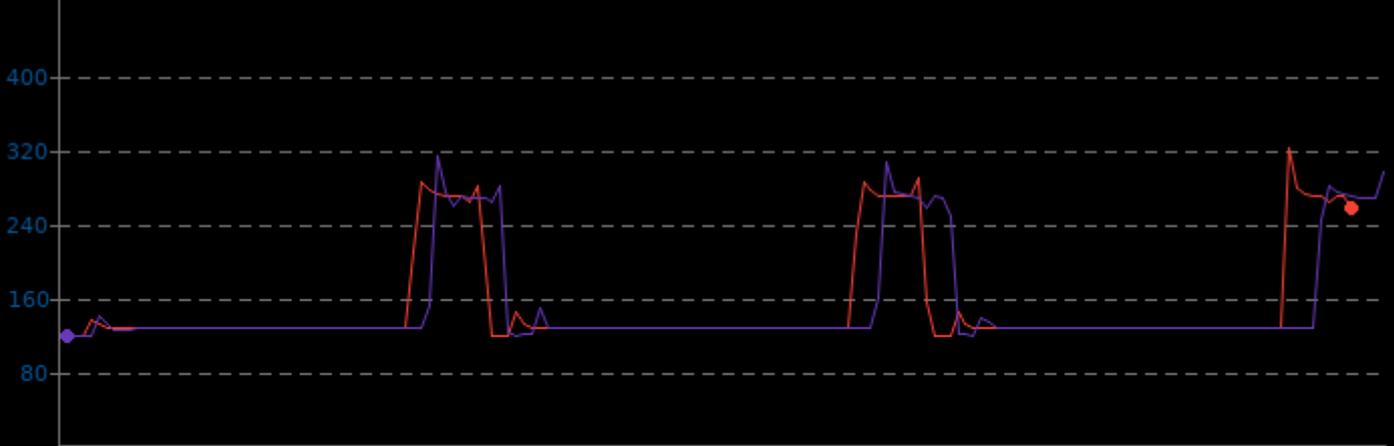


CLOMP 1.2

CPU Power Consumption Monitor

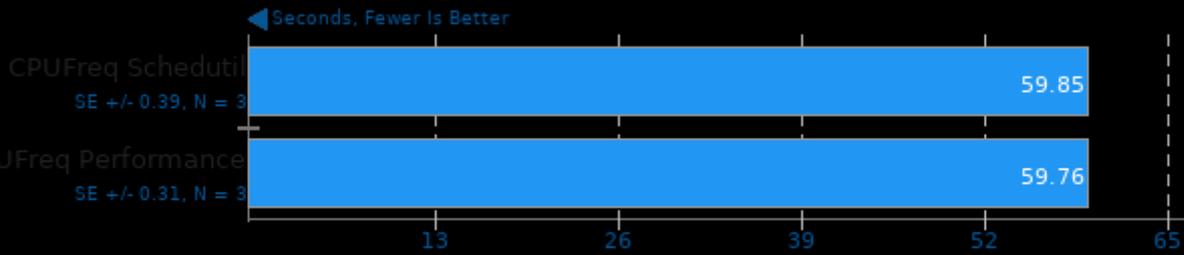
	Min	Avg	Max
CPUFreq Scheduling	119.9	152.6	321.5
CPUFreq Performance	119.9	151.3	312.5

Watts, Fewer Is Better



GPAW 20.1

Input: Carbon Nanotube



1. (CC) gcc options: -pthread -shared -fwrapv -O2 -xc -lblas -lmpi

GPAW 20.1

CPU Power Consumption Monitor

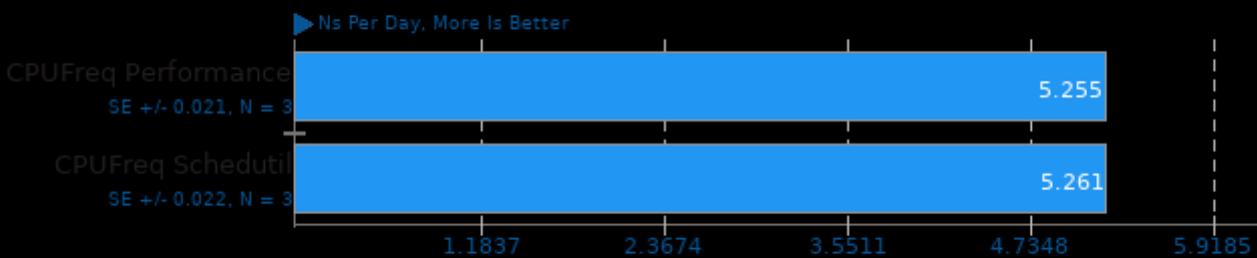
	Min	Avg	Max
CPUFreq Scheduling	120.4	404.8	464.0
CPUFreq Performance	120.3	403.9	464.2

▼ Watts, Fewer Is Better



GROMACS 2020.3

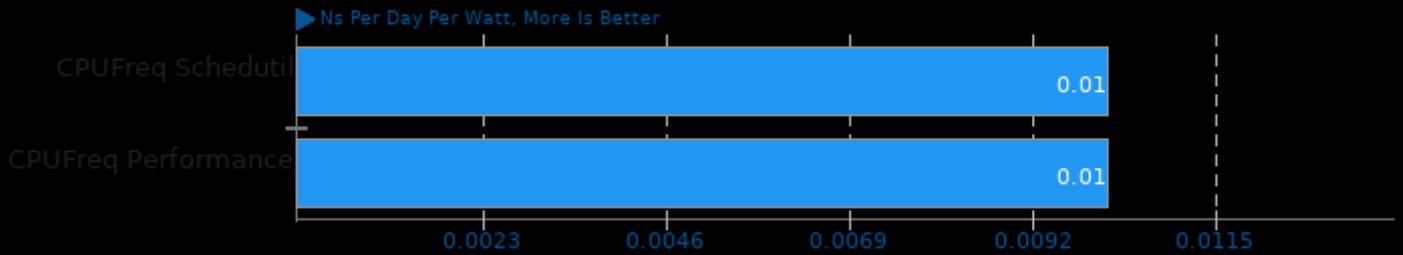
Water Benchmark



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

GROMACS 2020.3

Water Benchmark

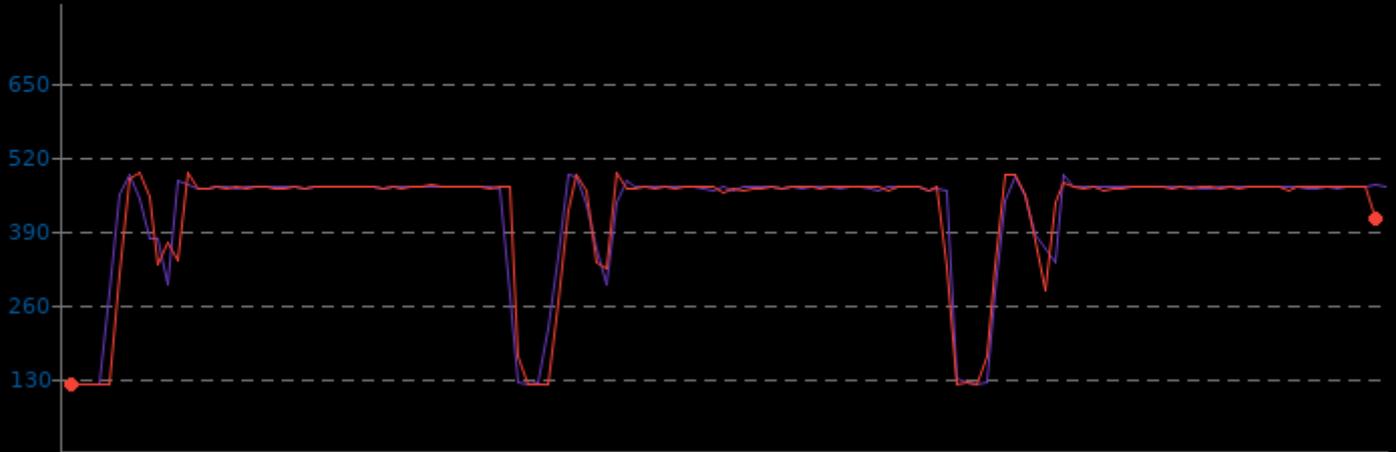


GROMACS 2020.3

CPU Power Consumption Monitor

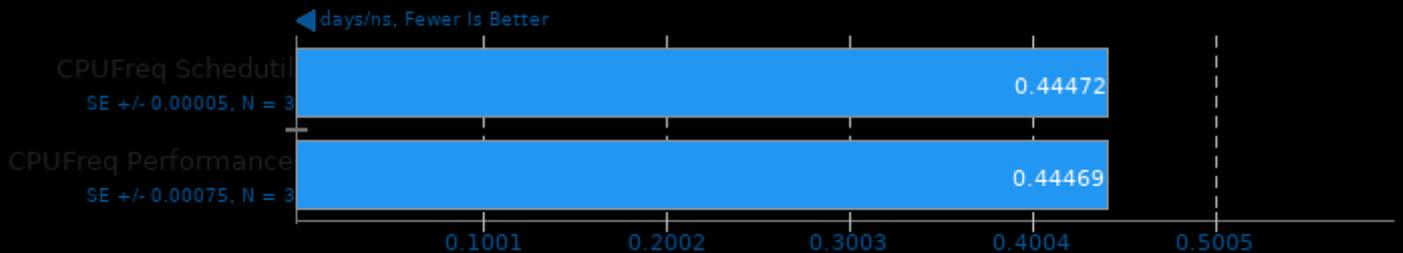
	Min	Avg	Max
CPUFreq Performance	121.4	424.3	488.3
CPUFreq Schedutil	121.3	421.6	491.7

▼ Watts, Fewer Is Better



NAMD 2.14

ATPase Simulation - 327,506 Atoms

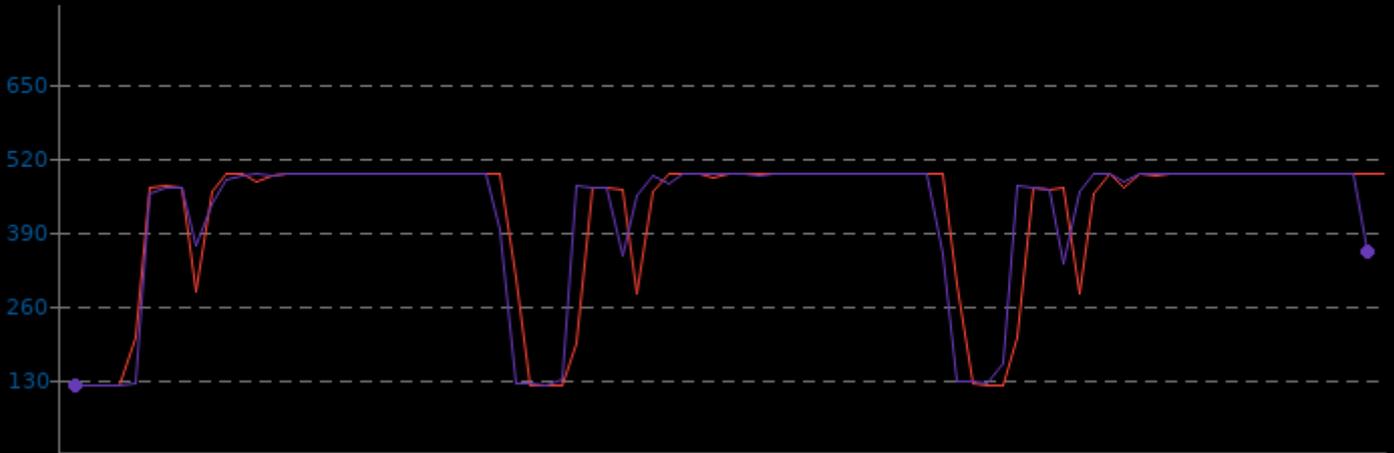


NAMD 2.14

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.6	423.2	492.1
CPUFreq Performance	122.0	422.4	492.1

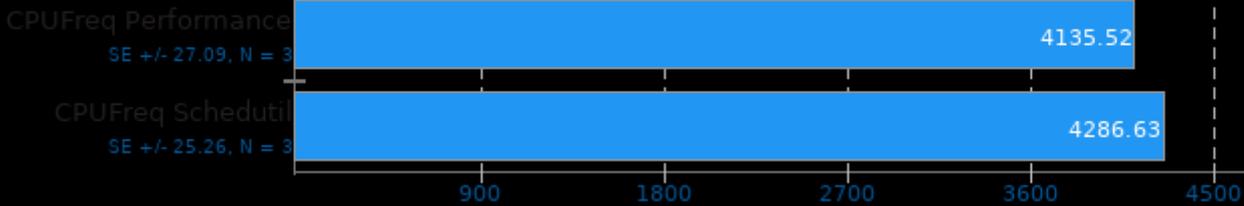
Watts, Fewer Is Better



Himeno Benchmark 3.0

Poisson Pressure Solver

MFLOPS, More Is Better

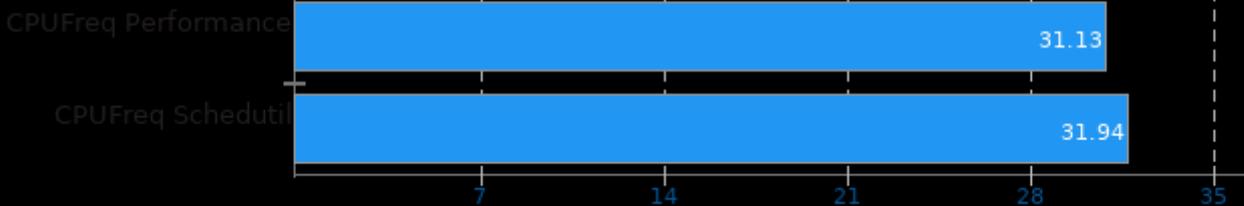


1. (CC) gcc options: -O3 -mavx2

Himeno Benchmark 3.0

Poisson Pressure Solver

MFLOPS Per Watt, More Is Better

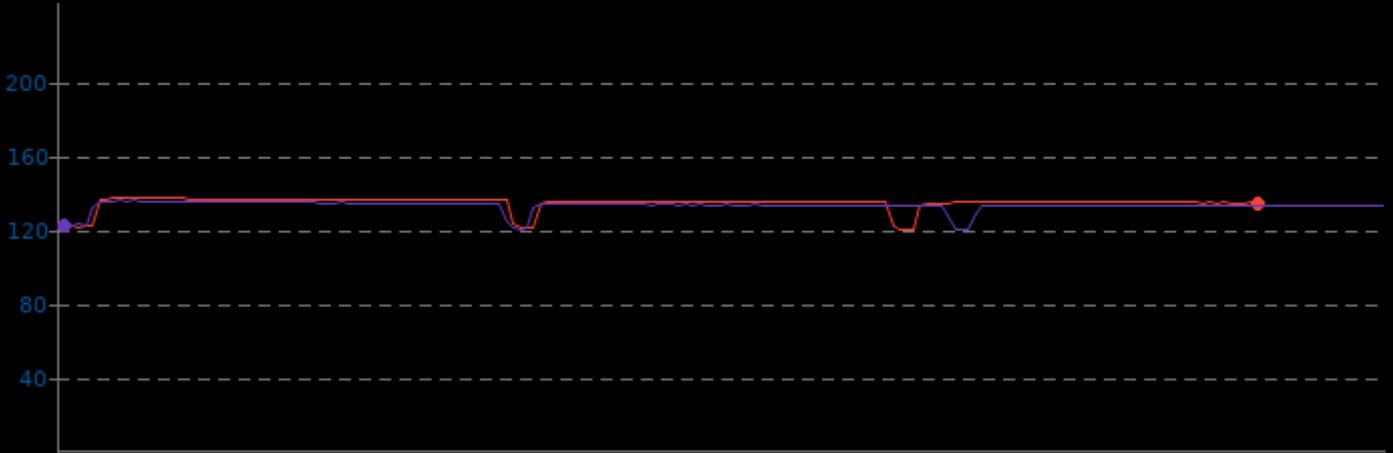


Himeno Benchmark 3.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.4	134.2	136.7
CPUFreq Performance	120.2	132.8	135.7

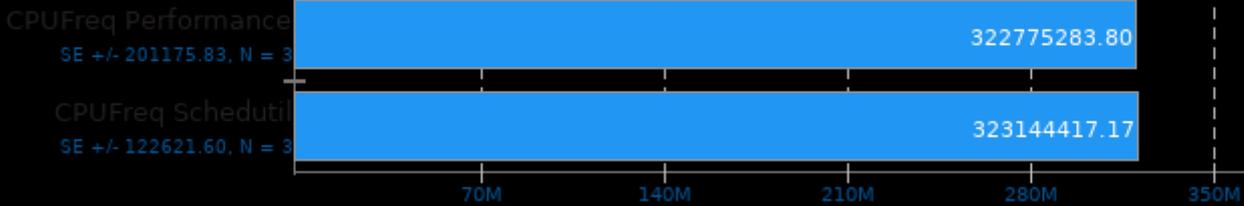
Watts, Fewer Is Better



Hierarchical INTegration 1.0

Test: FLOAT

QUIPs, More Is Better

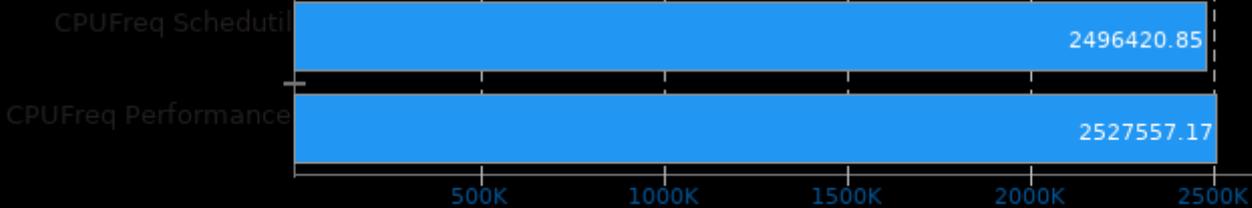


1. (CO) gcc options: -O3 -march=native -lm

Hierarchical INTegration 1.0

Test: FLOAT

QUIPs Per Watt, More Is Better

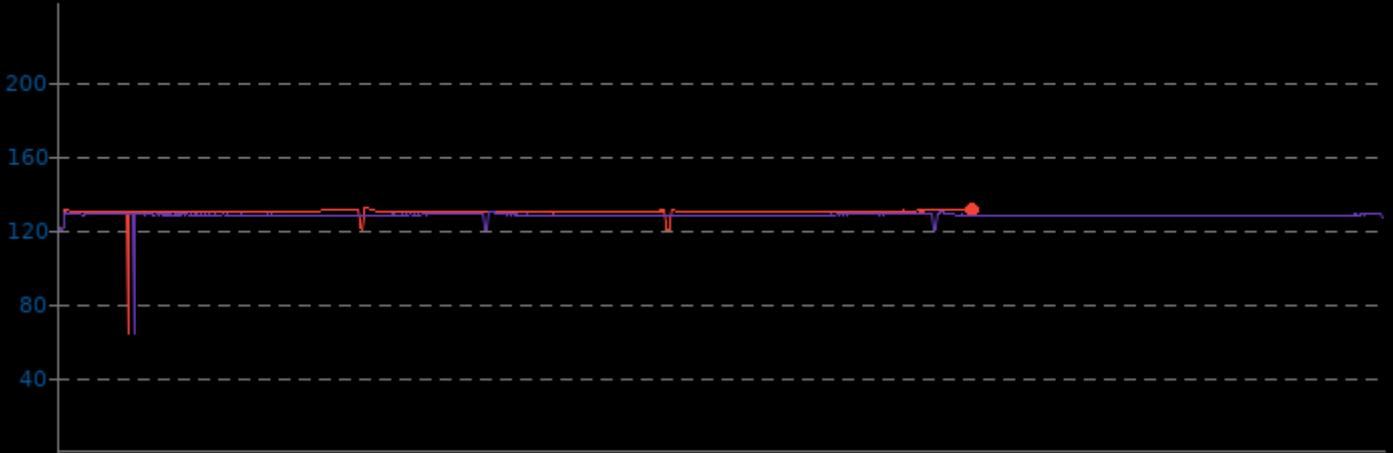


Hierarchical INTegration 1.0

CPU Power Consumption Monitor

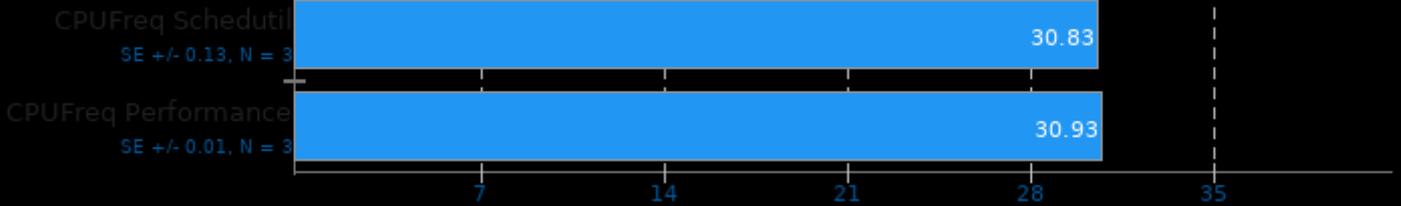
	Min	Avg	Max
CPUFreq Schedutil	64.8	129.4	131.6
CPUFreq Performance	64.2	127.7	129.4

Watts, Fewer Is Better



High Performance Conjugate Gradient 3.1

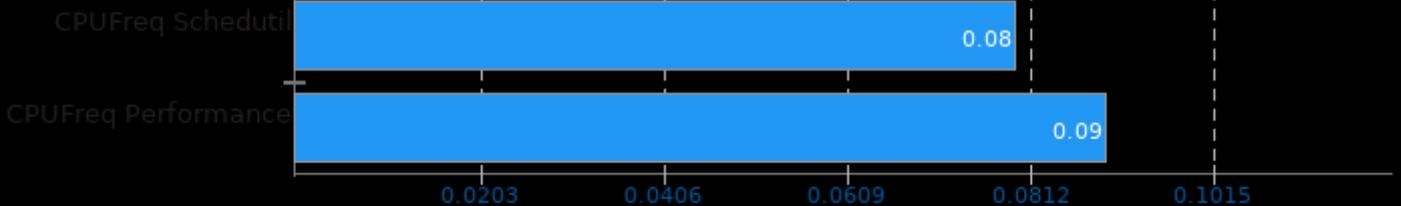
Gflop/s, More Is Better



1. (CXX) g++ options: -O3 -ffast-math -ftree-vectorize -pthread -lmpi_cxx -lmpi

High Performance Conjugate Gradient 3.1

Gflop/s Per Watt, More Is Better

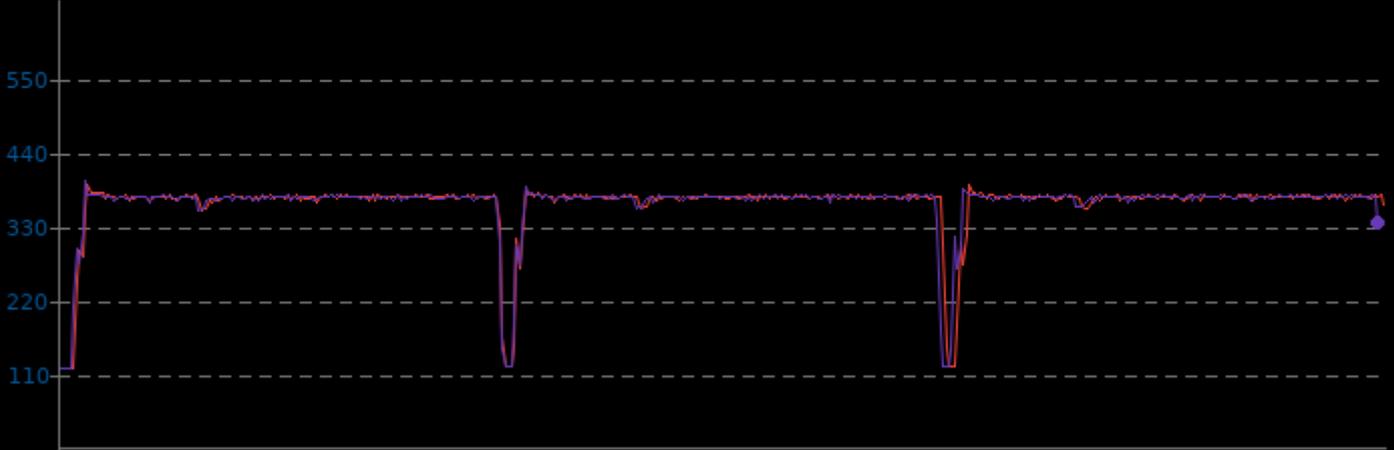


High Performance Conjugate Gradient 3.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.5	363.8	391.8
CPUFreq Performance	119.8	363.8	399.1

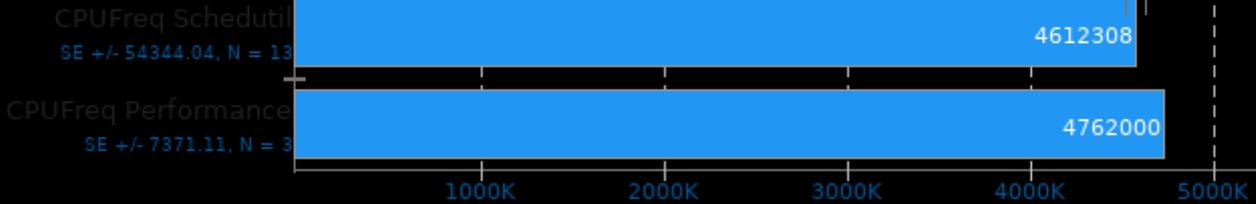
Watts, Fewer Is Better



John The Ripper 1.9.0-jumbo-1

Test: MD5

Real C/S, More Is Better

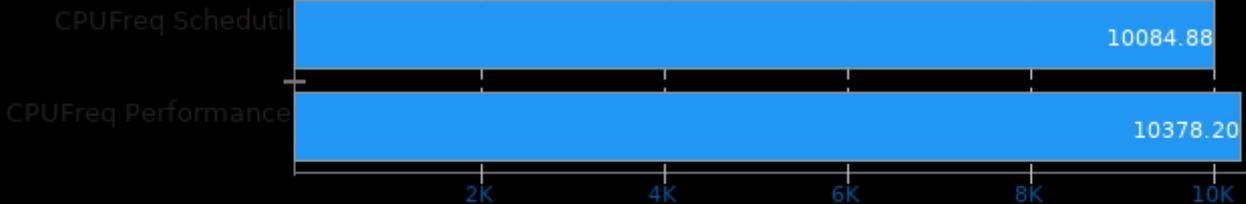


1. (CO) gcc options: -m64 -lssl -lcrypto -fopenmp -lgmp -pthread -lm -lz -ldl -lcrypt -lbz2

John The Ripper 1.9.0-jumbo-1

Test: MD5

Real C/S Per Watt, More Is Better

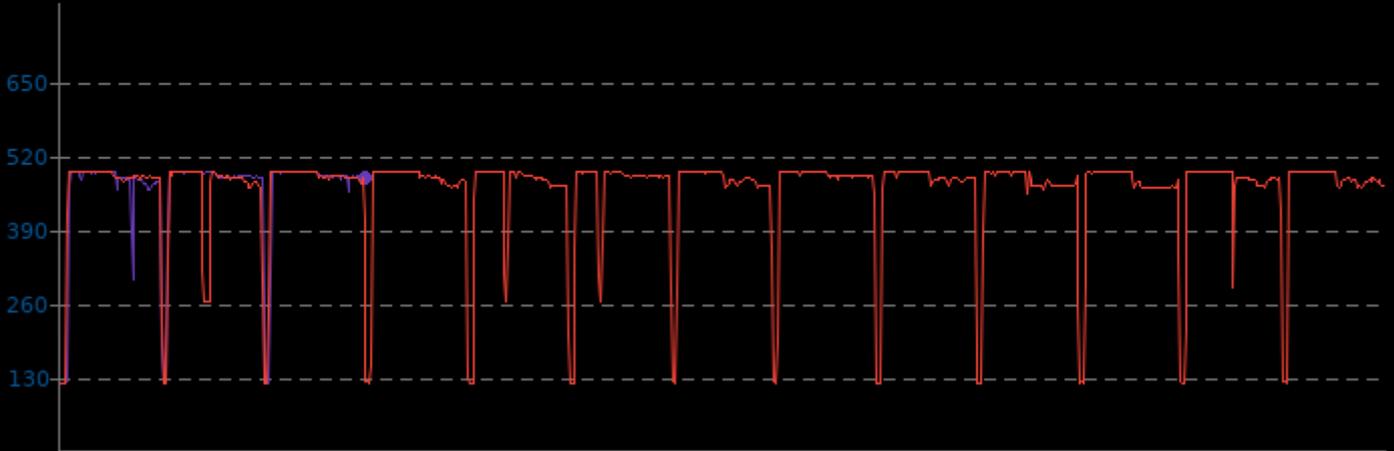


John The Ripper 1.9.0-jumbo-1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	122.4	458.8	492.1
CPUFreq Schedutil	122.0	457.3	492.3

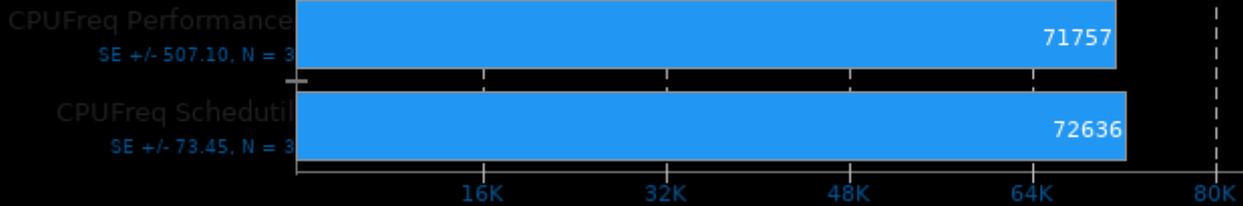
▼ Watts, Fewer Is Better



John The Ripper 1.9.0-jumbo-1

Test: Blowfish

► Real C/S, More Is Better

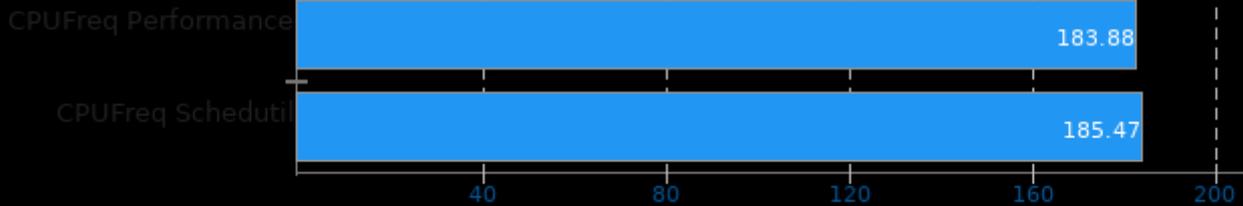


1. (CC) gcc options: -m64 -lssl -lcrypto -fopenmp -lgmp -pthread -lm -lz -ldl -lcrypt -lbz2

John The Ripper 1.9.0-jumbo-1

Test: Blowfish

► Real C/S Per Watt, More Is Better

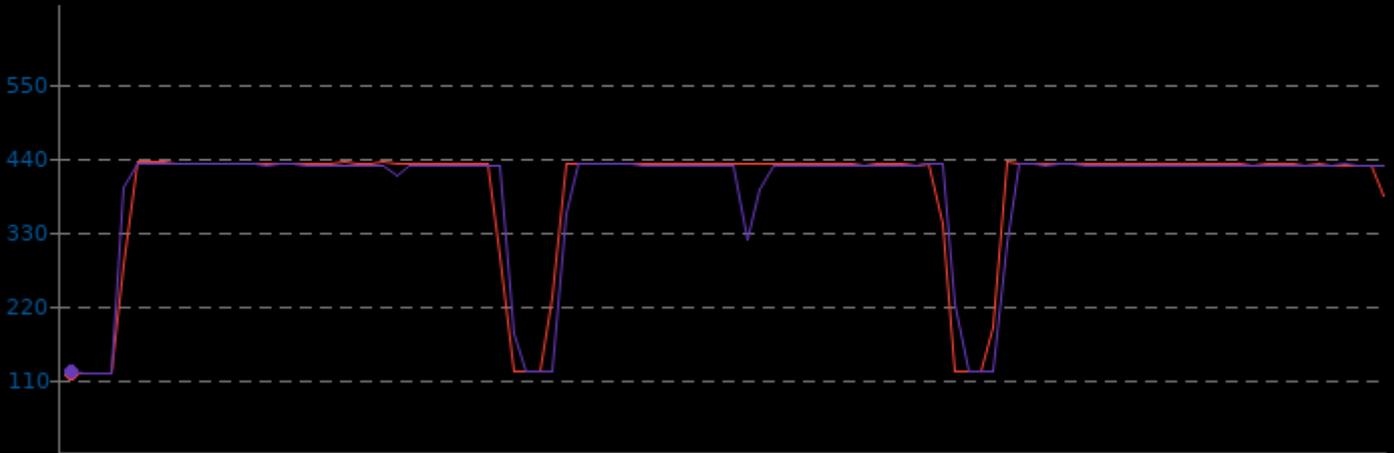


John The Ripper 1.9.0-jumbo-1

CPU Power Consumption Monitor

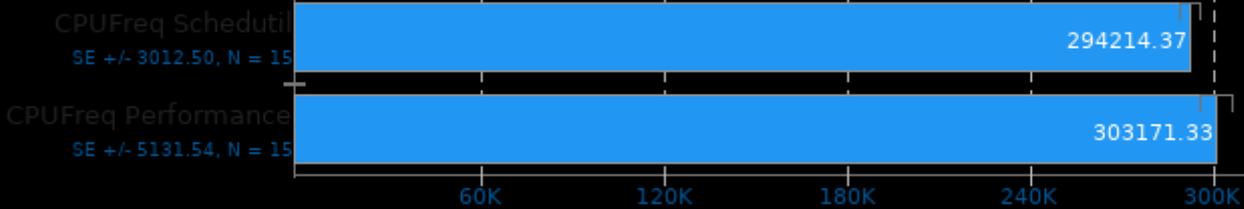
	Min	Avg	Max
CPUFreq Schedutil	121.5	391.6	433.0
CPUFreq Performance	122.1	390.2	430.6

Watts, Fewer Is Better



KeyDB 6.0.16

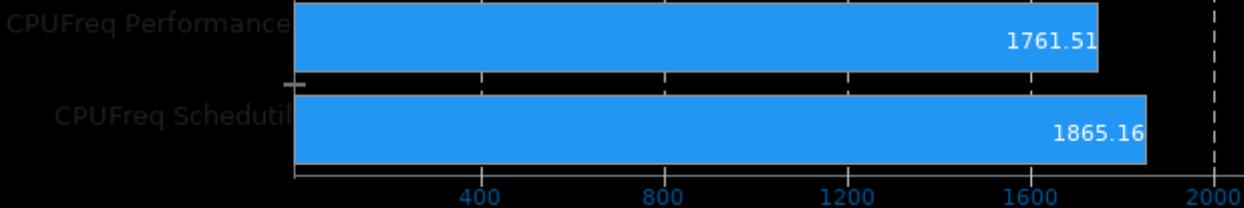
Ops/sec, More Is Better



1. (CXX) g++ options: -O2 -levent_openssl -levent -lcrypto -lssl -lthread -lz -lpcrc

KeyDB 6.0.16

Ops/sec Per Watt, More Is Better

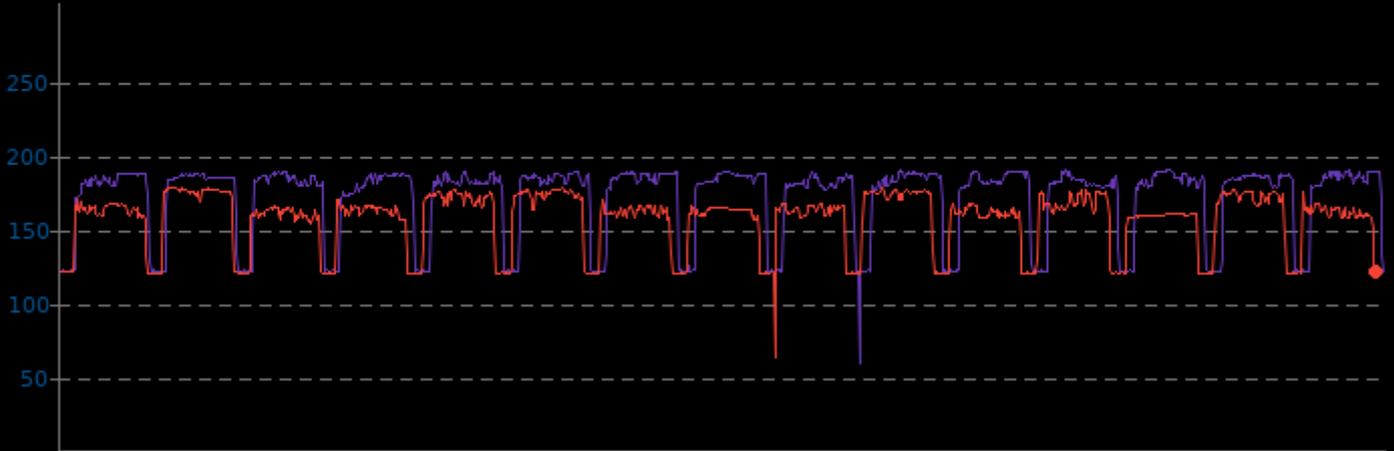


KeyDB 6.0.16

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	60.8	172.1	190.1
CPUFreq Schedutil	64.4	157.7	178.6

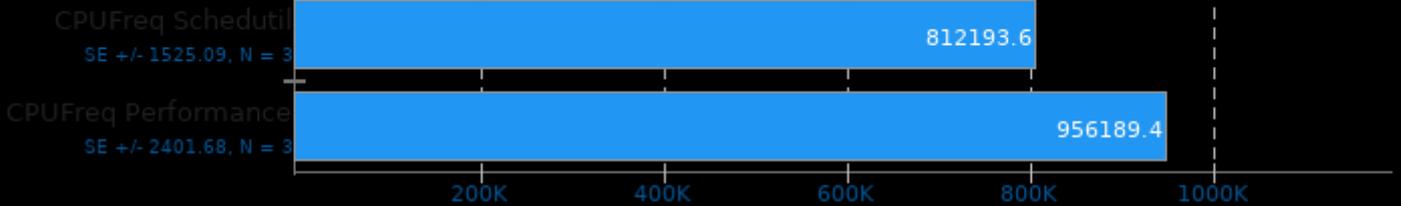
▼ Watts, Fewer Is Better



InfluxDB 1.8.2

Concurrent Streams: 4 - Batch Size: 10000 - Tags: 2,5000,1 - Points Per Series: 10000

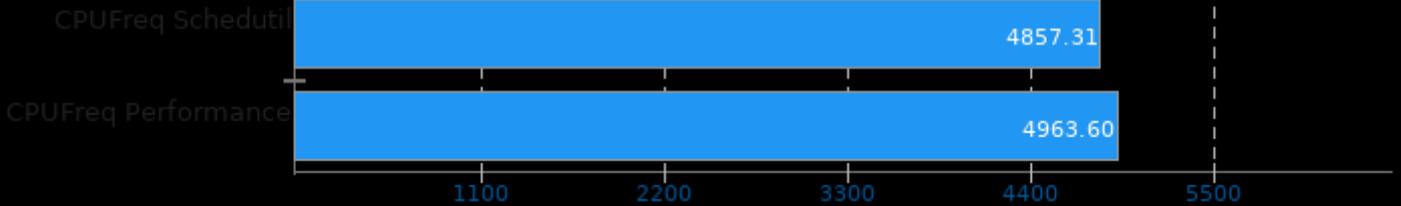
► val/sec, More Is Better



InfluxDB 1.8.2

Concurrent Streams: 4 - Batch Size: 10000 - Tags: 2,5000,1 - Points Per Series: 10000

► val/sec Per Watt, More Is Better

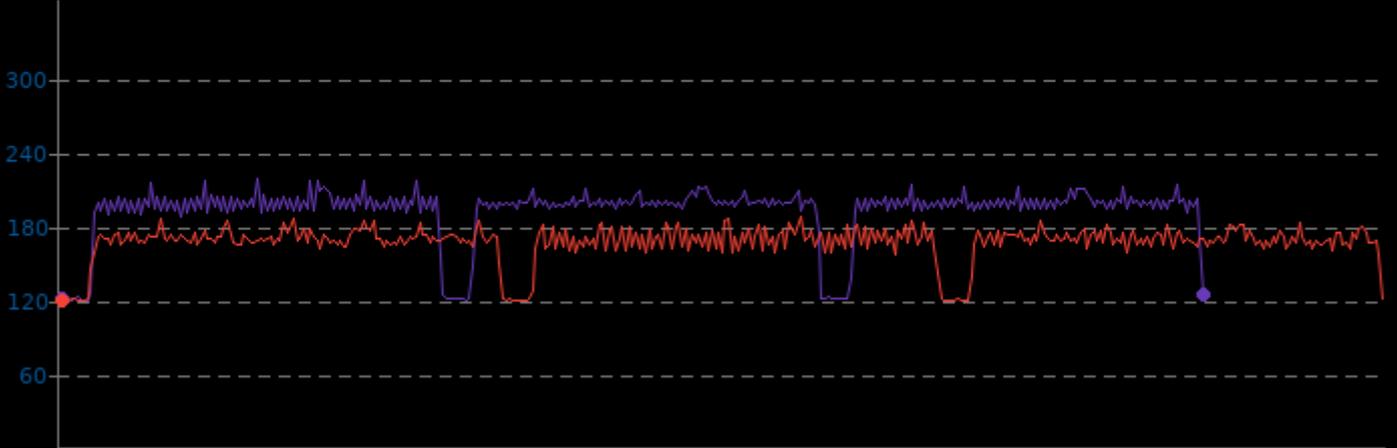


InfluxDB 1.8.2

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.8	192.6	218.3
CPUFreq Schedutil	120.5	167.2	187.5

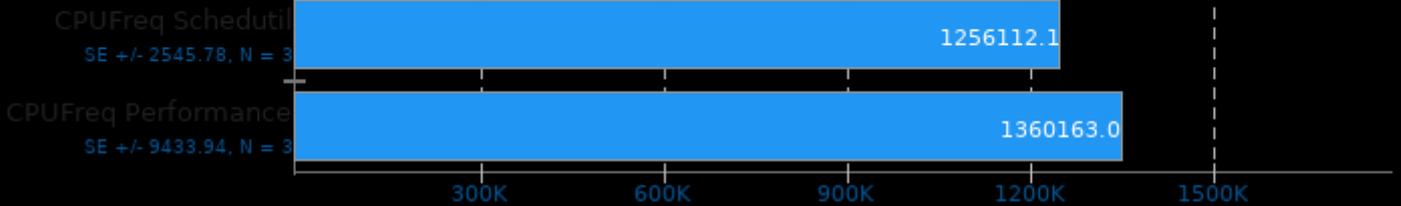
Watts, Fewer Is Better



InfluxDB 1.8.2

Concurrent Streams: 64 - Batch Size: 10000 - Tags: 2,5000,1 - Points Per Series: 10000

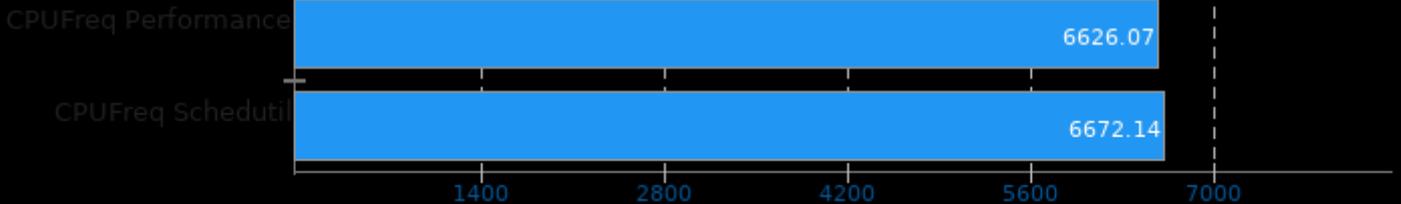
val/sec, More Is Better



InfluxDB 1.8.2

Concurrent Streams: 64 - Batch Size: 10000 - Tags: 2,5000,1 - Points Per Series: 10000

val/sec Per Watt, More Is Better

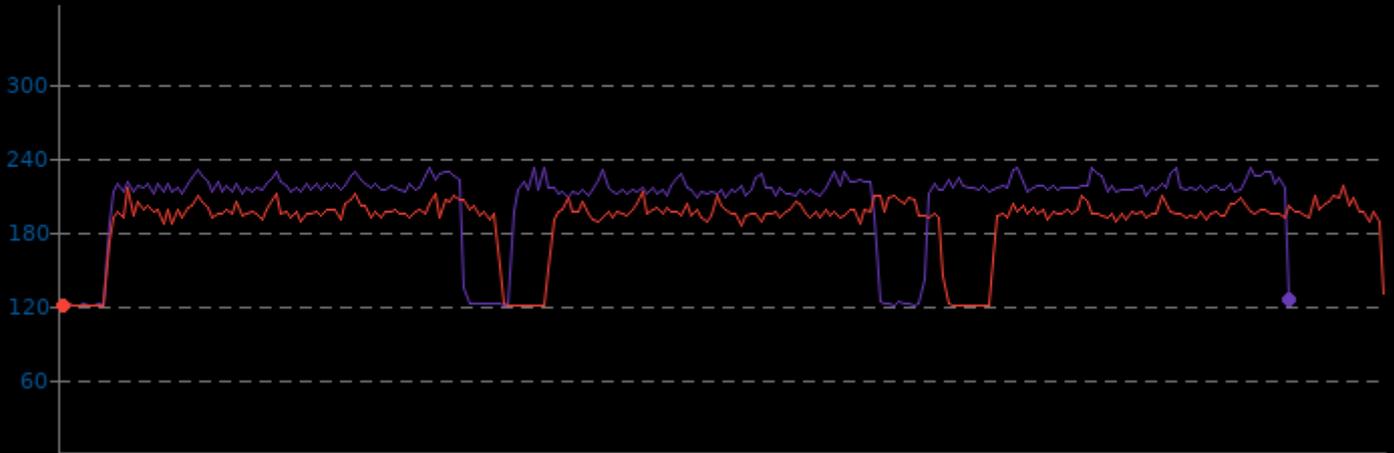


InfluxDB 1.8.2

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.9	205.3	232.0
CPUFreq Schedutil	120.3	188.3	217.2

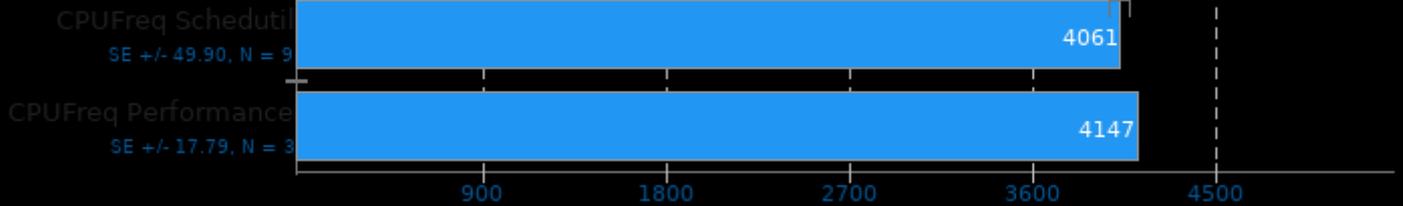
▼ Watts, Fewer Is Better



LeelaChessZero 0.26

Backend: BLAS

► Nodes Per Second, More Is Better

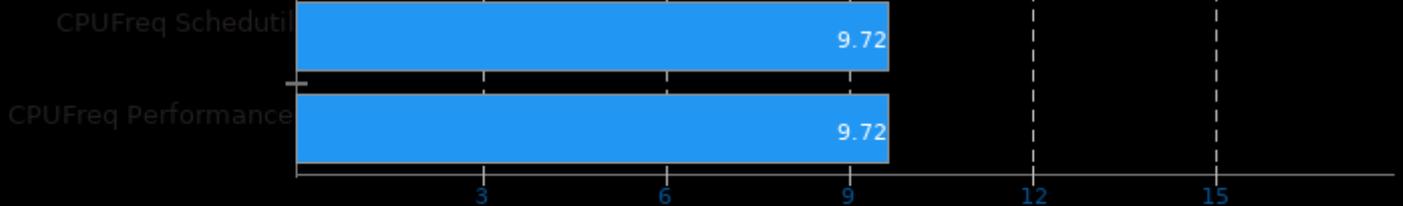


1. (CXX) g++ options: -fipo -pthread

LeelaChessZero 0.26

Backend: BLAS

► Nodes Per Second Per Watt, More Is Better

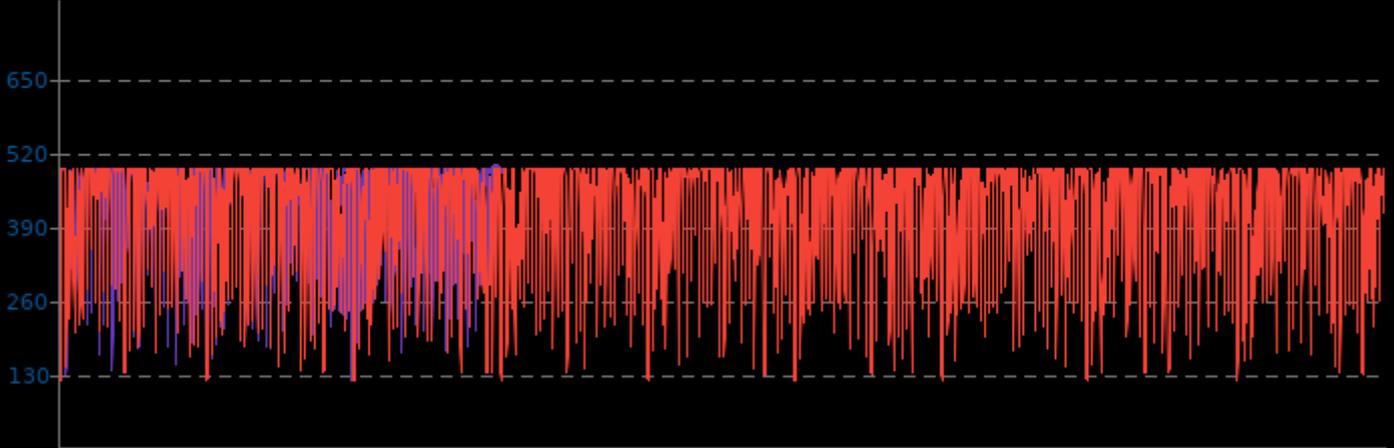


LeelaChessZero 0.26

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.0	426.6	492.4
CPUFreq Schedutil	120.4	417.7	492.3

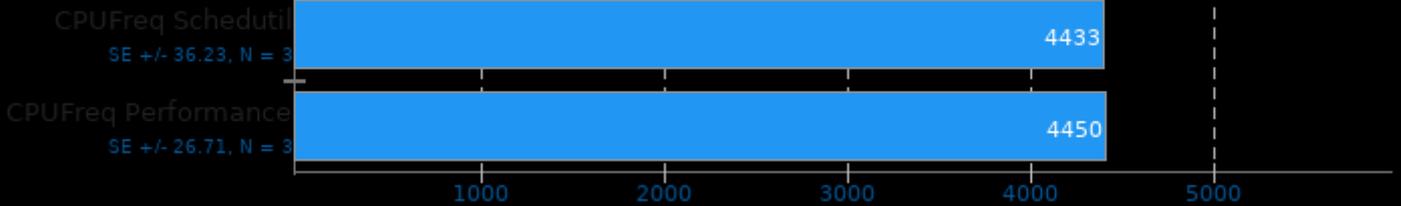
▼ Watts, Fewer Is Better



LeelaChessZero 0.26

Backend: Eigen

► Nodes Per Second, More Is Better

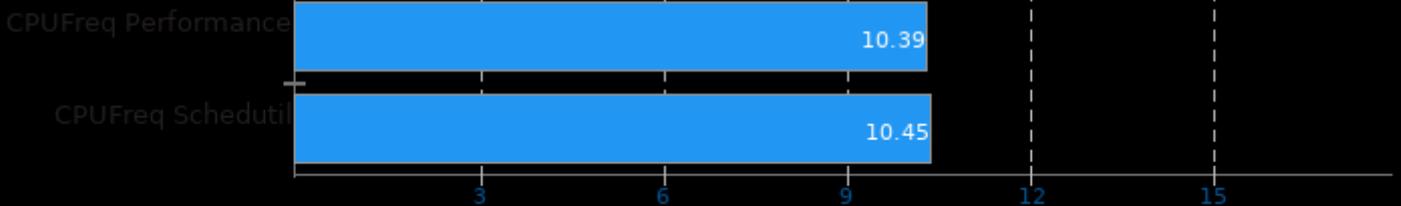


1. (CXX) g++ options: -fipo -pthread

LeelaChessZero 0.26

Backend: Eigen

► Nodes Per Second Per Watt, More Is Better

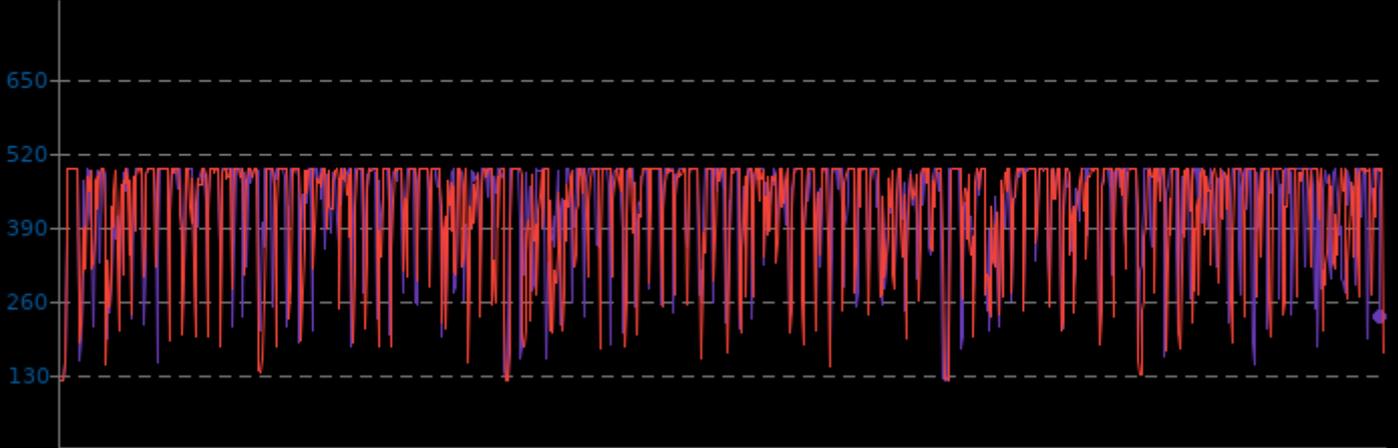


LeelaChessZero 0.26

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.9	428.4	492.3
CPUFreq Schedutil	121.4	424.2	492.4

▼ Watts, Fewer Is Better



LuxCoreRender 2.3

Scene: DLSC

► M samples/sec, More Is Better

CPUFreq Schedutil
SE +/- 0.10, N = 3



CPUFreq Performance
SE +/- 0.09, N = 3



LuxCoreRender 2.3

Scene: DLSC

► M samples/sec Per Watt, More Is Better

CPUFreq Schedutil



CPUFreq Performance



LuxCoreRender 2.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.5	459.0	493.1
CPUFreq Performance	122.0	458.4	493.1

▼ Watts, Fewer Is Better

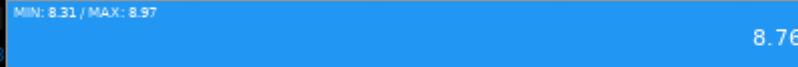


LuxCoreRender 2.3

Scene: Rainbow Colors and Prism

► M samples/sec, More Is Better

CPUFreq Schedutil
SE +/- 0.09, N = 3



CPUFreq Performance
SE +/- 0.04, N = 3



LuxCoreRender 2.3

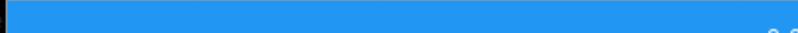
Scene: Rainbow Colors and Prism

► M samples/sec Per Watt, More Is Better

CPUFreq Schedutil



CPUFreq Performance



LuxCoreRender 2.3

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.7	461.8	493.2
CPUFreq Performance	122.2	461.6	493.9

Watts, Fewer Is Better



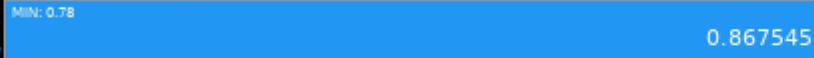
oneDNN 2.0

Harness: Convolution Batch Shapes Auto - Data Type: f32 - Engine: CPU

ms, Fewer Is Better

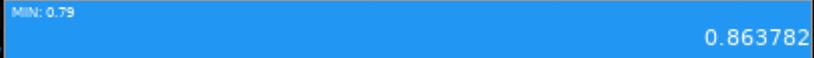
CPUFreq Performance

SE +/- 0.001697, N = 7



CPUFreq Schedutil

SE +/- 0.001510, N = 7



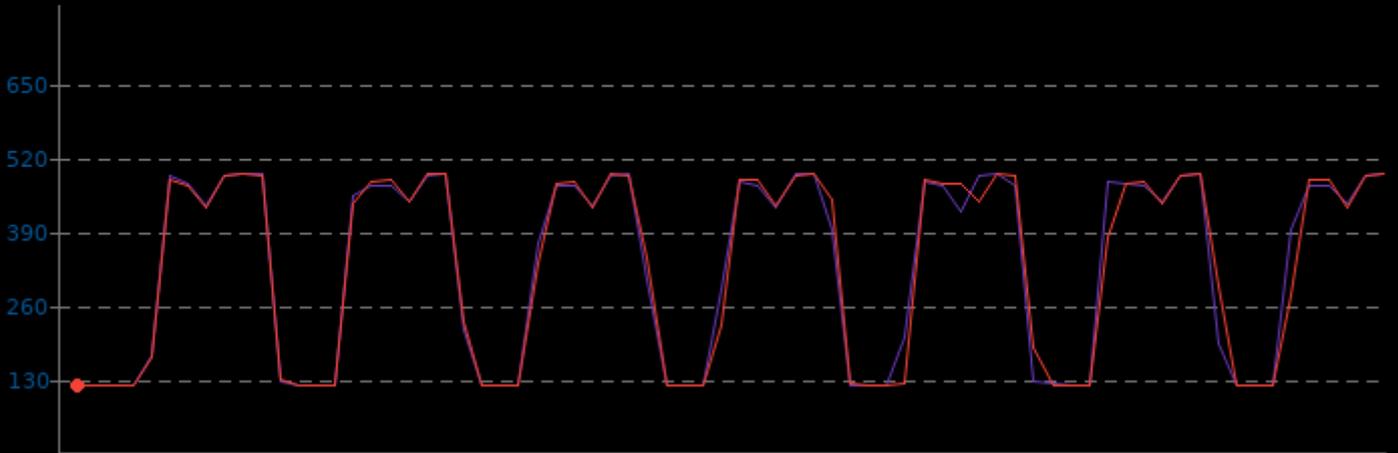
1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.8	332.1	492.4
CPUFreq Schedutil	121.6	331.1	492.0

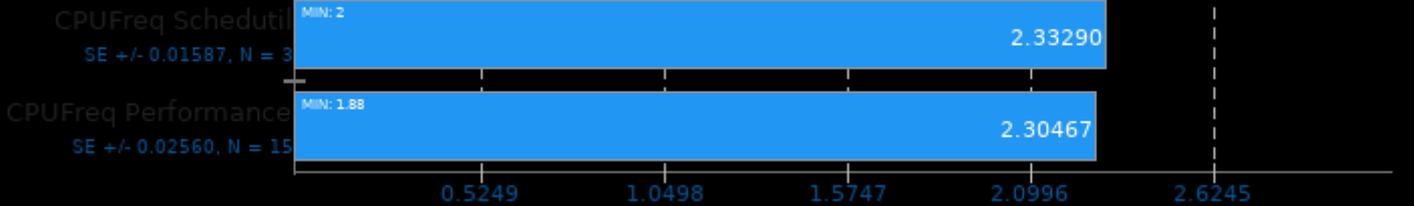
Watts, Fewer Is Better



oneDNN 2.0

Harness: Deconvolution Batch shapes_1d - Data Type: f32 - Engine: CPU

ms, Fewer Is Better



1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.8	285.6	468.7
CPUFreq Performance	121.0	284.2	491.8

Watts, Fewer Is Better

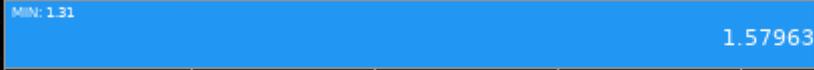


oneDNN 2.0

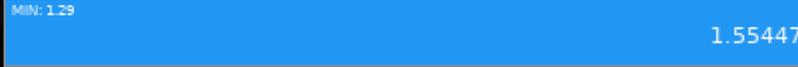
Harness: IP Shapes 1D - Data Type: f32 - Engine: CPU

ms, Fewer Is Better

CPUFreq Performance
SE +/- 0.01359, N = 4



CPUFreq Schedutil
SE +/- 0.01340, N = 4



0.3554 0.7108 1.0662 1.4216 1.777

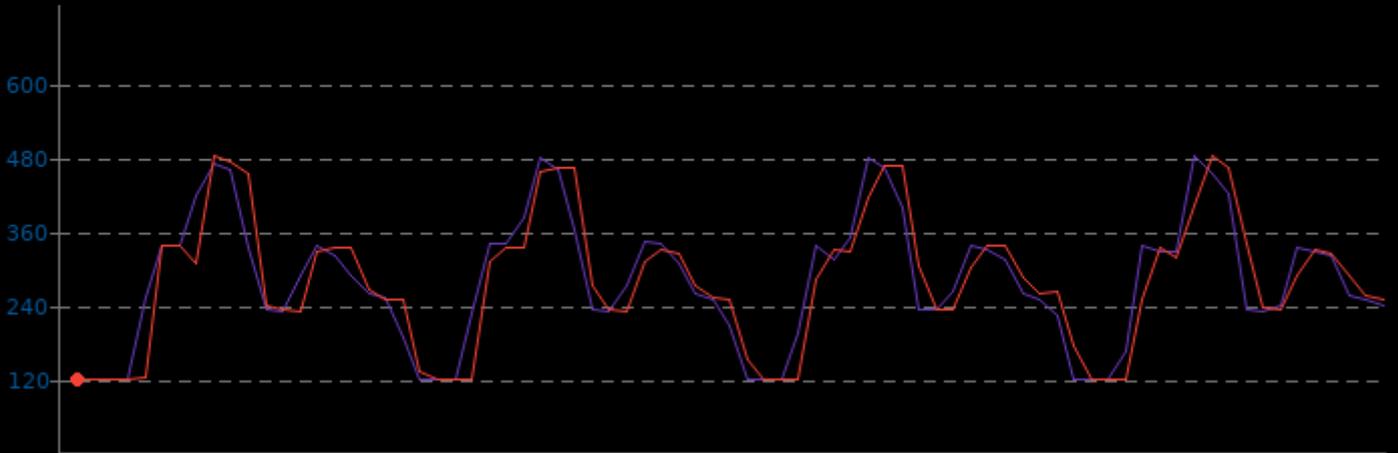
1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.0	280.4	481.1
CPUFreq Schedutil	120.5	279.6	482.7

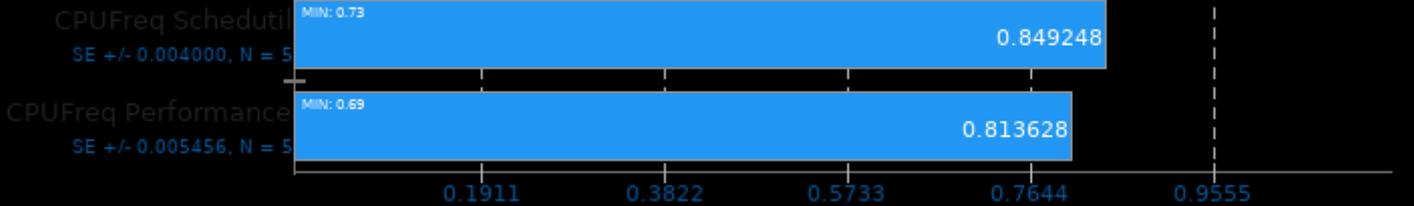
Watts, Fewer Is Better



oneDNN 2.0

Harness: IP Shapes 3D - Data Type: f32 - Engine: CPU

ms, Fewer Is Better



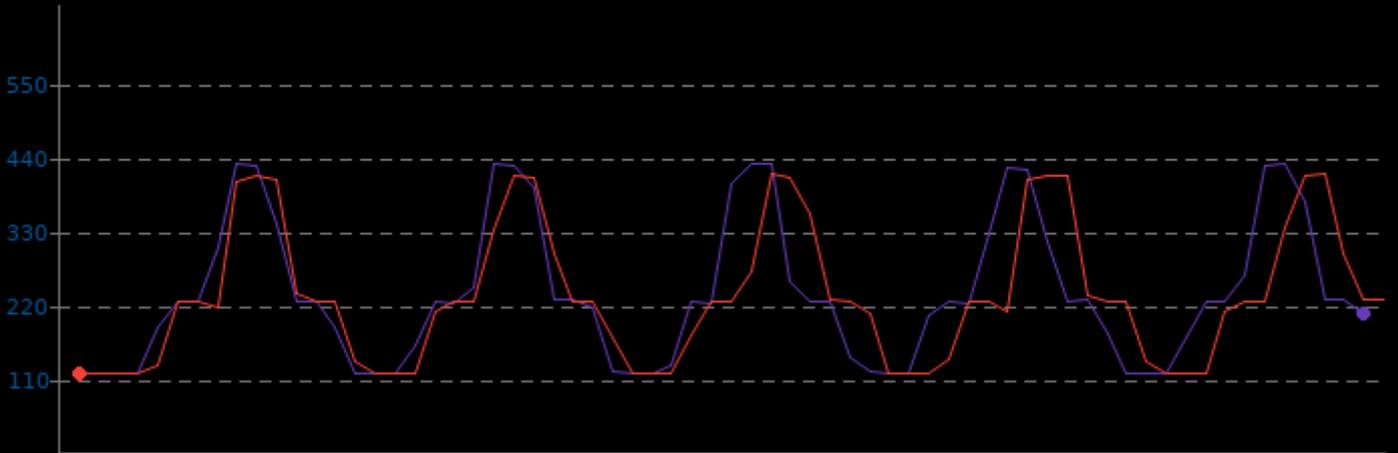
1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.1	239.4	430.2
CPUFreq Schedutil	120.7	235.0	415.0

