GPU Teaching Kit

Accelerated Computing

Lecture 1.2 – Course Introduction

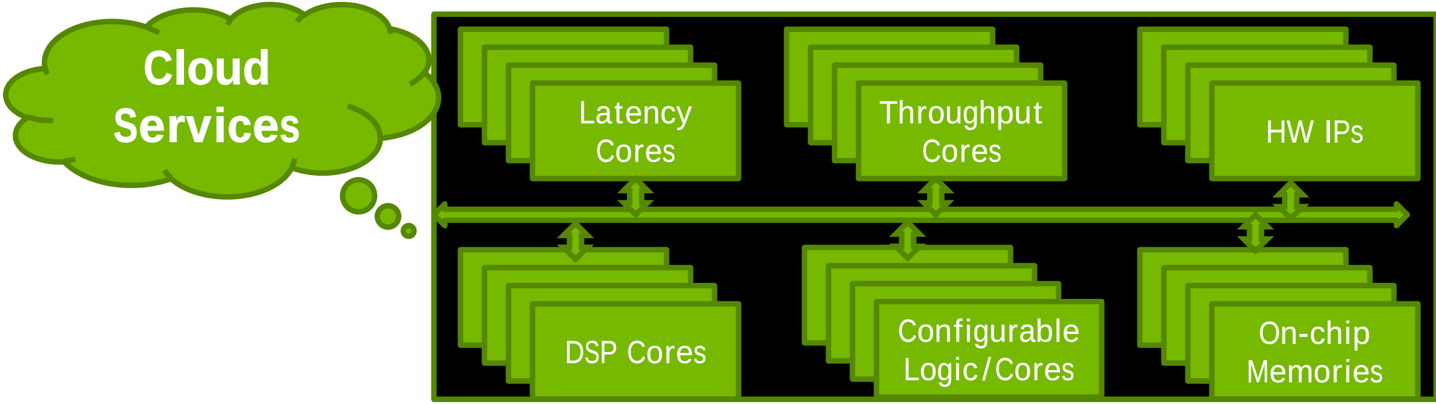
Introduction to Heterogeneous Parallel Computing

Objectives

- To learn the major differences between latency devices (CPU cores) and throughput devices (GPU cores)
- To understand why winning applications increasingly use both types of devices

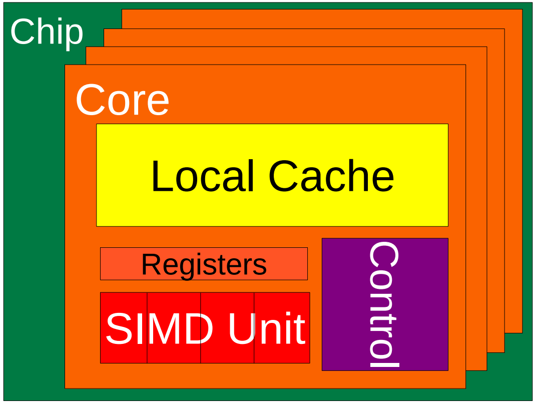
Heterogeneous Parallel Computing

– Use the best match for the job (heterogeneity in mobile SOC)

