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Java Virtual Machine Benchmark

Benchmark JVM implementations

Automated Executive Summary

OpenJDK 17 had the most wins, coming in first place for 47% of the tests.

Based on the geometric mean of all complete results, the fastest (OpenJDK 17) was 1.389x the speed of the slowest (OpenJ9 17). GraaVM 17 was 0.918x the speed of OpenJDK 17 and OpenJ9 17 was 0.784x the speed of GraaVM 17.

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

Java SciMark (Computational Test: Sparse Matrix Multiply) at 5.979x
Java SciMark (Computational Test: Monte Carlo) at 3.001x
Java JMH (Throughput) at 2.298x
Renaissance (Test: Scala Dotty) at 1.831x
Java SciMark (Computational Test: Jacobi Successive Over-Relaxation) at 1.473x
Java SciMark (Computational Test: Composite) at 1.416x
Renaissance (Test: Finagle HTTP Requests) at 1.393x
Sunflow Rendering System (Global Illumination + Image Synthesis) at 1.334x
Renaissance (Test: Savina Reactors.IO) at 1.288x
Renaissance (Test: Apache Spark Bayes) at 1.271x.

Test Systems:

OpenJDK 17

OpenJ9 17

Processor: OpenJ9 17 @ 3.70GHz (6 Cores / 12 Threads), Motherboard: Gigabyte B550 AORUS ELITE V2 (F15d BIOS), Chipset: AMD Starship/Matisse, Memory: 16GB, Disk: 512GB Viper M.2 VPR100, Graphics: NVIDIA GeForce GTX 1650 4GB, Audio: NVIDIA TU116 HD Audio, Monitor: 27G2G5, Network: Realtek RTL8125 2.5GbE

OS: Arch Linux, Kernel: 6.3.9-arch1-1 (x86_64), Desktop: KDE Plasma 5.27.6, Display Server: X Server 1.21.1.8, Display Driver: NVIDIA 535.54.03, OpenGL: 4.6.0, Compiler: GCC 13.1.1 20230429, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: NVIDIA_drm.modeset=1 - Transparent Huge Pages: always
Processor Notes: Scaling Governor: acpi-cpufreq schedutil (Boost: Enabled) - CPU Microcode: 0xa201016
Java Notes: OMR 85a21674f
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + mmio_stale_data: Not affected + retbleed: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Retpolines IBPB: conditional IBRS_FW STIBP: always-on RSB filling PBRSB-eIBRS: Not affected + srbds: Not affected + tsx_async_abort: Not affected

GraaVM 17

Processor: OpenJ9 17 @ 3.70GHz (6 Cores / 12 Threads), Motherboard: Gigabyte B550 AORUS ELITE V2 (F15d BIOS), Chipset: AMD Starship/Matisse, Memory: 16GB, Disk: 512GB Viper M.2 VPR100, Graphics: NVIDIA GeForce GTX 1650 4GB, Audio: NVIDIA TU116 HD Audio, Monitor: 27G2G5, Network: Realtek RTL8125 2.5GbE

OS: Arch Linux, Kernel: 6.4.3-arch1-1 (x86_64), Desktop: KDE Plasma 5.27.6, Display Server: X Server 1.21.1.8, Display Driver: NVIDIA 535.54.03, OpenGL: 4.6.0, Compiler: GCC 13.1.1 20230429, File-System: ext4, Screen Resolution: 1920x1080

Kernel Notes: NVIDIA_drm.modeset=1 - Transparent Huge Pages: always
Processor Notes: Scaling Governor: acpi-cpufreq schedutil (Boost: Enabled) - CPU Microcode: 0xa201016
Java Notes: OpenJDK Runtime Environment GraalVM CE 22.3.1 (build 17.0.6+10-jvmci-22.3-b13)
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + mmio_stale_data: Not affected + retbleed: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Retpolines IBPB: conditional IBRS_FW STIBP: always-on RSB filling PBRSB-eIBRS: Not affected + srbds: Not affected + tsx_async_abort: Not affected

	OpenJDK 17	OpenJ9 17	GraaVM 17
Java SciMark - Composite (Mflops)	**3529**	**2491**	2806
Normalized	100%	70.6%	79.53%
Standard Deviation	5.6%	1%	0.1%
Java SciMark - Monte Carlo (Mflops)	**1813**	**604.16**	874.74
Normalized	100%	33.33%	48.25%
Standard Deviation	0.7%	1%	0%
Java SciMark - F.F.T (Mflops)	2671	**2480**	**2760**
Normalized	96.77%	89.87%	100%
Standard Deviation	0.9%	2.6%	0.4%
Java SciMark - S.M.M (Mflops)	**3177**	**531.30**	2432
Normalized	100%	16.73%	76.57%
Standard Deviation	0.5%	0.1%	0.2%

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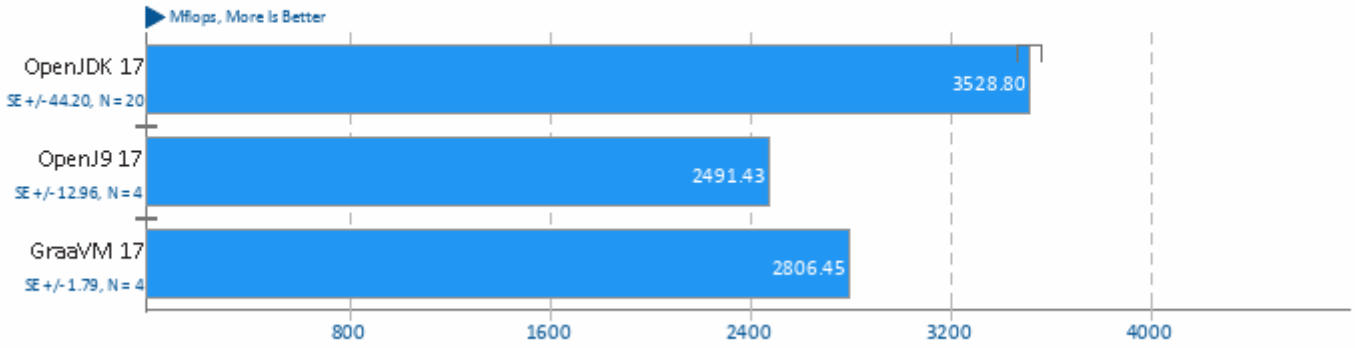
Java SciMark - D.L.M.F (Mflops)	**7421**	6645	**6474**
Normalized	100%	89.54%	87.24%
Standard Deviation	17%	1.5%	0.2%
Java SciMark - J.S.O.R (Mflops)	2194	**2197**	**1492**
Normalized	99.85%	100%	67.9%
Standard Deviation	0%	0.1%	0.5%
Bork File Encrypter - F.E.T (sec)	6.543	**7.831**	**6.512**
Normalized	99.53%	83.16%	100%
Standard Deviation	0.2%	0.2%	2.5%
DaCapo Benchmark - H2 (msec)	2009	**2881**	**1891**
Normalized	94.13%	65.64%	100%
Standard Deviation	8%	5.2%	9.7%
Renaissance - Scala Dotty (ms)	**634.7**	**1162**	872.8
Normalized	100%	54.6%	72.72%
Standard Deviation	1%	5.8%	0.4%
Renaissance - Apache Spark ALS (ms)	**2178**		**2135**
Normalized	97.99%		100%
Standard Deviation	1.1%		0.6%
Renaissance - Apache Spark Bayes (ms)	**1563**		**1230**
Normalized	78.69%		100%
Standard Deviation	3%		3.5%
Renaissance - Savina Reactors.IO (ms)	**3870**	**4985**	3959
Normalized	100%	77.64%	97.75%
Standard Deviation	0.6%	2.6%	0.4%
Renaissance - A.S.P (ms)	**2318**		**2371**
Normalized	100%		97.74%
Standard Deviation	0.6%		0.4%
Renaissance - F.H.R (ms)	**2598**	**3620**	3007
Normalized	100%	71.77%	86.41%
Standard Deviation	0.8%	0.9%	2.4%
Renaissance - A.U.C.T (ms)	**7289**	**9027**	7653
Normalized	100%	80.74%	95.24%
Standard Deviation	0.4%	1%	2.5%
Renaissance - G.A.U.J.F (ms)	2146	**2327**	**1861**
Normalized	86.74%	79.99%	100%
Standard Deviation	1%	9.7%	1%
Java Vertx benchmarks - V.J.b (Ops/s)	606823	**380722**	**629314**
Normalized	96.43%	60.5%	100%
Standard Deviation	191%	207.5%	191.8%
Java JMH - Throughput (Ops/s)	**11944504971**	**27450419034**	20208437039
Normalized	43.51%	100%	73.62%
Sunflow Rendering System - G.I.I.S (sec)	0.969	**1.154**	**0.865**
Normalized	89.27%	74.96%	100%
Standard Deviation	0.4%	2.2%	0.6%

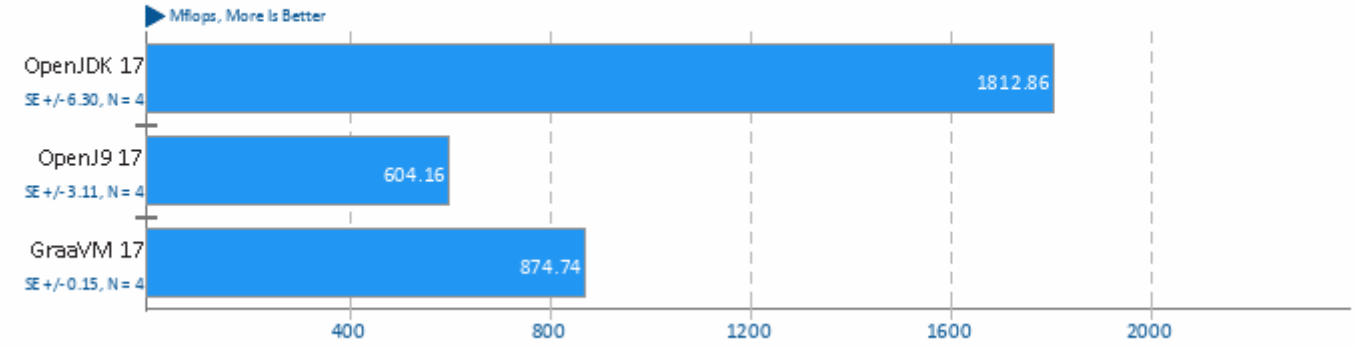
Java SciMark 2.0

Computational Test: Composite



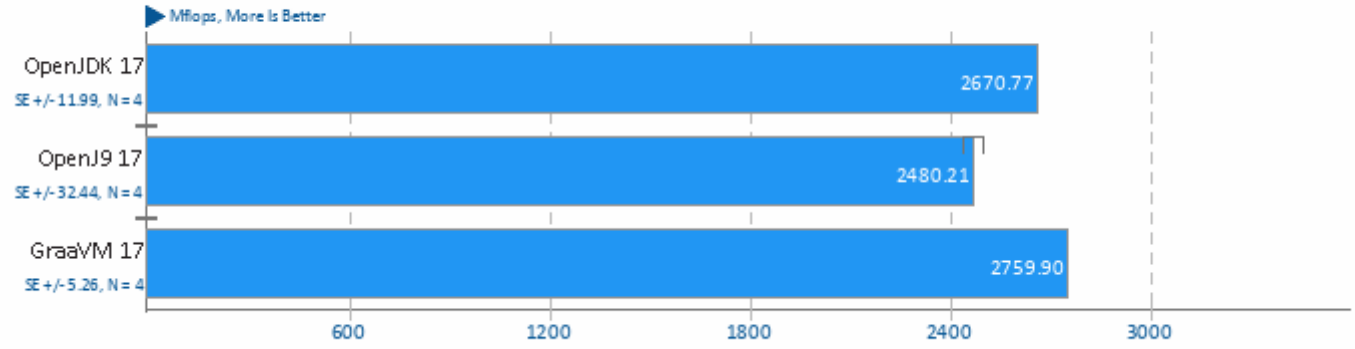
Java SciMark 2.0

Computational Test: Monte Carlo



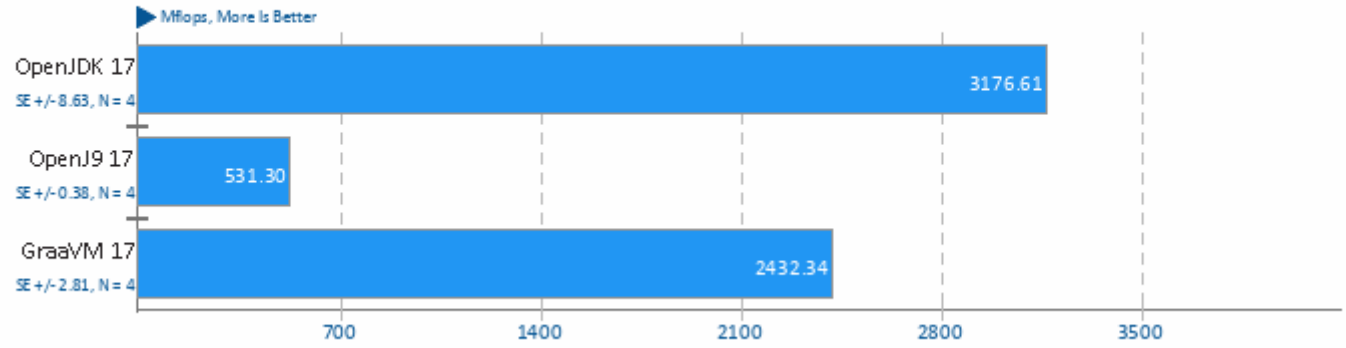
Java SciMark 2.0

Computational Test: Fast Fourier Transform



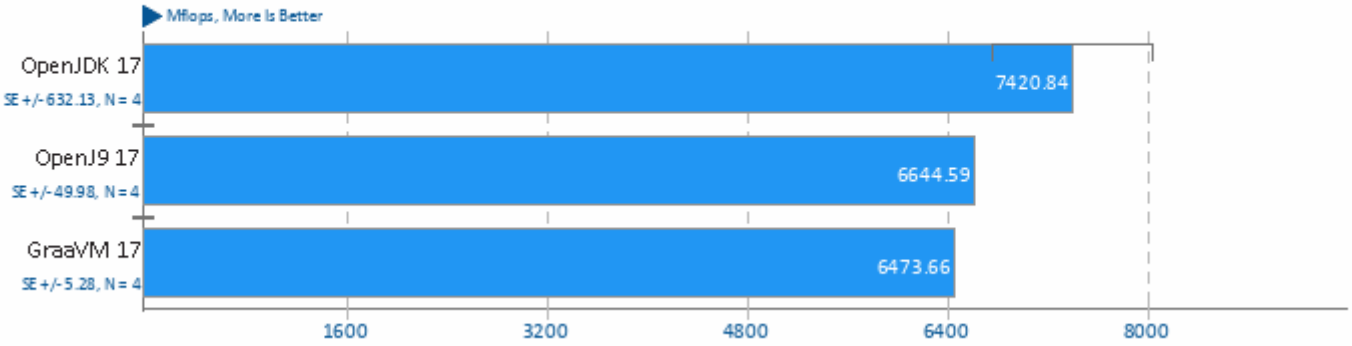
Java SciMark 2.0

