Java virtual machines benchmark

Test various java virtual machines (JVMs)

Automated Executive Summary

OpenJDK 17 had the most wins, coming in first place for 45% of the tests.

Based on the geometric mean of all complete results, the fastest (OpenJDK 17) was 1.36x the speed of the slowest (Eclipse OpenJ9). GraalVM CE 22.3.1 Java 17 was 0.923x the speed of OpenJDK 17 and Eclipse OpenJ9 was 0.797x the speed of GraalVM CE 22.3.1 Java 17.

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

Java SciMark (Computational Test: Sparse Matrix Multiply) at 5.992x
Java SciMark (Computational Test: Monte Carlo) at 2.975x
Java JMH (Throughput) at 2.256x
Java SciMark (Computational Test: Jacobi Successive Over-Relaxation) at 1.476x
Sunflow Rendering System (Global Illumination + Image Synthesis) at 1.398x
Renaissance (Test: Finagle HTTP Requests) at 1.35x
Java SciMark (Computational Test: Composite) at 1.336x
Renaissance (Test: Apache Spark Bayes) at 1.301x
Renaissance (Test: Savina Reactors.IO) at 1.251x

Renaissance (Test: Akka Unbalanced Cobwebbed Tree) at 1.229x.

Test Systems:

OpenJDK 17

GraalVM CE 22.3.1 Java 17

Eclipse OpenJ9

Processor: AMD Ryzen 5 5600X 6-Core @ 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: 6.1.8-arch1-1 (x86_64), Desktop: KDE Plasma 5.26.5, Display Server: X Server 1.21.1.6, Display Driver: NVIDIA 525.85.05, OpenGL: 4.6.0, Compiler: GCC 12.2.1 20230111, 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
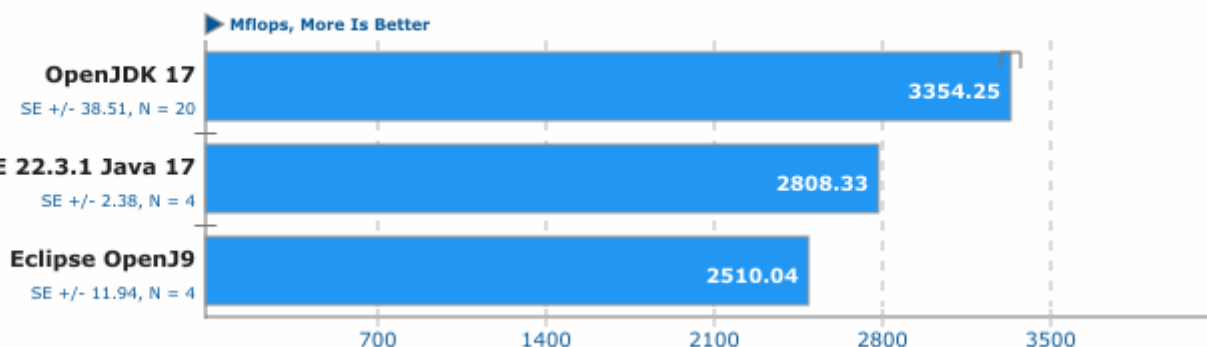
	OpenJDK 17	GraalVM CE 22.3.1 Java 17	Eclipse OpenJ9
Java SciMark - Composite (Mflops)	3354	2808	2510
Normalized	100%	83.72%	74.83%
Standard Deviation	5.1%	0.2%	1%
Java SciMark - Monte Carlo (Mflops)	1808	872.80	607.69
Normalized	100%	48.27%	33.61%
Standard Deviation	0.6%	0.6%	0.8%
Java SciMark - F.F.T (Mflops)	2685	2764	2548
Normalized	97.14%	100%	92.17%
Standard Deviation	0.8%	0.1%	0.7%
Java SciMark - S.M.M (Mflops)	3183	2435	531.25
Normalized	100%	76.5%	16.69%
Standard Deviation	0.3%	0%	0.1%
Java SciMark - D.L.M.F (Mflops)	6864	6480	6665
Normalized	100%	94.42%	97.1%
Standard Deviation	13.4%	0.3%	1.5%
Java SciMark - J.S.O.R (Mflops)	2195	1489	2199
Normalized	99.81%	67.73%	100%

Standard Deviation	0%	0.4%	0%
Bork File Encrypter - F.E.T (sec)	**6.450**	6.577	**7.857**
Normalized	100%	98.07%	82.09%
Standard Deviation	1%	2.2%	0.4%
DaCapo Benchmark - H2 (msec)	2015	**1884**	**2929**
Normalized	93.5%	100%	64.32%
Standard Deviation	6.4%	6.3%	5%
Renaissance - Scala Dotty (ms)	**630.2**	808.3	**1149**
Normalized	100%	77.97%	54.84%
Standard Deviation	0.8%	6.2%	5.8%
Renaissance - Rand Forest (ms)	**485.6**	**453.6**	
Normalized	93.41%	100%	
Standard Deviation	1%	0.7%	
Renaissance - ALS Movie Lens (ms)	**4734**	**4642**	
Normalized	98.06%	100%	
Standard Deviation	0.5%	0.7%	
Renaissance - Apache Spark ALS (ms)	**1503**	**1324**	
Normalized	88.09%	100%	
Standard Deviation	0.5%	3%	
Renaissance - Apache Spark Bayes (ms)	**1615**	**1241**	
Normalized	76.84%	100%	
Standard Deviation	0.3%	2.4%	
Renaissance - Savina Reactors.IO (ms)	**3947**	3953	**4937**
Normalized	100%	99.87%	79.95%
Standard Deviation	0.9%	2.5%	1.2%
Renaissance - A.S.P (ms)	**2338**	**2330**	
Normalized	99.66%	100%	
Standard Deviation	1.6%	1.8%	
Renaissance - F.H.R (ms)	**2709**	3040	**3658**
Normalized	100%	89.12%	74.06%
Standard Deviation	2.4%	1.8%	0.6%
Renaissance - A.U.C.T (ms)	**7297**	7689	**8971**
Normalized	100%	94.91%	81.34%
Standard Deviation	0.4%	1.6%	0.6%
Renaissance - G.A.U.J.F (ms)	2184	**1888**	**2247**
Normalized	86.45%	100%	84.02%
Standard Deviation	1.8%	0.2%	2%
Java JMH - Throughput (Ops/s)	**12194179716**	20565723592	**27515845953**
Normalized	44.32%	74.74%	100%
Sunflow Rendering System - G.I.I.S (sec)	0.927	**0.847**	**1.184**
Normalized	91.37%	100%	71.54%
Standard Deviation	1.3%	1.1%	2.2%

Java SciMark 2.0
Computational Test: Composite

▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 38.51, N = 20	3354.25
GraalVM CE 22.3.1 Java 17 SE +/- 2.38, N = 4	2808.33
Eclipse OpenJ9 SE +/- 11.94, N = 4	2510.04

700   1400   2100   2800   3500

Java SciMark 2.0
Computational Test: Monte Carlo

▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 5.23, N = 4	1808.07
GraalVM CE 22.3.1 Java 17 SE +/- 2.42, N = 4	872.80
Eclipse OpenJ9 SE +/- 2.45, N = 4	607.69

400   800   1200   1600   2000
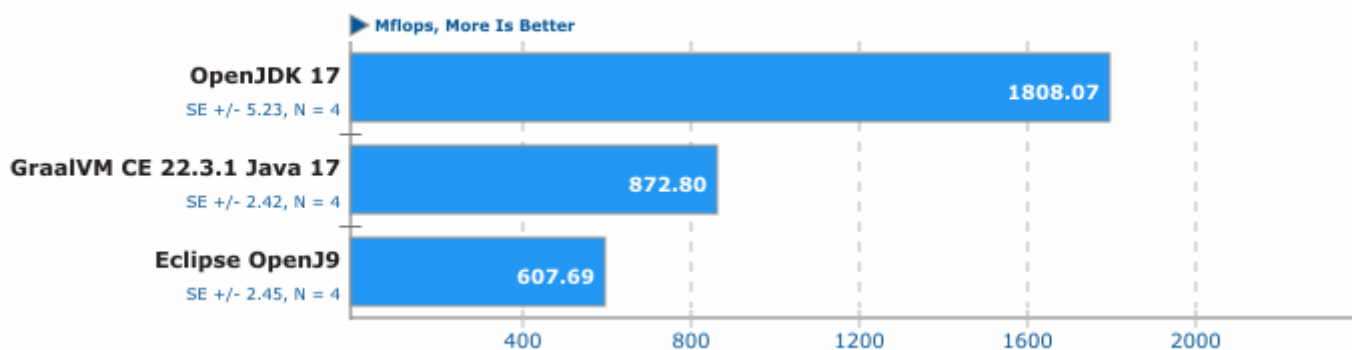
Java SciMark 2.0
Computational Test: Fast Fourier Transform
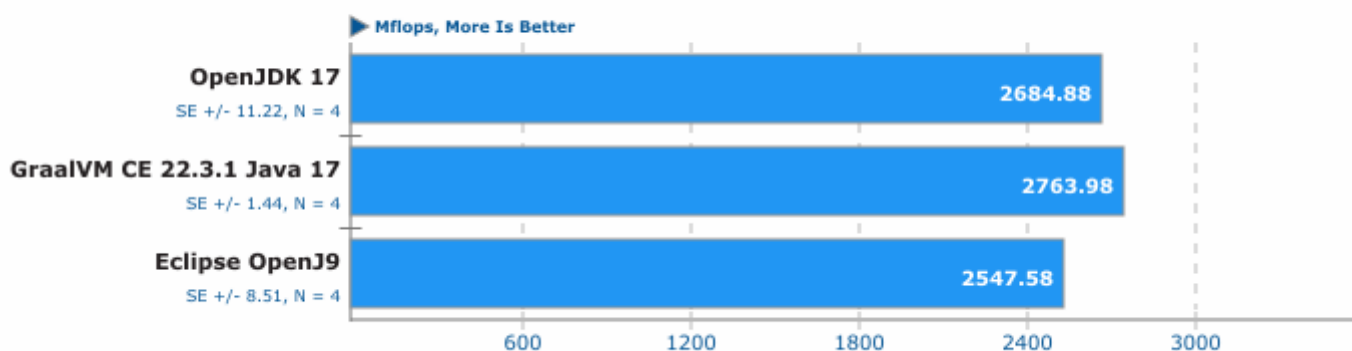
▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 11.22, N = 4	2684.88
GraalVM CE 22.3.1 Java 17 SE +/- 1.44, N = 4	2763.98
Eclipse OpenJ9 SE +/- 8.51, N = 4	2547.58

600   1200   1800   2400   3000

Java SciMark 2.0
Computational Test: Sparse Matrix Multiply

▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 5.48, N = 4	3183.32
GraalVM CE 22.3.1 Java 17 SE +/- 0.46, N = 4	2435.15
Eclipse OpenJ9 SE +/- 0.22, N = 4	531.25

700   1400   2100   2800   3500

Java SciMark 2.0
Computational Test: Dense LU Matrix Factorization
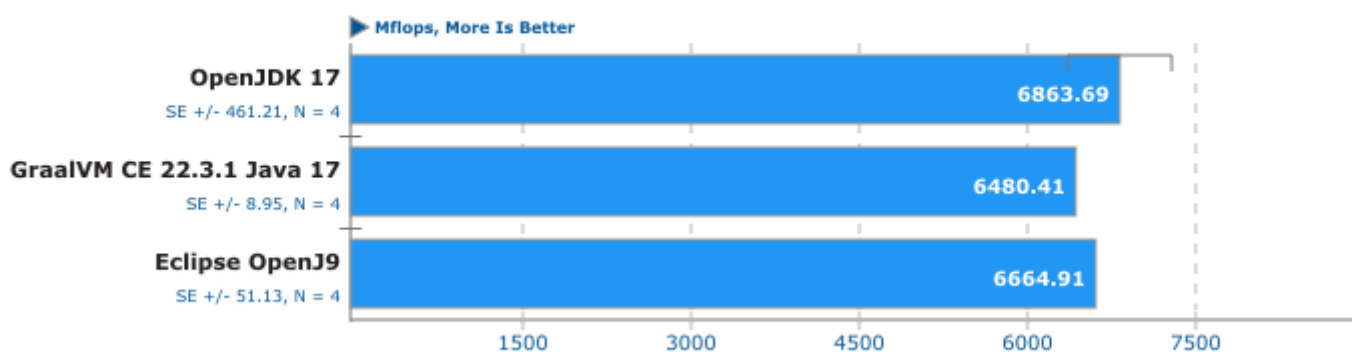
▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 461.21, N = 4	6863.69
GraalVM CE 22.3.1 Java 17 SE +/- 8.95, N = 4	6480.41
Eclipse OpenJ9 SE +/- 51.13, N = 4	6664.91

1500   3000   4500   6000   7500

Java SciMark 2.0
Computational Test: Jacobi Successive Over-Relaxation

▶ **Mflops, More Is Better**

OpenJDK 17 SE +/- 0.53, N = 4	2194.55
GraalVM CE 22.3.1 Java 17 SE +/- 3.15, N = 4	1489.31
Eclipse OpenJ9 SE +/- 0.40, N = 4	2198.78

