JMH MULTITHREADED BENCHMARK REPORT

===

Source File: multithread-results
Date: 2026-02-19 10:20:23

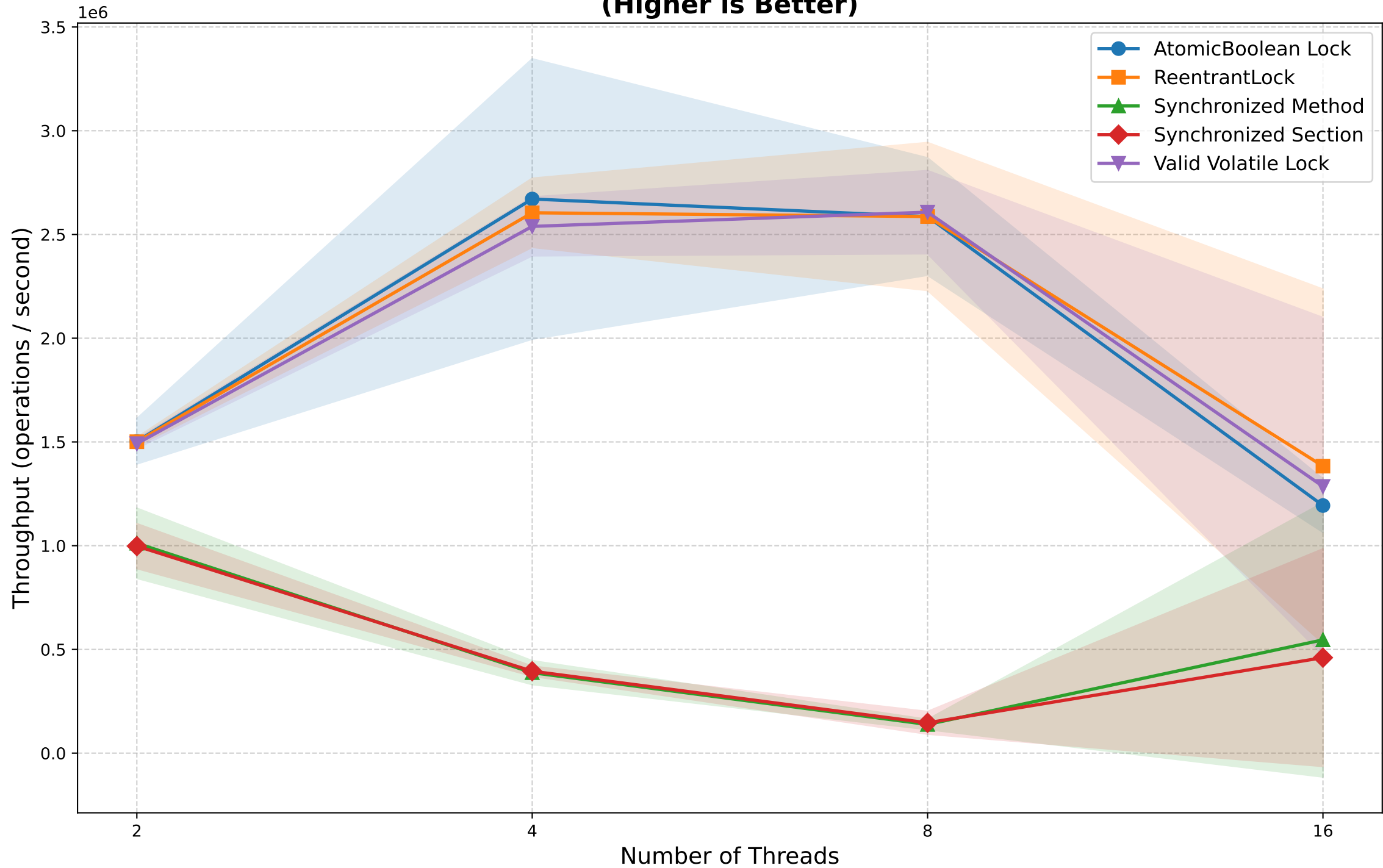Benchmark: MultiThreadUniqueListBenchmark
Operations per Thread: 10
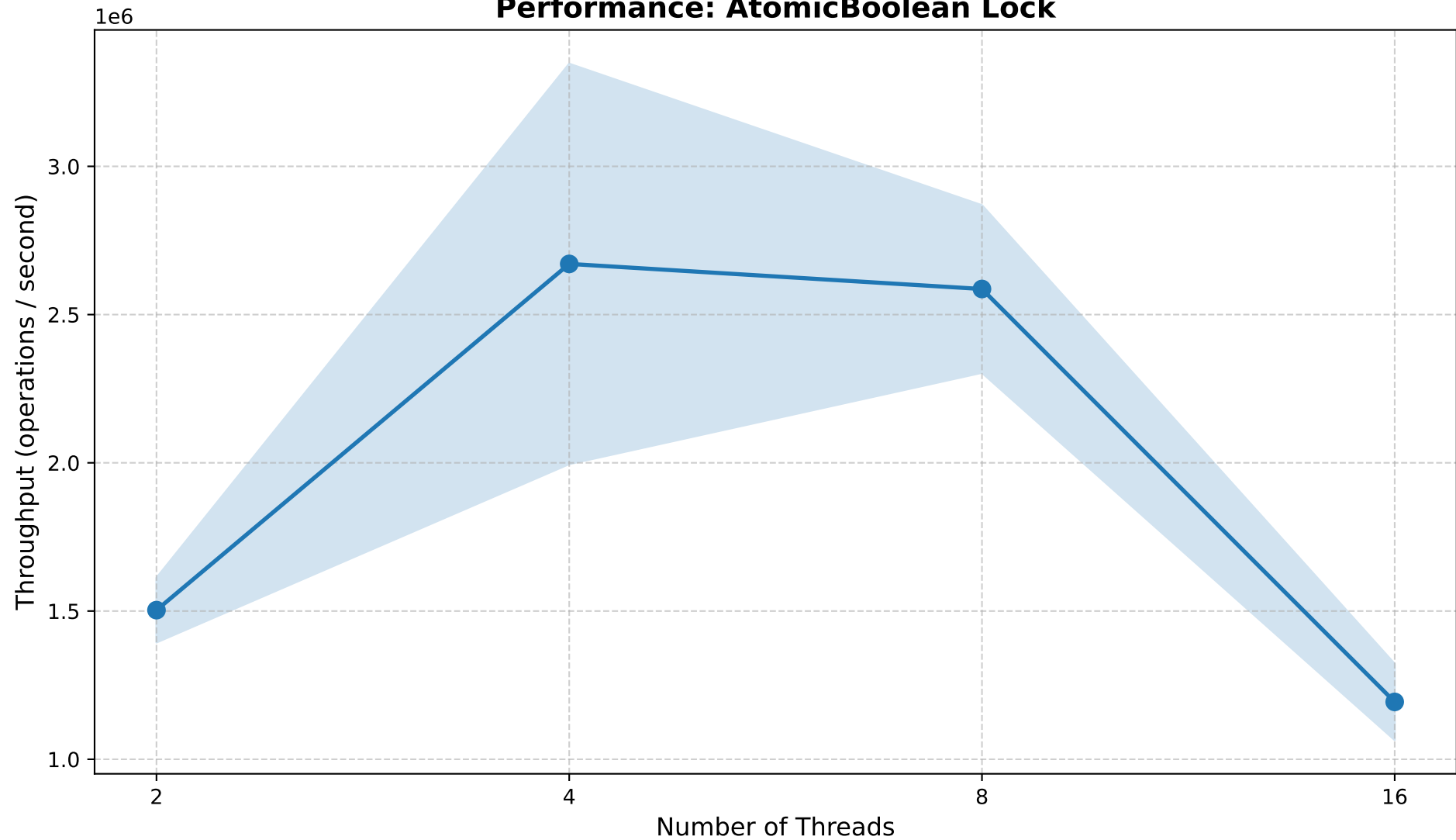Thread Configs: [2, 4, 8, 16]

Implementations Compared:
- Synchronized Method
- Synchronized Section
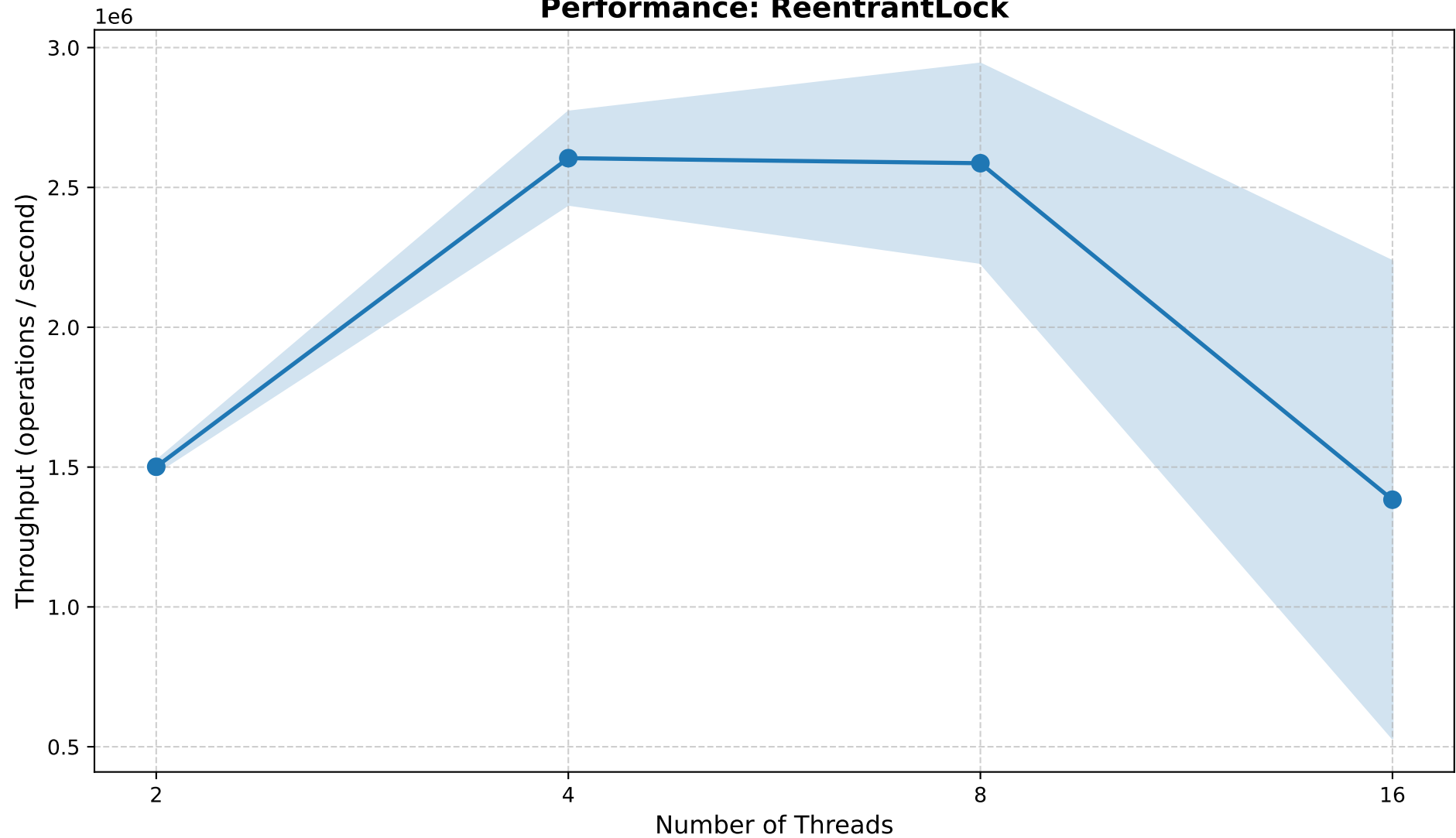- AtomicBoolean Lock
- Valid Volatile Lock
- ReentrantLock

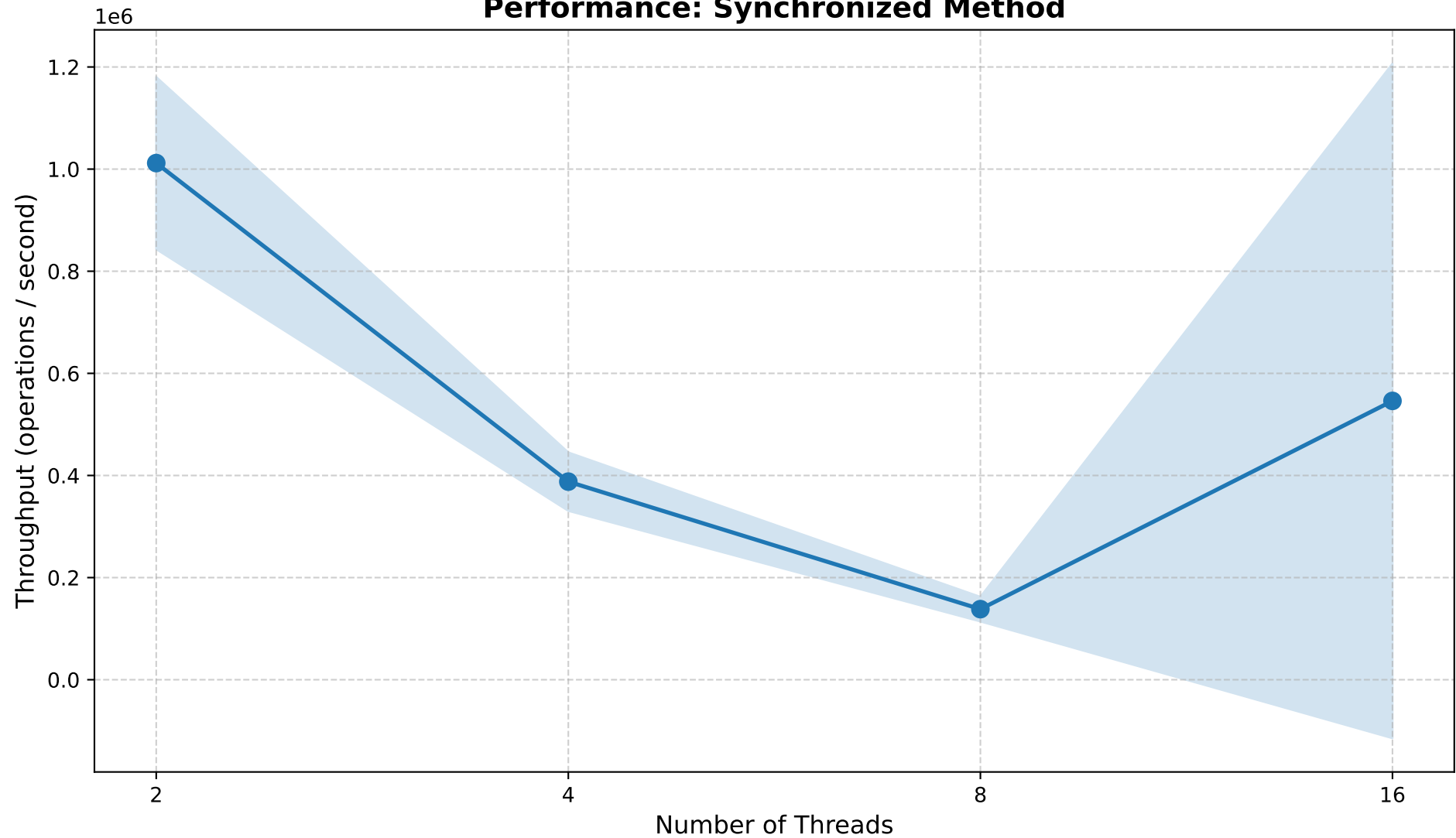JMH Multi-threaded Benchmark: Throughput vs. Threads
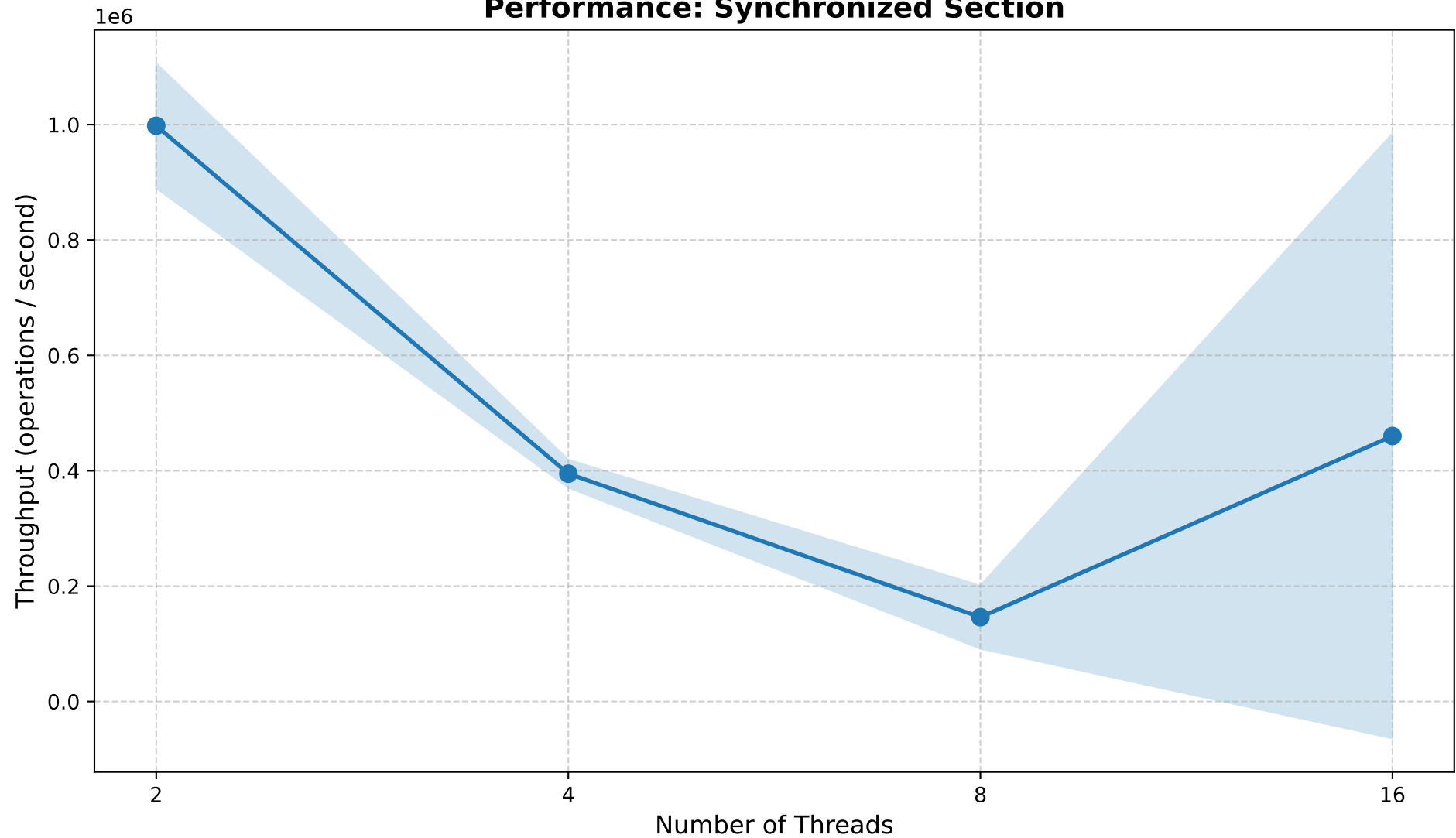(Higher is Better)