Computational Test: Sparse Matrix Multiply



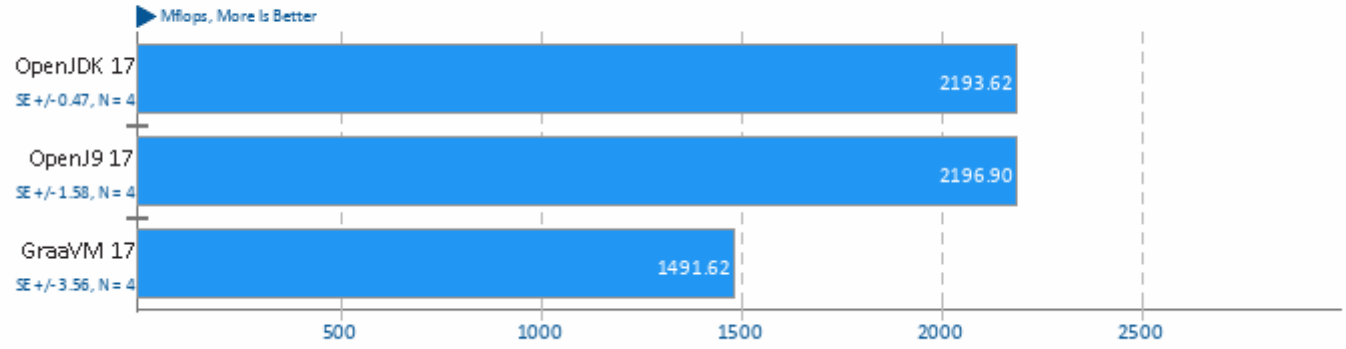
Java SciMark 2.0

Computational Test: Dense LU Matrix Factorization



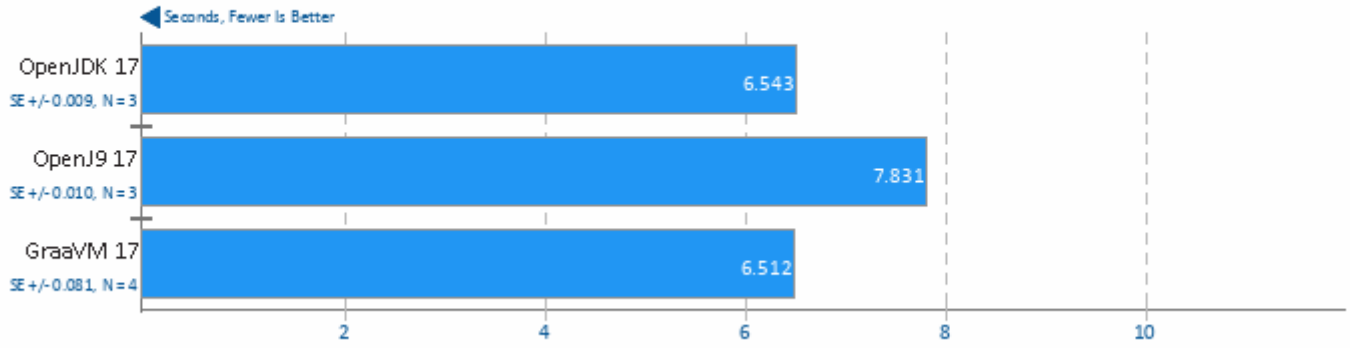
Java SciMark 2.0

Computational Test: Jacobi Successive Over-Relaxation



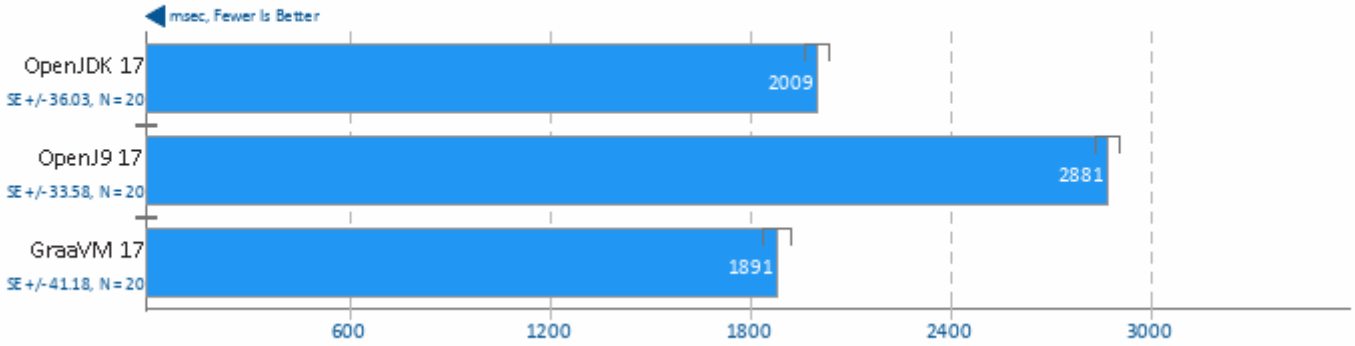
Bork File Encrypter 1.4

File Encryption Time



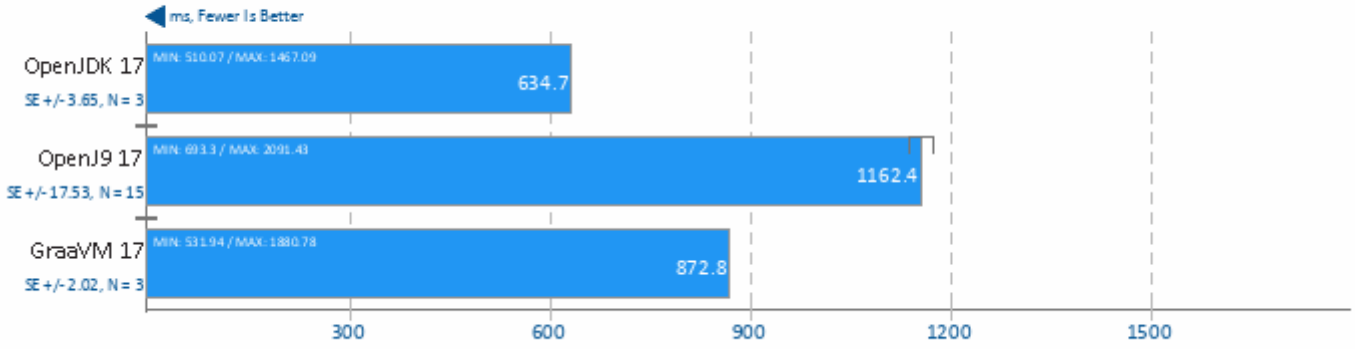