500   1000   1500   2000   2500

Java virtual machines benchmark

Bork File Encrypter 1.4

File Encryption Time

◀ **Seconds, Fewer Is Better**

OpenJDK 17
SE +/- 0.039, N = 3
6.450

GraalVM CE 22.3.1 Java 17
SE +/- 0.073, N = 4
6.577

Eclipse OpenJ9
SE +/- 0.016, N = 3
7.857

| 2 | 4 | 6 | 8 | 10 |
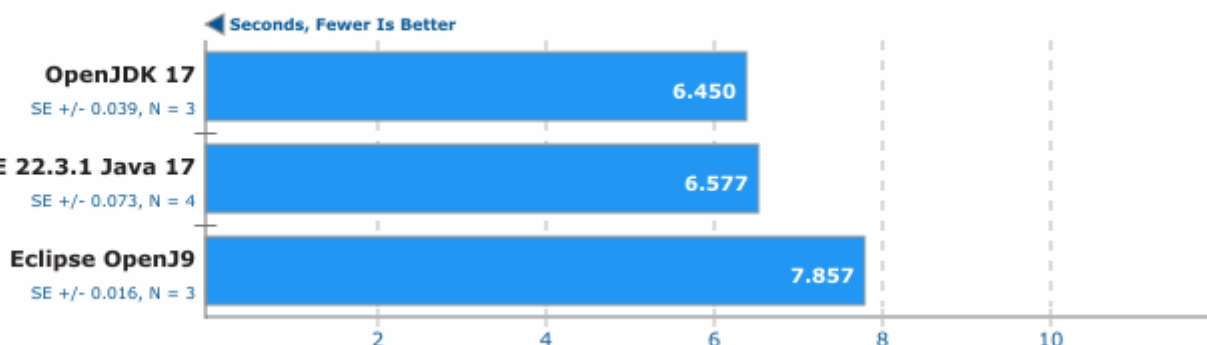
DaCapo Benchmark 9.12-MR1

Java Test: H2

◀ **msec, Fewer Is Better**

OpenJDK 17
SE +/- 28.98, N = 20
2015

GraalVM CE 22.3.1 Java 17
SE +/- 26.58, N = 20
1884

Eclipse OpenJ9
SE +/- 32.77, N = 20
2929

| 600 | 1200 | 1800 | 2400 | 3000 |
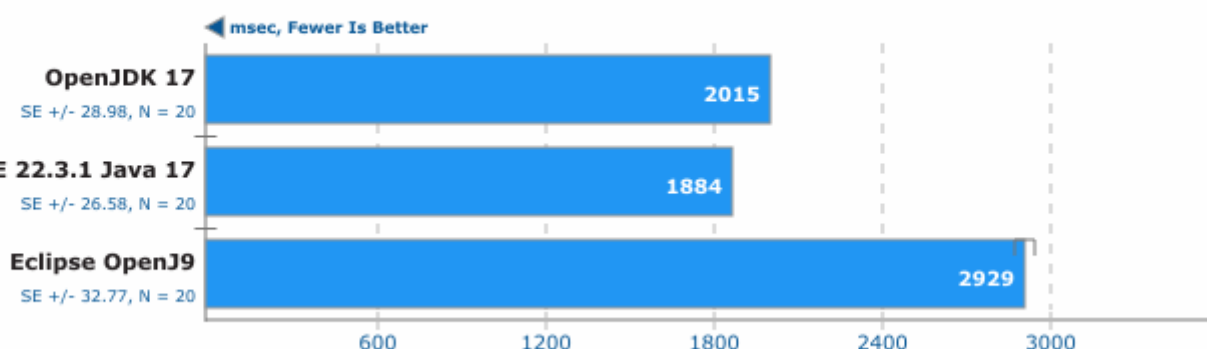
Renaissance 0.14

Test: Scala Dotty

◀ **ms, Fewer Is Better**

OpenJDK 17
SE +/- 2.99, N = 3
MIN: 507.69 / MAX: 1363.62
630.2

GraalVM CE 22.3.1 Java 17
SE +/- 13.04, N = 15
MIN: 518.35 / MAX: 2139.9
808.3

Eclipse OpenJ9
SE +/- 17.22, N = 15
MIN: 679.44 / MAX: 2086.53
1149.2

| 200 | 400 | 600 | 800 | 1000 |

Renaissance 0.14

Test: Random Forest

◀ **ms, Fewer Is Better**

OpenJDK 17
SE +/- 2.67, N = 3
MIN: 437.74 / MAX: 591.2
485.6

GraalVM CE 22.3.1 Java 17
SE +/- 1.75, N = 3
MIN: 408.53 / MAX: 614.76
453.6

| 110 | 220 | 330 | 440 | 550 |

Renaissance 0.14
Test: ALS Movie Lens
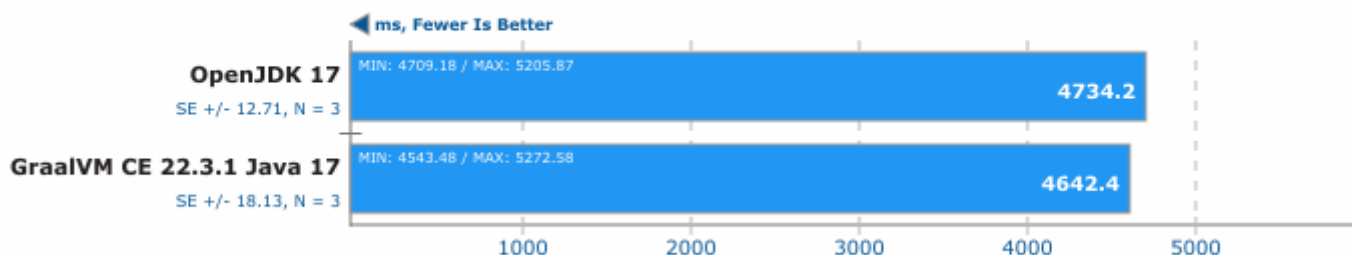
◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 12.71, N = 3
MIN: 4709.18 / MAX: 5205.87
4734.2

GraalVM CE 22.3.1 Java 17
SE +/- 18.13, N = 3
MIN: 4543.48 / MAX: 5272.58
4642.4

1000 2000 3000 4000 5000

Renaissance 0.14
Test: Apache Spark ALS

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 4.42, N = 3
MIN: 1409.79 / MAX: 1645.34
1502.5

GraalVM CE 22.3.1 Java 17
SE +/- 10.08, N = 15
MIN: 1196.12 / MAX: 1462.47
1323.5

300 600 900 1200 1500

Renaissance 0.14
Test: Apache Spark Bayes

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 3.26, N = 3
MIN: 1227.29 / MAX: 1620.12
1614.5

GraalVM CE 22.3.1 Java 17
SE +/- 10.40, N = 8
MIN: 908.74 / MAX: 1300.62
1240.6

300 600 900 1200 1500
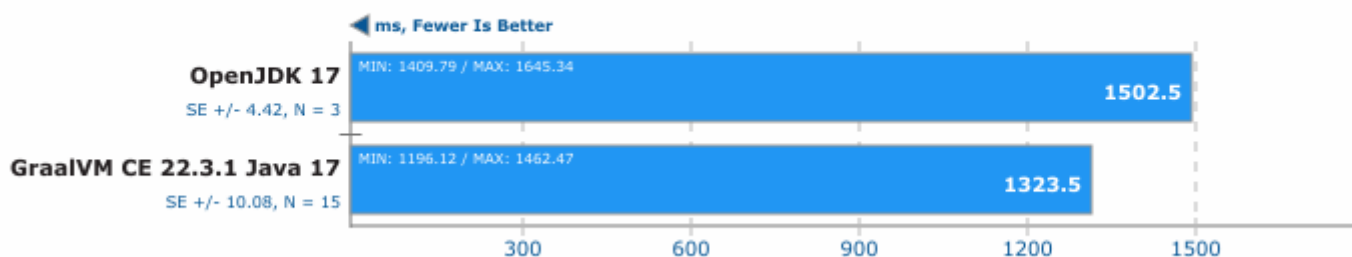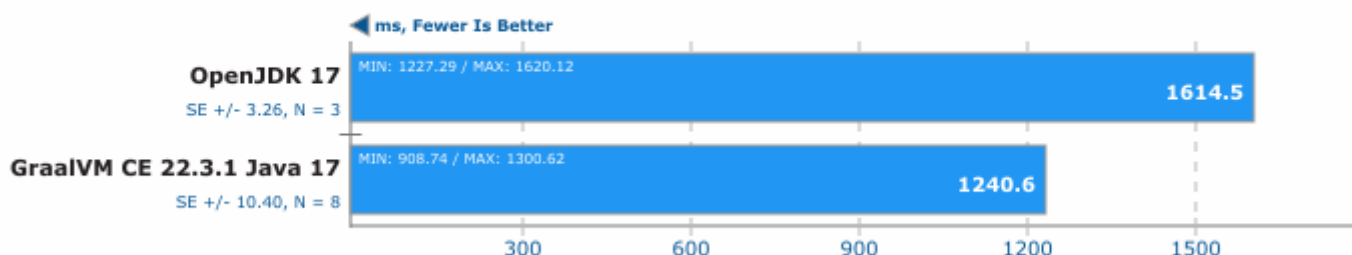
Renaissance 0.14
Test: Savina Reactors.IO

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 21.49, N = 3
MIN: 3911.81 / MAX: 5270.29
3947.4

GraalVM CE 22.3.1 Java 17
SE +/- 34.82, N = 8
MIN: 3855.31 / MAX: 6132.47
3952.5

Eclipse OpenJ9
SE +/- 33.86, N = 3
MIN: 4871.62 / MAX: 7265.25
4937.3

1100 2200 3300 4400 5500

Renaissance 0.14
Test: Apache Spark PageRank

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 21.43, N = 3
MIN: 2151.17 / MAX: 2441.18
2337.5

GraalVM CE 22.3.1 Java 17
SE +/- 23.95, N = 3
MIN: 2158.93 / MAX: 2429.41
2329.6

| 500 | 1000 | 1500 | 2000 | 2500 |
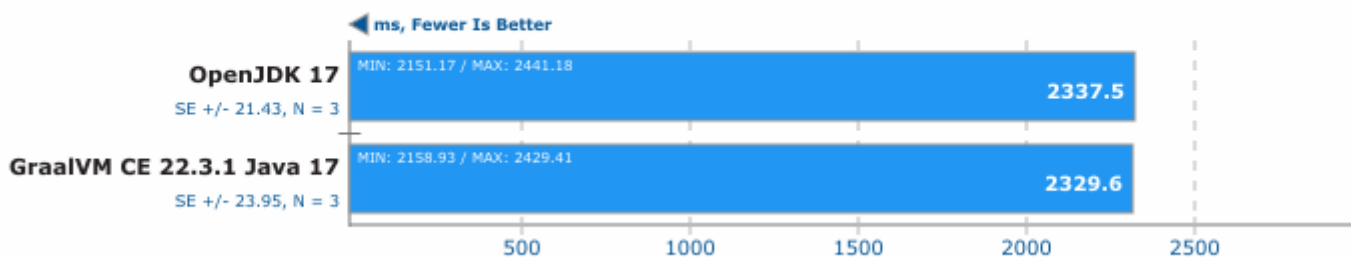
Eclipse OpenJ9 has problems with Apache SparkÂ

Renaissance 0.14
Test: Finagle HTTP Requests

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 26.79, N = 6
MIN: 2273.89 / MAX: 3371.98
2709.2

GraalVM CE 22.3.1 Java 17
SE +/- 31.13, N = 3
MIN: 2246.26 / MAX: 6458.11
3039.8

Eclipse OpenJ9
SE +/- 12.33, N = 3
MIN: 3239.88 / MAX: 4435.46
3658.1

| 800 | 1600 | 2400 | 3200 | 4000 |
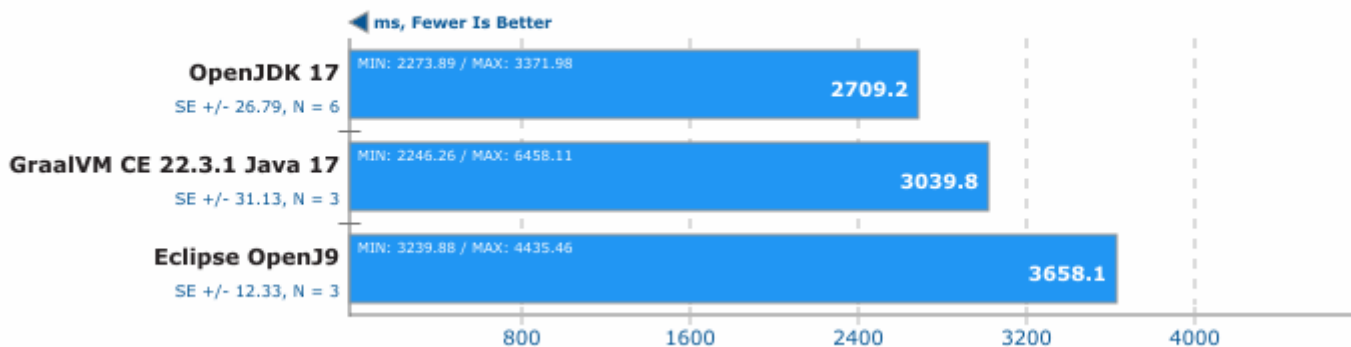
Renaissance 0.14
Test: Akka Unbalanced Cobwebbed Tree

◀ ms, Fewer Is Better

OpenJDK 17
SE +/- 18.89, N = 3
MIN: 5565.99 / MAX: 7334.71
7297.0

GraalVM CE 22.3.1 Java 17
SE +/- 71.35, N = 3
MIN: 5818.1 / MAX: 7820.74
7688.5

Eclipse OpenJ9
SE +/- 30.67, N = 3
MIN: 6791.31 / MAX: 9030
8971.1

| 2K | 4K | 6K | 8K | 10K |
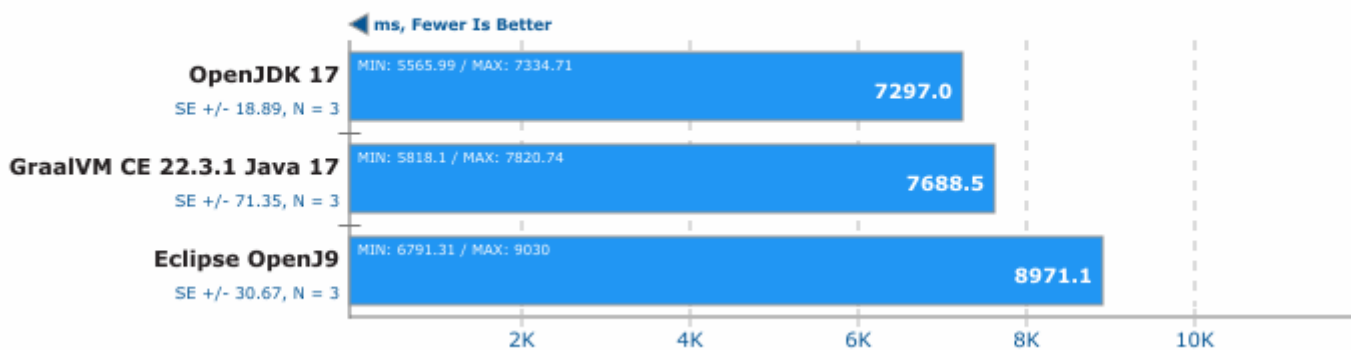
Renaissance 0.14
Test: Genetic Algorithm Using Jenetics + Futures

◀ ms, Fewer Is Better

OpenJDK 17
MIN: 1928.54 / MAX: 2268.79
SE +/- 22.56, N = 3
2183.7

GraalVM CE 22.3.1 Java 17
MIN: 1580.17 / MAX: 2018.8
SE +/- 2.09, N = 3
1887.8

Eclipse OpenJ9
MIN: 1724.18 / MAX: 2571.89
SE +/- 25.75, N = 3
2246.8

| 500 | 1000 | 1500 | 2000 | 2500 |

Java JMH
Throughput

▶ Ops/s, More Is Better

OpenJDK 17
12194179715.86

GraalVM CE 22.3.1 Java 17
20565723591.71

Eclipse OpenJ9
27515845953.46

| 6000M | 12000M | 18000M | 24000M | 30000M |
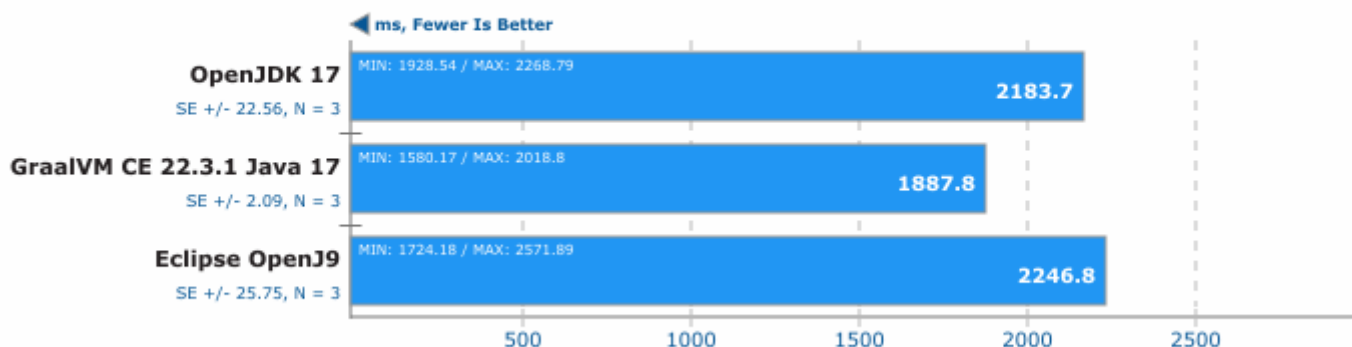
Sunflow Rendering System 0.07.2
Global Illumination + Image Synthesis

◀ Seconds, Fewer Is Better

OpenJDK 17
MIN: 0.86 / MAX: 1.24
SE +/- 0.007, N = 3
0.927

GraalVM CE 22.3.1 Java 17
MIN: 0.74 / MAX: 1.29
SE +/- 0.005, N = 3
0.847

Eclipse OpenJ9
MIN: 0.9 / MAX: 1.96
SE +/- 0.013, N = 4
1.184

| 0.2664 | 0.5328 | 0.7992 | 1.0656 | 1.332 |

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

Geometric Mean Of Java Tests
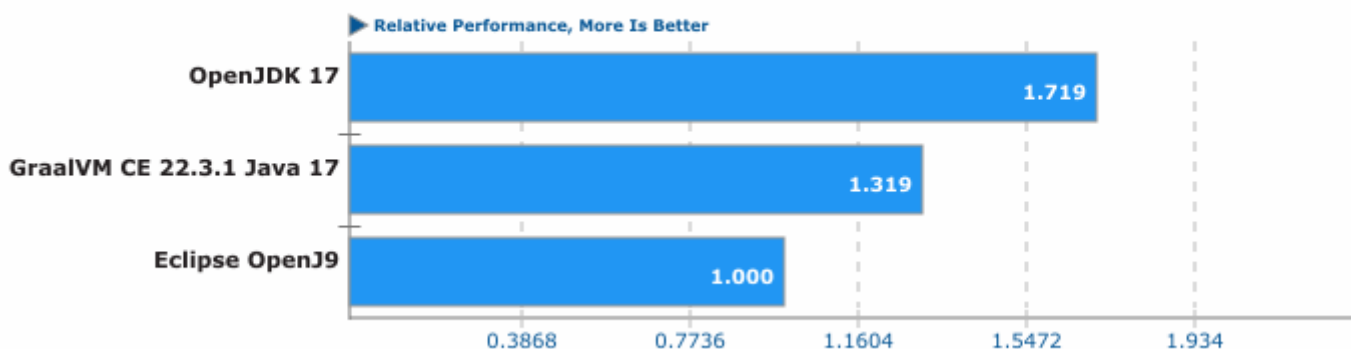**Result Composite - Java virtual machines benchmark**

Relative Performance, More Is Better

OpenJDK 17	1.360
GraalVM CE 22.3.1 Java 17	1.255
Eclipse OpenJ9	1.000

0.306   0.612   0.918   1.224   1.53

Geometric mean based upon tests: pts/sunflow, pts/bork, pts/java-scimark2, pts/dacapobench, pts/java-jmh and pts/renaissance
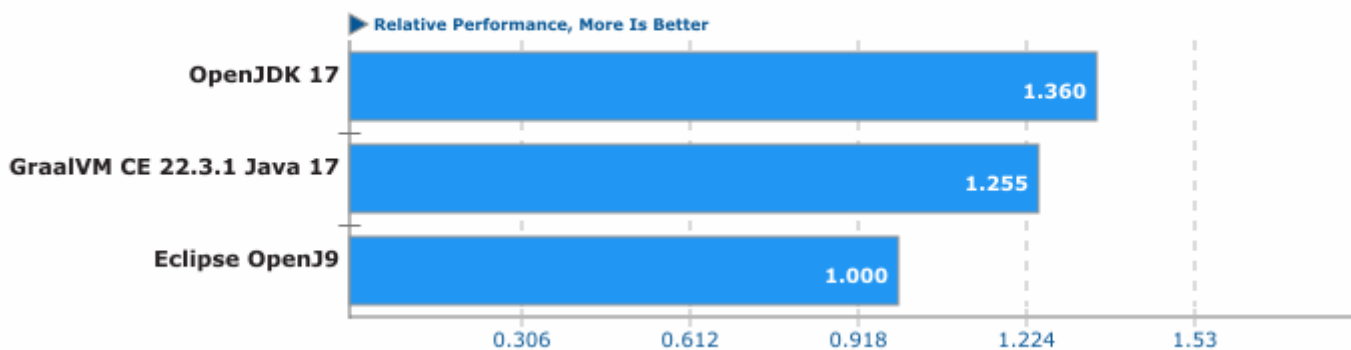
Geometric Mean Of java-platforms-test
Result Composite - Java virtual machines benchmark

Relative Performance, More Is Better

OpenJDK 17	1.719
GraalVM CE 22.3.1 Java 17	1.319
Eclipse OpenJ9	1.000

0.3868   0.7736   1.1604   1.5472   1.934

Geometric mean based upon tests: pts/java-scimark2

Geometric Mean Of jvm-benchmark Tests
Result Composite - Java virtual machines benchmark

Relative Performance, More Is Better

OpenJDK 17	1.360
GraalVM CE 22.3.1 Java 17	1.255
Eclipse OpenJ9	1.000

0.306   0.612   0.918   1.224   1.53

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

This file was automatically generated via the Phoronix Test Suite benchmarking software on Friday, 27 January 2023 20:32.