

Dasharo vs vendor firmware performance with Qubes OS

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- [!\[\]\(4f49380f3d6bce047bc47b2072cc076f_img.jpg\) linkedin.com/in/michał-kopec-a8b216200](https://www.linkedin.com/in/michał-kopec-a8b216200)
- 1 year at 3mdeb
- coreboot development
- firmware security

- Introduction
- coreboot performance
- Performance knobs
- The tests
- Summary

- Computers are getting faster
- It's now perfectly normal to buy a laptop with an 8 core / 16 thread CPU or a desktop with 16 cores / 32 threads
- Software has become more optimized for multi-core systems
- Developers know how to put that extra computing power to work

- coreboot has often had lower performance than vendor firmware
- Setting defaults from the CPU datasheet will not get close to the full performance
- Intel provides FSP, a blob for memory and other silicon init
 - FSP exposes various performance and power saving parameters
 - No open source alternative exists for Skylake and newer

- There is an enormous amount of different knobs:
 - Power limits
 - Thermal limits
 - Turbo boost
 - Memory profiles
 - Fan curves
 - Loadline calibration
 - and much more

- On the desktop, performance is limited by power delivery and cooling
- The CPU will boost as long as it stays within the thermal and power limits
- We can tune:
 - power limits
 - power saving features
 - voltage regulator parameters

- Performance in laptops is a balance of:
 - Power
 - Heat
 - Noise
- We can tune these with:
 - Power limits
 - Fan speeds
- Difficult to get right
 - Some new laptops let the user switch these on the fly

- To measure the actual performance difference on some of the platforms that Dasharo runs on
- All tests were done on Qubes v4.1.1
- For benchmarking, Phoronix Test Suite was installed in a Debian 11 qube
- The tests:
 - Compression / decompression
 - Video transcoding
 - Code compilation
 - sysbench

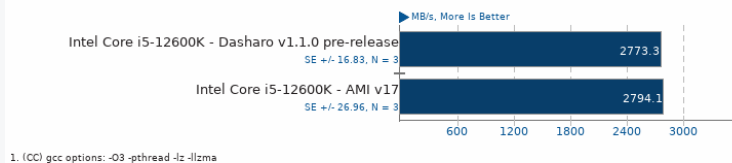
- The platforms:
 - MSI Z690-A PRO DDR4 with an Intel i5-12600K CPU (10 core)
 - Two NovaCustom NS5x laptops, one with an Intel i5-1135G7 CPU, and one with an i5-11300H chip
- All tests were done in a temperature-controlled environment with 17 degrees ambient temperature

- Tons of knobs in Alder Lake-S
- Configuration:
 - i5-12600K 10 core / 16 thread processor (6 high-performance P-cores and 4 efficiency-focused E-cores)
 - 16 GB DDR4 running at 2400MHz (JEDEC spec), dual channel
 - Noctua NH-U12S redux cooler
- Tests were done on MSI (AMI) vendor BIOS version 17 and Dasharo v1.1.0 pre-release version

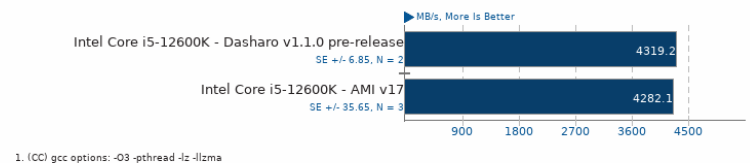
- 15 inch laptop with an Intel Tiger Lake-U CPU
- Comes with Dasharo out of the box
- Tested CPUs:
 - i5-1135G7: Quad-core, 4.2 GHz, 28W TDP, 32GB DDR4 @ 3200 MHz, dual channel
 - i5-11300H: Quad-core, 4.4 GHz, 32W TDP, 64GB DDR4 @ 2666 MHz, dual channel
- Tests were done on the previous BIOS vendor (Insyde) BIOS v1.07.07 and Dasharo v1.3.0 with an open-source Embedded Controller firmware
- Much fewer variables to tune: most importantly, power limits and fan speeds

- Relevant to users working with massive compressed files
- Compression test results:

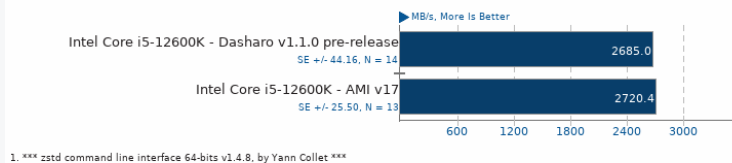
Zstd Compression 1.5.0
Compression Level: 3 - Compression Speed



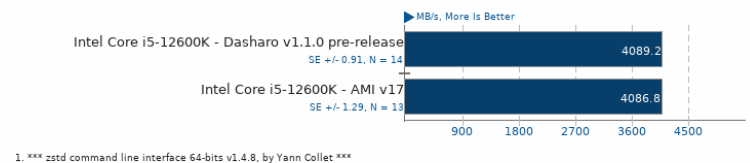
Zstd Compression 1.5.0
Compression Level: 3 - Decompression Speed



Zstd Compression
Compression Level: 3 - Compression Speed



Zstd Compression
Compression Level: 3 - Decompression Speed

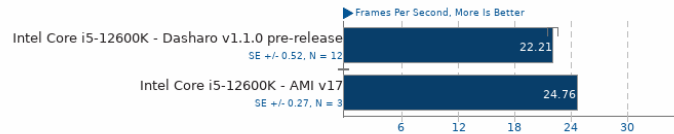


- Performance is within the margin of error!

- Relevant to users working with video files
- Compression test results:

x264 2022-02-22

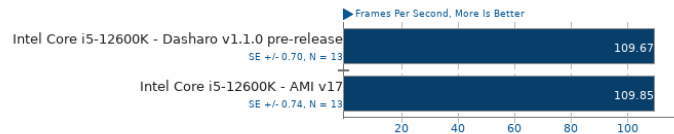
Video Input: Bosphorus 4K



1. (CC) gcc options: -ldl -m64 -lm -lpthread -O3 -fno

x264 2022-02-22

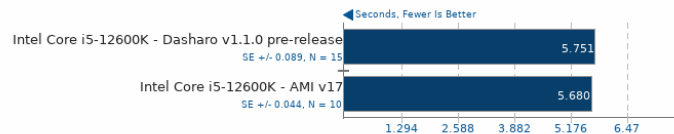
Video Input: Bosphorus 1080p



1. (CC) gcc options: -ldl -m64 -lm -lpthread -O3 -fno

FFmpeg 4.0.2

H.264 HD To NTSC DV



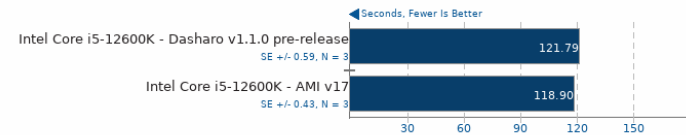
1. (CC) gcc options: -lavdevice -lavfilter -lavformat -lavcodec -lswresample -lswscale -lavutil -lm -lxcb -lasound -pthread -lbz2 -llzma -std=c11 -fomit-frame

- There is one outlier: 4K video transcoding
- Next to no difference in 1080p and 720p transcoding
- Not sure what the reason might be at the moment, but definitely worth investigating

- Relevant to programmers
- Compilation test results:
- These tests measure how long it takes to compile code
- Dasharo loses by 1-2% in these tests
- Not a huge difference, but worth improving nevertheless

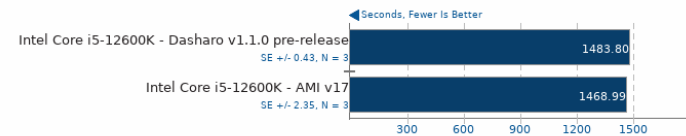
Timed Linux Kernel Compilation 5.18

Build: defconfig



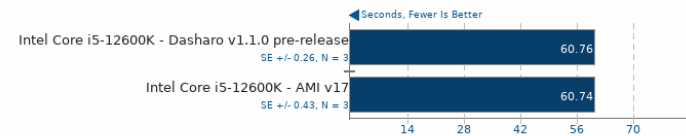
Timed Linux Kernel Compilation 5.18

Build: allmodconfig



Timed FFmpeg Compilation 4.4

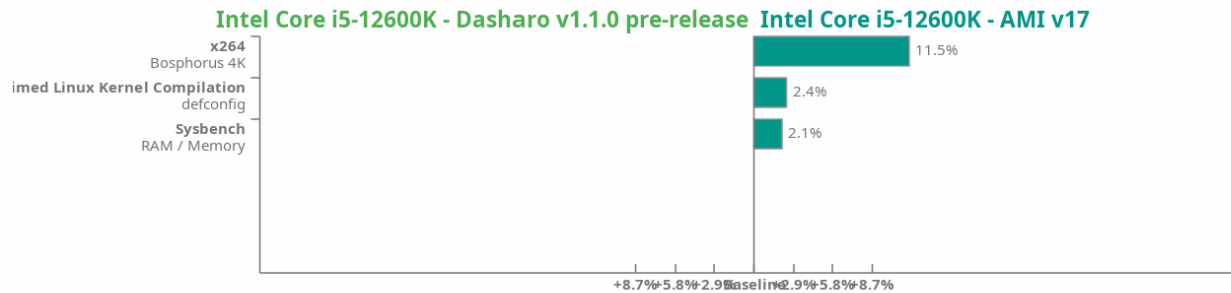
Time To Compile





Intel Core i5-12600K - Dasharo v1.1.0 pre-release vs. Intel Core i5-12600K - AMI v17 Comparison

Phoronix Test Suite 10.8.4



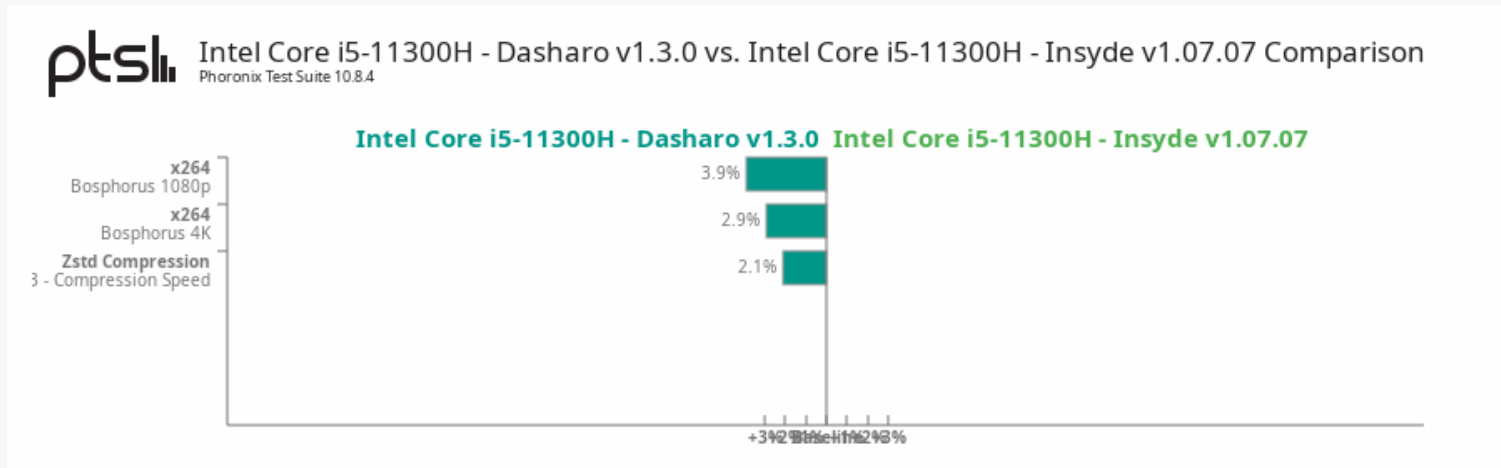
Intel Core i5-12600K - Dasharo v1.1.0 pre-release, msi-z690a-ami-custom-2

ptsli	Intel Core i5-12600K - Dasharo v1.1.0 pre-release	Intel Core i5-12600K - AMI v17
compress-zstd: 3 - Compression Speed	2773.3	2794.1
compress-zstd: 3 - Compression Speed	2685.0	2720.4
x264: Bosphorus 4K	22.21	24.76
x264: Bosphorus 1080p	109.67	109.85
build-ffmpeg: Time To Compile	60.763	60.738
build-linux-kernel: defconfig	121.786	118.897
build-linux-kernel: allmodconfig	1483.803	1468.986
ffmpeg: H.264 HD To NTSC DV	5.751	5.680
sysbench: RAM / Memory	6345.24	6480.11
sysbench: CPU	34358.30	34352.67
compress-zstd: 3 - Decompression Speed	4319.2	4282.1
compress-zstd: 3 - Decompression Speed	4089.2	4086.8

OpenBenchmarking.org

	Intel Core i5-1135G7 - Insyde v1.07.07	Intel Core i5-1135G7 - Dasharo v1.3.0
Zstd Compression - 3 - Compression Speed (MB/s)	2144	2116
Normalized	100%	98.69%
Standard Deviation	1.6%	0.9%
Zstd Compression - 3 - Compression Speed (MB/s)	2028	2053
Normalized	98.76%	100%
Standard Deviation	3.2%	0.8%
x264 - Bosphorus 4K (FPS)	9.74	9.58
Normalized	100%	98.36%
Standard Deviation	1.2%	1.9%
x264 - Bosphorus 1080p (FPS)	43.94	42.83
Normalized	100%	97.47%
Standard Deviation	1%	2.5%
Timed FFmpeg Compilation - Time To Compile (sec)	149.793	152.132
Normalized	100%	98.46%
Standard Deviation	0.8%	0.7%
Timed Linux Kernel Compilation - defconfig (sec)	287.200	284.038
Normalized	98.9%	100%
Standard Deviation	0.4%	0.3%
Timed Linux Kernel Compilation - allmodconfig (sec)	3769	3823
Normalized	100%	98.58%
Standard Deviation	0.3%	1.4%
FFmpeg - H.2.H.T.N.D (sec)	6.863	6.911
Normalized	100%	99.31%
Standard Deviation	1.5%	0.9%
Sysbench - RAM / Memory (MiB/sec)	3123	3146
Normalized	99.28%	100%
Standard Deviation	0.2%	0.2%
Sysbench - CPU (Events/sec)	12623	12624
Normalized	100%	100%
Standard Deviation	0%	0%

- With a more powerful processor, Dasharo actually edges ahead!



	Intel Core i5-11300H - Dasharo v1.3.0	Intel Core i5-11300H - Insyde v1.07.07
Zstd Compression - 3 - Compression Speed (MB/s)	2052	2026
Normalized	100%	98.73%
Standard Deviation	1%	0.6%
Zstd Compression - 3 - Compression Speed (MB/s)	1980	1940
Normalized	100%	97.94%
Standard Deviation	0.8%	0.6%
x264 - Bosphorus 4K (FPS)	10.24	9.95
Normalized	100%	97.17%
Standard Deviation	2.2%	2.9%
x264 - Bosphorus 1080p (FPS)	44.91	43.22
Normalized	100%	96.24%
Standard Deviation	2.5%	2.3%
Timed FFmpeg Compilation - Time To Compile (sec)	151.183	149.359
Normalized	98.79%	100%
Standard Deviation	0.3%	0.2%
Timed Linux Kernel Compilation - defconfig (sec)	291.764	288.001
Normalized	98.71%	100%
Standard Deviation	0.5%	0.8%
Timed Linux Kernel Compilation - allmodconfig (sec)	3804	3761
Normalized	98.88%	100%
Standard Deviation	0.3%	0.2%
FFmpeg - H.2.H.T.N.D (sec)	6.556	6.603
Normalized	100%	99.29%
Standard Deviation	1.6%	1.4%
Sysbench - RAM / Memory (MiB/sec)	3250	3263
Normalized	99.61%	100%
Standard Deviation	0.1%	0.2%
Sysbench - CPU (Events/sec)	13261	13262
Normalized	99.99%	100%
Standard Deviation	0%	0%

- There aren't any Qubes specific performance problems with Dasharo
- We're at the point where coreboot performance is close enough to the proprietary alternative
- There are still some areas to improve
 - Mainboard specific tuning on the desktop
 - Platform profiles on mobile
- But at the moment, for regular users, there is no reason not to switch

Q&A