OpenCL Performance Prediction using Architecture-Independent Features

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July 17, 2018

Trends in Supercomputing – A view from the Top500

OpenCL – The Language of Heterogenous

Overview of EOD

- Extended Open Dwarfs (EOD) Benchmark Suite
- Based off the OpenDwarfs benchmark suite[1]
- Benchmarks selected following diversity analysis and 13 Berkeley Dwarfs taxonomy
- Built in OpenCL

[1] Krommydas, K. OpenDwarfs: Characterization of dwarf-based benchmarks on fixed and reconfigurable architectures. Journal of Signal Processing Systems, vol. 85, no. 3, pp. 373-392, 2016

Extensions

- Diverse:
  - 4 different problem sizes per application
  - Added applications – currently 11
- Reproducible: Minimum of 2 sec runs per benchmark
- Precise:
  - High resolution timers with LibSciBench
  - Reported with one cycle resolution and roughly 6 ns of overhead
- Portable:
  - Based on an OpenCL backend
  - Tested on a wide range of hardware

Hardware

Name	Vendor	Type	Series	Core Count	Clock Frequency (MHz) (min/max/turbo)	Cache (KiB) (L1/L2/L3)	TDP (W)	Launch Date
Xeon E5-2697 v2	Intel	CPU	Ivy Bridge	24*	1200/2700/3500	32/256/30720	130	Q3 2013
i7-6700K	Intel	CPU	Skylake	8*	800/4000/4300	32/256/8192	91	Q3 2015
i5-3550	Intel	CPU	Ivy Bridge	4*	1600/3380/3700	32/256/6144	77	Q2 2012
Titan X	Nvidia	GPU	Pascal	3584†	1417/1531/–	48/2048/–	250	Q3 2016
GTX 1080	Nvidia	GPU	Pascal	2560†	1607/1733/–	48/2048/–	180	Q2 2016
GTX 1080 Ti	Nvidia	GPU	Pascal	3584†	1480/1582/–	48/2048/–	250	Q1 2017
K20m	Nvidia	GPU	Kepler	2496†	706/–/–	64/1536/–	225	Q4 2012
K40m	Nvidia	GPU	Kepler	2880†	745/875/–	64/1536/–	235	Q4 2013
FirePro S9150	AMD	GPU	Hawaii	2816‖	900/–/–	16/1024/–	235	Q3 2014
HD 7970	AMD	GPU	Tahiti	2048‖	925/1010/–	16/768/–	250	Q4 2011
R9 290X	AMD	GPU	Hawaii	2816‖	1000/–/–	16/1024/–	250	Q3 2014
R9 295x2	AMD	GPU	Hawaii	5632‖	1018/–/–	16/1024/–	500	Q2 2014
R9 Fury X	AMD	GPU	Fuji	4096‖	1050/–/–	16/2048/–	273	Q2 2015
RX 480	AMD	GPU	Polaris	4096‖	1120/1266/–	16/2048/–	150	Q2 2016
Xeon Phi 7210	Intel	MIC	KNL	256‡	1300/1500/–	32/1024/–	215	Q2 2016

* HyperThreaded cores

† CUDA cores

‖ Stream processors

‡ Each physical core has 4 hardware threads per core, thus 64 cores

Overview of AIWC

- Architecture-Independent Workload Characterisation (AIWC)
- Plugin for OclGrind – an Extensible OpenCL device simulator[2]
- Beta available – https://github.com/BeauJoh/Oclgrind – and will be merged into default OclGrind

[2] J. Price and S. McIntosh-Smith, "Oclgrind: An extensible opencl device simulator," in Proceedings of the 3rd International Workshop on OpenCL, 2015, p. 12.