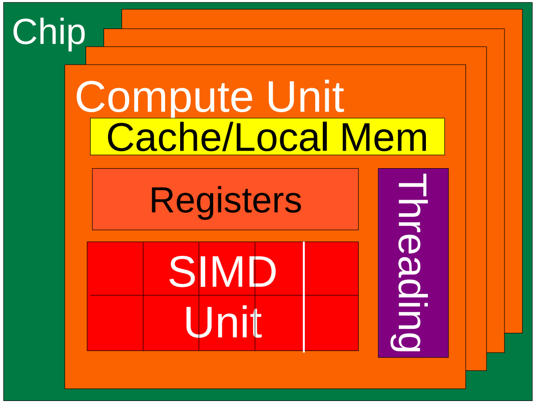


CPU and GPU are designed very differently

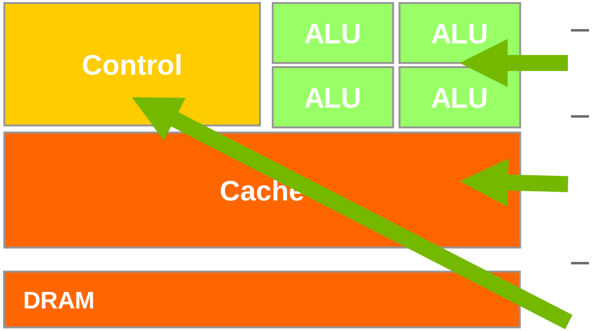
CPU
Latency Oriented Cores



GPU
Throughput Oriented Cores

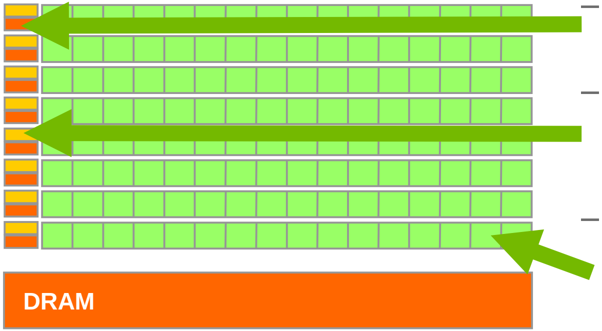


CPUs: Latency Oriented Design



- Powerful ALU
  - Reduced operation latency
- Large caches
  - Convert long latency memory accesses to short latency cache accesses
- Sophisticated control
  - Branch prediction for reduced branch latency
  - Data forwarding for reduced data latency

GPUs: Throughput Oriented Design



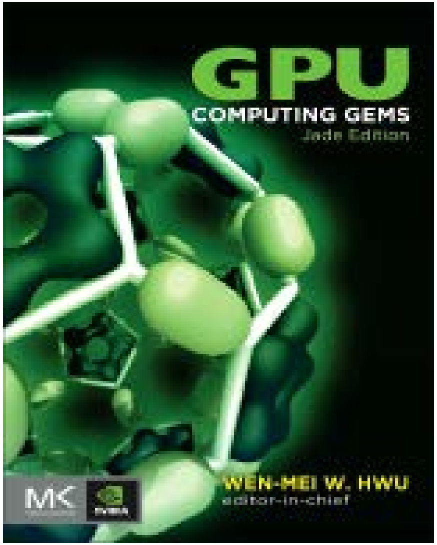
- Small caches
  - To boost memory throughput
- Simple control
  - No branch prediction
  - No data forwarding
- Energy efficient ALUs
  - Many, long latency but heavily pipelined for high throughput
- Require massive number of threads to tolerate latencies
  - Threading logic
  - Thread state

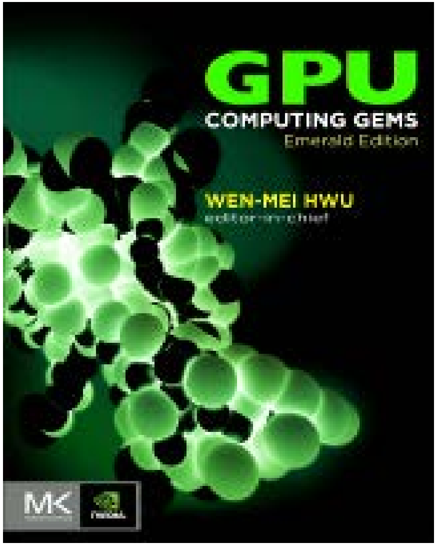
Winning Applications Use Both CPU and GPU

- CPUs for sequential parts where latency matters
  - CPUs can be 10X+ faster than GPUs for sequential code

- GPUs for parallel parts where throughput wins
  - GPUs can be 10X+ faster than CPUs for parallel code

GPU computing reading resources





90 articles in two volumes

Heterogeneous Parallel Computing in Many Disciplines

- Financial Analysis
- Scientific Simulation
- Engineering Simulation
- Data Intensive Analytics
- Medical Imaging
- Digital Audio Processing
- Digital Video Processing
- