

## Tools/APS/example\_stream

### Example Intel Application Performance Snapshot: stream

- Prepare environment

```
module purge
module add compiler/intel/2022
```
- Build stream benchmark

```
icc -std=c11 -Ofast -xHost -ipo -qopenmp \
    stream.c -o stream
```
- Set up APS environment on cluster HoreKa

```
# Standalone
source /software/all/toolkit/Intel_OneAPI/vtune/latest/apsvars.sh

# or as part of Intel VTune
module add devel/vtune/2023
```
- Set up APS environment on cluster BwUniCluster 2.0

```
source /software/all/toolkit/Intel_OneAPI/vtune/latest/apsvars.sh
```
- Run benchmark stream with APS

```
export OMP_NUM_THREADS=76
export KMP_AFFINITY=verbose,granularity=core,respect,scatter
aps ./stream -n 2500000000

-----
STREAM version $Revision: 5.10 $
-----
This system uses 8 bytes per array element.
-----
Array size = 2499999936 (elements)
Memory per array = 19073.5 MiB (= 18.6 GiB).
Total memory required = 57220.5 MiB (= 55.9 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 (yyyyymm): 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 128429 microseconds.  
 (= 128429532 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:	309238.3	0.129884	0.129350	0.130081
Scale:	309508.1	0.129582	0.129237	0.130091
Add:	311823.7	0.192909	0.192416	0.193625
Triad:	312619.3	0.192425	0.191927	0.192974

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

Intel(R) VTune(TM) Profiler 2023.1.0 collection completed successfully. Use the "aps --

- Generate APS report:

aps **--report** <...>/aps\_result\_20220602

Loading 100.00%

| Summary information

-----  
 Application : stream  
 Report creation date : 2023-05-26 10:45:19  
 OpenMP threads number per Process: 76  
 HW Platform : Intel(R) Xeon(R) Processor code named Icelake  
 Frequency : 2.39 GHz  
 Logical core count per node : 152  
 Collector type : Driverless Perf per-process counting  
 Used statistics : <...>/aps\_result\_20230526  
 -----

| Your application might underutilize the available logical CPU cores  
 | because of insufficient parallel work, blocking on synchronization, or too much I/O.  
 |

Elapsed Time: 8.12 s

```

SP GFLOPS:                                0.00
DP GFLOPS:                                15.66
Average CPU Frequency:                    3.15 GHz
IPC Rate:                                 0.11
| The IPC value may be too low.
| This could be caused by issues such as memory stalls, instruction starvation,
| branch misprediction or long latency instructions.
| Use Intel(R) VTune(TM) Profiler Microarchitecture Exploration analysis to
| specify particular reasons of low IPC.
Serial Time:                              0.05 s                0.57% of Elapsed Time
OpenMP Imbalance:                         0.13 s                1.63% of Elapsed Time
Physical Core Utilization:                 92.70%
Average Physical Core Utilization:         70.44 out of 76 Physical Cores
Memory Stalls:                             90.00% of Pipeline Slots
| The metric value can indicate that a significant fraction of execution
| pipeline slots could be stalled due to demand memory load and stores. See the
| second level metrics to define if the application is cache- or DRAM-bound and
| the NUMA efficiency. Use Intel(R) VTune(TM) Profiler Memory Access analysis to
| review a detailed metric breakdown by memory hierarchy, memory bandwidth
| information, and correlation by memory objects.
Cache Stalls:                             1.30% of Cycles
DRAM Stalls:                              88.20% of Cycles
| The metric value indicates that a significant fraction of cycles could be
| stalled on the main memory (DRAM) because of demand loads or stores. Use
| Intel(R) VTune(TM) Profiler Memory Access Analysis to get more details if the
| code is latency- or bandwidth-bound and what can be done to increase memory
| access efficiency.
Average DRAM Bandwidth:                    N/A
| Data for this metric is not collected since it requires system-wide
| performance monitoring. Make sure the sampling driver is properly installed on
| your system: https://software.intel.com/en-us/vtune-amplifier-help-sep-driver.
| Otherwise, enable a driverless Perf-based sampling collection by setting the
| /proc/sys/kernel/perf_event_paranoid value to 0 or less.
NUMA:                                     0.00% of Remote Accesses
Vectorization:                             100.00%
Instruction Mix:
  SP FLOPs:                                0.00% of uOps
  DP FLOPs:                                16.30% of uOps
  Packed:                                  100.00% from DP FP
    128-bit:                               0.00%
    256-bit:                               100.00%
| A significant fraction of floating point arithmetic vector instructions
| executed with partial vector load. A possible reason is compilation with
| legacy instruction set. Check the compiler options. Another possible reason is
| compiler code generation specifics. Use Intel(R) Advisor to learn more.
    512-bit:                               0.00%

```

Scalar:	0.00% from DP FP
Non-FP:	83.70% of uOps
FP Arith/Mem Rd Instr. Ratio:	0.57
FP Arith/Mem Wr Instr. Ratio:	1.02
Memory Footprint:	
Resident:	58605.00 MB
Virtual:	63899.00 MB

Graphical representation of this data is available in the HTML report: <...>/aps\_report