DaCapo Benchmark 9.12-MR1

Java Test: H2



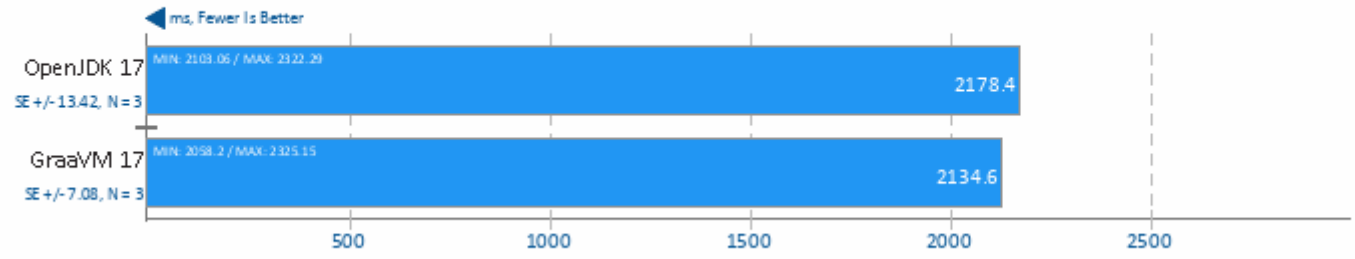
Renaissance 0.14

Test: Scala Dotty



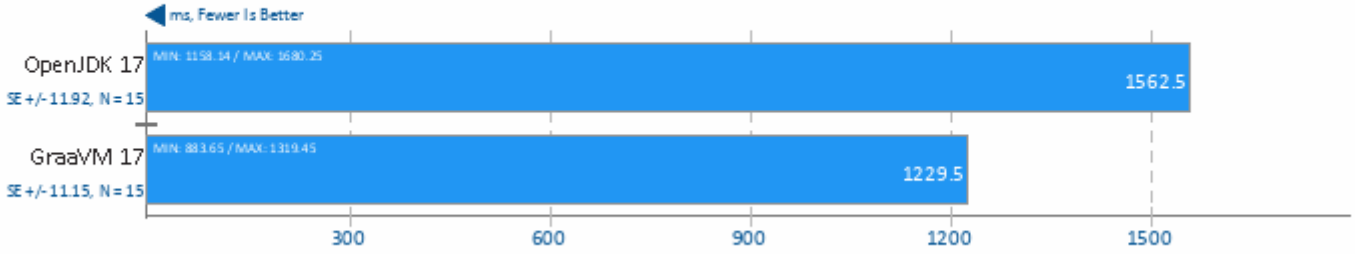
Renaissance 0.14

Test: Apache Spark ALS



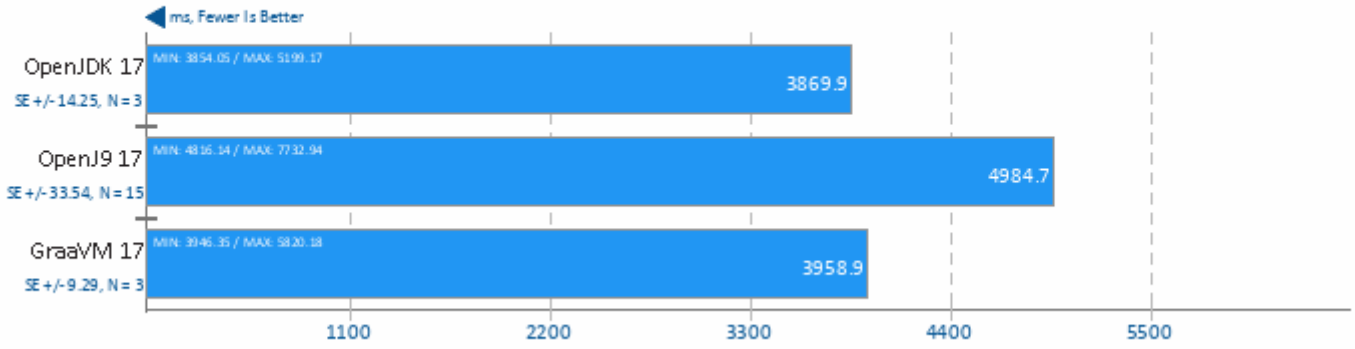
Renaissance 0.14

Test: Apache Spark Bayes



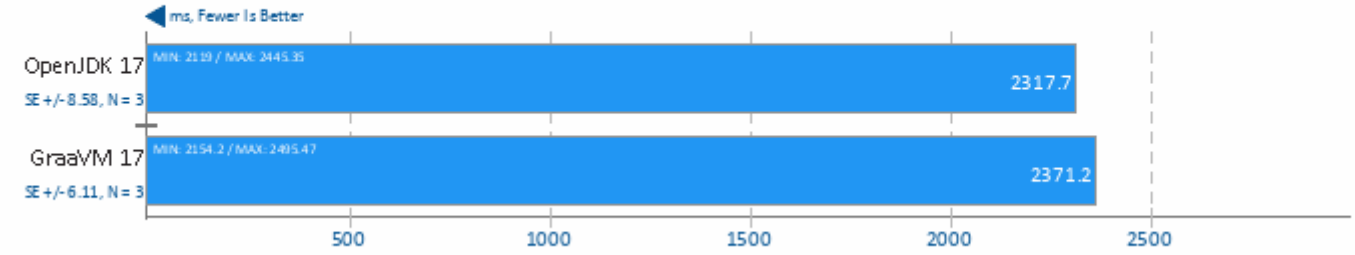
Renaissance 0.14

Test: Savina Reactors.IO



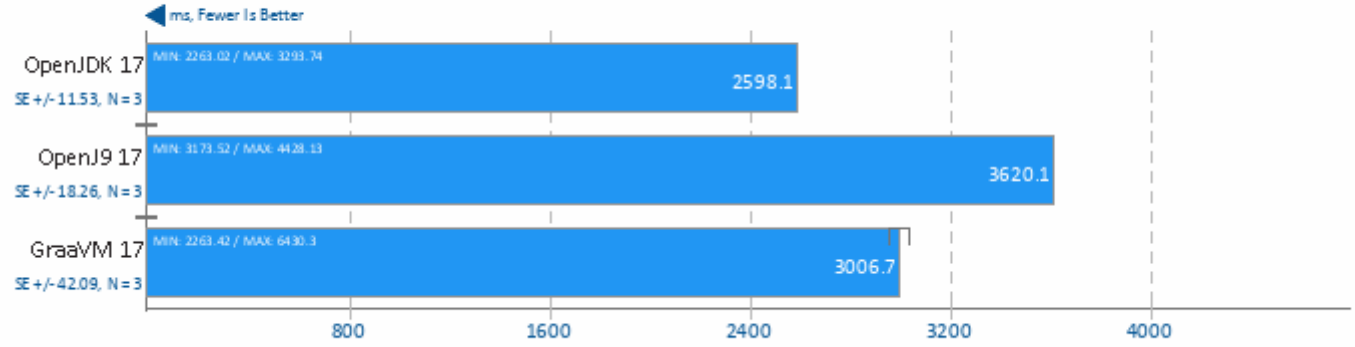
Renaissance 0.14

Test: Apache Spark PageRank



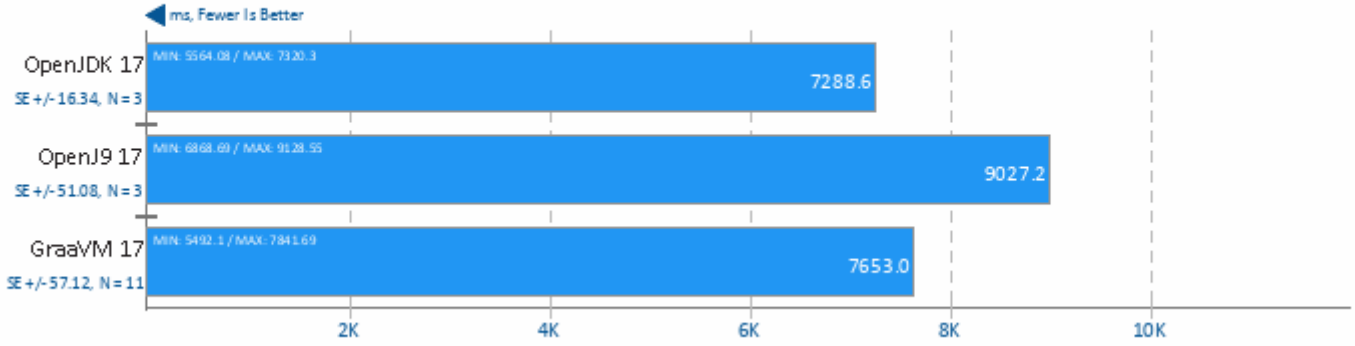
Renaissance 0.14

Test: Finagle HTTP Requests



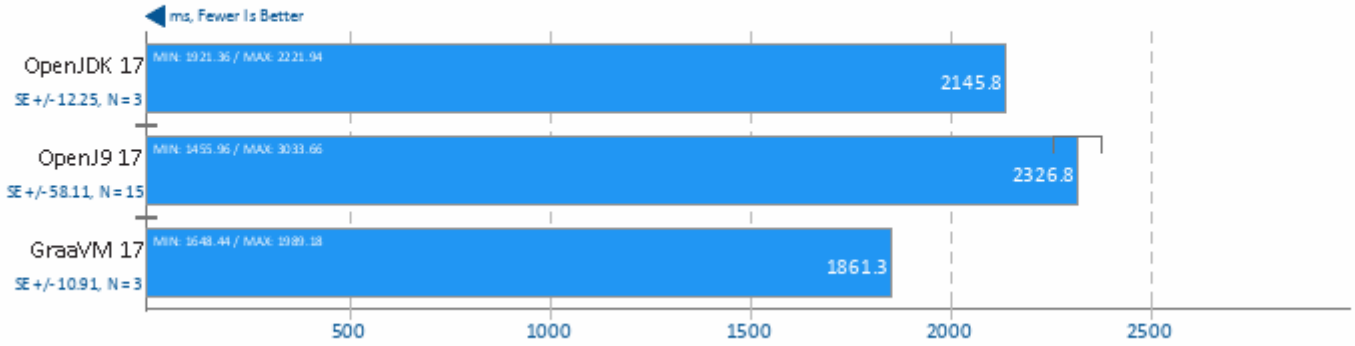
Renaissance 0.14

Test: Akka Unbalanced Cobwebbed Tree



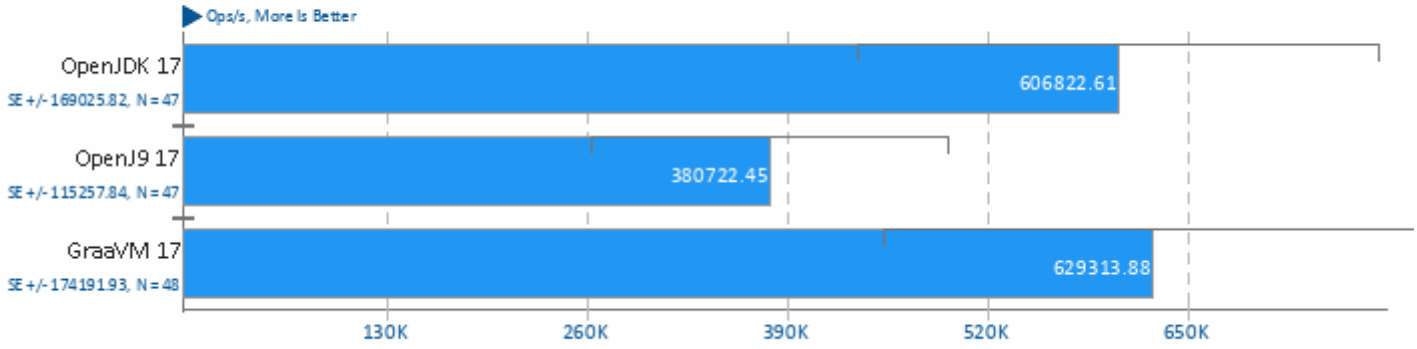
Renaissance 0.14

