探討雲端 OpenCL 服務之議題

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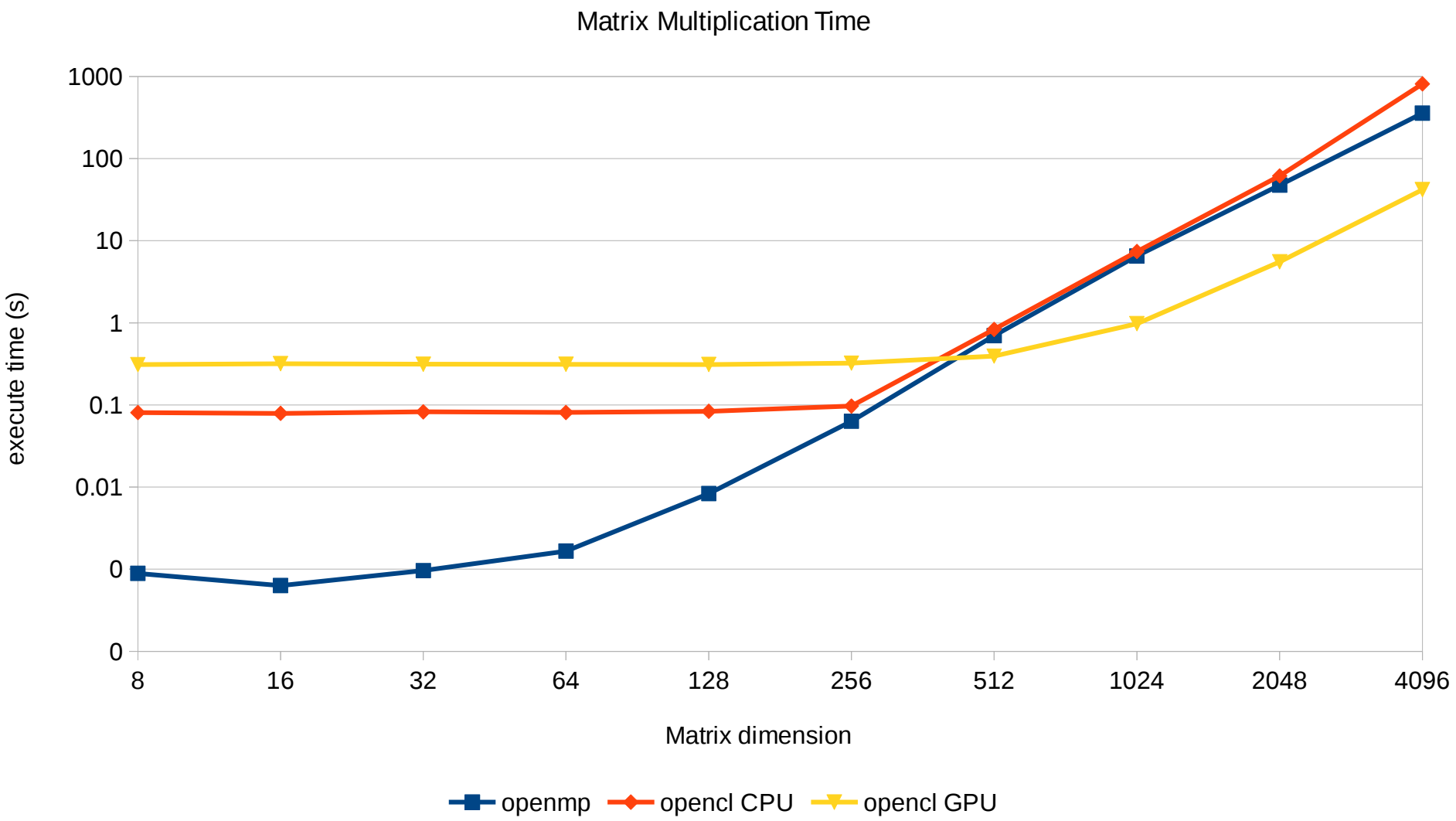
Introduction

- Heterogeneous architectures arise
  - OpenCL is a promising programming model
  - Thus worth considering …... OpenCLaaS ?
- We use a micro benchmark, compare OpenCL performance to a traditional parallelism programming model, i.e. OpenMP
- We then discuss the security issues, like resource isolation, and permission leakage

Performance Evaluation (2/3)

- We implement and tune $O(n^3)$ matrix multiplication on OpenMP and OpenCL
  - OpenMP
    - Use multi-thread
    - Scheduling policies
    - Directive optimization
  - OpenCL
    - Every Result(x,y) use a compute unit, trying different configurations
    - Observing the scalibility

Performance Evaluation (3/3)



Memory Isolation (1/4)

- Privacy is Gold
- When we do our computation on the devices, there is high possibility that we can read the data leaved by previous users.
  - We do the experiment on 3 platforms
    - OpenCL GPU
    - x86
    - cuda

Memory Isolation (3/4)

- Experiment
  - Normal user
    - Allocate 10240 Byte memory
    - Write “HELLOWORLD” to memory once
  - Hacker
    - Allocate 4096 Byte memory
    - Read memory and try to find the “HELLOWORLD” pattern
      - If he/she find one, then “hit”
    - Repeat 1000 times

Memory Isolation (4/4)

- Result in percentage of (#hits) / (#total trial)
  - OpenCL GPU
    - 100%
  - X86
    - 0 %
  - Cuda
    - 1.5 %

Exploitation

- Simple thought:
  - Runtime compilers should allocate some memory region that is modifiable and executable
  - Let's play with this!
- DEMO

Summary

- We start all the three small study in the past 24 hours
  - We have a lot of fun :)
- OpenCL as a standard has draw great attention, and perform well in many cases
  - We believe this will be proved by other groups
- However, there remain some serious issues
  - And we present in a proof-of-concept style

Very HAPPY to coding with you guys!

Thanks!