

Tools/time/example_stream

Example /usr/bin/time: stream

Prepare environment

```
module purge
module add compiler/intel/2022
```

Build benchmark

```
icc -std=c11 -Ofast -xHost -ipo -qopenmp \
    stream.c -o stream
```

Serial execution

```
export OMP_NUM_THREADS=1
/usr/bin/time ./stream -n 1000000000
```

```
-----
STREAM version $Revision: 5.10 $
-----
```

```
This system uses 8 bytes per array element.
-----
```

```
Array size = 1000000000 (elements)
Memory per array = 7629.4 MiB (= 7.5 GiB).
Total memory required = 22888.2 MiB (= 22.4 GiB).
Each kernel will be executed 10 times.
  The *best* time for each kernel (excluding the first iteration)
  will be used to compute the reported bandwidth.
-----
```

```
OpenMP version (yyymm): 201611
Number of Threads requested = 1
Number of Threads counted = 1
-----
```

```
Your clock granularity appears to be 1000 ticks per microseconds.
Each test below will take on the order of 1232528 microseconds.
  (= 1232528756 clock ticks)
Increase the size of the arrays if this shows that
```

you are not getting at least 20 clock ticks per test.

WARNING -- The above is only a rough guideline.
For best results, please be sure you know the
precision of your system timer.

Function	Best Rate MB/s	Med time	Min time	Max time
Copy:	21819.6	0.734463	0.733285	0.735423
Scale:	21213.1	0.755385	0.754252	0.757456
Add:	18866.7	1.272457	1.272085	1.274740
Triad:	18830.8	1.275592	1.274509	1.280414

Solution Validates: avg error less than 1.000000e-13 on all three arrays

48.67user 2.92system 0:51.69elapsed 99%CPU (0avgtext+0avgdata 23441340maxresident)k
2048inputs+0outputs (11major+52234minor)pagefaults 0swaps

What causes the high system time?: Memory page allocation and wiping!

Relation user, sys and elapsed time:

Relation vector size and maxresident:

Parallel execution

```
export OMP_NUM_THREADS=76
export KMP_AFFINITY="verbose,granularity=core,respect,scatter"
/usr/bin/time ./stream -n 1000000000
```

```
OMP: Info #154: KMP_AFFINITY: Initial OS proc set respected: 0-151
OMP: Info #214: KMP_AFFINITY: decoding x2APIC ids.
OMP: Info #156: KMP_AFFINITY: 152 available OS procs
OMP: Info #157: KMP_AFFINITY: Uniform topology
OMP: Info #285: KMP_AFFINITY: topology layer "LL cache" is equivalent to "socket".
OMP: Info #285: KMP_AFFINITY: topology layer "L3 cache" is equivalent to "socket".
OMP: Info #285: KMP_AFFINITY: topology layer "L2 cache" is equivalent to "core".
OMP: Info #285: KMP_AFFINITY: topology layer "L1 cache" is equivalent to "core".
OMP: Info #191: KMP_AFFINITY: 2 sockets x 38 cores/socket x 2 threads/core (76 total cores)
OMP: Info #216: KMP_AFFINITY: OS proc to physical thread map:
OMP: Info #171: KMP_AFFINITY: OS proc 0 maps to socket 0 core 0 thread 0
...
OMP: Info #171: KMP_AFFINITY: OS proc 151 maps to socket 1 core 37 thread 1
OMP: Info #144: KMP_AFFINITY: Threads may migrate across 1 innermost levels of machine
OMP: Info #252: KMP_AFFINITY: pid 4093998 tid 4093998 thread 0 bound to OS proc set 0,76
...
OMP: Info #252: KMP_AFFINITY: pid 4093998 tid 4094074 thread 75 bound to OS proc set 75,151
...
```

STREAM version \$Revision: 5.10 \$

This system uses 8 bytes per array element.

Array size = 999999944 (elements)
Memory per array = 7629.4 MiB (= 7.5 GiB).
Total memory required = 22888.2 MiB (= 22.4 GiB).
Each kernel will be executed 10 times.
The *best* time for each kernel (excluding the first iteration)
will be used to compute the reported bandwidth.

OpenMP version (yyymm): 201611
Number of Threads requested = 76
Number of Threads counted = 76

Your clock granularity appears to be 1000 ticks per microseconds.
Each test below will take on the order of 51439 microseconds.
(= 51439436 clock ticks)
Increase the size of the arrays if this shows that
you are not getting at least 20 clock ticks per test.

WARNING -- The above is only a rough guideline.
For best results, please be sure you know the
precision of your system timer.

Function	Best Rate MB/s	Med time	Min time	Max time
Copy:	315994.4	0.050745	0.050634	0.052998
Scale:	313958.3	0.051009	0.050962	0.052837
Add:	319920.9	0.075328	0.075019	0.075730
Triad:	318699.6	0.075450	0.075306	0.075544

Solution Validates: avg error less than 1.000000e-13 on all three arrays

227.16user 15.61system 0:03.22elapsed 7535%CPU (0avgtext+0avgdata 23451024maxresident)k
536inputs+0outputs (1major+116483minor)pagefaults 0swaps

Relation user, sys and elapsed time: