A Survey of State-of-the-Art NVIDIA GPU Profilers

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Overview of Profilers

NVIDIA Visual Profiler (NVVP) is a profiler with a graphical user interface. It is included in the CUDA Toolkit, and it does not require any code modification.

CUDA Profiling Tools Interface (CUPTI) is a C library that allows access to hardware counters of the GPU. It also allows the user to attach user-defined functions to CUDA API calls for more complicated profiling functionality.

PAPI CUDA component is a C profiling library built on top of CUPTI. It provides the low level functionality of CUPTI with more built in features.

Visualization

This figure shows a timeline for a GeMTC histogram application generated by NVVP. It clearly display asynchronous memory transfers at the top and the kernel execution in the middle. The bottom of the screen also shows data such as throughput for each memory transfer.

Metrics

This figure shows throughput calculated using the duration (collected in NVVP) and the flops (collected in CUPTI). This is an example of the type of metrics that can be collected in CUPTI and NVVP. NVVP can collect most of the same metrics much more easily.

Profiler Comparison

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Conclusions

- NVIDIA Visual Profiler (NVVP) is very easy to use and fairly featureful. Only requires a compiled binary (no code modification)
- CUPTI is complicated to use, but it provides direct to access to all hardware counters.
- PAPI CUDA component is a slightly more featured version of CUPTI, but is more complicated to use.
- Overall, NVVP seems to be the best choice due to that fact that it easy to use and has most of the features that the other profilers have.

Future Work

Future work includes an in-depth study on GeMTC framework. This future work would leverage the tools surveyed in this work to evaluate the efficiency of GeMTC warp workers. Currently, it is unknown how much time is spent fetching applications versus actually running them. Other future work includes doing a similar survey for tools that visualize and evaluate applications on the Intel Xeon Phi coprocessor.