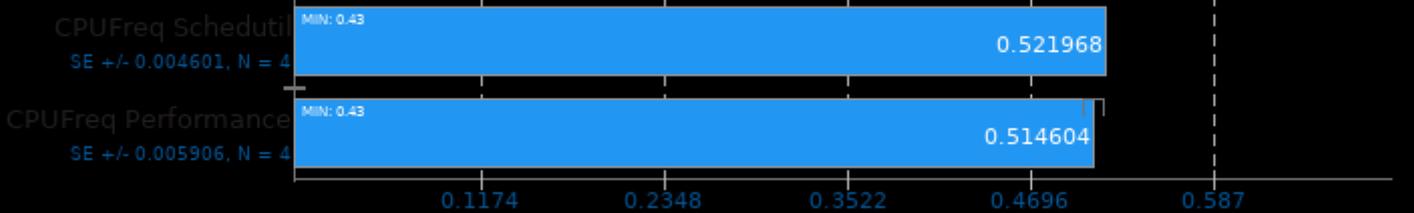
Watts, Fewer Is Better



oneDNN 2.0

Harness: Matrix Multiply Batch Shapes Transformer - Data Type: f32 - Engine: CPU

ms, Fewer Is Better



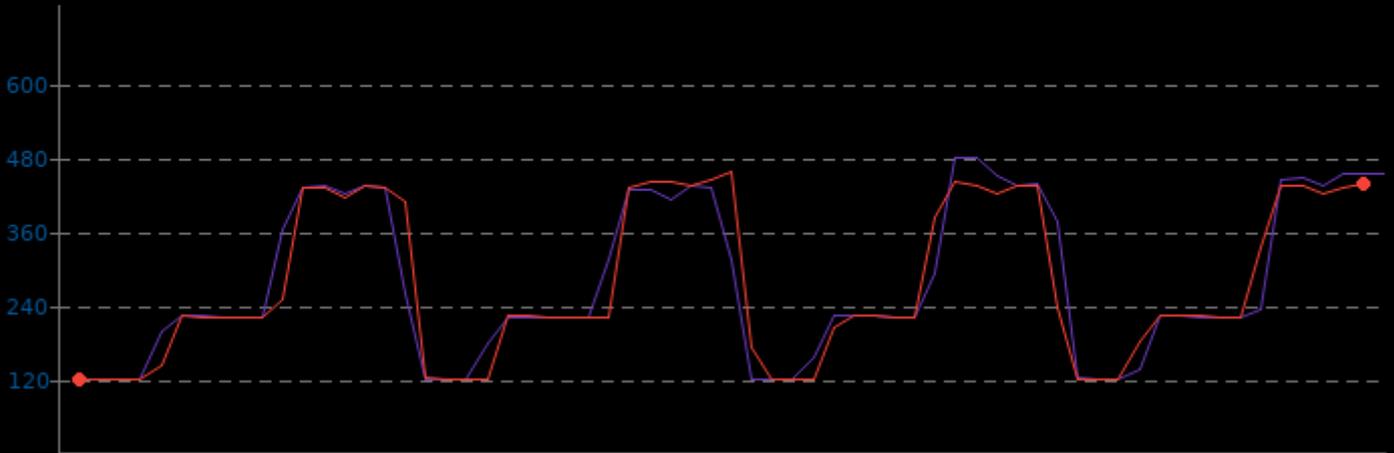
1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.7	278.8	480.5
CPUFreq Schedutil	120.6	274.8	455.7

Watts, Fewer Is Better



oneDNN 2.0

Harness: Recurrent Neural Network Training - Data Type: f32 - Engine: CPU

ms, Fewer Is Better

CPUFreq Performance
SE +/- 35.45, N = 15



CPUFreq Schedutil
SE +/- 3.00, N = 3



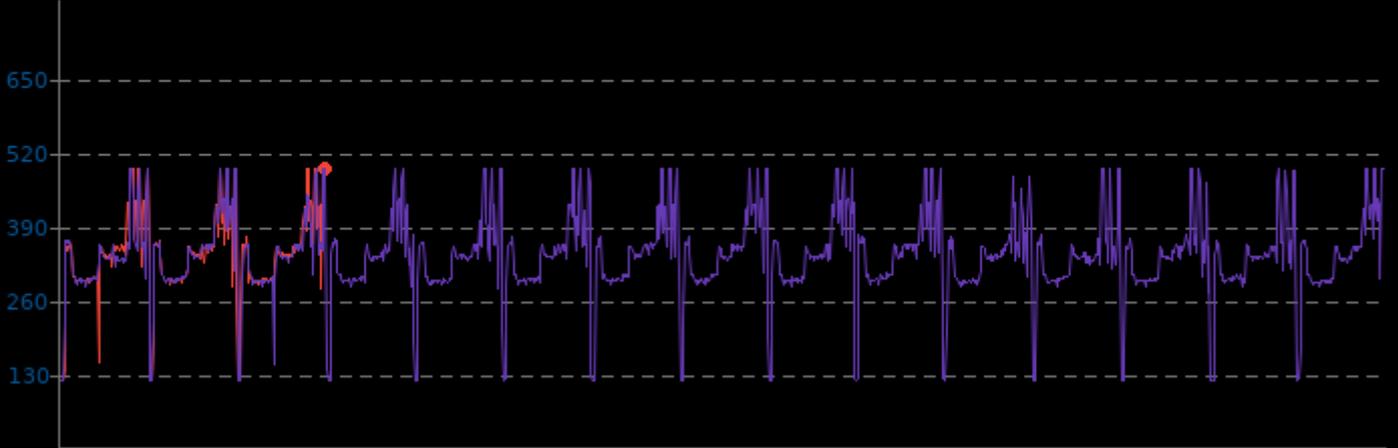
1. (CXX) g++ options: -O3 -std=c++11 -fopenmp -mssse4.1 -fpic -pie -pthread

oneDNN 2.0

CPU Power Consumption Monitor

	Min	Avg	Max
■ CPUFreq Schedutil	120.6	341.5	492.2
■ CPUFreq Performance	120.8	339.2	492.3

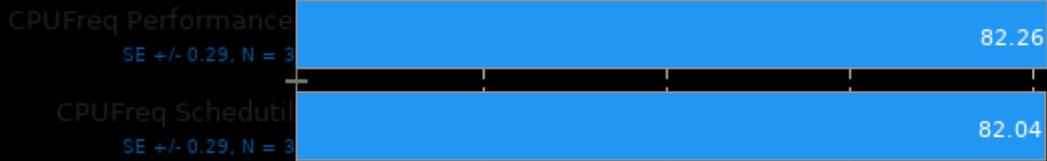
▼ Watts, Fewer Is Better



Timed MrBayes Analysis 3.2.7

Primate Phylogeny Analysis

◀ Seconds, Fewer Is Better



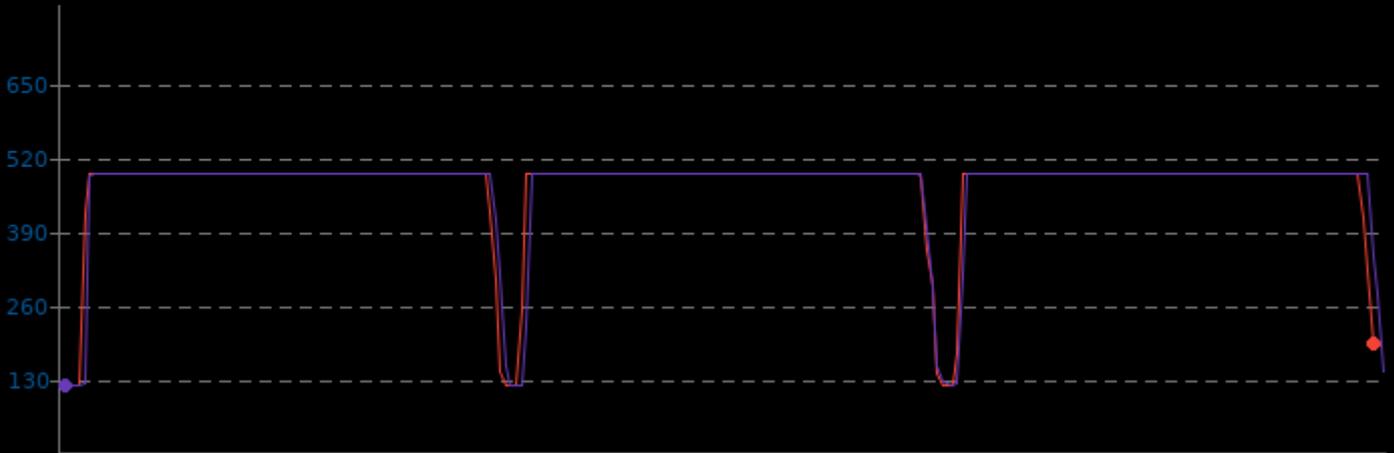
1. (CC) gcc options: -mmmx -msse -msse2 -msse3 -mssse3 -msse4.1 -msse4.2 -msse4a -msha -maes -mavx -mfma -mavx2 -mrdnd -mbmi -mbmi2 -madx

Timed MrBayes Analysis 3.2.7

CPU Power Consumption Monitor

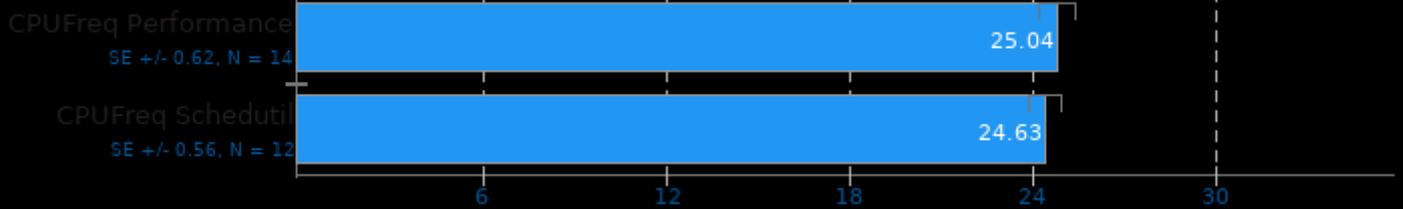
	Min	Avg	Max
CPUFreq Schedutil	120.9	467.9	492.0
CPUFreq Performance	121.2	465.5	492.0

Watts, Fewer Is Better



Nebular Empirical Analysis Tool 2020-02-29

Seconds, Fewer Is Better



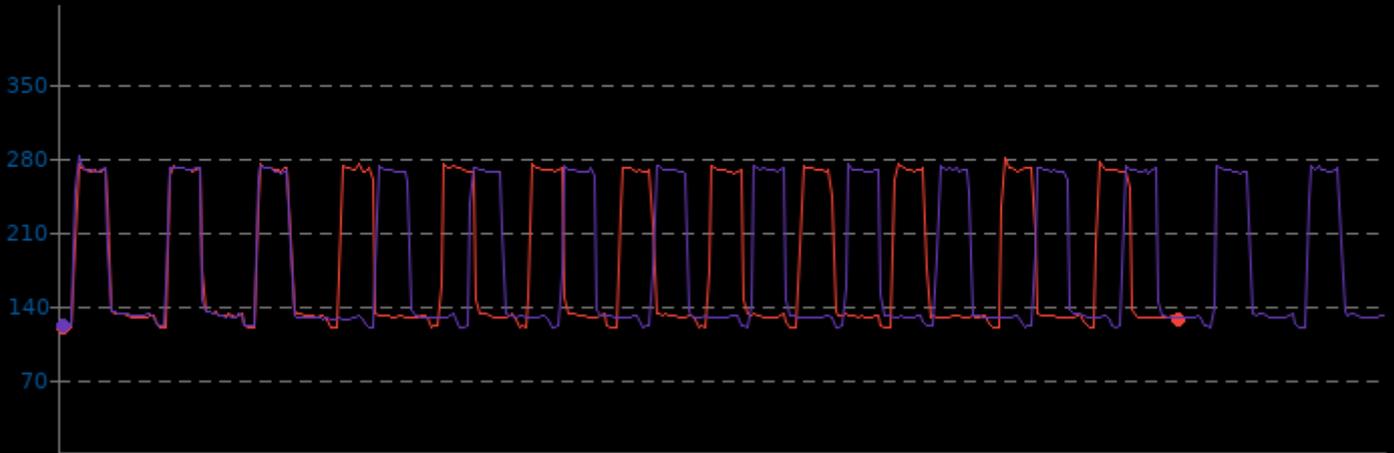
1. (F9X) gfortran options: -cpp -ffree-line-length-0 -jsource/ -fopenmp -O3 -fno-backtrace

Nebular Empirical Analysis Tool 2020-02-29

CPU Power Consumption Monitor

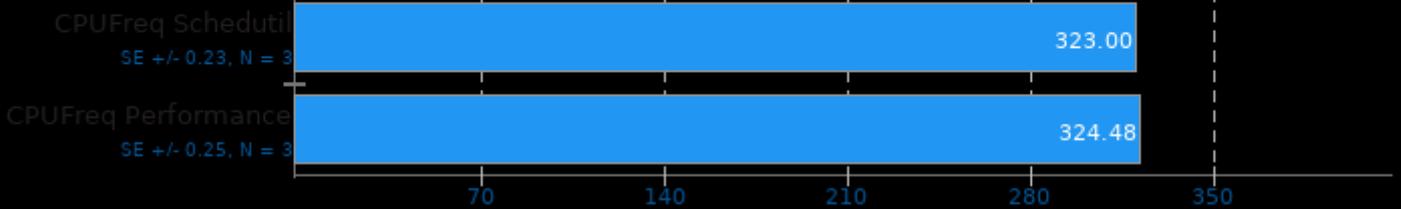
	Min	Avg	Max
CPUFreq Schedutil	120.1	179.4	280.2
CPUFreq Performance	120.5	178.5	280.4

▼ Watts, Fewer Is Better



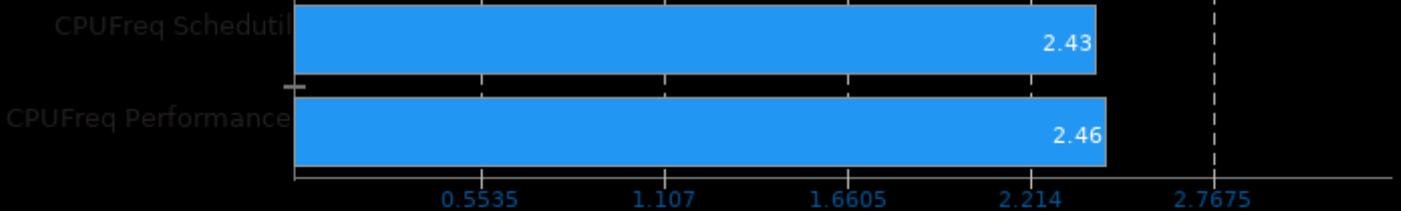
Numpy Benchmark

► Score, More Is Better



Numpy Benchmark

► Score Per Watt, More Is Better

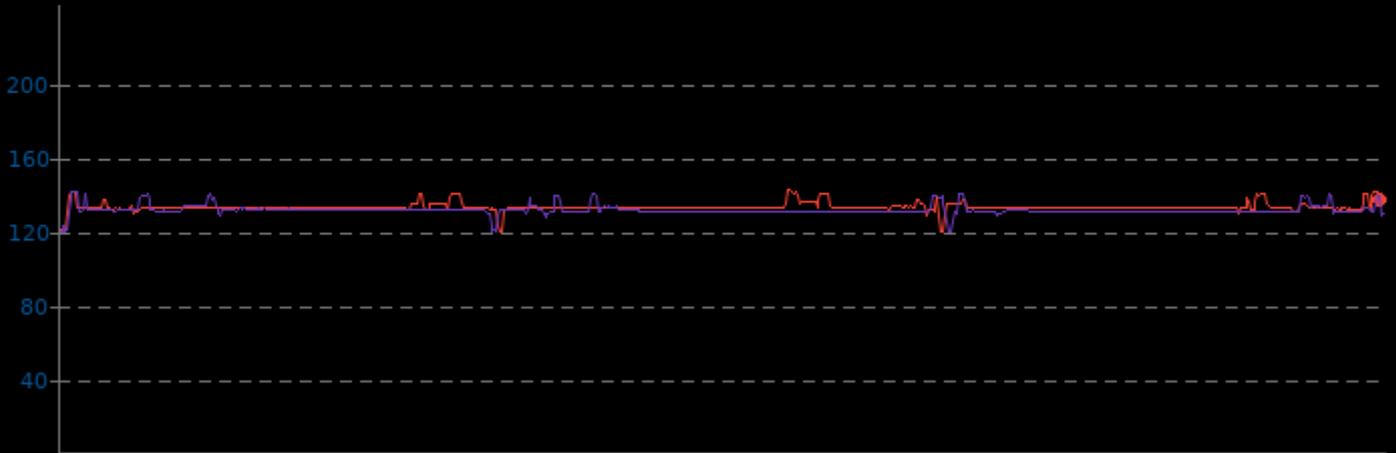


Numpy Benchmark

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.1	133.2	142.0
CPUFreq Performance	119.8	131.7	141.0

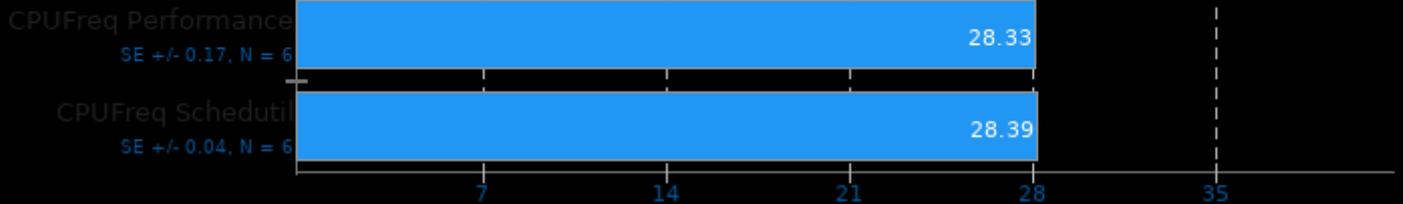
▼ Watts, Fewer Is Better



Intel Open Image Denoise 1.2.0

Scene: Memorial

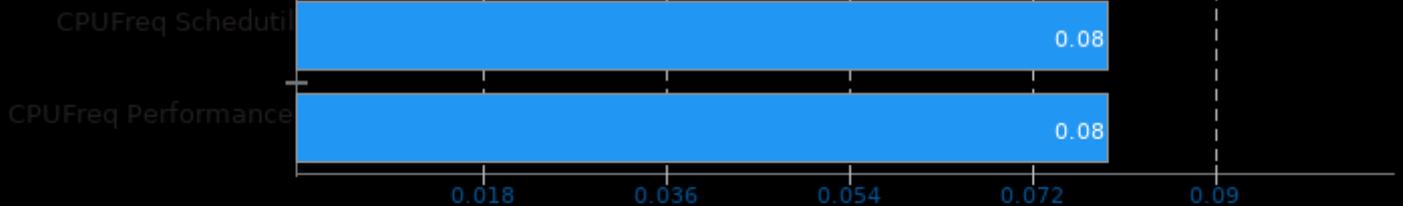
► Images / Sec, More Is Better



Intel Open Image Denoise 1.2.0

Scene: Memorial

► Images / Sec Per Watt, More Is Better

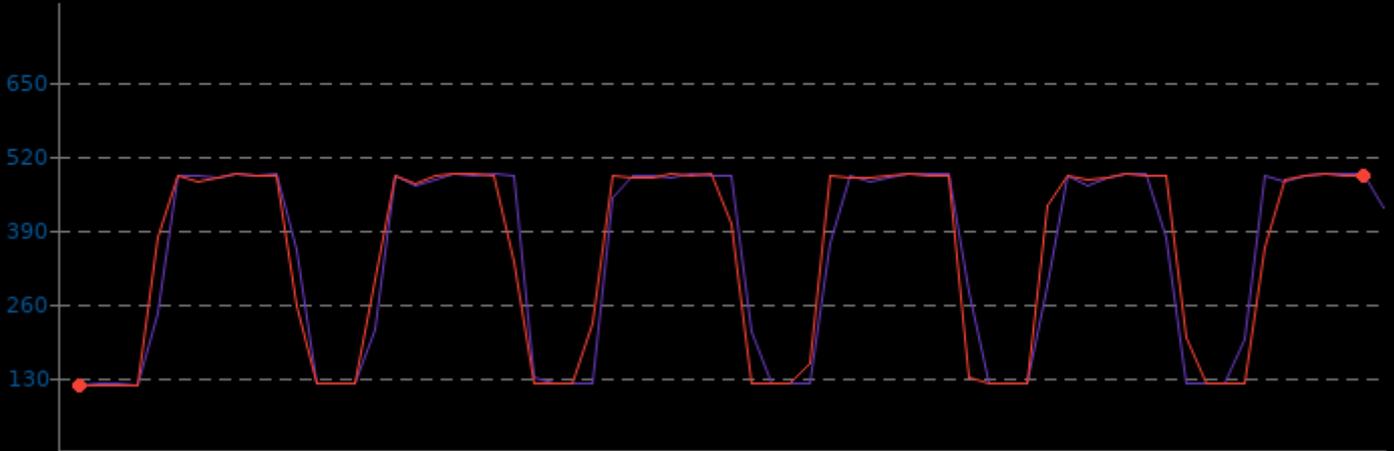


Intel Open Image Denoise 1.2.0

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.8	346.7	488.3
CPUFreq Schedutil	119.8	346.7	488.6

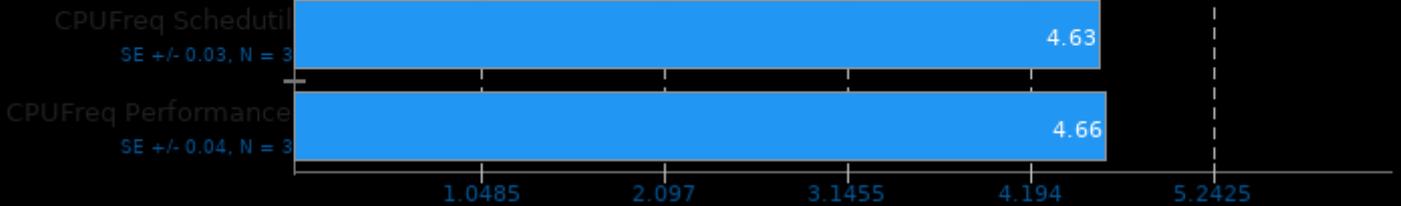
Watts, Fewer Is Better



PlaidML

FP16: No - Mode: Inference - Network: ResNet 50 - Device: CPU

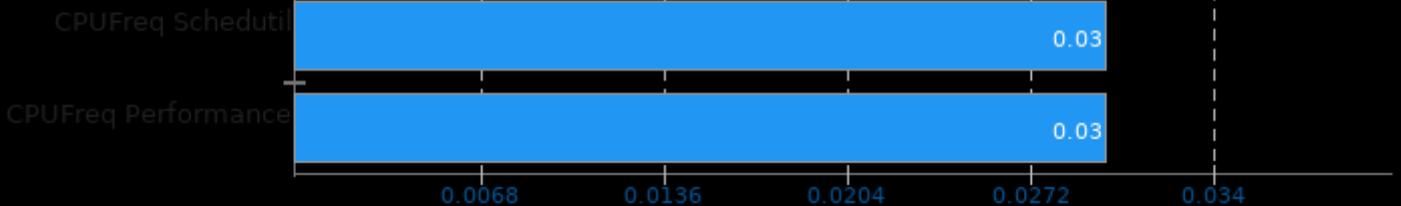
FPS, More Is Better



PlaidML

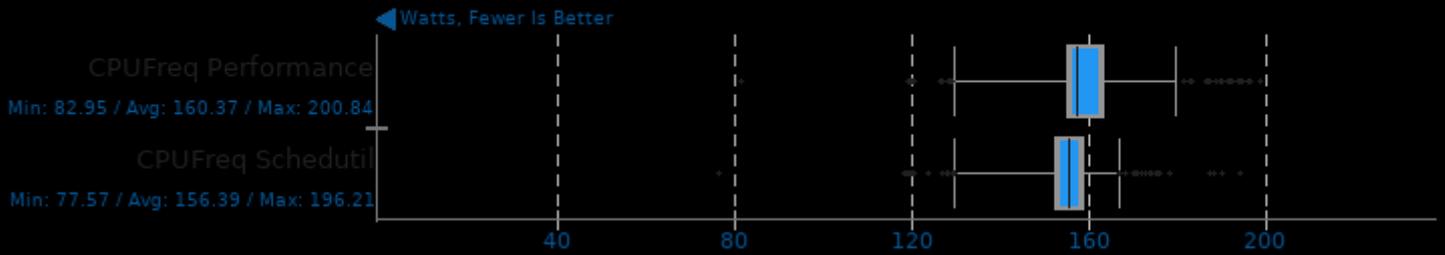
FP16: No - Mode: Inference - Network: ResNet 50 - Device: CPU

FPS Per Watt, More Is Better



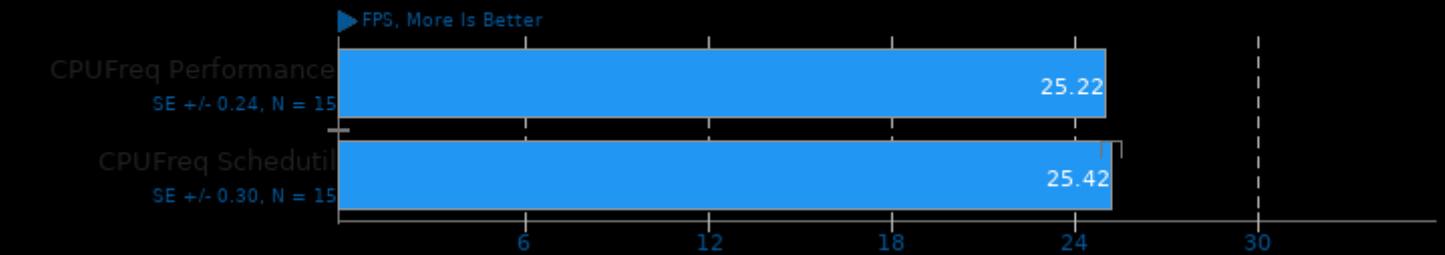
PlaidML

CPU Power Consumption Monitor



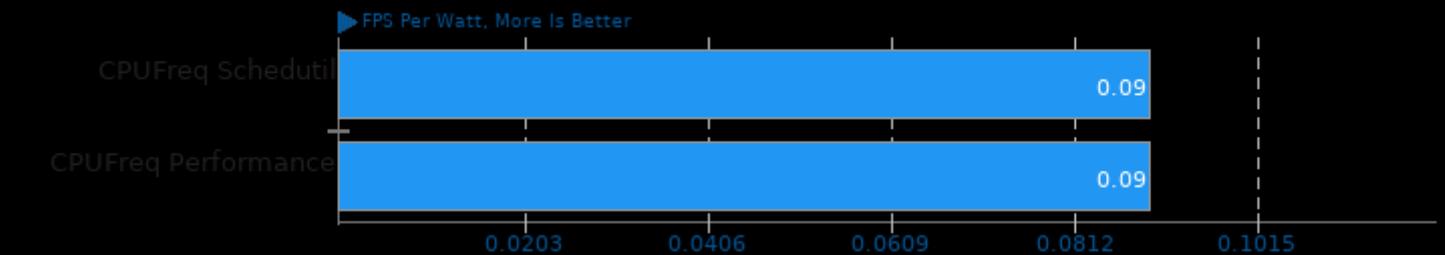
PlaidML

FP16: No - Mode: Inference - Network: VGG16 - Device: CPU



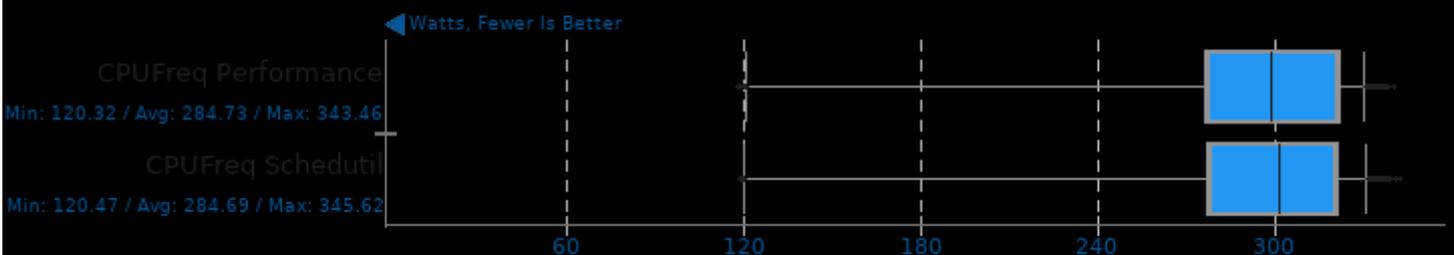
PlaidML

FP16: No - Mode: Inference - Network: VGG16 - Device: CPU



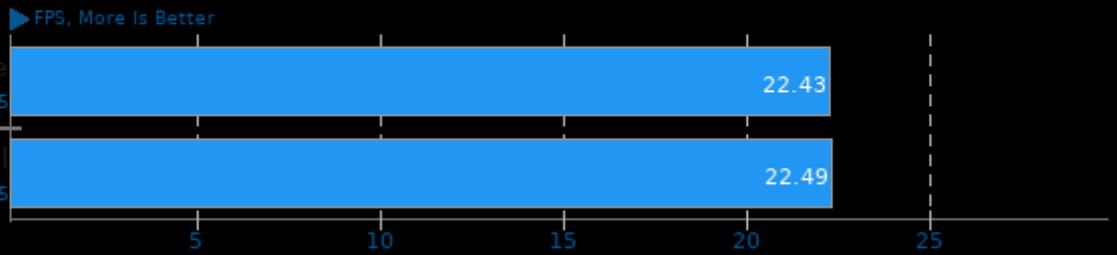
PlaidML

CPU Power Consumption Monitor



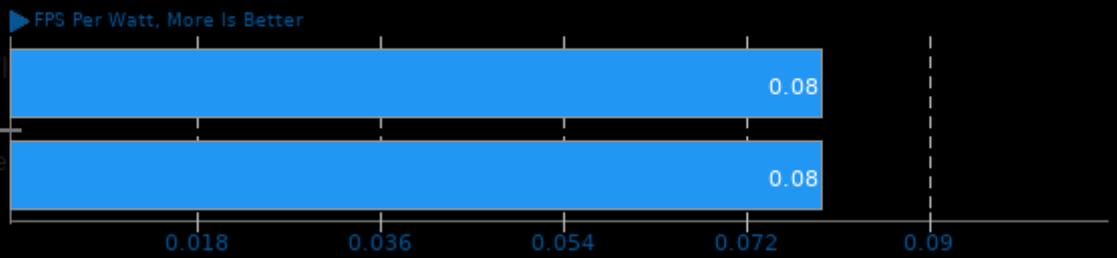
PlaidML

FP16: No - Mode: Inference - Network: VGG19 - Device: CPU



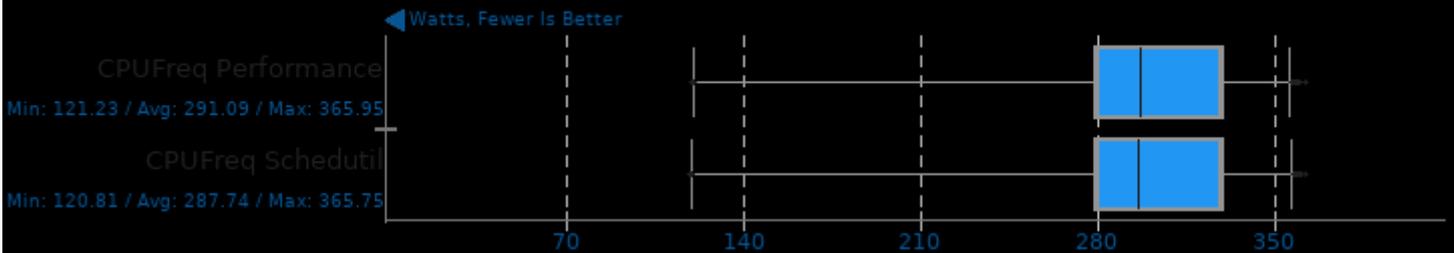
PlaidML

FP16: No - Mode: Inference - Network: VGG19 - Device: CPU



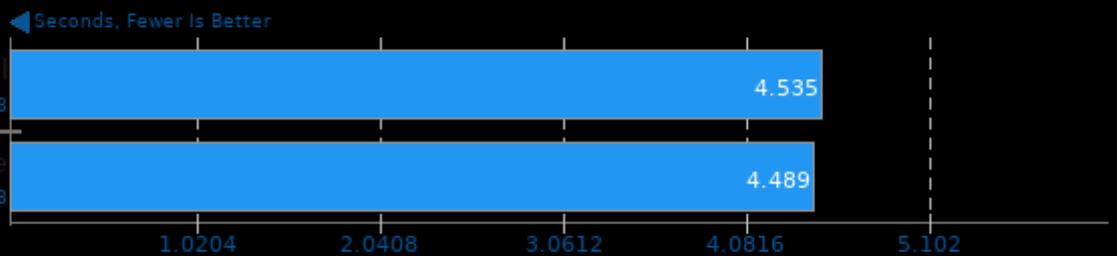
PlaidML

CPU Power Consumption Monitor



Primesieve 7.4

1e12 Prime Number Generation



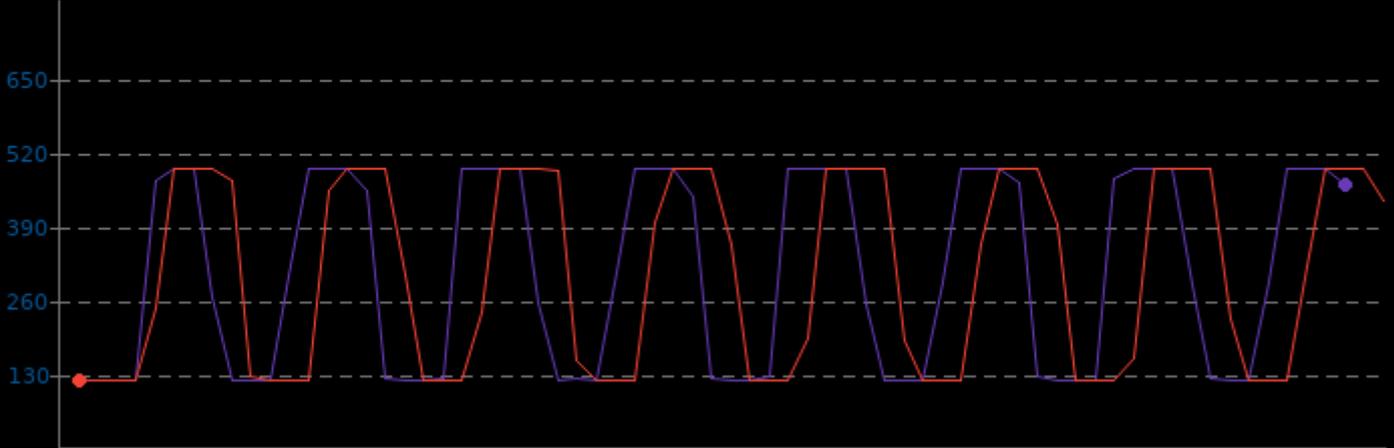
1. (CXX) g++ options: -O3 -lthread

Primesieve 7.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.3	310.0	492.0
CPUFreq Schedutil	121.0	309.6	492.0

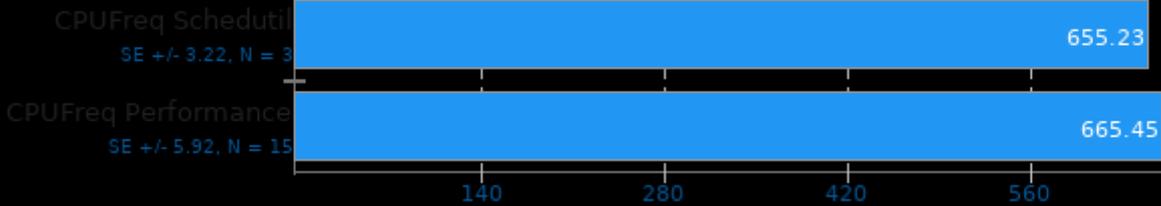
Watts, Fewer Is Better



TTSIOD 3D Renderer 2.3b

Phong Rendering With Soft-Shadow Mapping

FPS, More Is Better

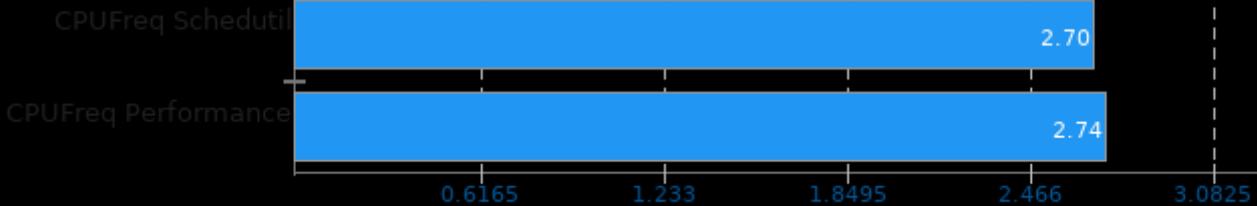


1. (CXX) g++ options: -O3 -fomit-frame-pointer -ffast-math -mtune=native -fno-math-errno -msse -mrecip -mfpmath=sse -msse2 -msse3 -lsdl -fopenmp -fwhole-program

TTSIOD 3D Renderer 2.3b

Phong Rendering With Soft-Shadow Mapping

FPS Per Watt, More Is Better

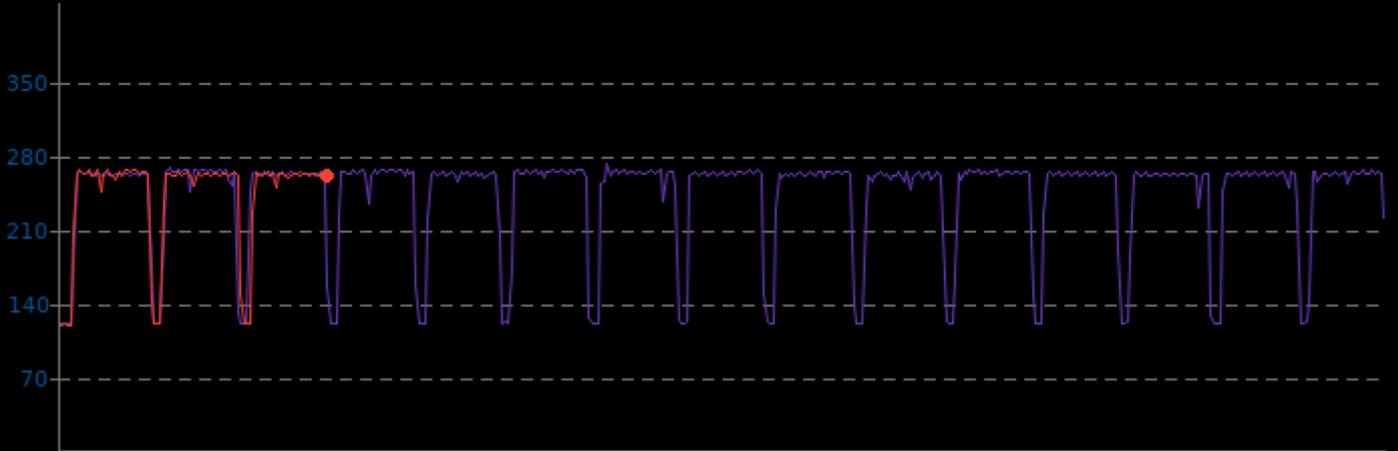


TTSIOD 3D Renderer 2.3b

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.0	243.0	271.3
CPUFreq Schedutil	120.7	242.4	266.3

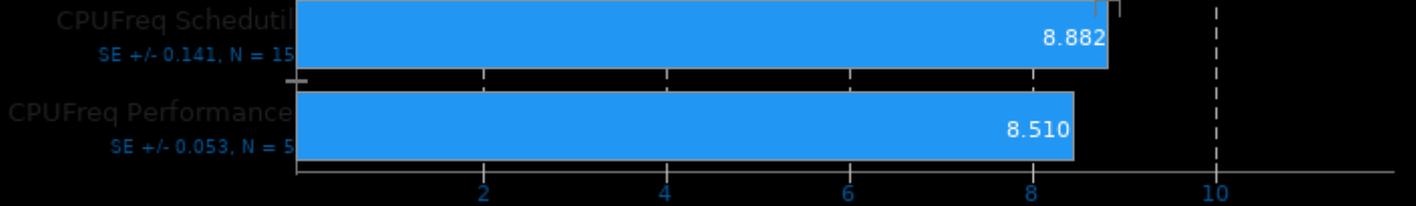
Watts, Fewer Is Better



Rodinia 3.1

Test: OpenMP CFD Solver

Seconds, Fewer Is Better



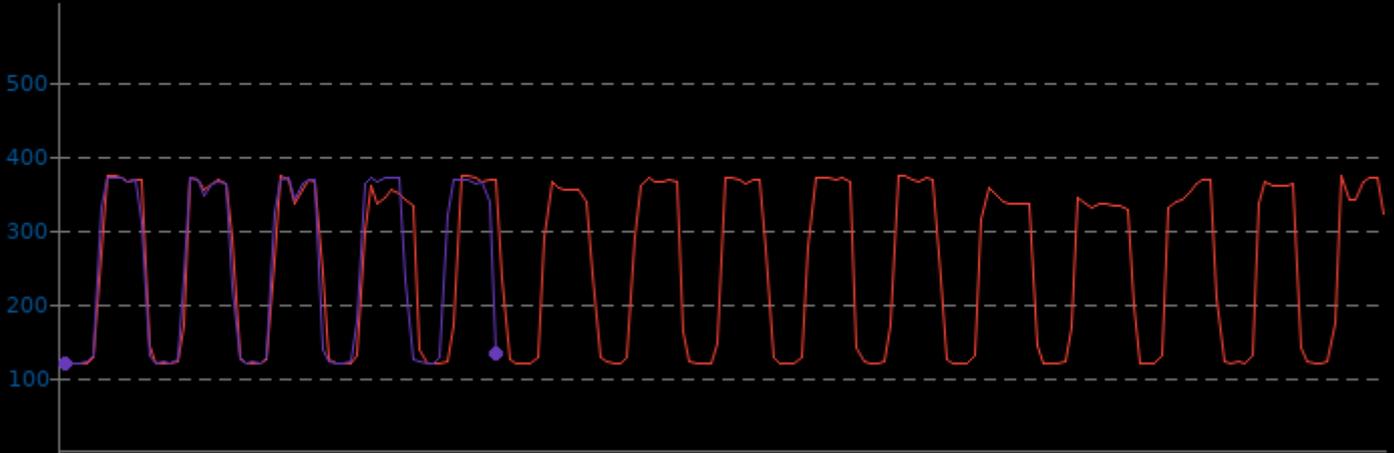
1. (CXX) g++ options: -O2 -fOpenCL

Rodinia 3.1

CPU Power Consumption Monitor

	Min	Avg	Max
■ CPUFreq Schedutil	121.0	253.4	373.0
■ CPUFreq Performance	120.9	253.1	370.6

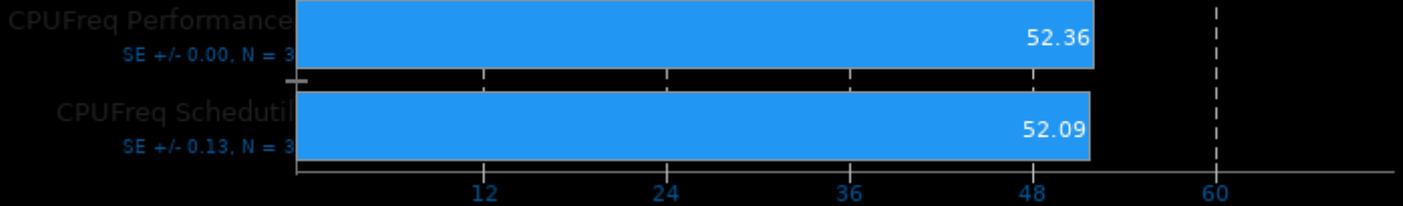
▼ Watts, Fewer Is Better



Rodinia 3.1

Test: OpenMP LavaMD

◀ Seconds, Fewer Is Better



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

Rodinia 3.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.8	433.4	492.3
CPUFreq Schedutil	120.7	430.6	492.3

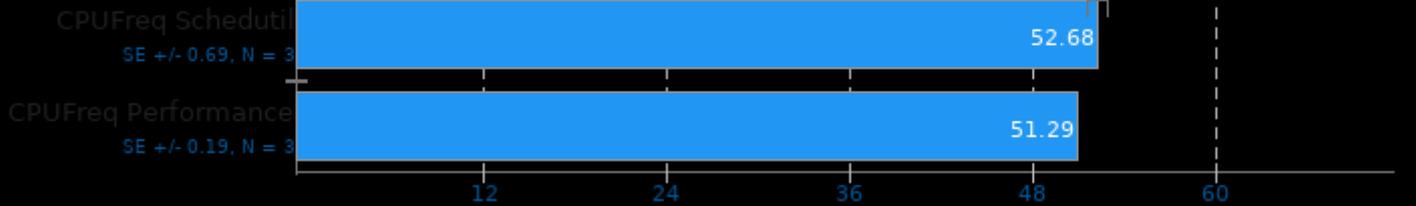
Watts, Fewer Is Better



Rodinia 3.1

Test: OpenMP Leukocyte

Seconds, Fewer Is Better



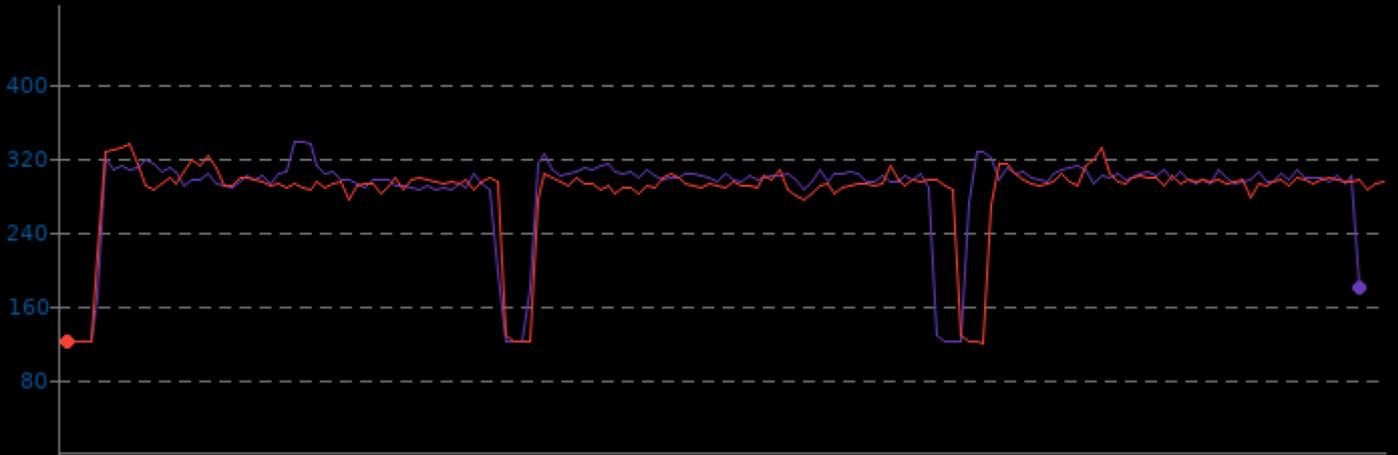
1. (CXX) g++ options: -O2 -fOpenCL

Rodinia 3.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	121.4	285.4	336.9
CPUFreq Schedutil	121.0	281.6	334.8

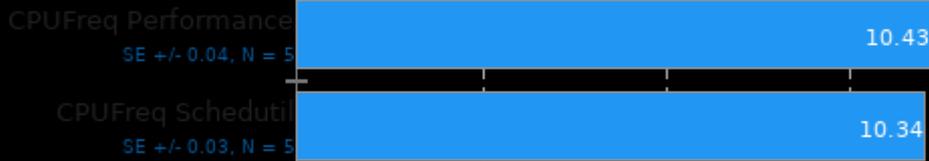
Watts, Fewer Is Better



Rodinia 3.1

Test: OpenMP Streamcluster

Seconds, Fewer Is Better



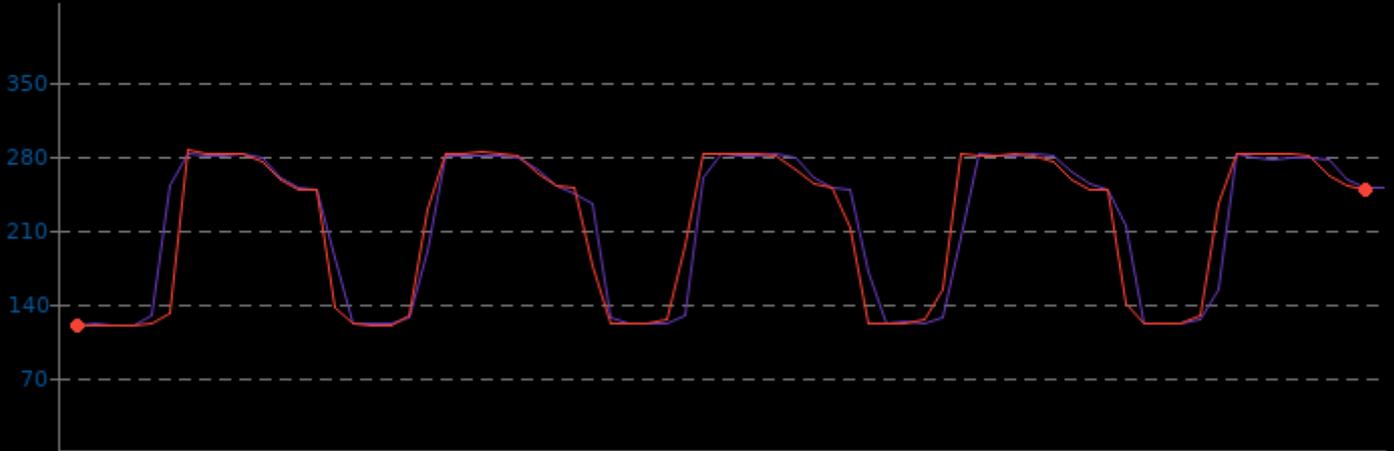
1. (CXX) g++ options: -O2 -fOpenCL

Rodinia 3.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.7	216.9	281.4
CPUFreq Schedutil	120.3	215.0	284.6

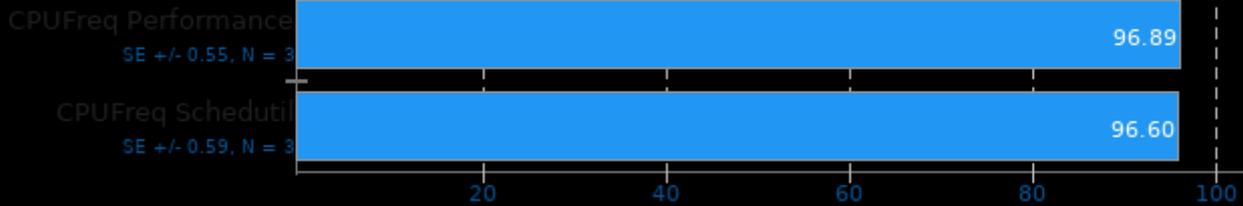
Watts, Fewer Is Better



Rodinia 3.1

Test: OpenMP HotSpot3D

Seconds, Fewer Is Better



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

Rodinia 3.1

CPU Power Consumption Monitor

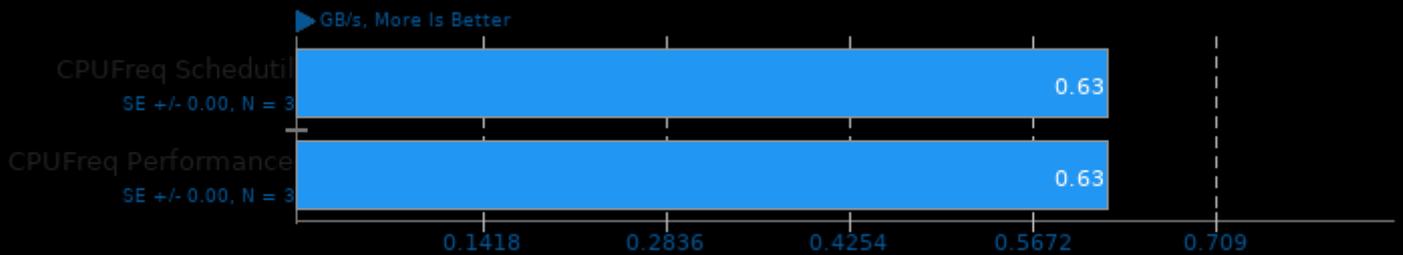
	Min	Avg	Max
CPUFreq Schedutil	120.1	157.6	257.7
CPUFreq Performance	119.8	156.2	253.4

Watts, Fewer Is Better



simdjson 0.7.1

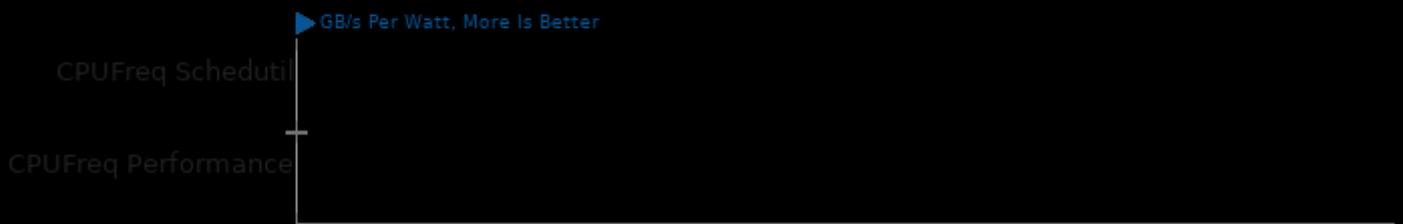
Throughput Test: PartialTweets



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

simdjson 0.7.1

Throughput Test: PartialTweets

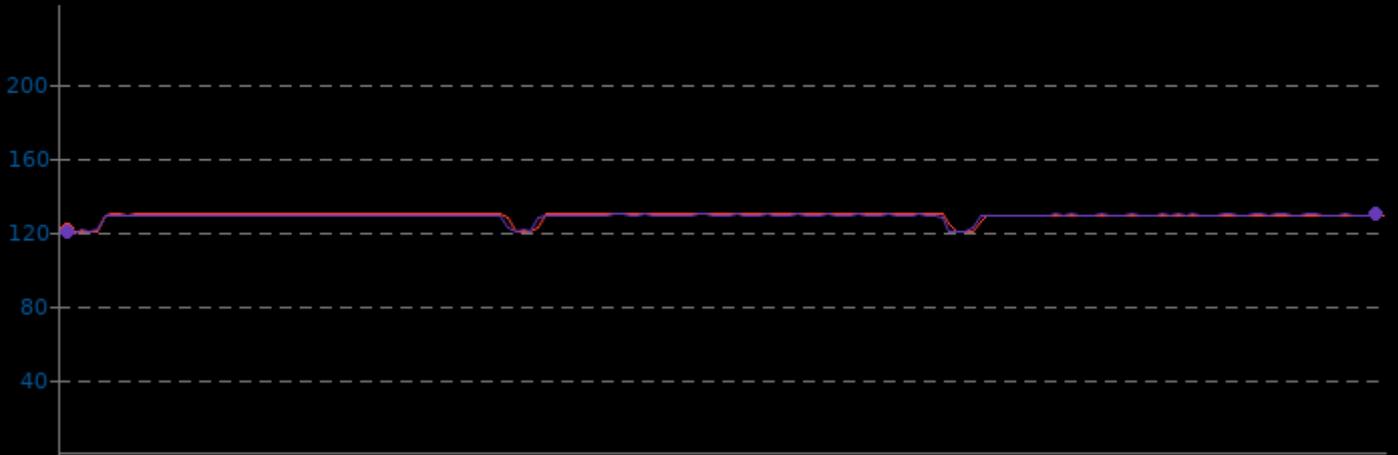


simdjson 0.7.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.8	128.6	130.0
CPUFreq Performance	119.4	128.3	129.2

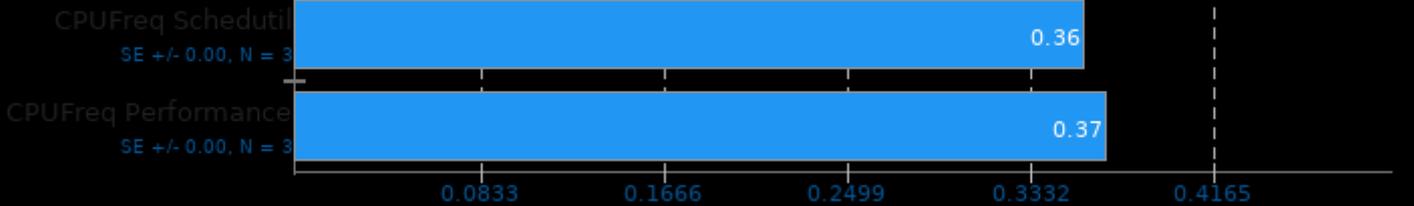
Watts, Fewer Is Better



simdjson 0.7.1

Throughput Test: LargeRandom

GB/s, More Is Better

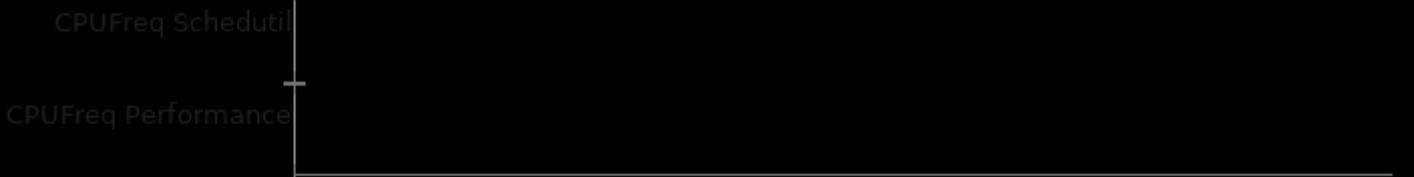


1. (CXX) g++ options: -O3 -pthread

simdjson 0.7.1

Throughput Test: LargeRandom

GB/s Per Watt, More Is Better

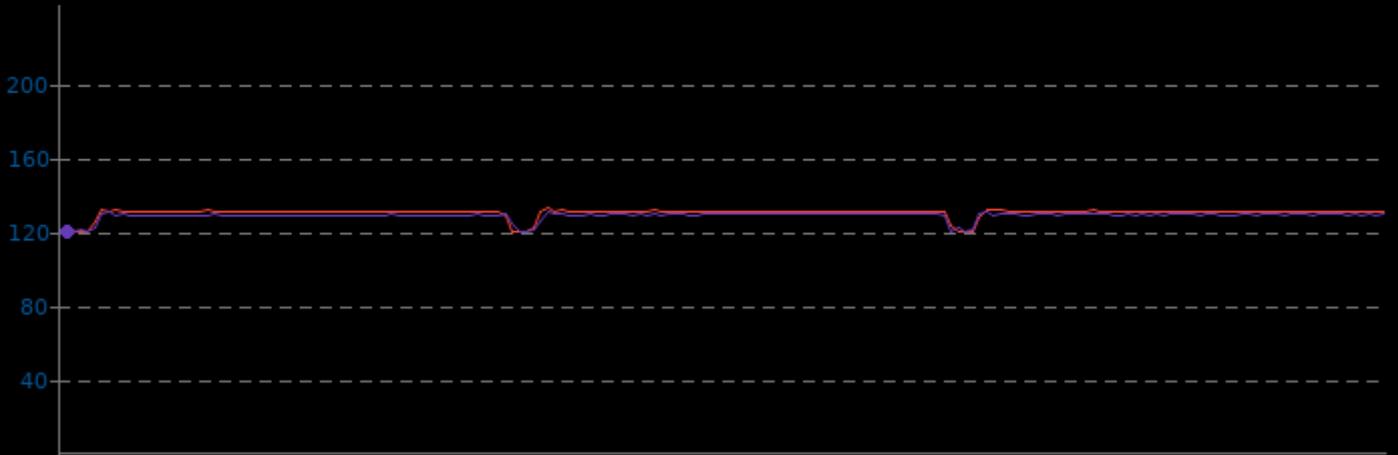


simdjson 0.7.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.1	129.9	132.4
CPUFreq Performance	119.7	128.6	131.1

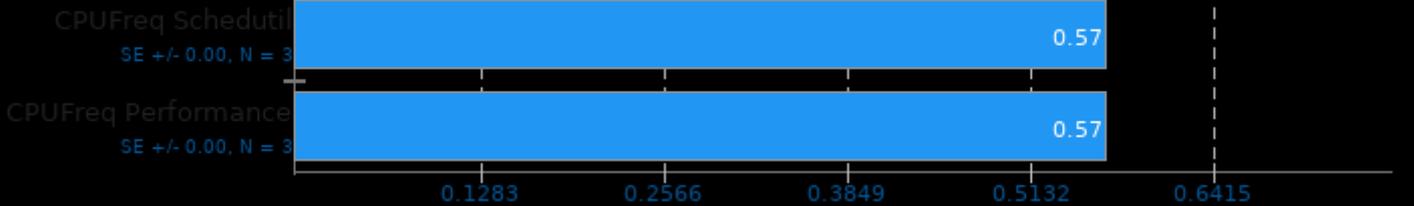
Watts, Fewer Is Better



simdjson 0.7.1

Throughput Test: Kostya

GB/s, More Is Better

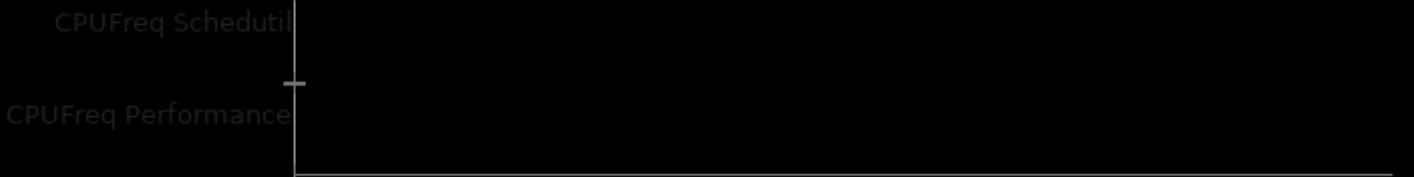


1. (CXX) g++ options: -O3 -pthread

simdjson 0.7.1

Throughput Test: Kostya

GB/s Per Watt, More Is Better

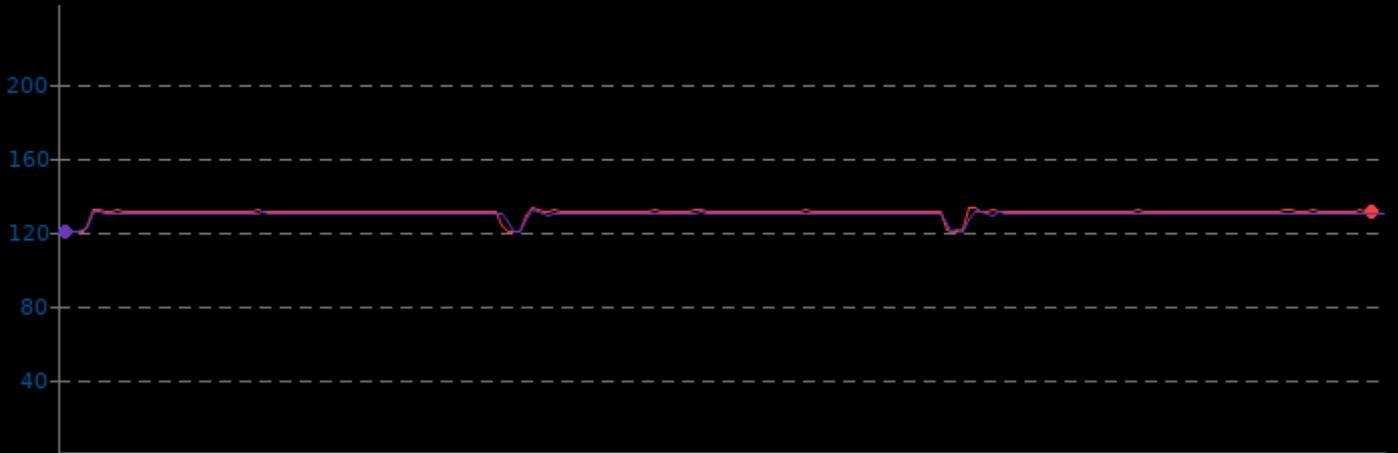


simdjson 0.7.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.9	130.5	132.8
CPUFreq Performance	119.8	128.9	131.5

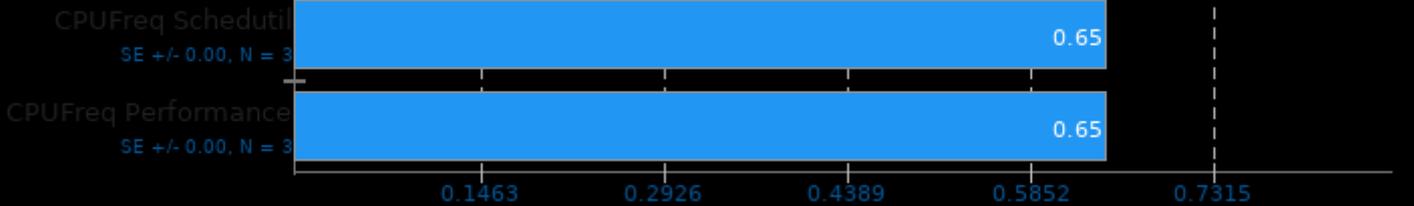
Watts, Fewer Is Better



simdjson 0.7.1

Throughput Test: DistinctUserID

GB/s, More Is Better

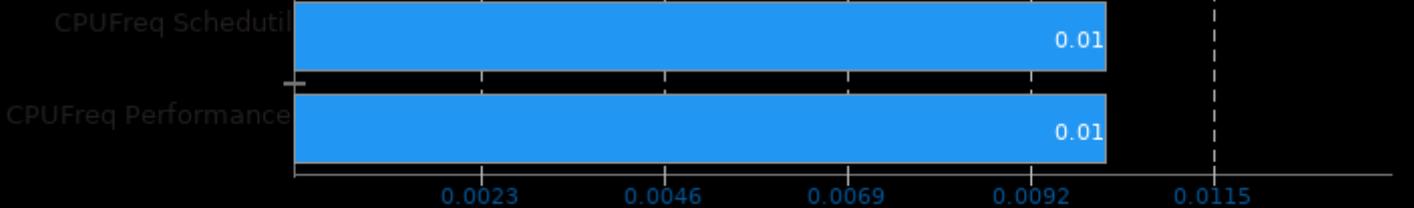


1. (CXX) g++ options: -O3 -pthread

simdjson 0.7.1

Throughput Test: DistinctUserID

GB/s Per Watt, More Is Better

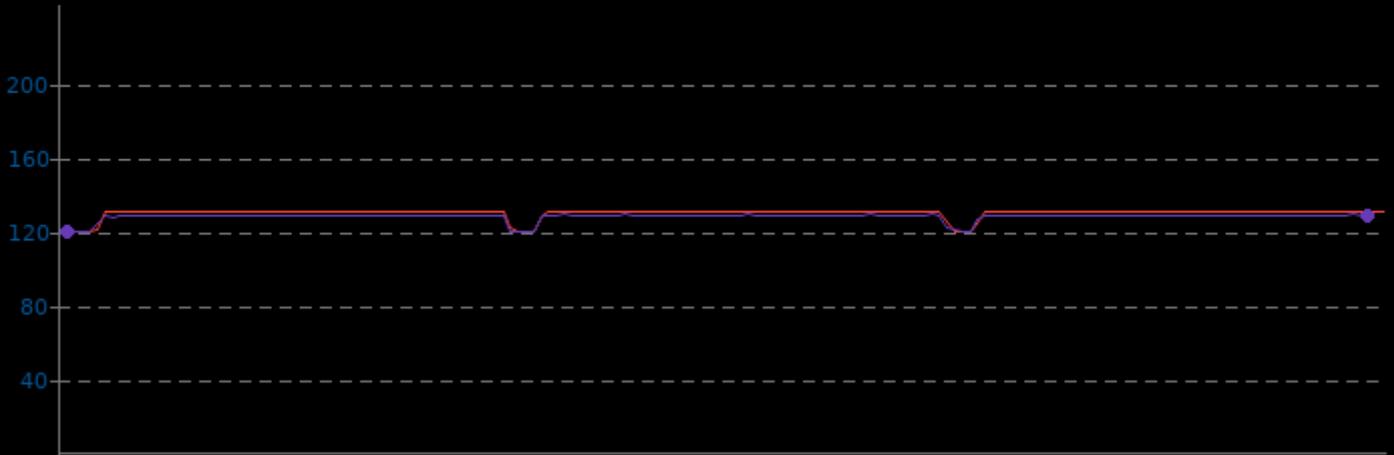


simdjson 0.7.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.1	129.7	130.6
CPUFreq Performance	119.7	128.1	129.2

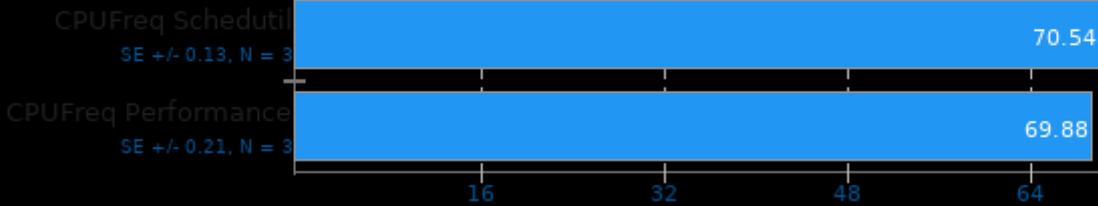
▼ Watts, Fewer Is Better



SQLite Speedtest 3.30

Timed Time - Size 1,000

◀ Seconds, Fewer Is Better



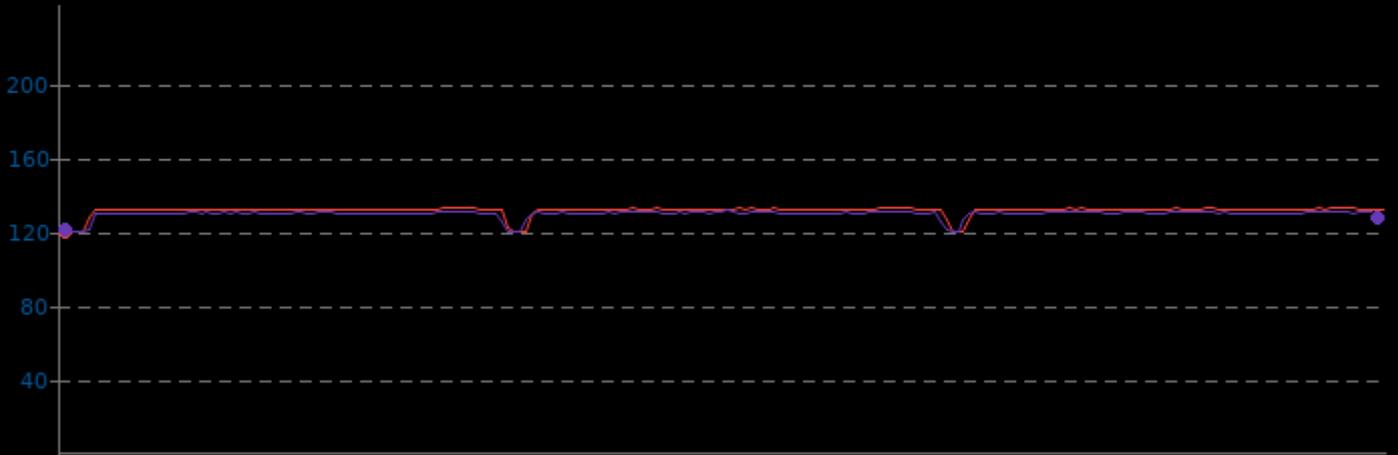
1. (CC) gcc options: -O2 -ldl -lz -lpthread

SQLite Speedtest 3.30

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.2	131.3	133.3
CPUFreq Performance	119.8	129.6	131.3

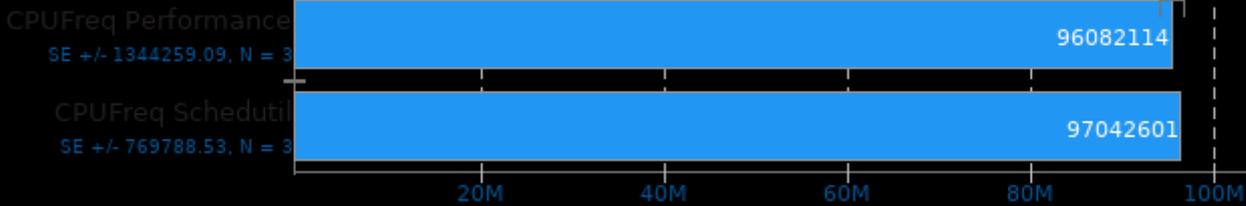
▼ Watts, Fewer Is Better



Stockfish 12

Total Time

► Nodes Per Second, More Is Better

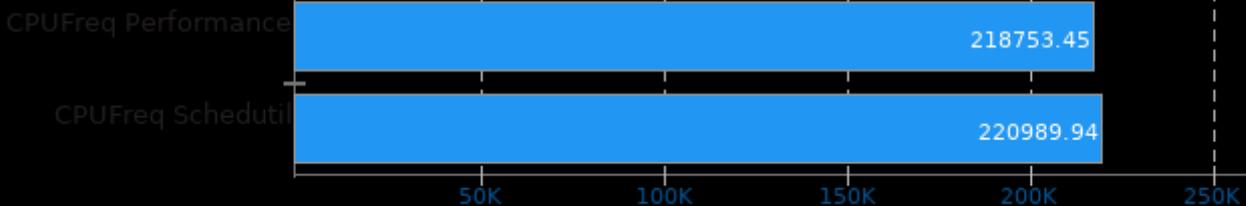


1. (CXX) g++ options: -m64 -pthread -fno-exceptions -std=c++17 -pedantic -O3 -msse -msse3 -mpopcnt -msse4.1 -mssse3 -msse2 -fno-float-exceptions -fno-float-exceptions=jobserver

Stockfish 12

Total Time

► Nodes Per Second Per Watt, More Is Better

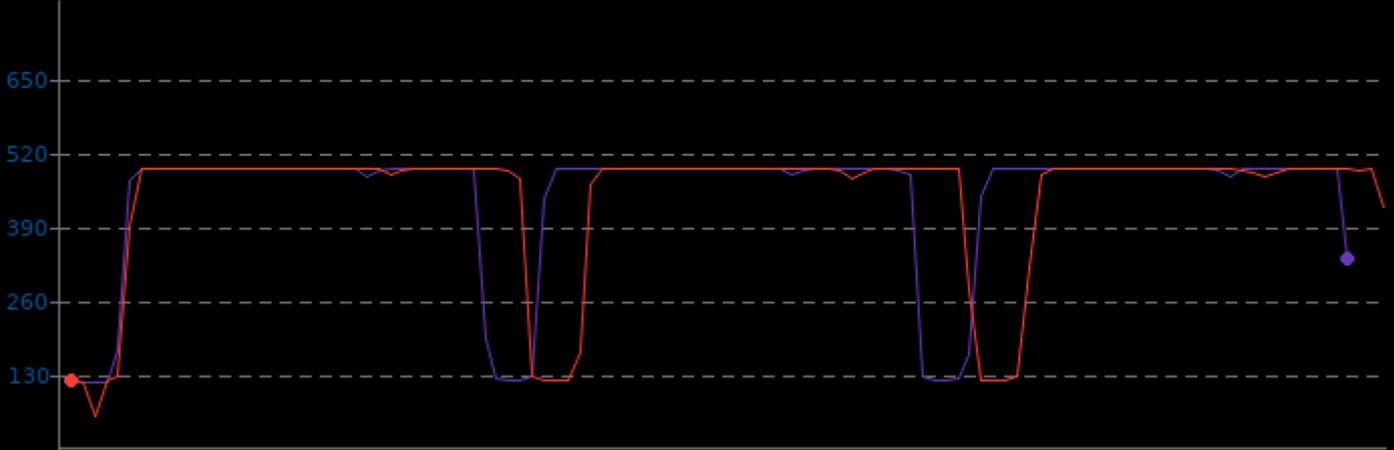


Stockfish 12

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.9	439.2	492.3
CPUFreq Schedutil	60.1	439.1	492.3

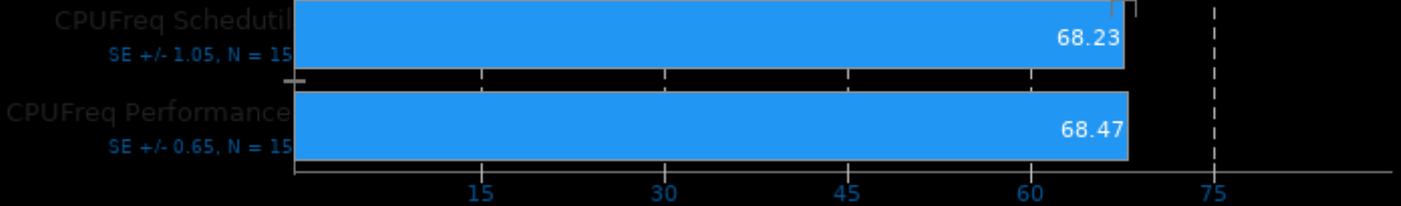
Watts, Fewer Is Better



SVT-AV1 0.8

Encoder Mode: Enc Mode 8 - Input: 1080p

Frames Per Second, More Is Better

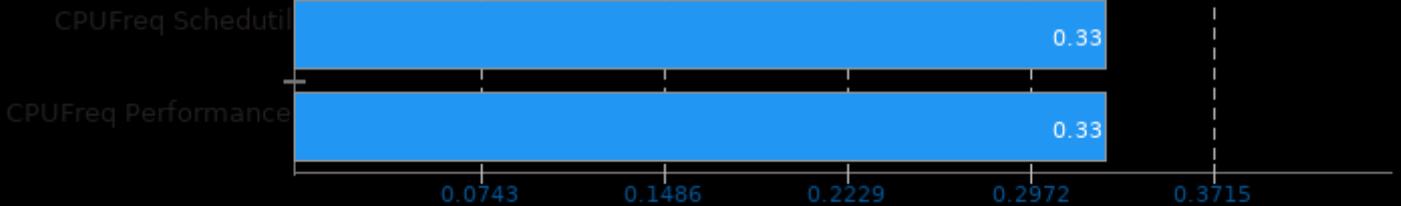


1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-AV1 0.8

Encoder Mode: Enc Mode 8 - Input: 1080p

Frames Per Second Per Watt, More Is Better

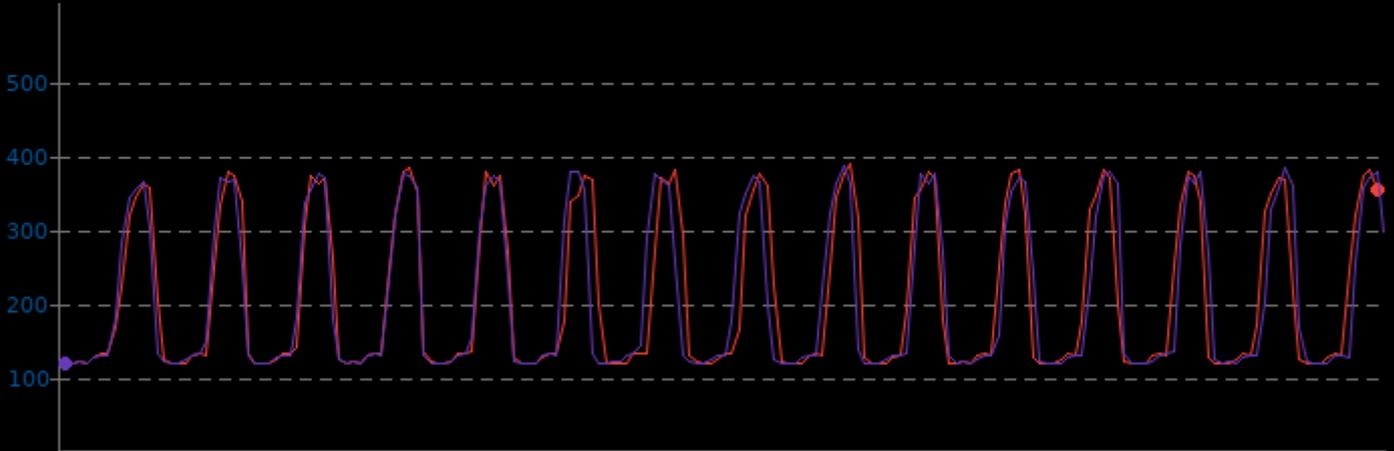


SVT-AV1 0.8

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.4	209.8	388.0
CPUFreq Performance	120.4	207.6	386.1

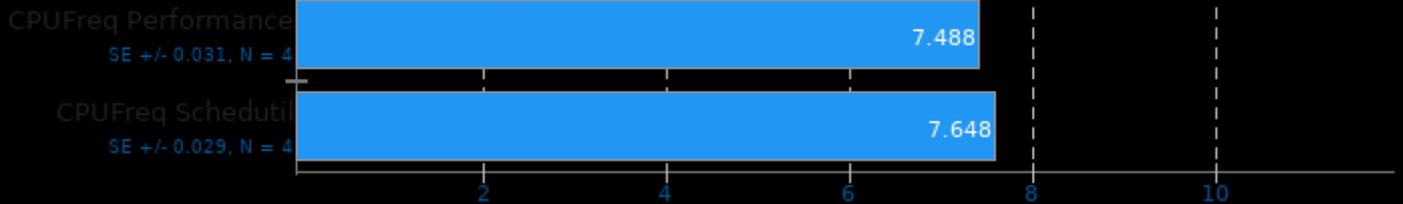
Watts, Fewer Is Better



SVT-AV1 0.8

Encoder Mode: Enc Mode 4 - Input: 1080p

Frames Per Second, More Is Better

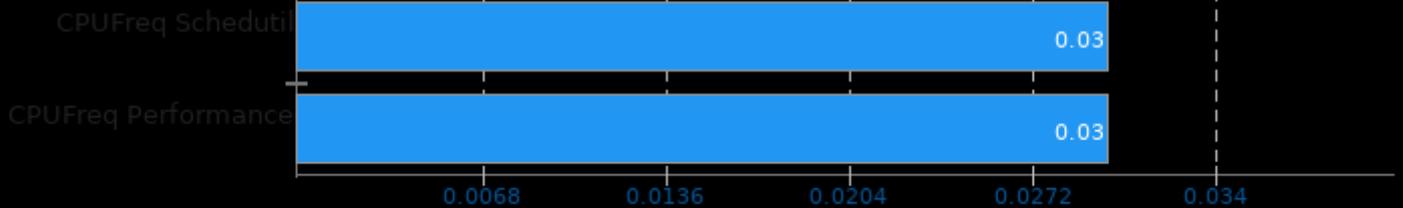


1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-AV1 0.8

Encoder Mode: Enc Mode 4 - Input: 1080p

Frames Per Second Per Watt, More Is Better

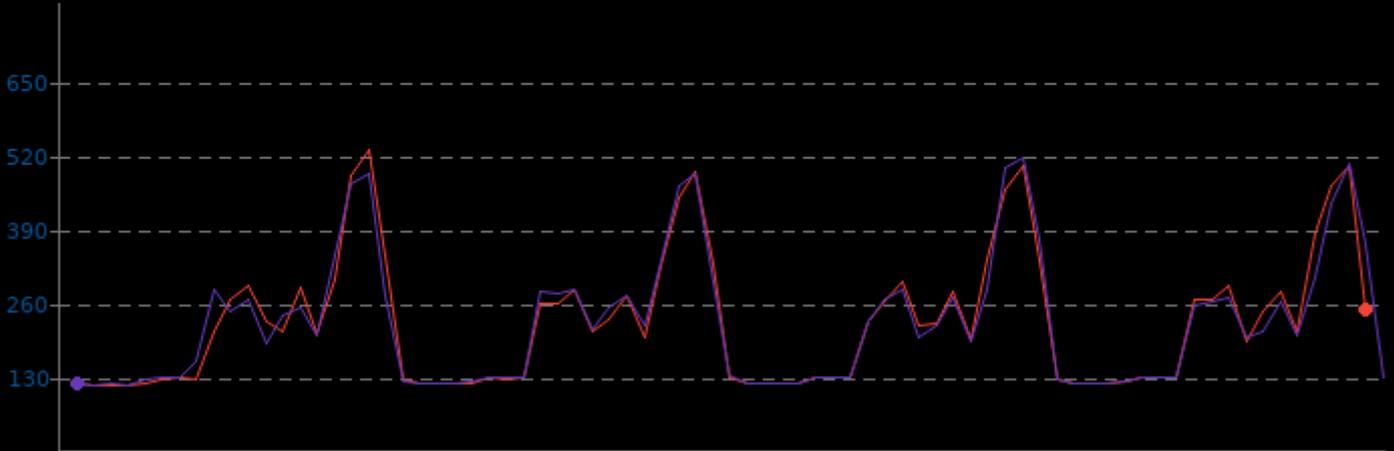


SVT-AV1 0.8

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.9	229.6	530.7
CPUFreq Performance	120.0	227.7	514.1

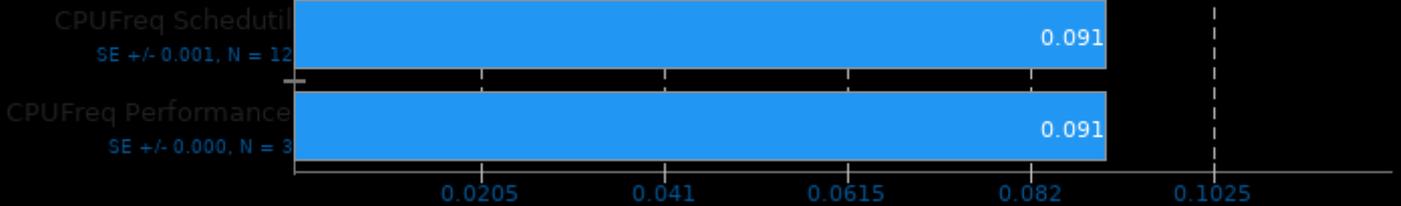
Watts, Fewer Is Better



SVT-AV1 0.8

Encoder Mode: Enc Mode 0 - Input: 1080p

Frames Per Second, More Is Better

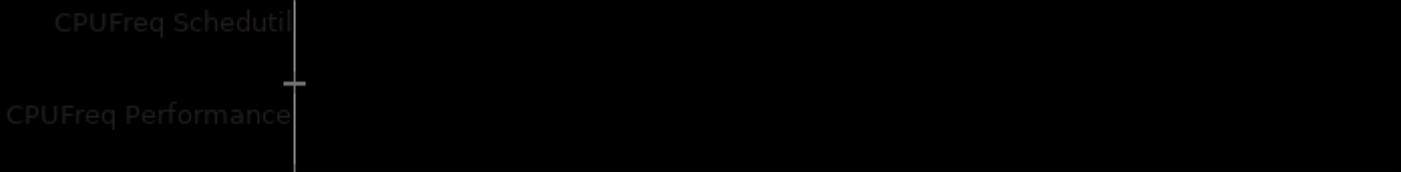


1. (CXX) g++ options: -O3 -fcommon -fPIE -fPIC -pie

SVT-AV1 0.8

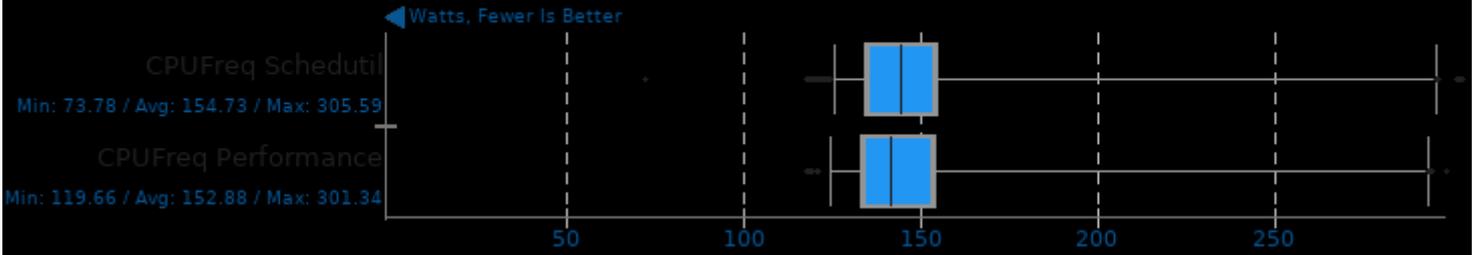
Encoder Mode: Enc Mode 0 - Input: 1080p

Frames Per Second Per Watt, More Is Better



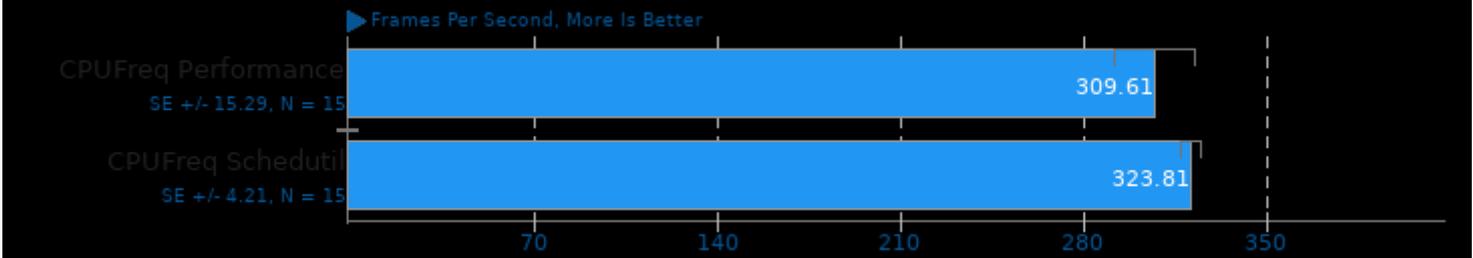
SVT-AV1 0.8

CPU Power Consumption Monitor



SVT-VP9 0.1

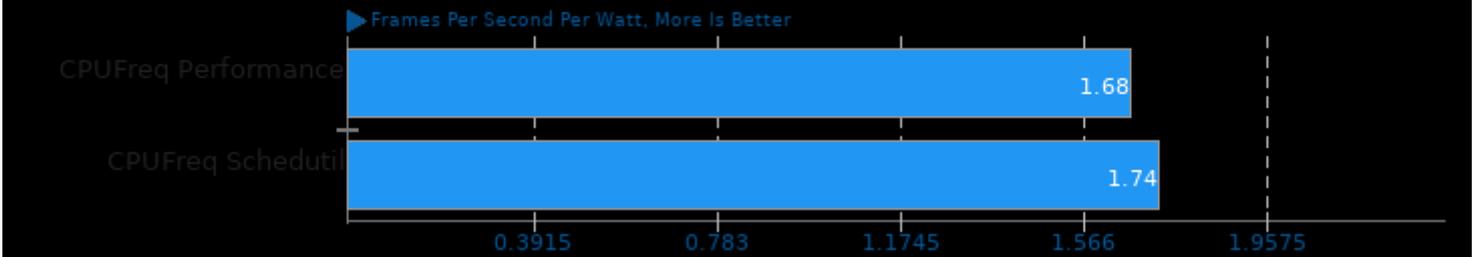
Tuning: Visual Quality Optimized - Input: Bosphorus 1080p



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

SVT-VP9 0.1

Tuning: Visual Quality Optimized - Input: Bosphorus 1080p

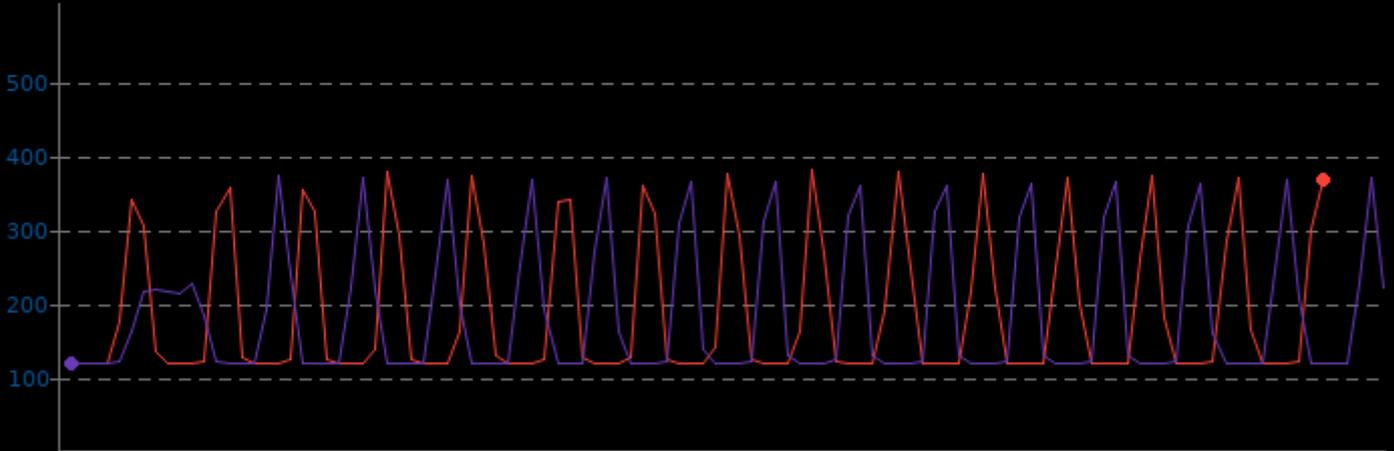


SVT-VP9 0.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.4	185.8	379.1
CPUFreq Performance	119.5	184.0	372.3

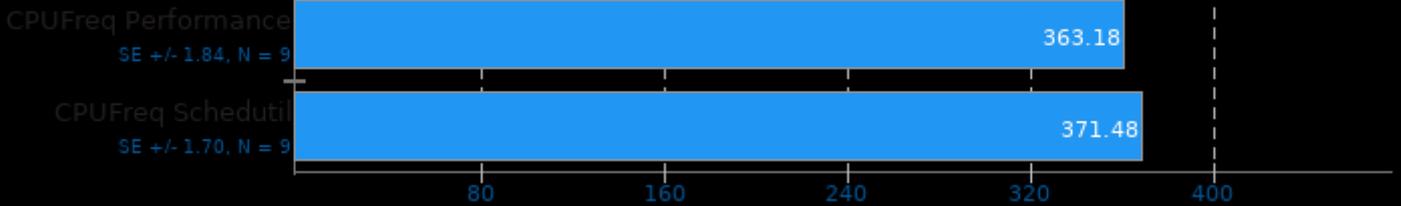
Watts, Fewer Is Better



SVT-VP9 0.1

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

Frames Per Second, More Is Better

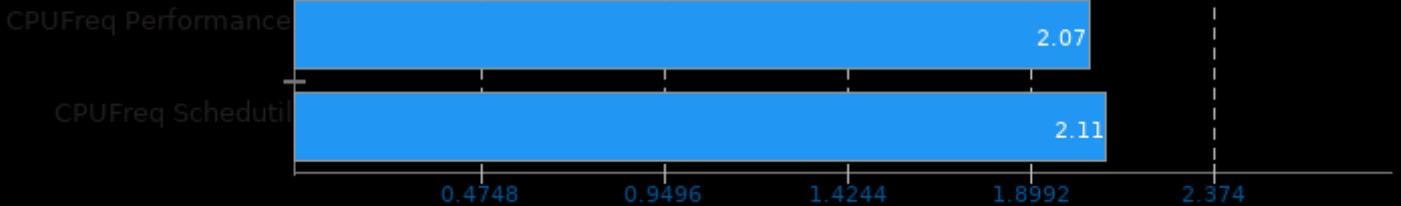


1. (C) gcc options: -O3 -fcommon -fPIE -fpic -fvisibility=hidden -pie -rdynamic -pthread -lrt -lm

SVT-VP9 0.1

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

Frames Per Second Per Watt, More Is Better

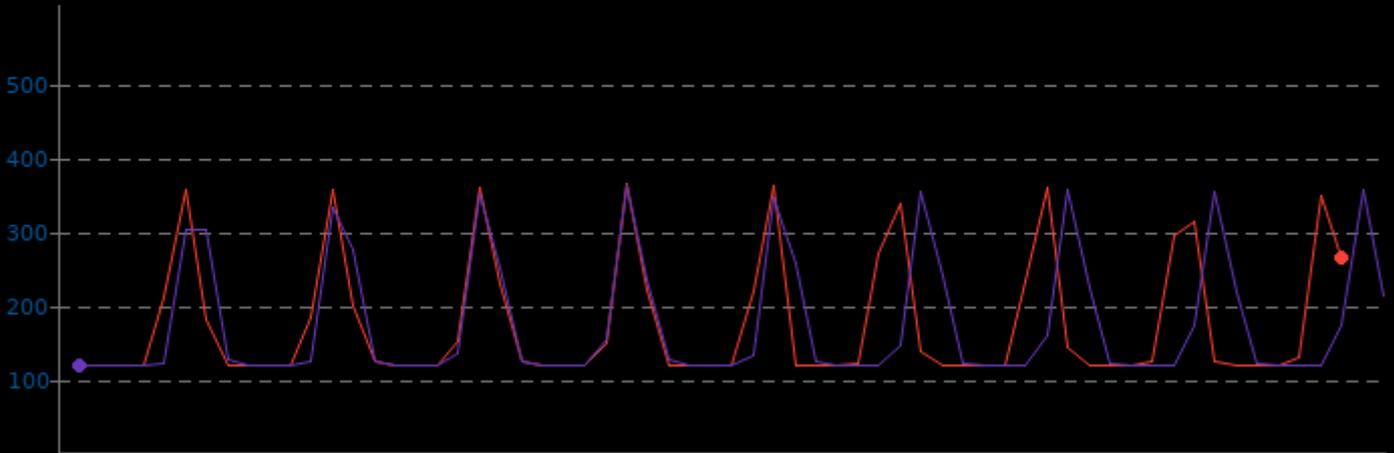


SVT-VP9 0.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.7	176.2	363.1
CPUFreq Performance	119.7	175.3	361.0

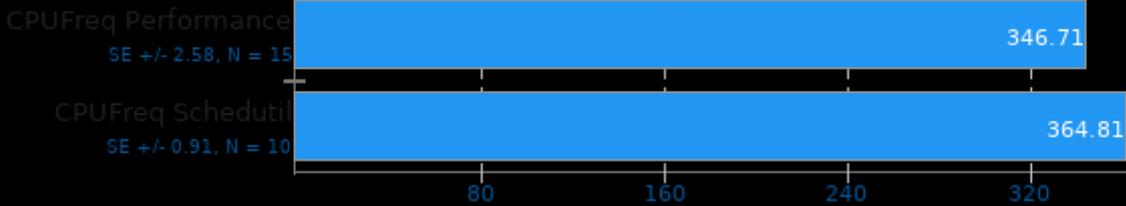
Watts, Fewer Is Better



SVT-VP9 0.1

Tuning: VMAF Optimized - Input: Bosphorus 1080p

Frames Per Second, More Is Better

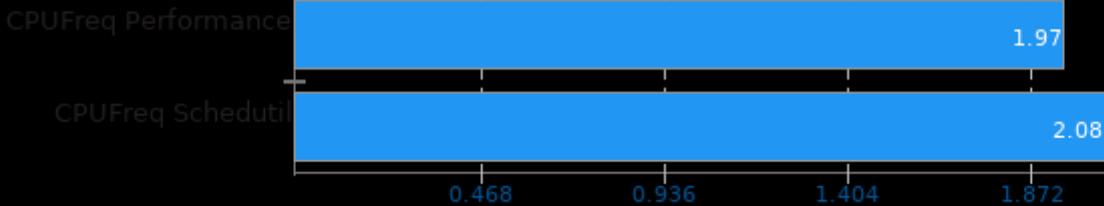


1. (C) gcc options: -O3 -fcommon -fPIE -fPIC -fvisibility=hidden -pie -rdynamic -pthread -lrt -lm

SVT-VP9 0.1

Tuning: VMAF Optimized - Input: Bosphorus 1080p

Frames Per Second Per Watt, More Is Better

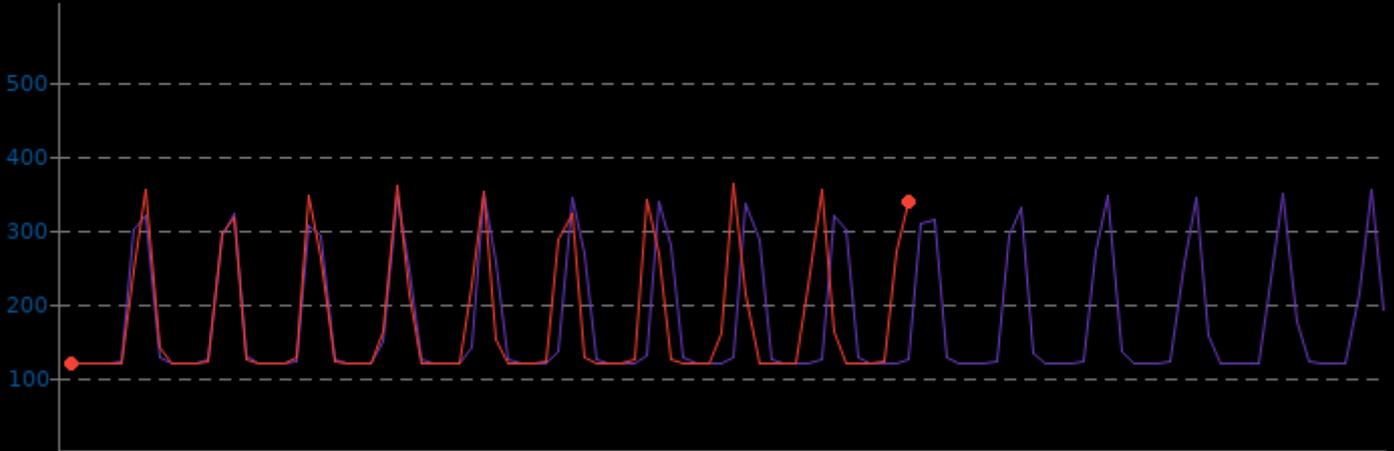


SVT-VP9 0.1

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	119.9	175.7	352.5
CPUFreq Schedutil	119.8	175.7	360.6

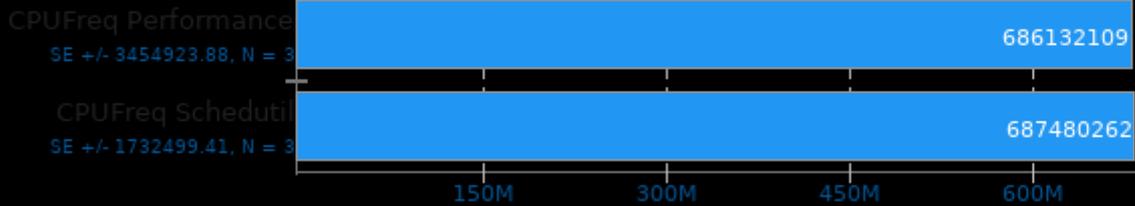
Watts, Fewer Is Better



Swet 1.5.16

Average

Operations Per Second, More Is Better

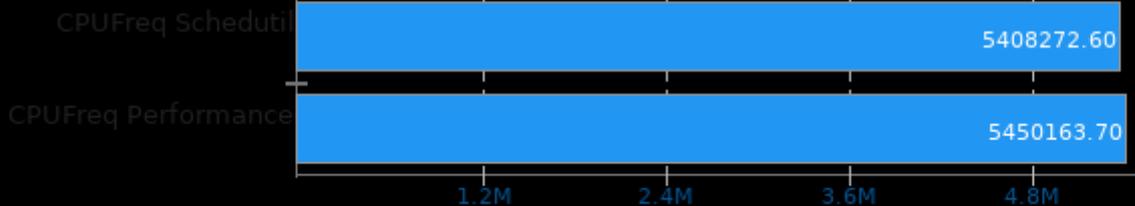


1. (CO) gcc options: -lm -pthread -curses -lrt

Swet 1.5.16

Average

Operations Per Second Per Watt, More Is Better

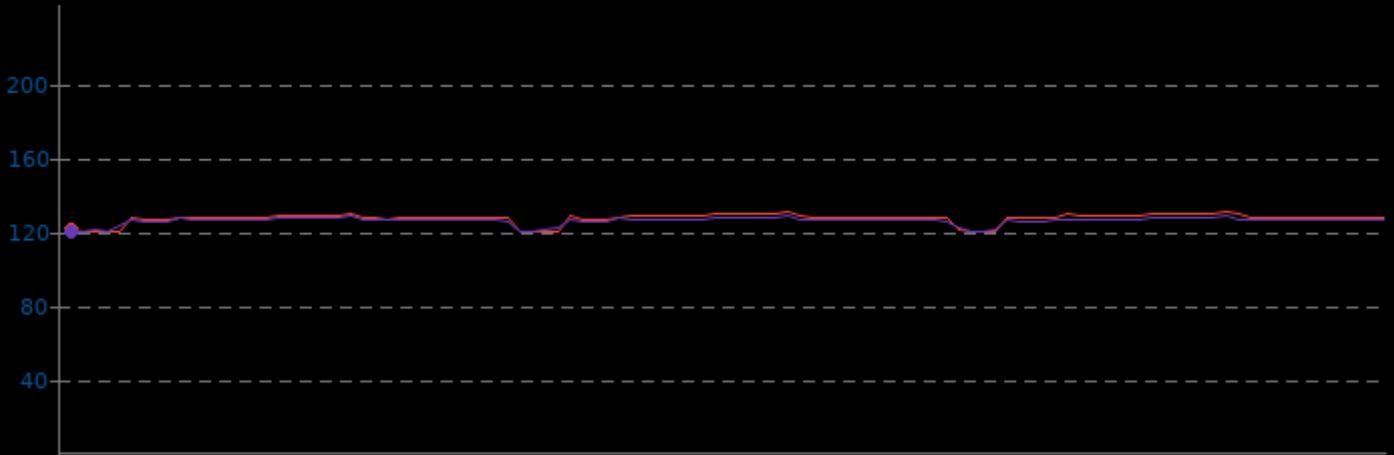


Swet 1.5.16

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.7	127.1	130.6
CPUFreq Performance	119.9	125.9	128.8

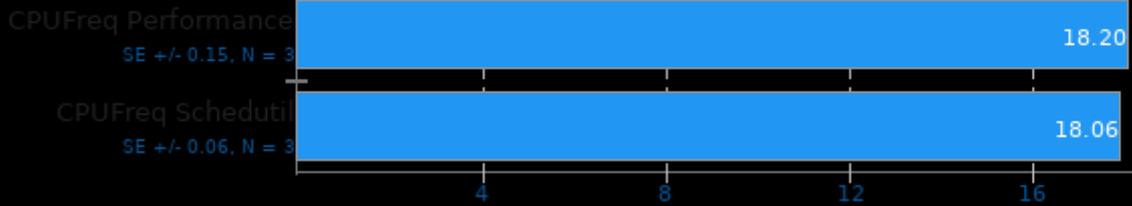
▼ Watts, Fewer Is Better



Tachyon 0.99b6

Total Time

◀ Seconds, Fewer Is Better



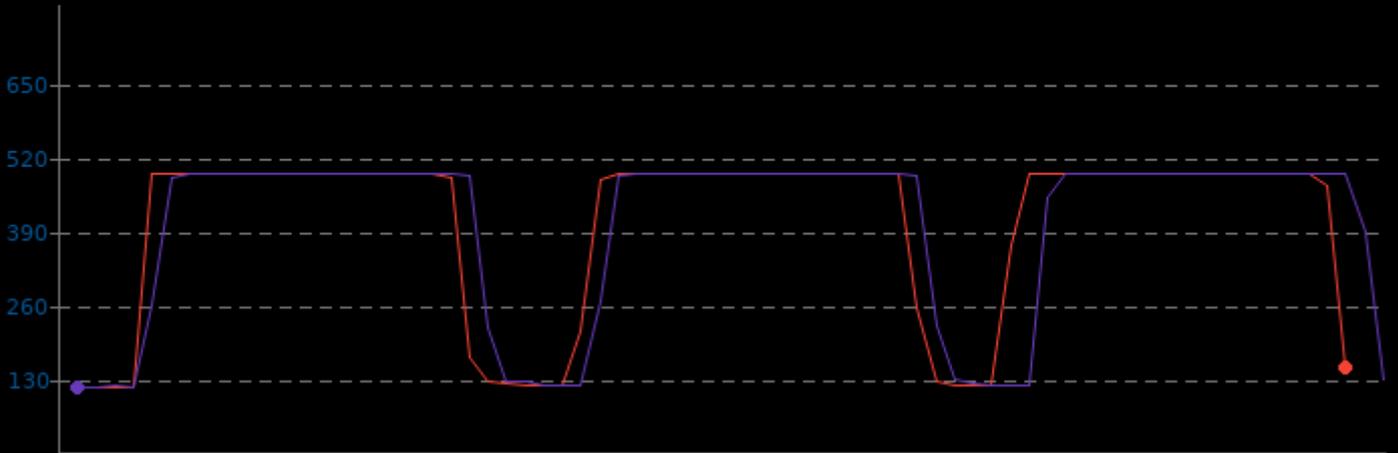
1. (CC) gcc options: -m64 -O3 -fomit-frame-pointer -ffast-math -ltachyon -lm -lpthread

Tachyon 0.99b6

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	119.9	402.8	492.0
CPUFreq Performance	120.0	397.8	492.0

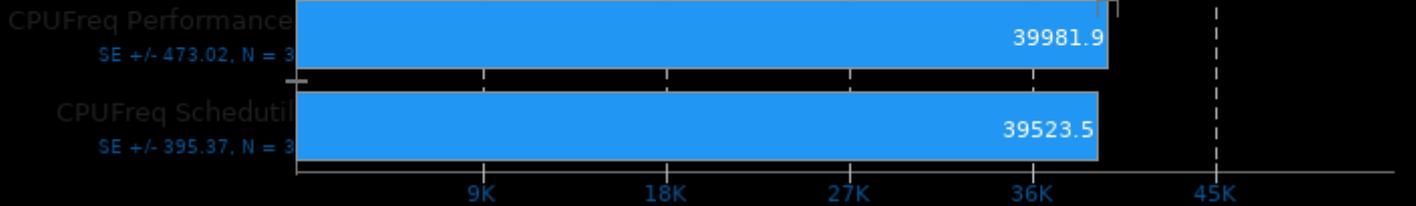
▼ Watts, Fewer Is Better

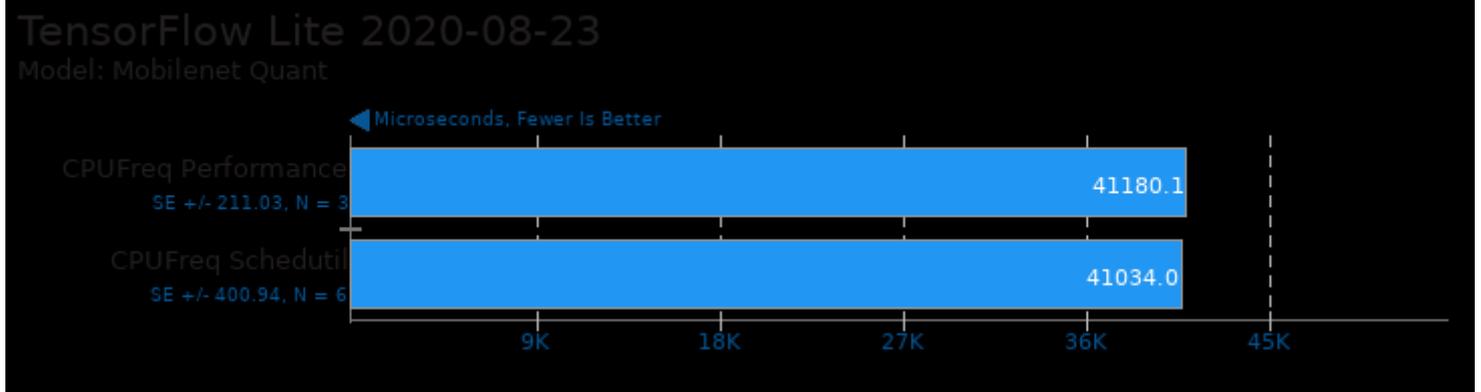
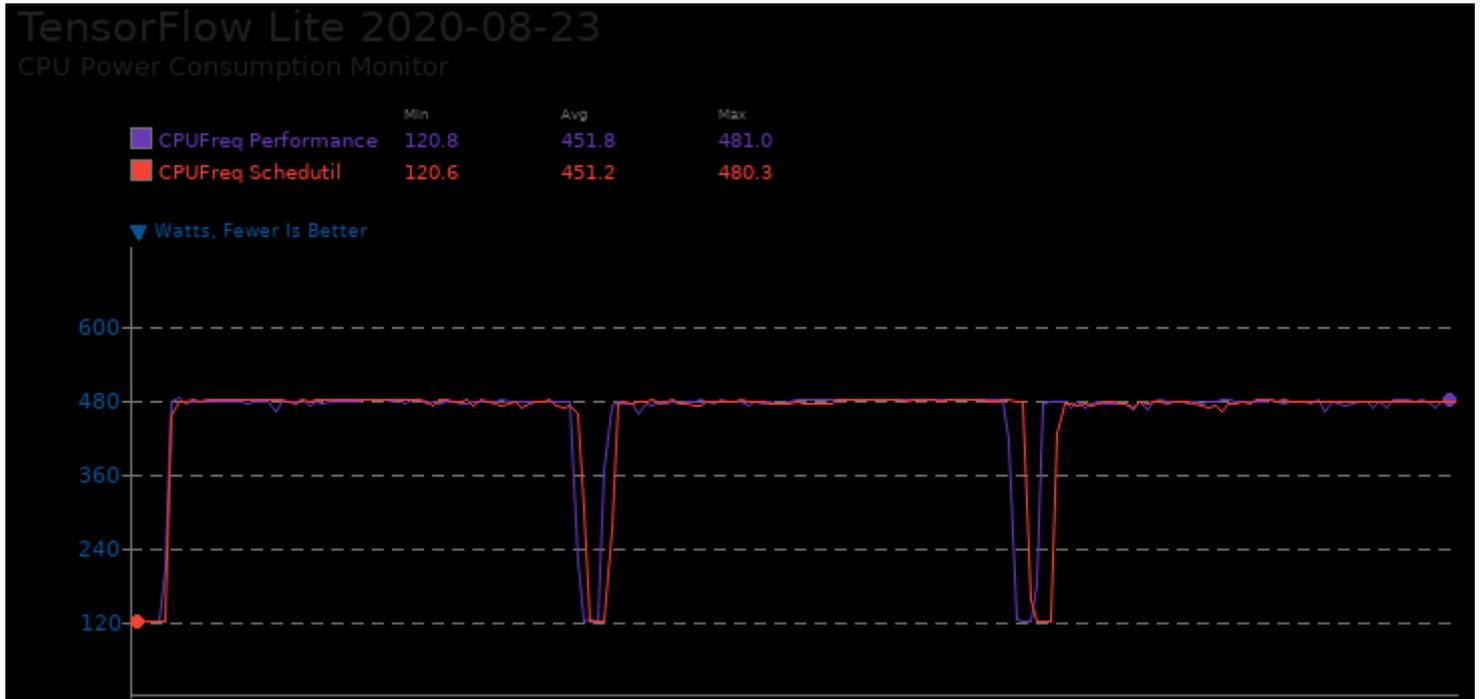


TensorFlow Lite 2020-08-23

Model: Mobilenet Float

◀ Microseconds, Fewer Is Better



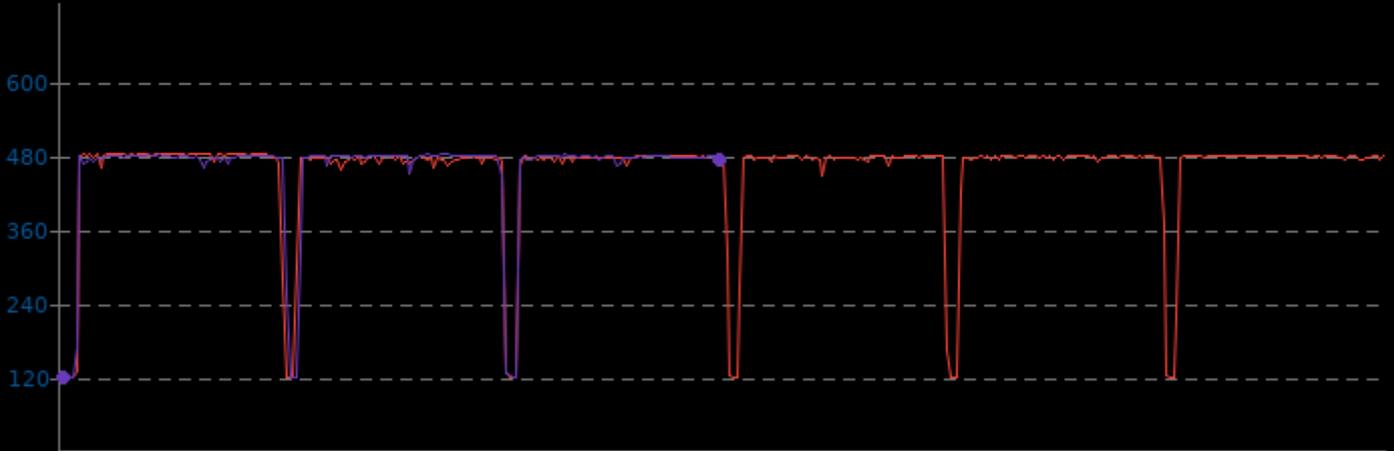


TensorFlow Lite 2020-08-23

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.2	453.6	483.1
CPUFreq Performance	121.6	453.0	481.2

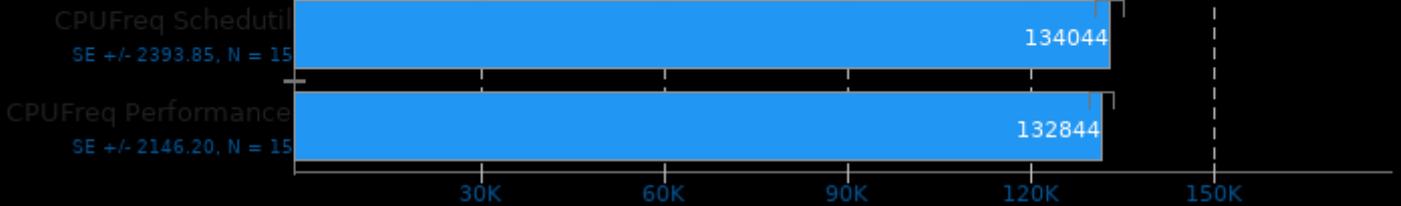
Watts, Fewer Is Better



TensorFlow Lite 2020-08-23

Model: NASNet Mobile

Microseconds, Fewer Is Better

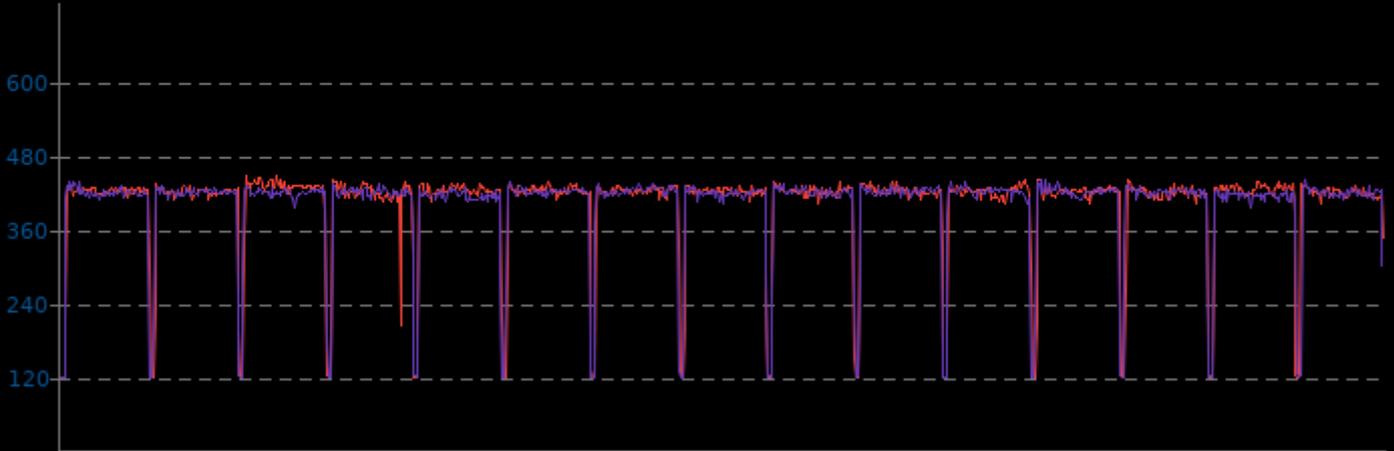


TensorFlow Lite 2020-08-23

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.5	403.7	446.4
CPUFreq Performance	121.8	401.7	439.7

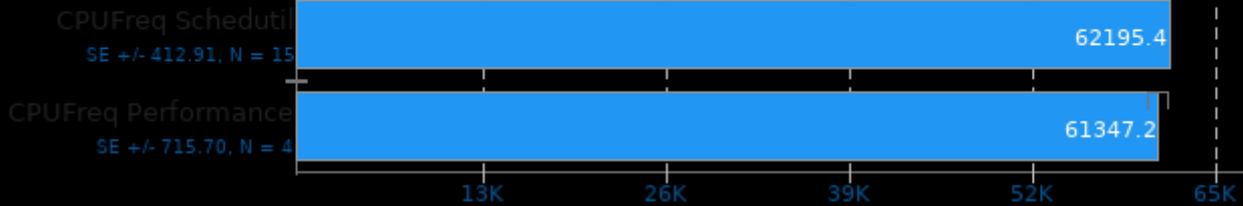
Watts, Fewer Is Better

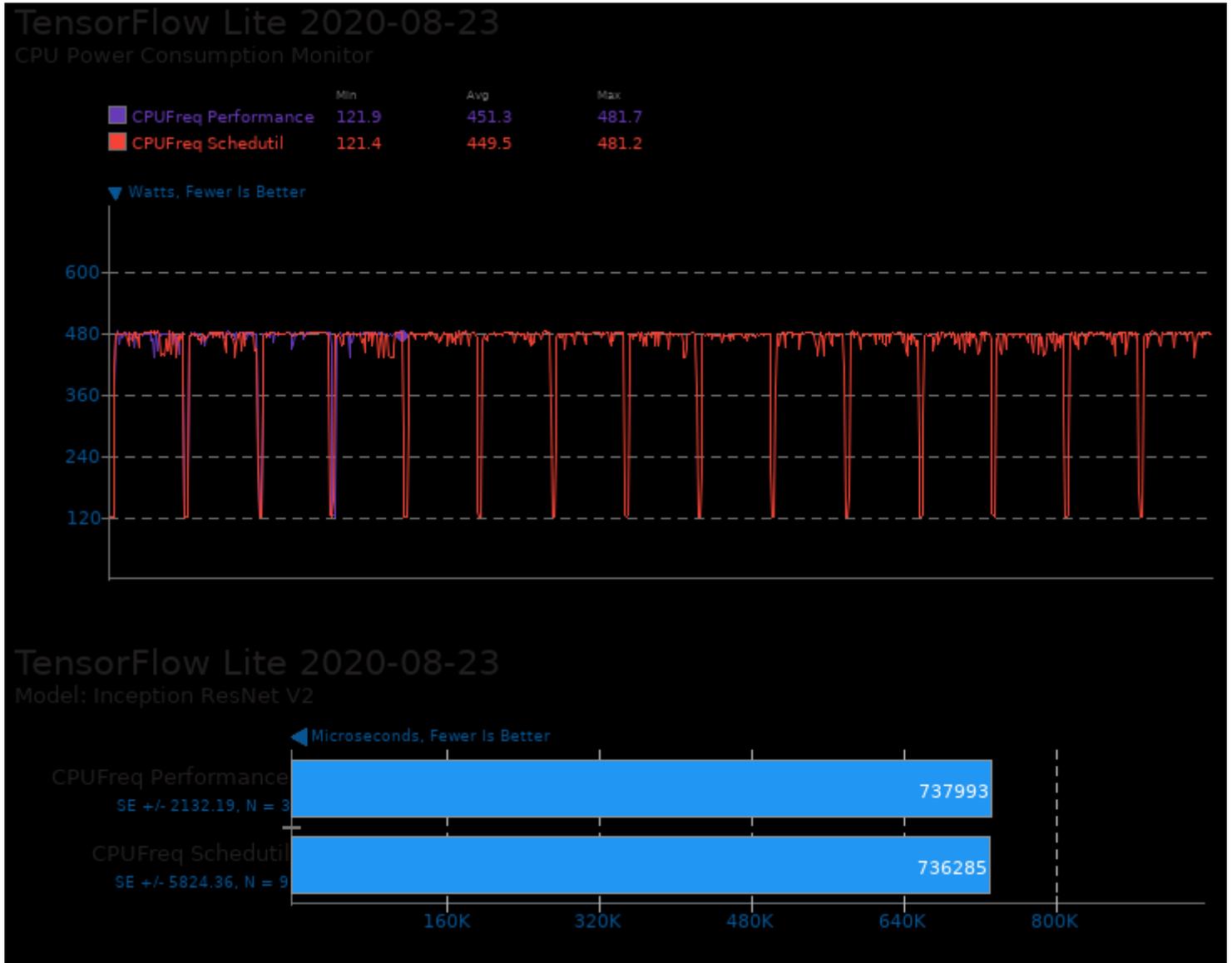


TensorFlow Lite 2020-08-23

Model: SqueezeNet

Microseconds, Fewer Is Better



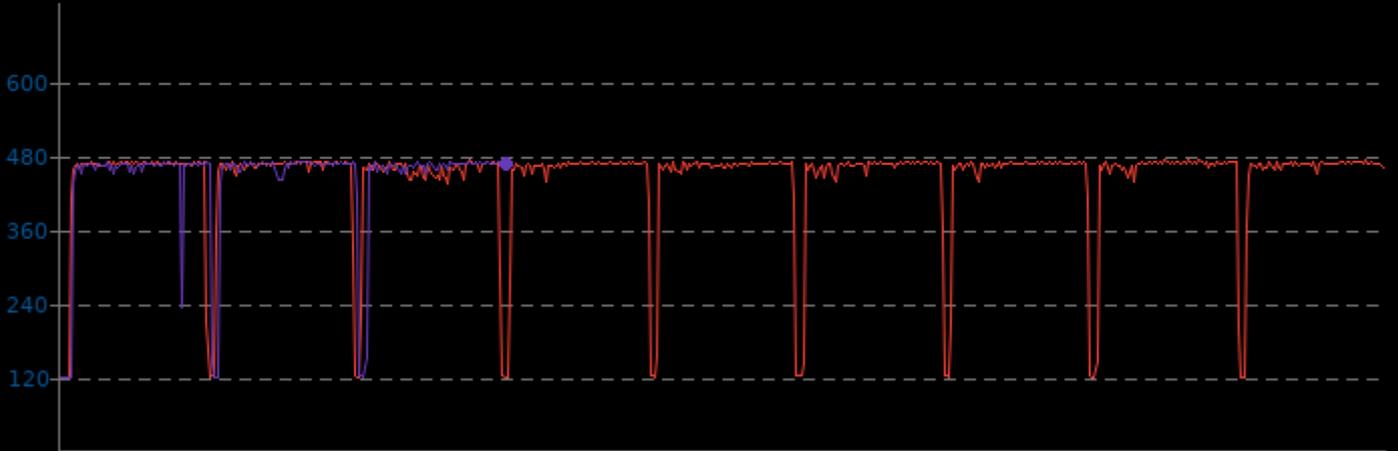


TensorFlow Lite 2020-08-23

CPU Power Consumption Monitor

	Min	Avg	Max
■ CPUFreq Schedutil	121.6	442.7	471.4
■ CPUFreq Performance	121.8	439.4	470.5

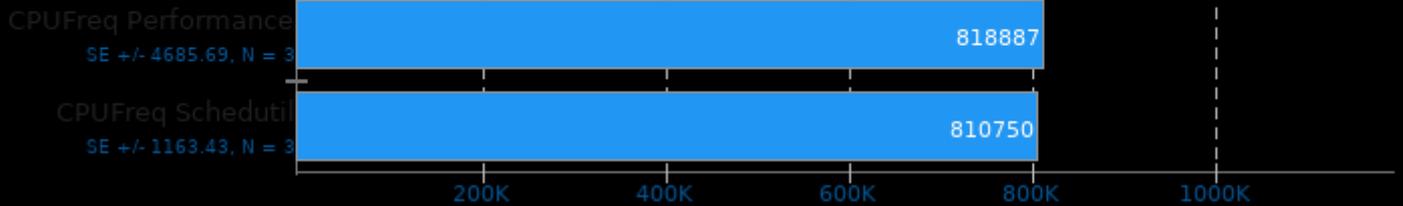
▼ Watts, Fewer Is Better



TensorFlow Lite 2020-08-23

Model: Inception V4

◀ Microseconds, Fewer Is Better

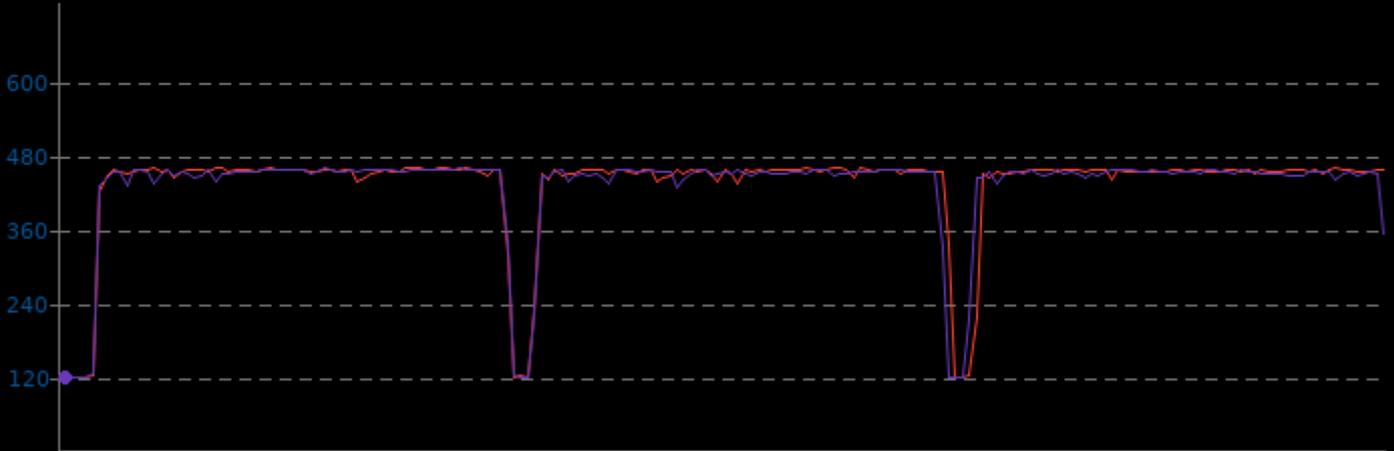


TensorFlow Lite 2020-08-23

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	121.5	431.6	460.9
CPUFreq Performance	121.7	429.0	458.6

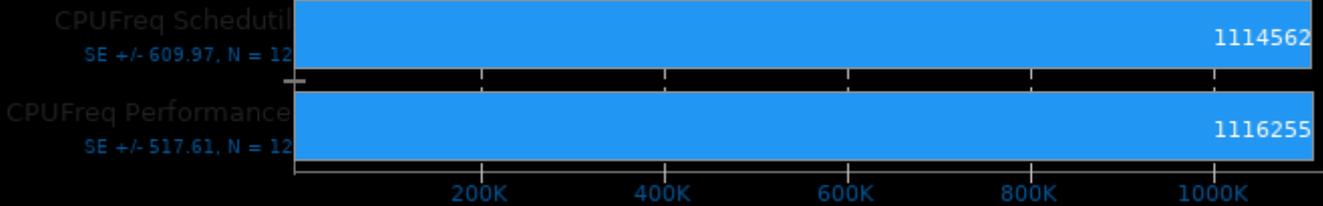
▼ Watts, Fewer Is Better



TSCP 1.81

AI Chess Performance

► Nodes Per Second, More Is Better

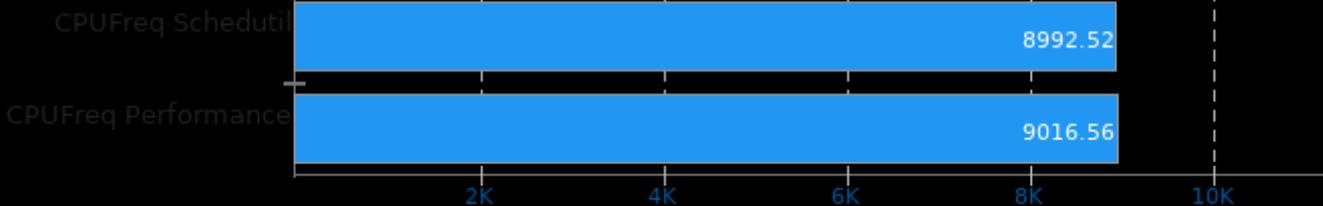


1. (CO) gcc options: -O3 -march=native

TSCP 1.81

AI Chess Performance

► Nodes Per Second Per Watt, More Is Better

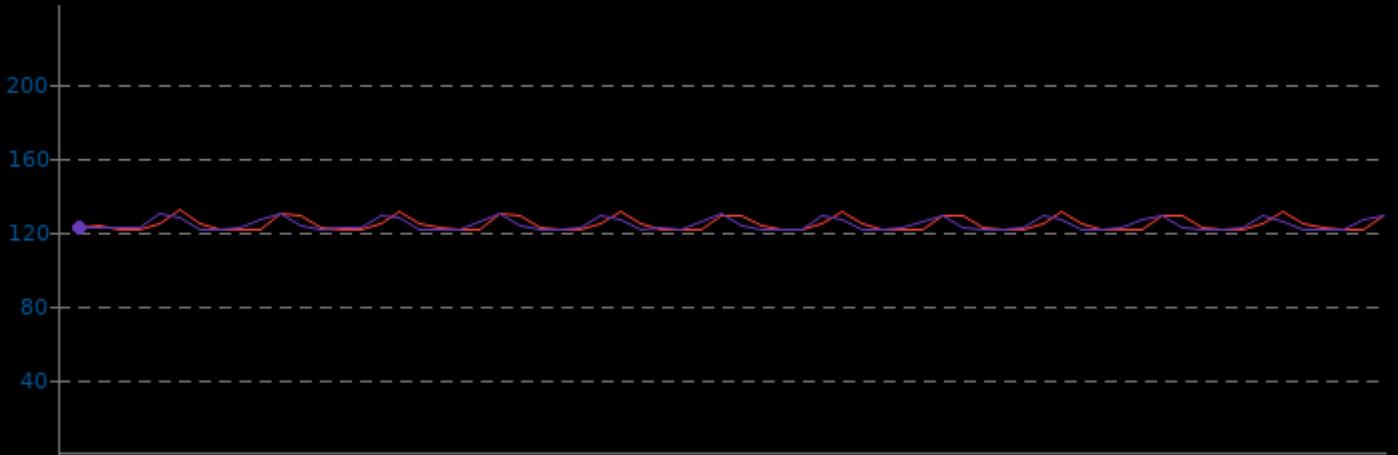


TSCP 1.81

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.7	123.9	131.5
CPUFreq Performance	120.8	123.8	129.7

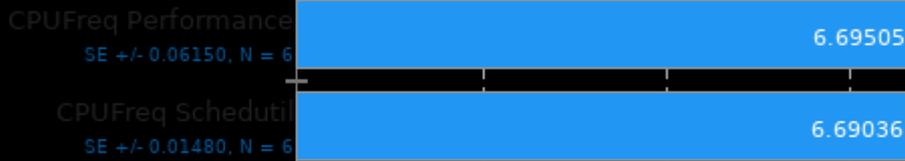
▼ Watts, Fewer Is Better



Tungsten Renderer 0.2.2

Scene: Hair

◀ Seconds, Fewer Is Better



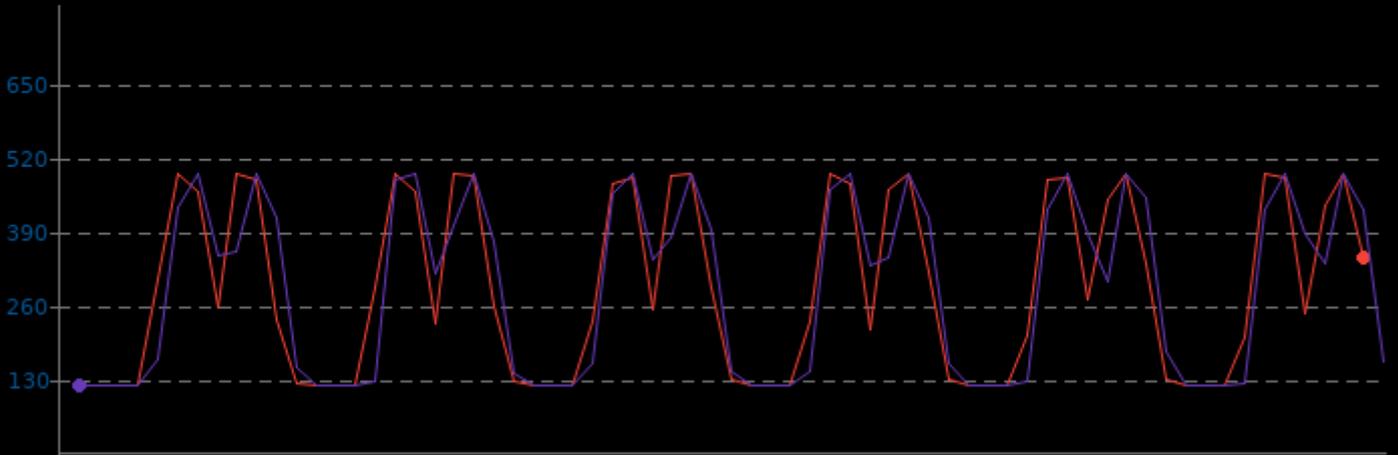
1. (CXX) g++ options: -std=c++0x -march=znver1 -msse2 -msse3 -mssse3 -msse4.1 -msse4.2 -msse4a -mfma -mbmi2 -mno-avx -mno-avx2 -mno-xop -m

Tungsten Renderer 0.2.2

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.5	291.2	492.0
CPUFreq Performance	120.7	289.5	492.0

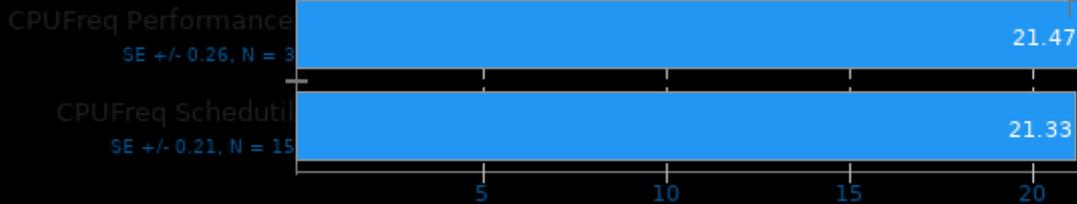
▼ Watts, Fewer Is Better



Tungsten Renderer 0.2.2

Scene: Water Caustic

◀ Seconds, Fewer Is Better



1. (CXX) g++ options: -std=c++0x -march=znver1 -msse2 -msse3 -mssse3 -msse4.1 -msse4.2 -msse4a -mfma -mbmi2 -mno-avx -mno-avx2 -mno-xop -m

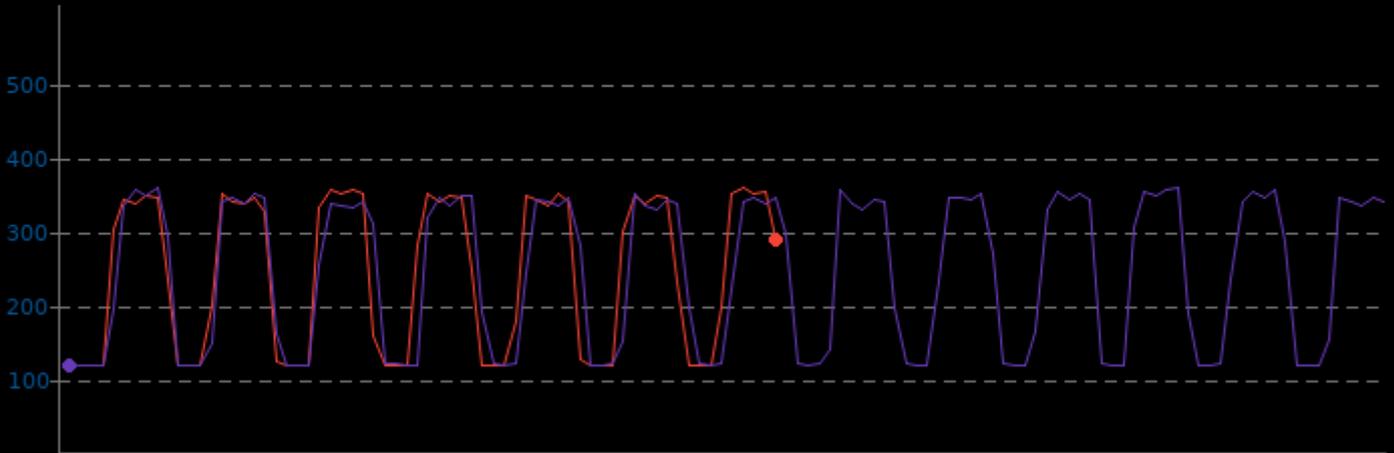


Tungsten Renderer 0.2.2

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Schedutil	120.2	246.3	358.5
CPUFreq Performance	120.3	246.2	358.6

▼ Watts, Fewer Is Better



Chaos Group V-RAY 4.10.07

Mode: CPU

► Ksamples, More Is Better

CPUFreq Schedutil
SE +/- 1018.74, N = 13

53460

CPUFreq Performance
SE +/- 503.58, N = 3

55014

12K 24K 36K 48K 60K

Chaos Group V-RAY 4.10.07

Mode: CPU

► Ksamples Per Watt, More Is Better

CPUFreq Schedutil

127.59

CPUFreq Performance

130.65

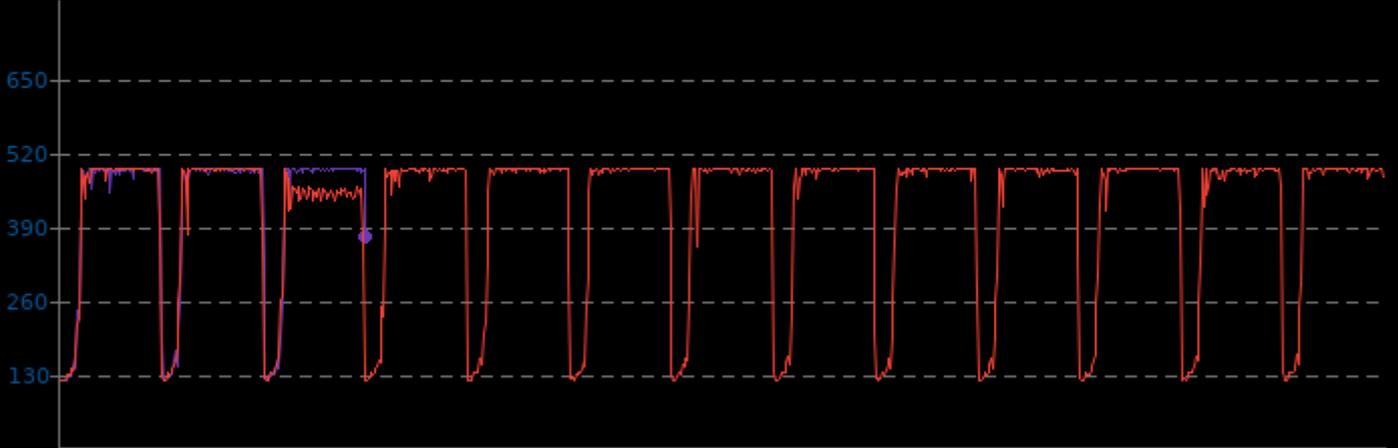
30 60 90 120 150

Chaos Group V-RAY 4.10.07

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.8	421.1	492.1
CPUFreq Schedutil	120.3	419.0	492.2

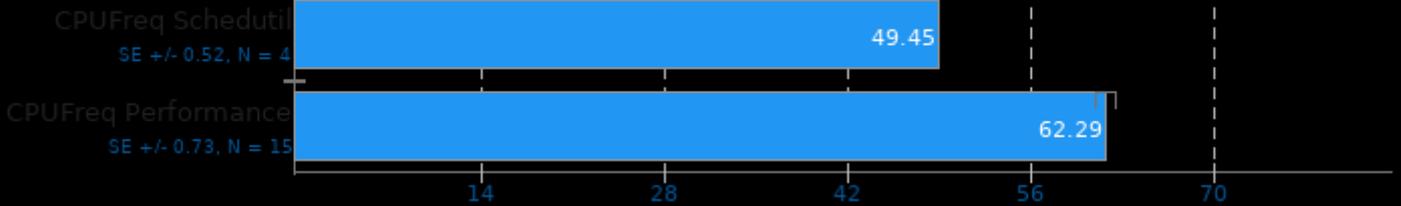
Watts, Fewer Is Better



x265 3.4

Video Input: Bosphorus 1080p

Frames Per Second, More Is Better

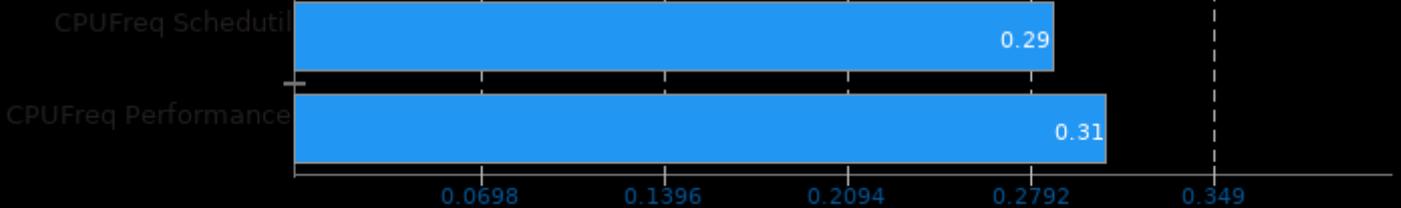


1. (CXX) g++ options: -O3 -dynamic -lpthread -lrt -ldl -lnuma

x265 3.4

Video Input: Bosphorus 1080p

Frames Per Second Per Watt, More Is Better



x265 3.4

CPU Power Consumption Monitor

	Min	Avg	Max
CPUFreq Performance	120.6	200.8	253.8
CPUFreq Schedutil	121.1	169.9	202.1

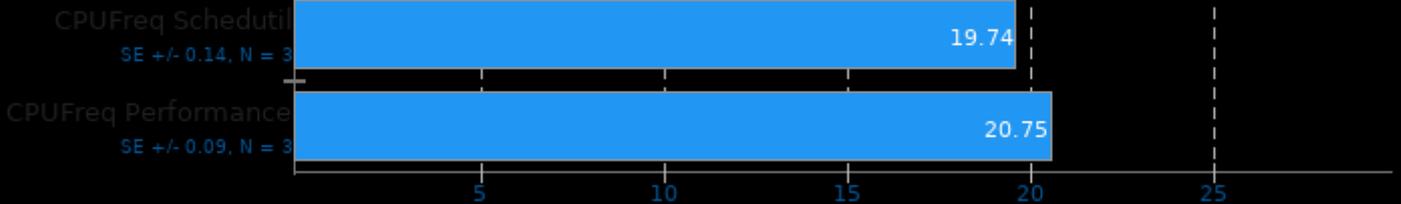
Watts, Fewer Is Better



x265 3.4

Video Input: Bosphorus 4K

Frames Per Second, More Is Better

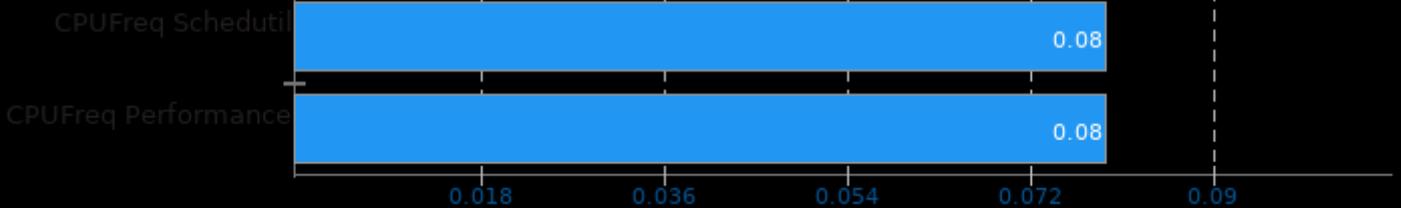


1. (CXX) g++ options: -O3 -dynamic -lpthread -lrt -ldl -lnuma

x265 3.4

Video Input: Bosphorus 4K

Frames Per Second Per Watt, More Is Better

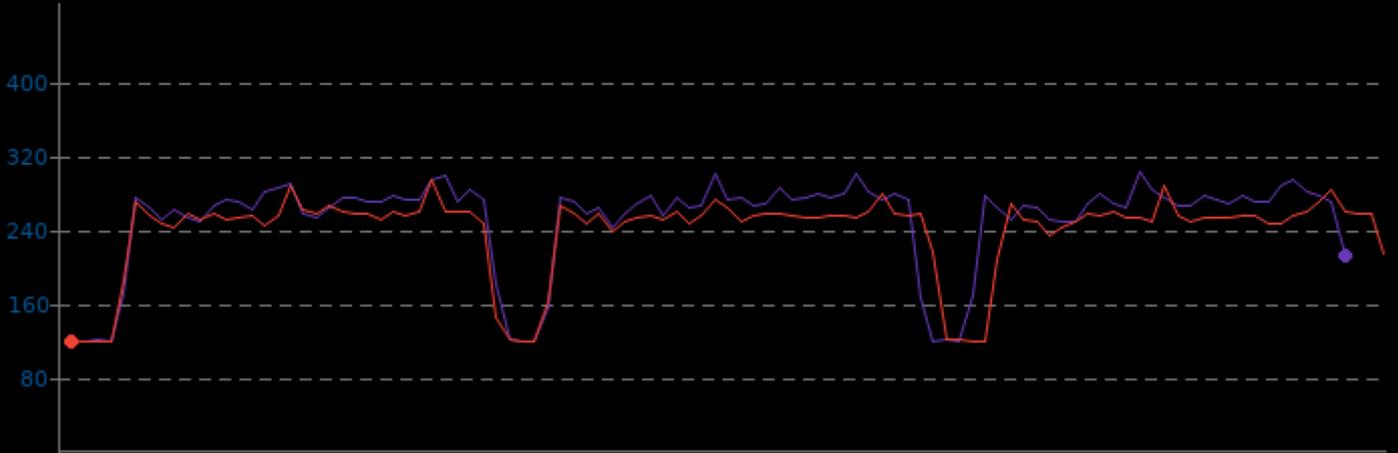


x265 3.4

CPU Power Consumption Monitor

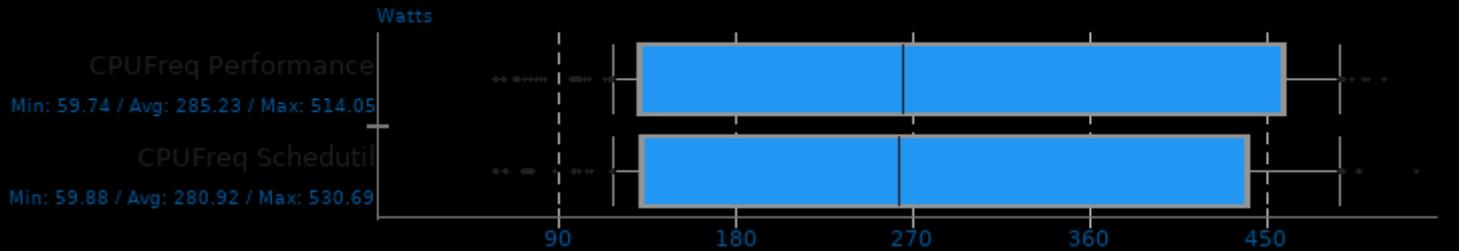
	Min	Avg	Max
CPUFreq Performance	120.3	250.4	301.8
CPUFreq Schedutil	120.6	238.0	293.2

Watts, Fewer Is Better

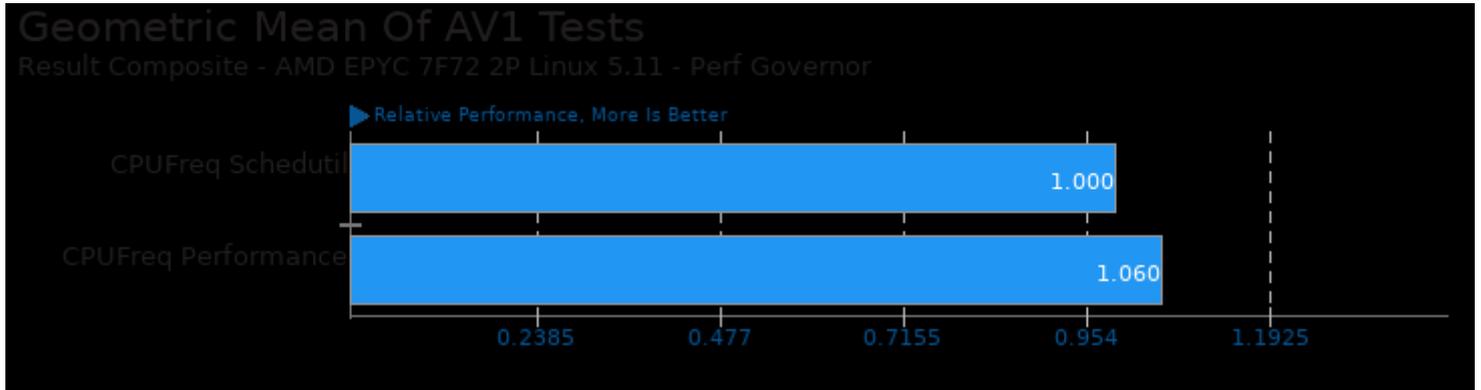


CPU Power Consumption Monitor

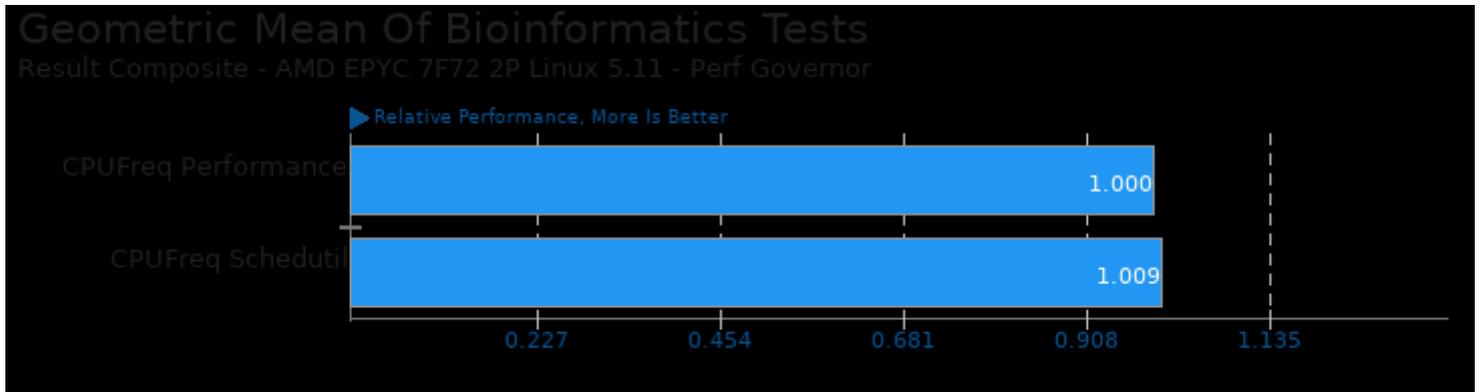
Phoronix Test Suite System Monitoring



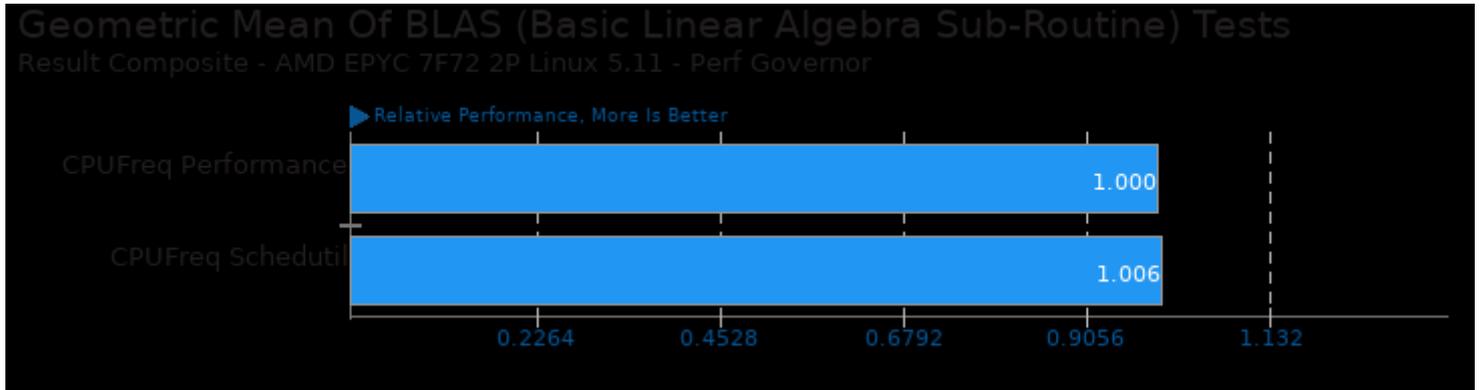
These geometric means are based upon test groupings / test suites for this result file.



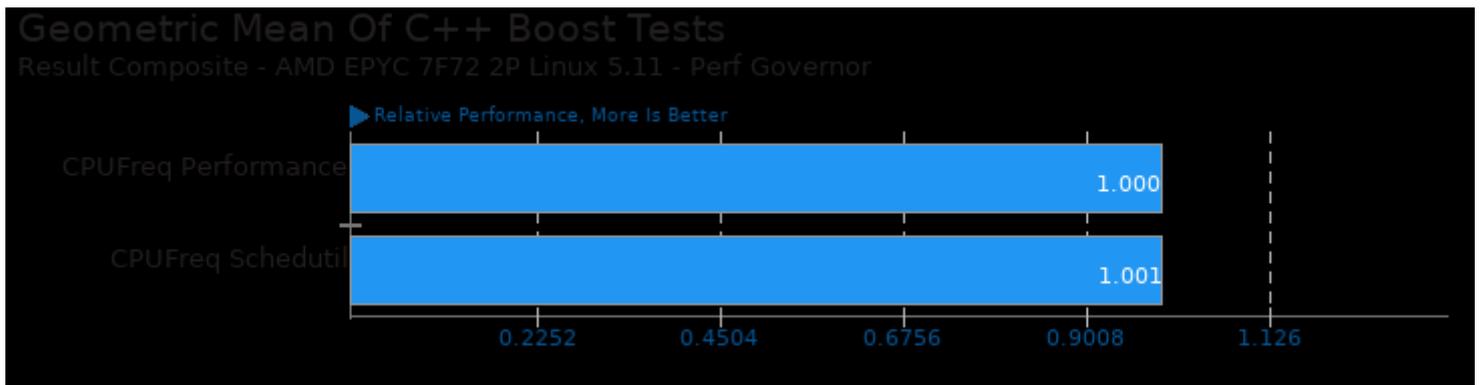
Geometric mean based upon tests: pts/dav1d, pts/svt-av1 and pts/rav1e



Geometric mean based upon tests: pts/himeno, pts/mrbayes and pts/qmcpack



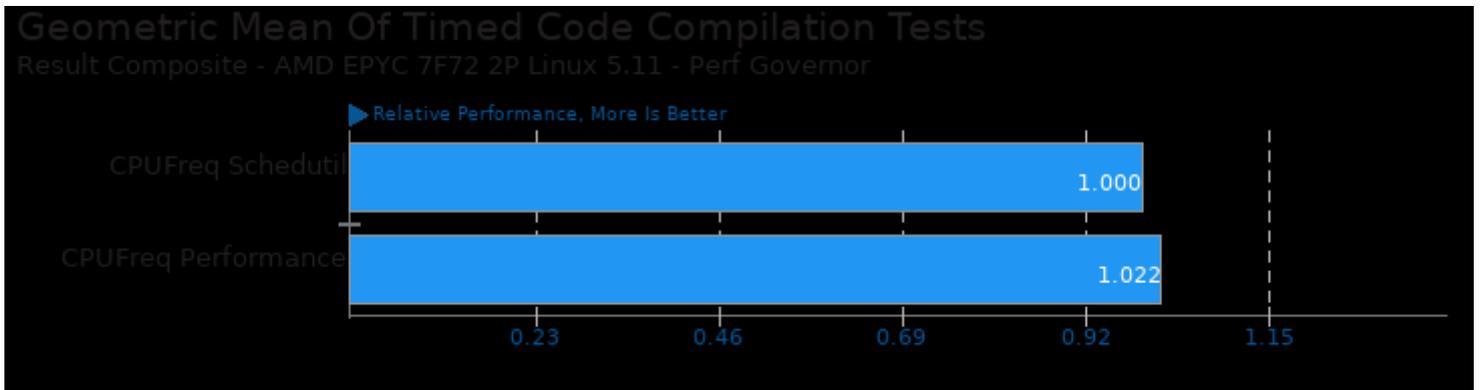
Geometric mean based upon tests: pts/qe, pts/qmcpack, pts/gpaw and pts/lczero



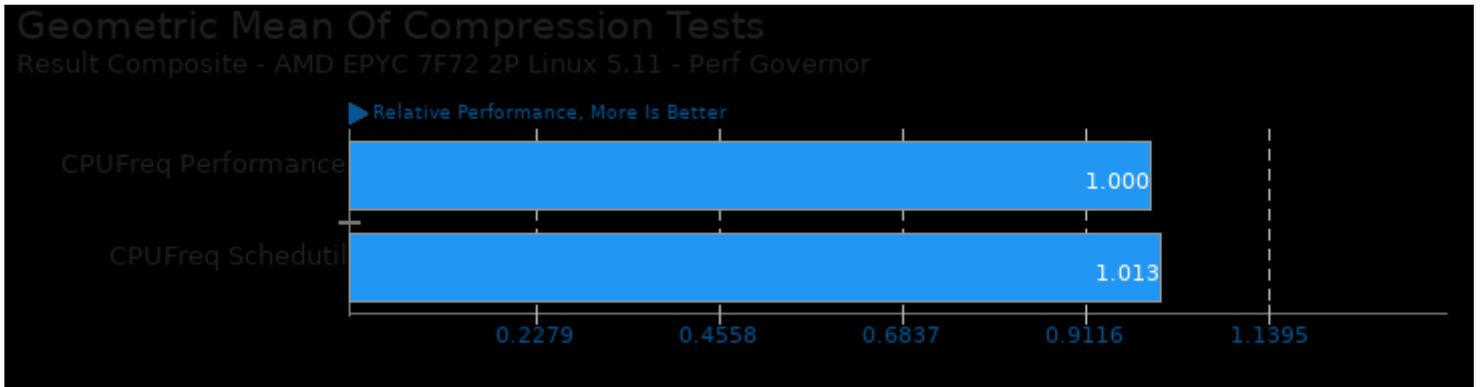
Geometric mean based upon tests: pts/openfoam, pts/qmcpack, pts/quantlib, pts/povray and pts/yafaray



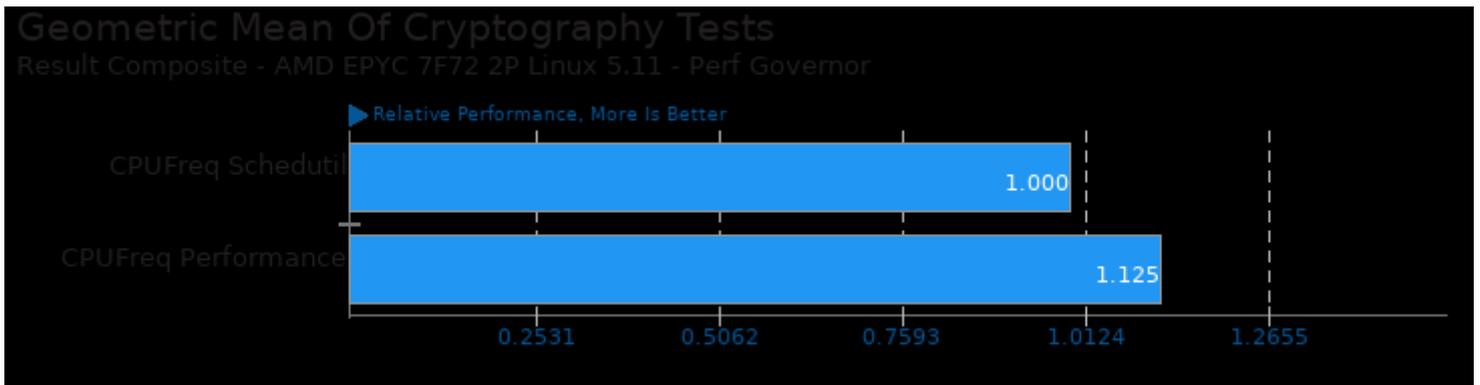
Geometric mean based upon tests: pts/tscp, pts/lczero, pts/stockfish and pts/asmfish



Geometric mean based upon tests: pts/build-linux-kernel, pts/build-gdb, pts/build-llvm, pts/build2 and pts/build-godot



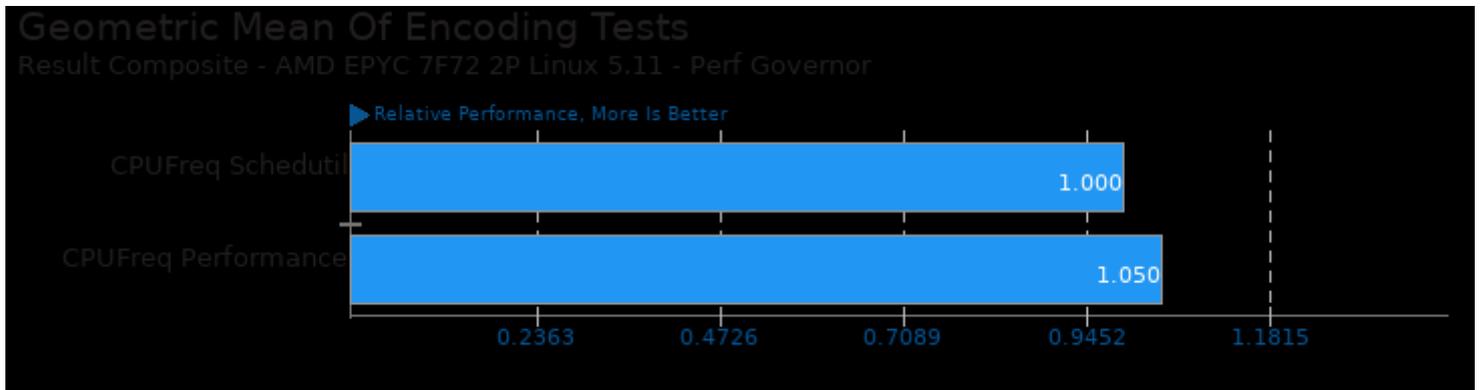
Geometric mean based upon tests: pts/compress-zstd and pts/compress-lz4



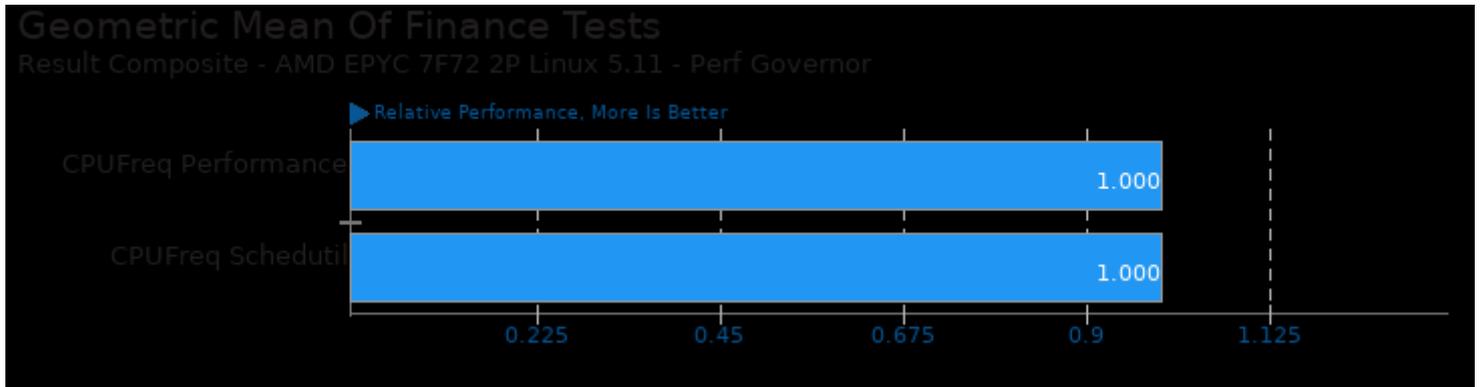
Geometric mean based upon tests: pts/gnupg, pts/gcrypt, pts/john-the-ripper and pts/cpumimer-opt



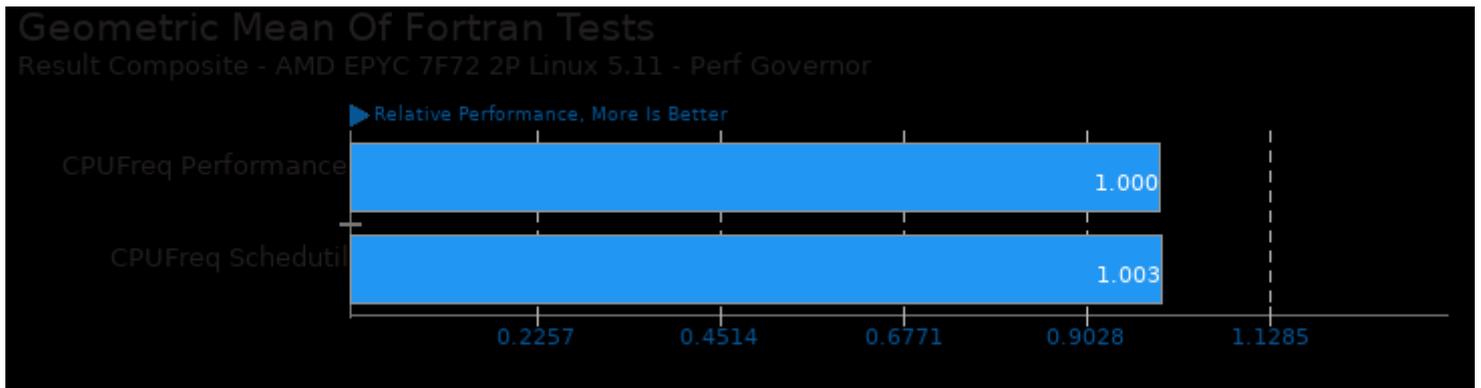
Geometric mean based upon tests: pts/sqlite-speedtest, pts/redis, pts/keydb and pts/influxdb