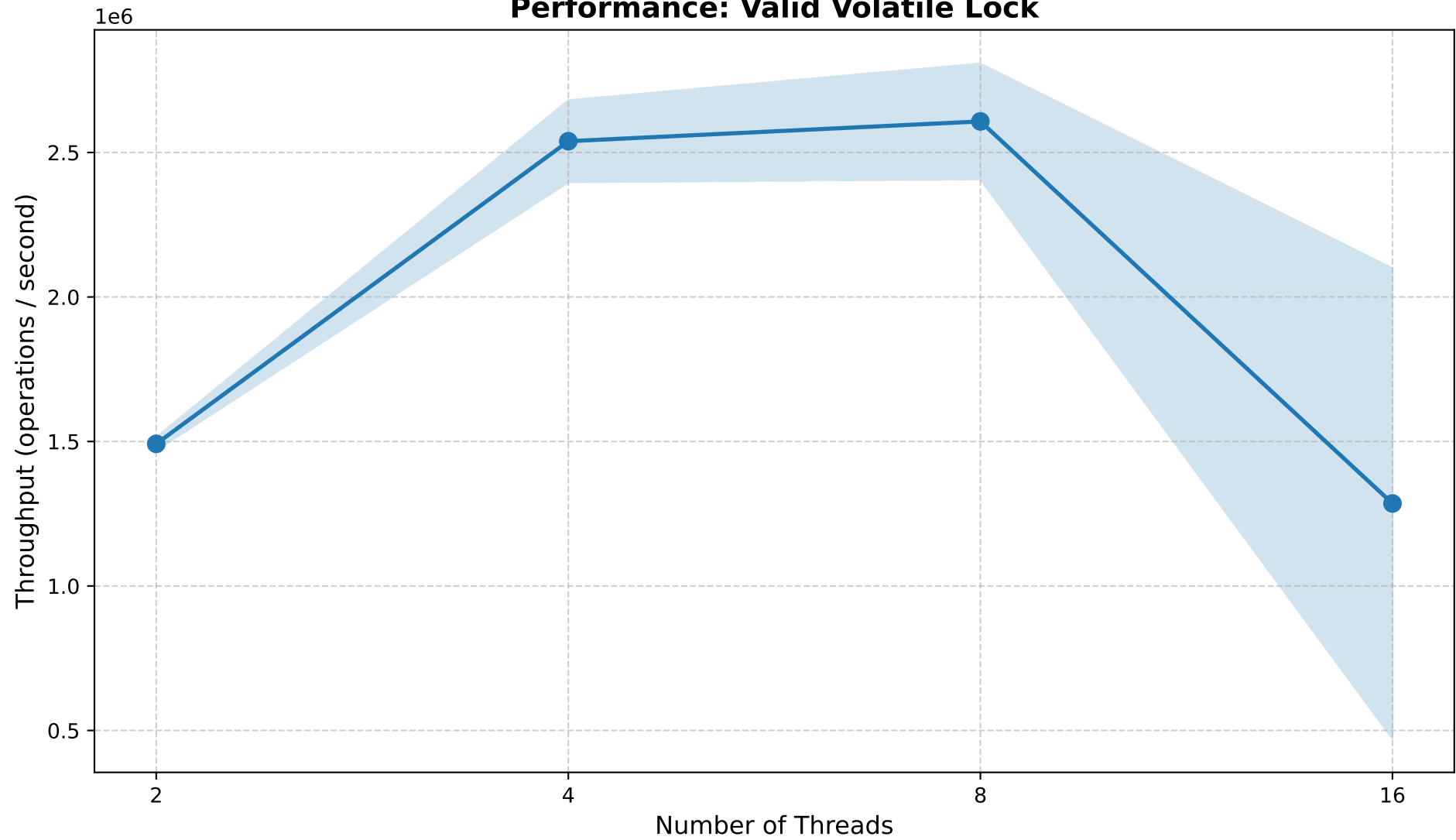**Performance: AtomicBoolean Lock**

Performance: ReentrantLock

Performance: Synchronized Method

Performance: Synchronized Section

Performance: Valid Volatile Lock

Summary Table: Throughput (M operations/sec)

Implementation	2 Threads	4 Threads	8 Threads	16 Threads
Synchronized Method	1.01 M ops/sec	0.39 M ops/sec	0.14 M ops/sec	0.55 M ops/sec
Synchronized Section	1.00 M ops/sec	0.39 M ops/sec	0.15 M ops/sec	0.46 M ops/sec
AtomicBoolean Lock	1.50 M ops/sec	2.67 M ops/sec	2.59 M ops/sec	1.19 M ops/sec
Valid Volatile Lock	1.49 M ops/sec	2.54 M ops/sec	2.61 M ops/sec	1.29 M ops/sec
ReentrantLock	1.50 M ops/sec	2.60 M ops/sec	2.59 M ops/sec	1.38 M ops/sec

```
BEST PERFORMANCE SUMMARY
========================

Threads = 2:
    • Winner: AtomicBoolean Lock
    • Throughput: 1.50 M ops/sec
    • Error: ±0.11 M ops/sec

Threads = 4:
    • Winner: AtomicBoolean Lock
    • Throughput: 2.67 M ops/sec
    • Error: ±0.68 M ops/sec

Threads = 8:
    • Winner: Valid Volatile Lock
    • Throughput: 2.61 M ops/sec
    • Error: ±0.20 M ops/sec

Threads = 16:
    • Winner: ReentrantLock
    • Throughput: 1.38 M ops/sec
    • Error: ±0.85 M ops/sec
```