Test: Genetic Algorithm Using Jenetics + Futures



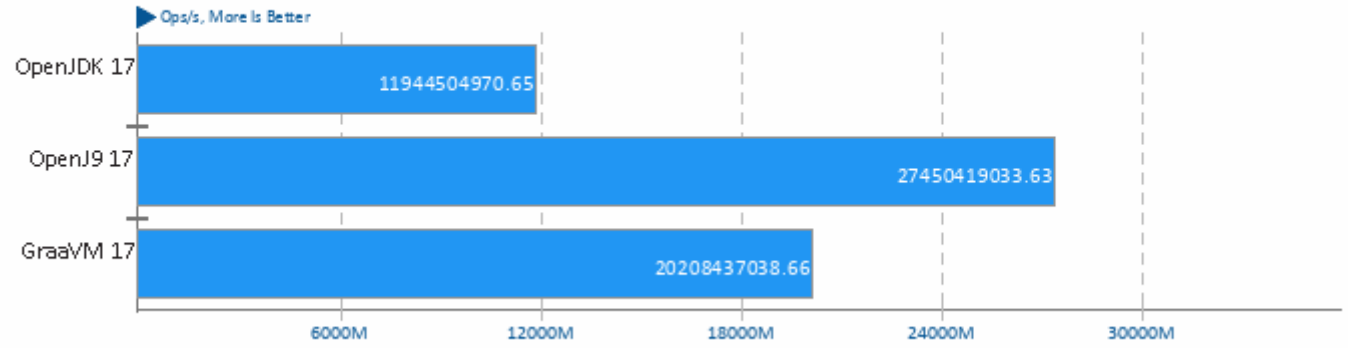
Java Vertx benchmarks 4.4

Test: Vertx JHM benchmark



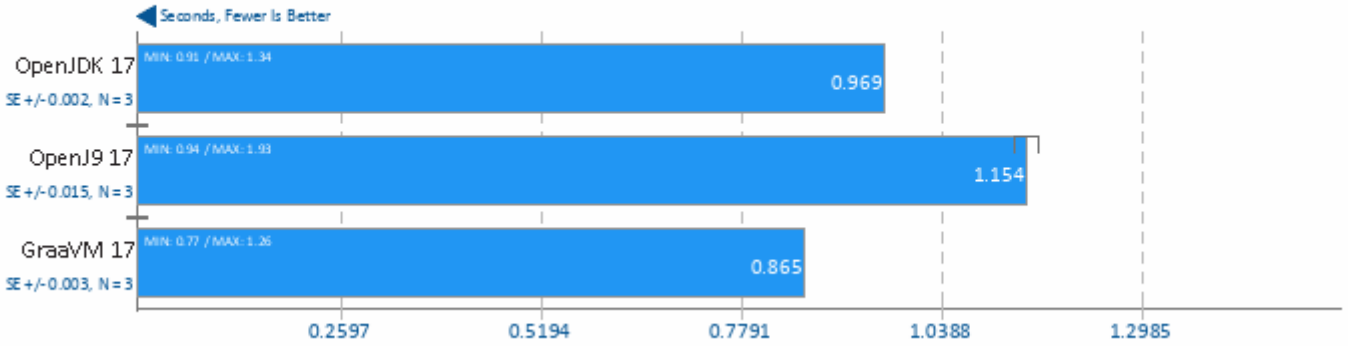
Java JMH

Throughput

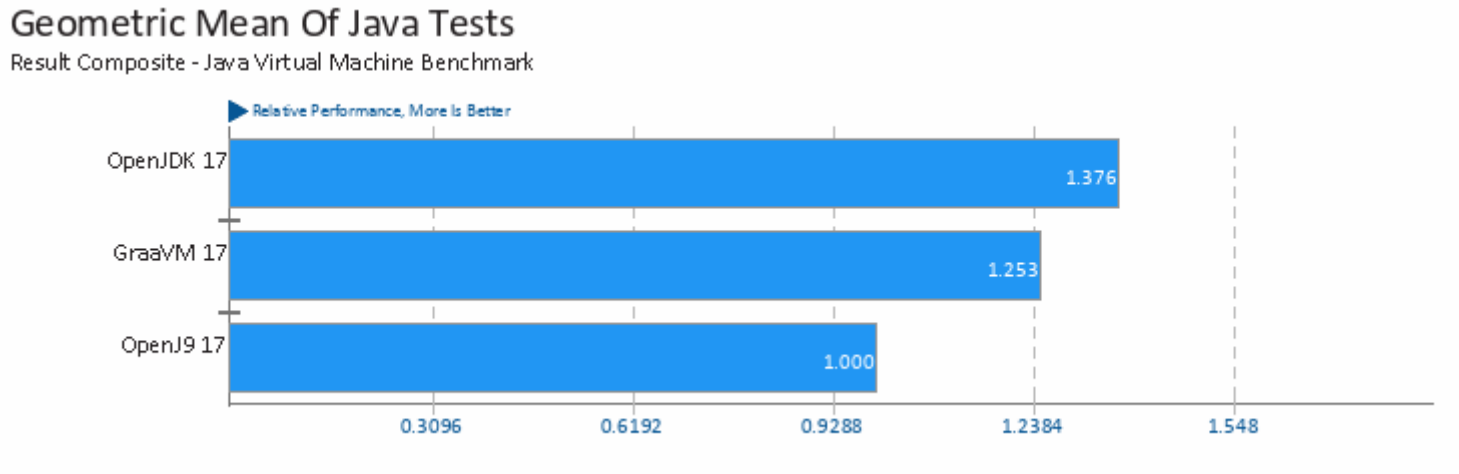


Sunflow Rendering System 0.07.2

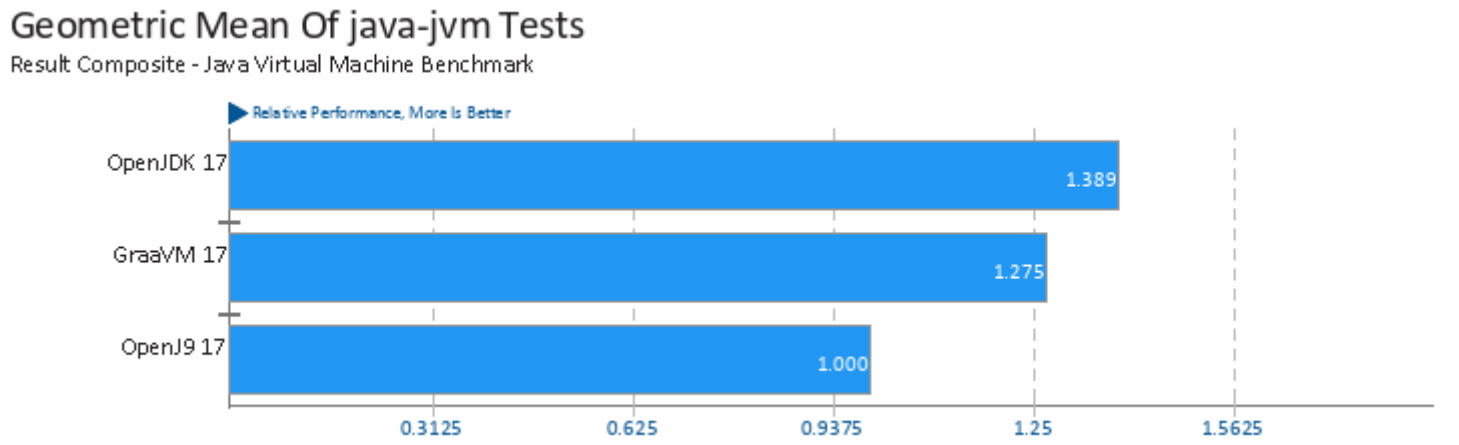
Global Illumination + Image Synthesis



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



Geometric mean based upon tests: pts/sunflow, pts/bork, pts/java-scimark2, pts/dacapobench, pts/java-jmh and pts/renaissance



Geometric mean based upon tests: pts/java-scimark2, pts/bork, pts/dacapobench, pts/renaissance, local/vertx, pts/java-jmh and pts/sunflow

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