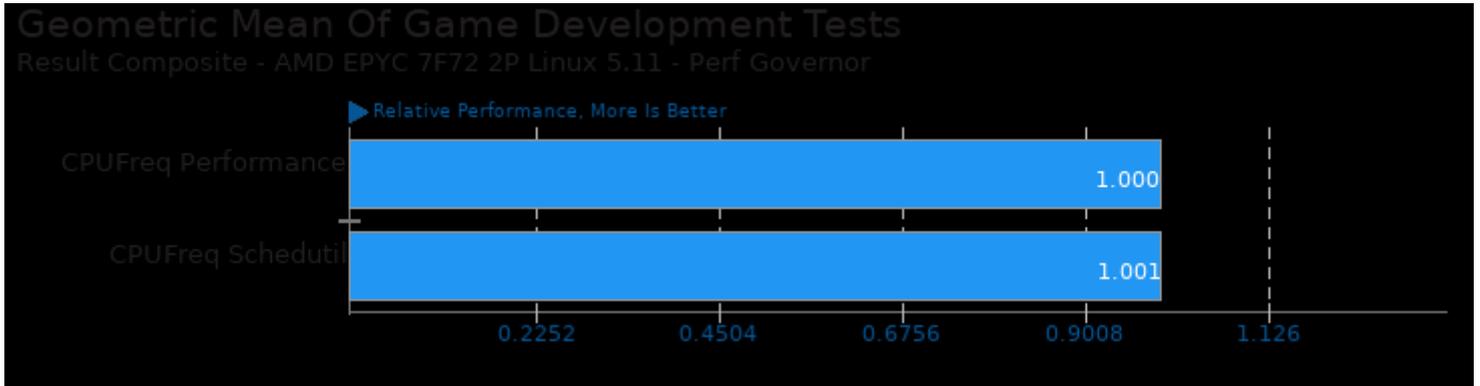
Geometric mean based upon tests: pts/svt-vp9, pts/x265, pts/dav1d, pts/svt-av1 and pts/rav1e



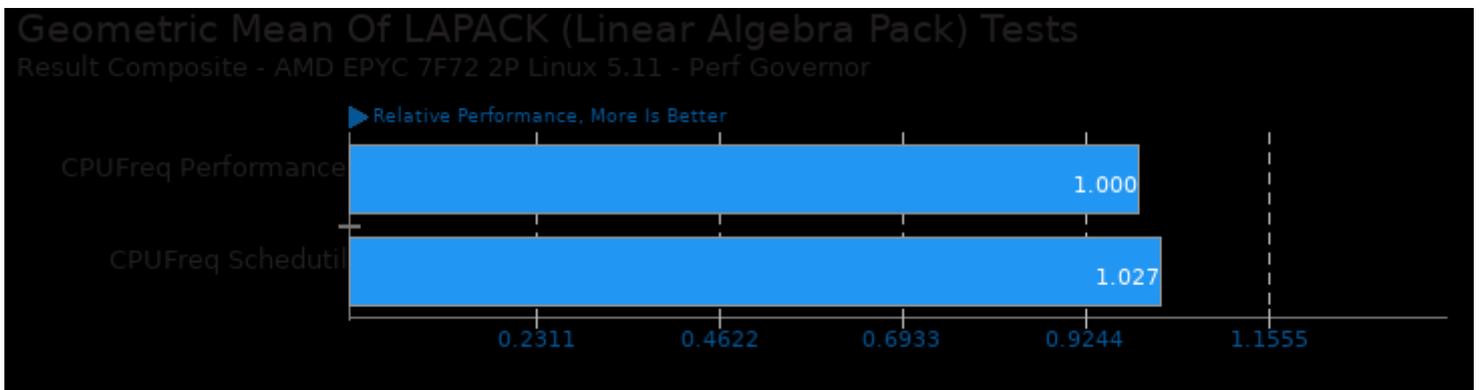
Geometric mean based upon tests: pts/financebench and pts/quantlib



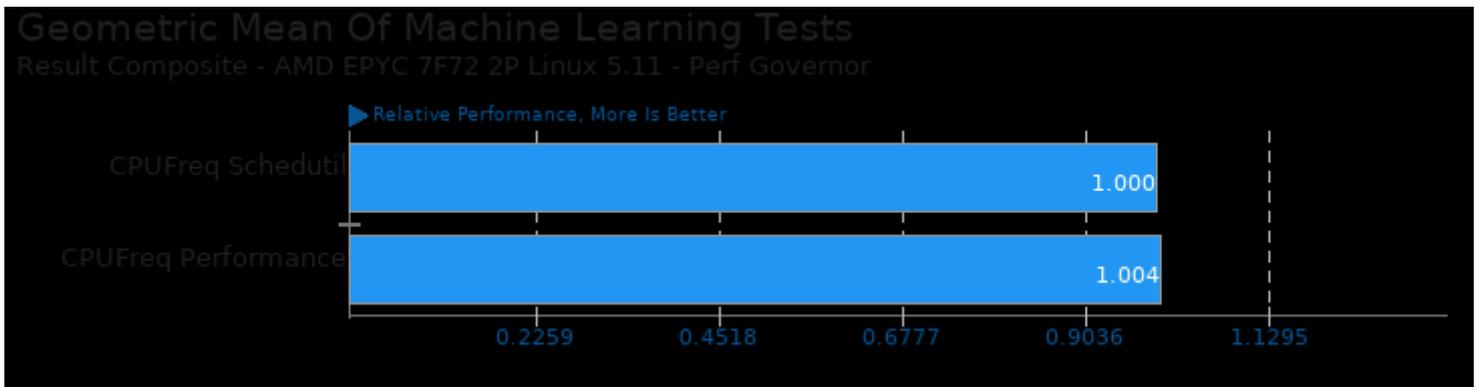
Geometric mean based upon tests: pts/lammps, pts/npb, pts/qe, pts/dolfyn, pts/ffte, pts/hpcg and pts/neat



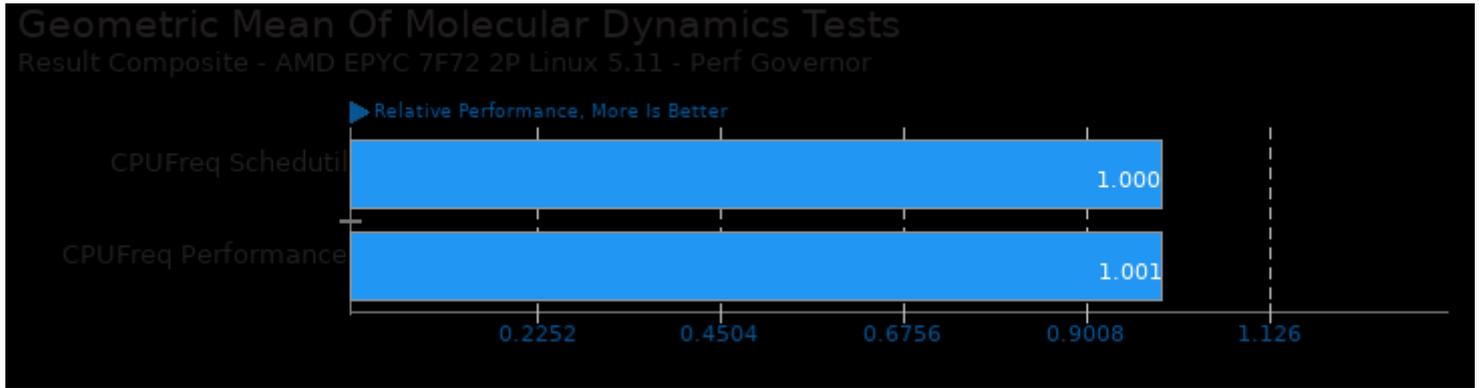
Geometric mean based upon tests: pts/astcenc, pts/etcpak, pts/build-godot, pts/blender and pts/oidn



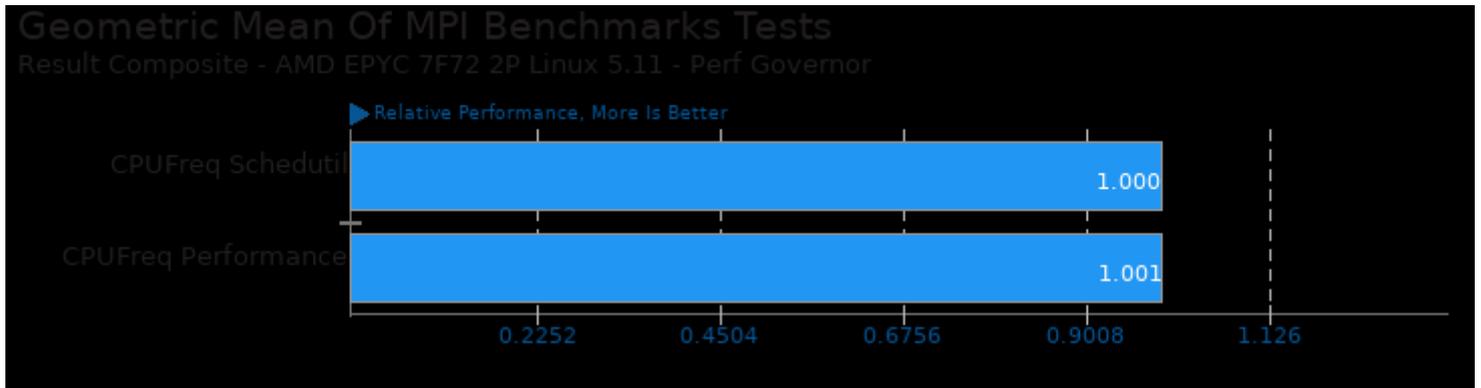
Geometric mean based upon tests: pts/qe and pts/qmcpack



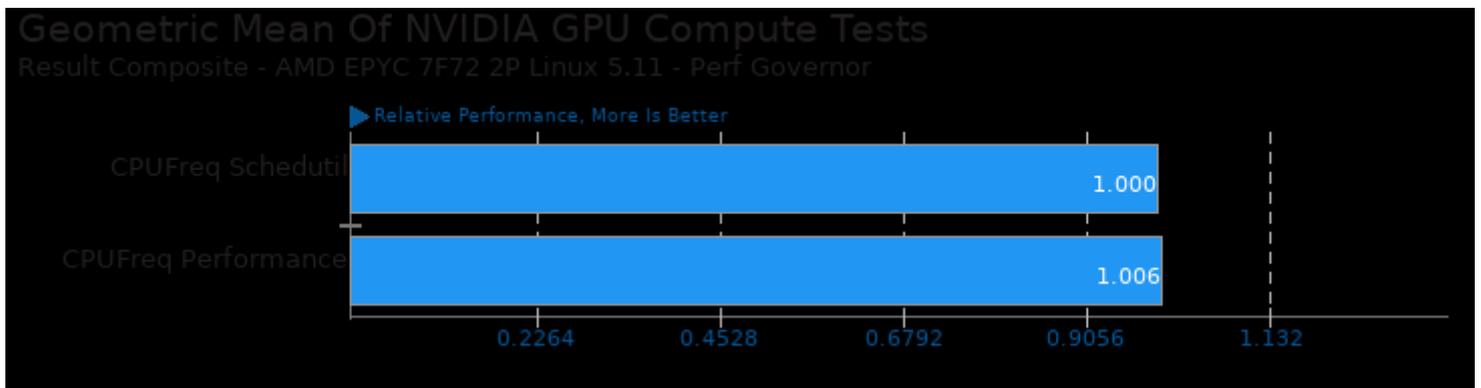
Geometric mean based upon tests: pts/tnn, pts/numpy, pts/ai-benchmark, pts/tensorflow-lite, pts/onednn, pts/onnx, pts/plaidml and pts/lczero



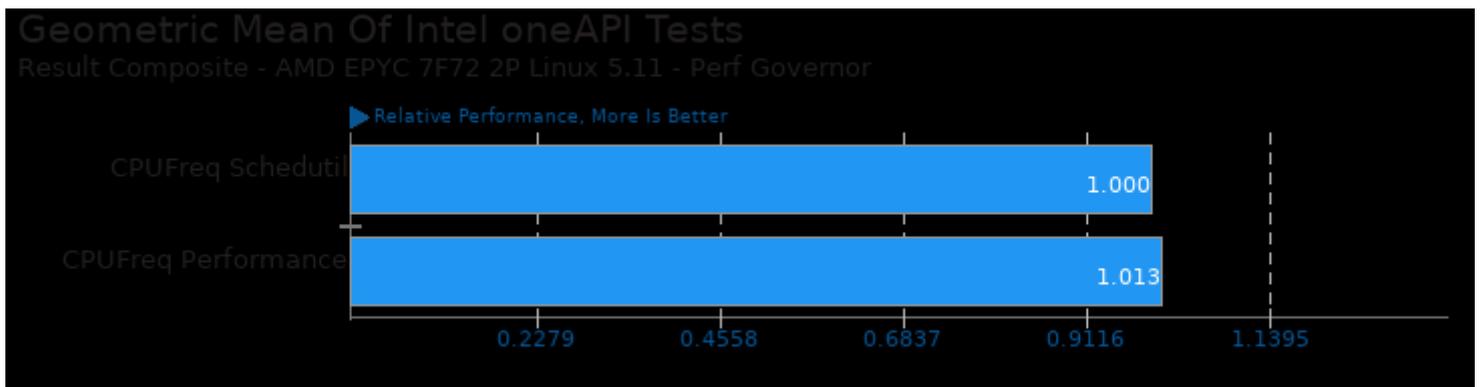
Geometric mean based upon tests: pts/namd, pts/gromacs, pts/dolfyn, pts/lammps, pts/lulesh and pts/openfoam



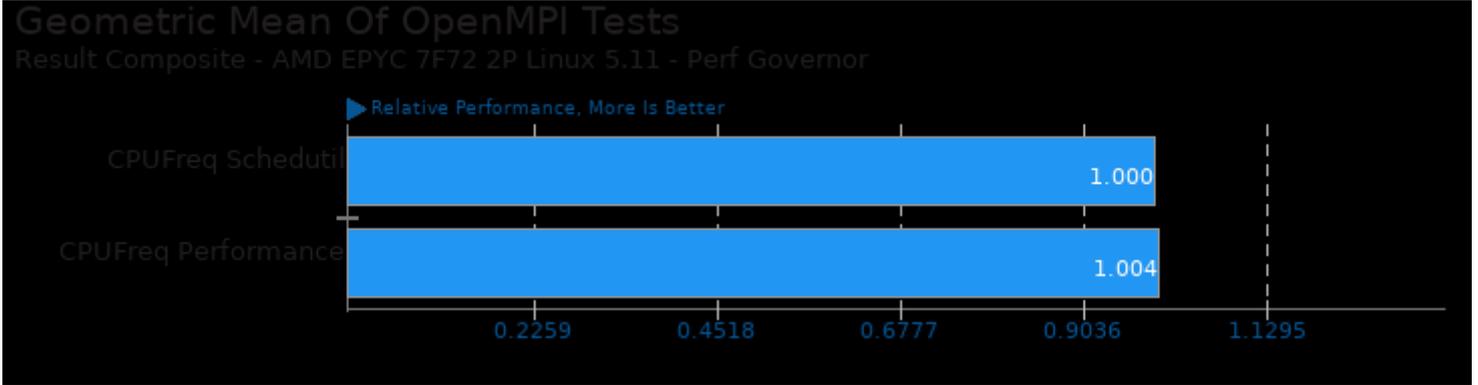
Geometric mean based upon tests: pts/askap, pts/lammps, pts/gpaw, pts/gromacs, pts/qmcpack, pts/hpcg, pts/mrbayes and pts/npb



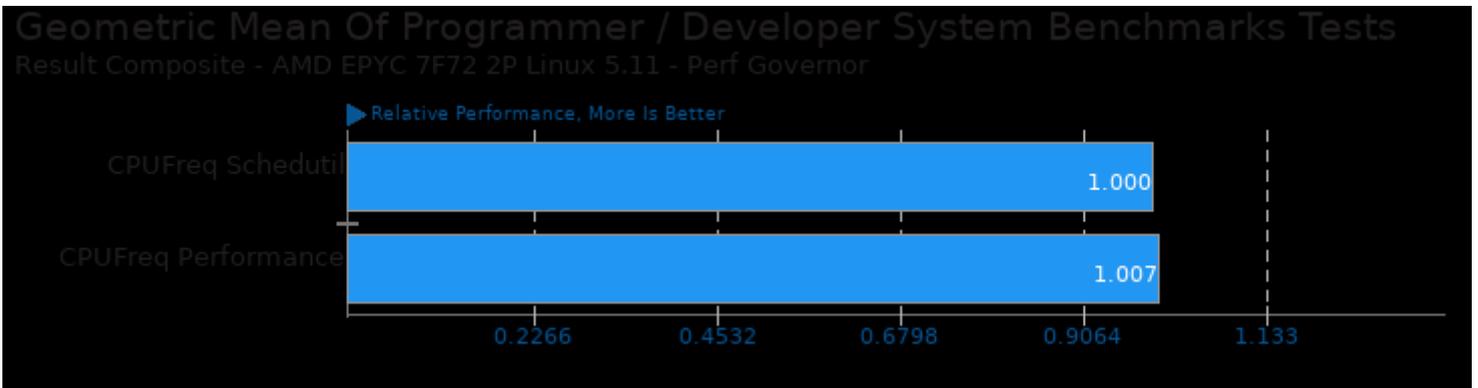
Geometric mean based upon tests: pts/gromacs, pts/luxcorerender, pts/rodingia, pts/financebench, pts/plaidml, pts/lczero, pts/v-ray and pts/blender



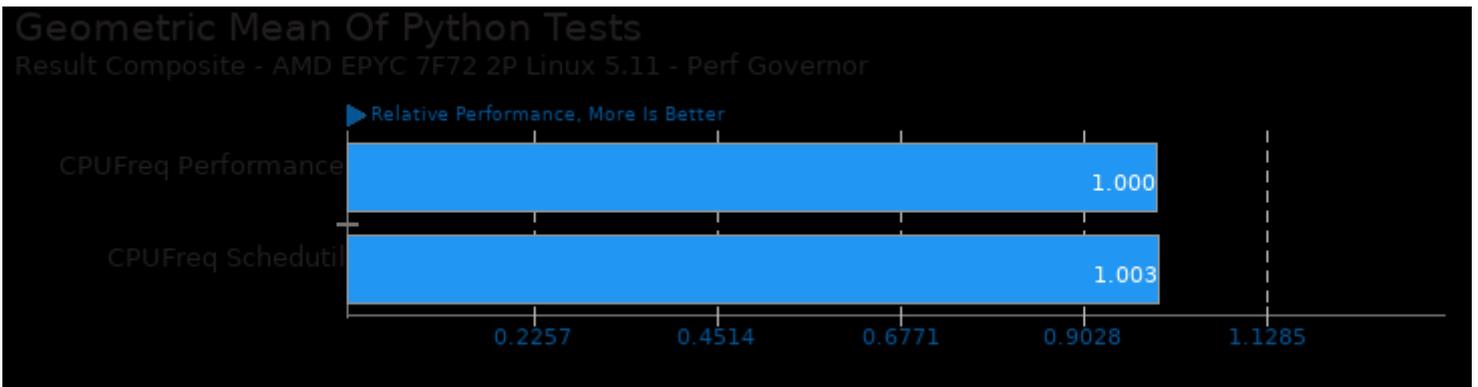
Geometric mean based upon tests: pts/onednn, pts/oidn, pts/ospray and pts/tungsten



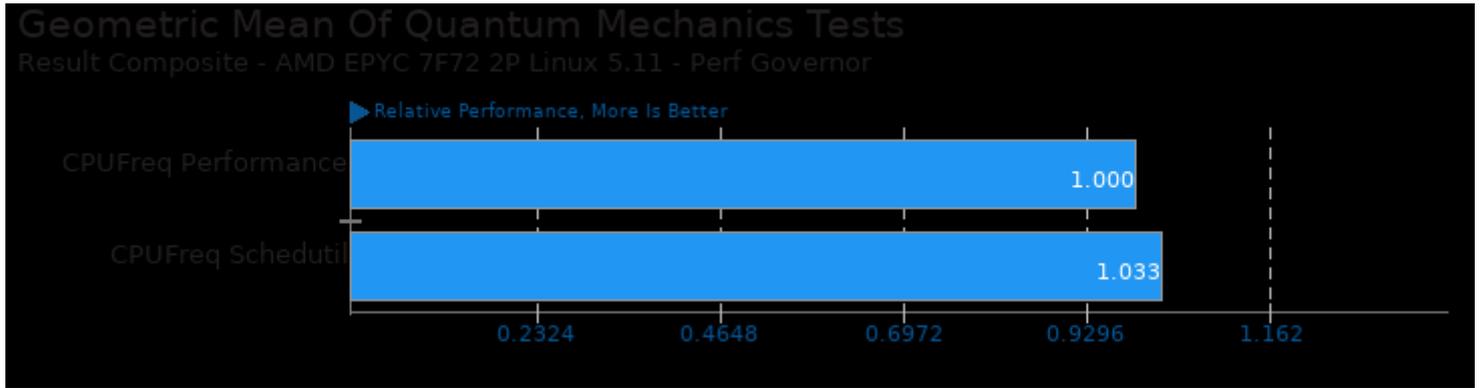
Geometric mean based upon tests: pts/amg, pts/ior, pts/lammps, pts/lulesh, pts/npb, pts/openfoam, pts/qe, pts/qmcpack, pts/reion, pts/askap, pts/gpaw, pts/gromacs, pts/hpcg, pts/mrbayes and pts/rodinia



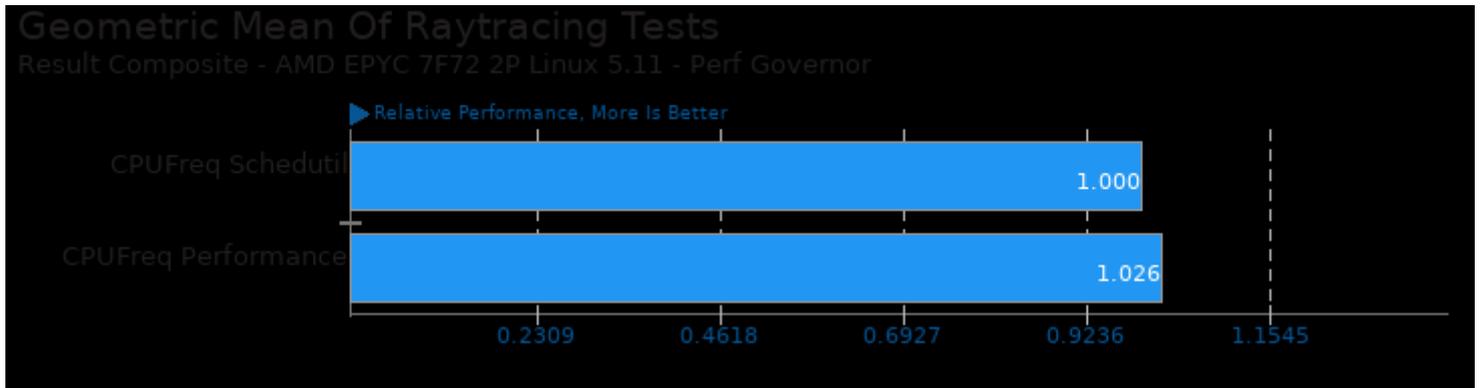
Geometric mean based upon tests: pts/simdjson, pts/sqlite-speedtest, pts/compress-zstd, pts/build-linux-kernel, pts/build-gdb, pts/build-llvm, pts/build2, pts/build-godot and pts/amg



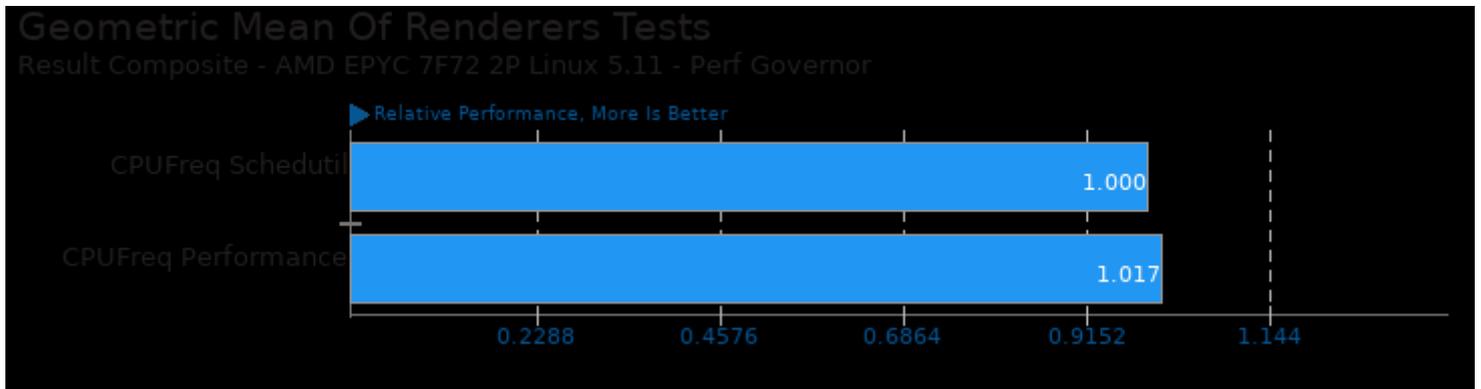
Geometric mean based upon tests: pts/cython-bench and pts/numpy



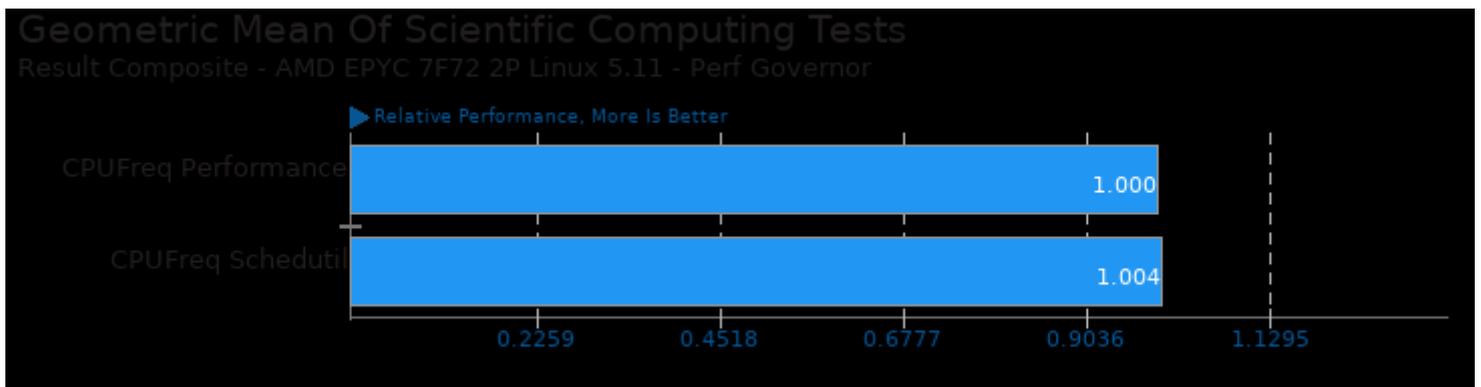
Geometric mean based upon tests: pts/gpaw and pts/qe



Geometric mean based upon tests: pts/ospray, pts/tachyon, pts/povray and pts/yafaray



Geometric mean based upon tests: pts/ospray, pts/tachyon, pts/povray, pts/yafaray, pts/blender, pts/tungsten, pts/luxcorerender, pts/ttsiod-renderer and pts/v-ray

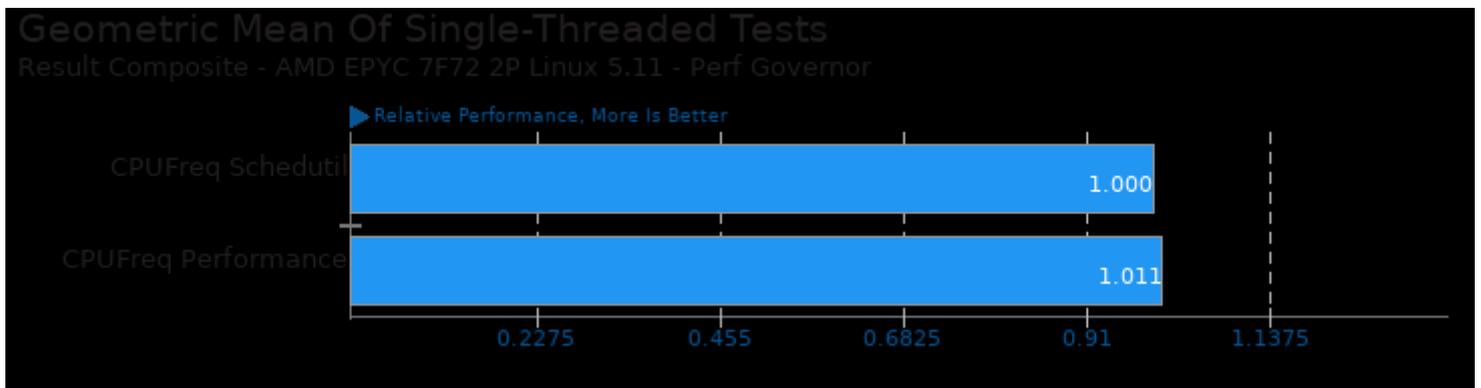


Geometric mean based upon tests: pts/ffte, pts/fftw, pts/neat, pts/amg, pts/namd, pts/gromacs, pts/dolfyn, pts/lammps,

pts/lulesh, pts/openfoam, pts/himeno, pts/mrbayes, pts/qmcpack, pts/gpaw and pts/qe



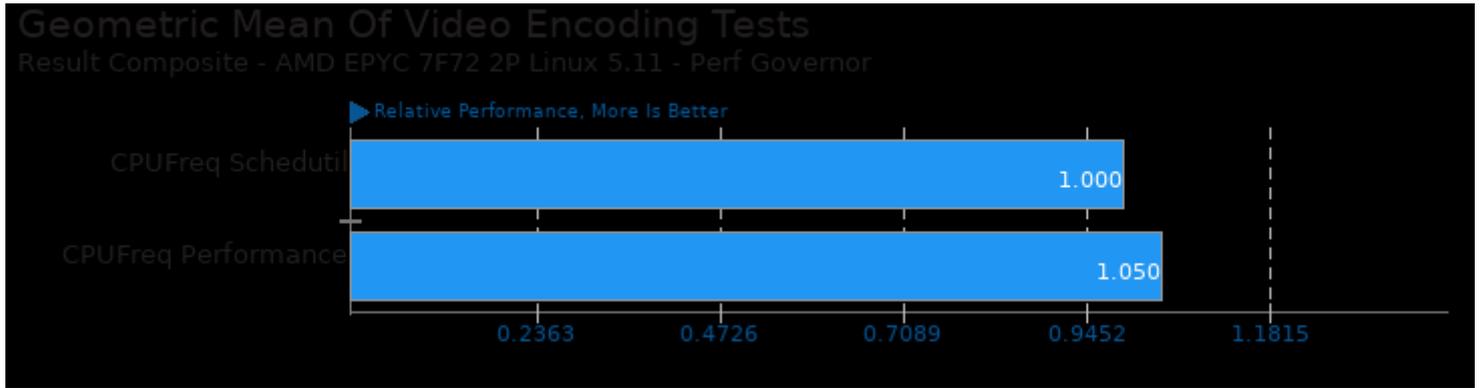
Geometric mean based upon tests: pts/blogbench, pts/redis, pts/keydb, pts/simdjson, pts/sqlite-speedtest and pts/influxdb



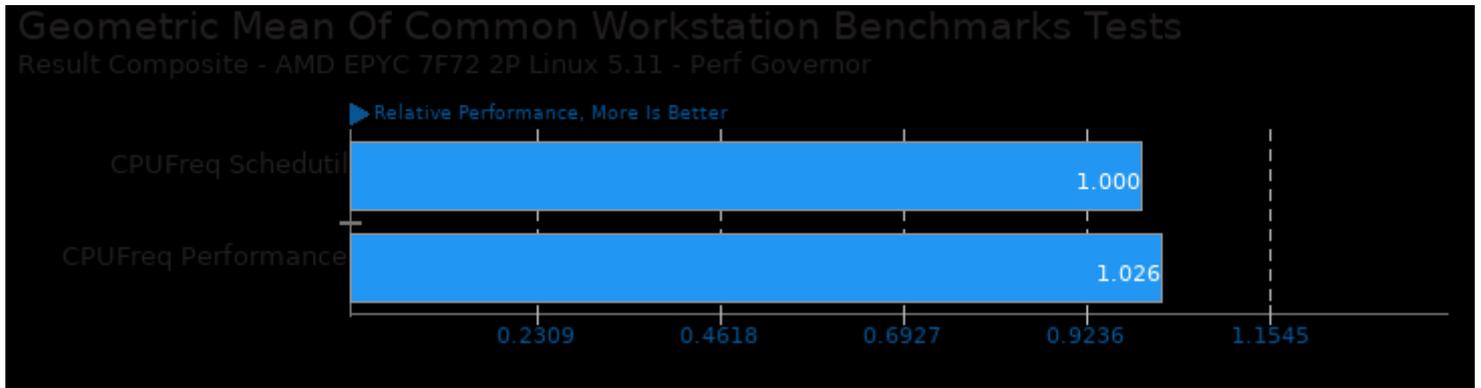
Geometric mean based upon tests: pts/byte, pts/swet, pts/numpy, pts/gnupg, pts/redis and pts/hint



Geometric mean based upon tests: pts/astcenc and pts/etcpak



Geometric mean based upon tests: pts/svt-vp9, pts/x265, pts/dav1d, pts/svt-av1 and pts/rav1e



Geometric mean based upon tests: pts/blender, pts/rodinia, pts/himeno, pts/brl-cad, pts/x265 and pts/swt

This file was automatically generated via the Phoronix Test Suite benchmarking software on Thursday, 28 March 2024 08:35.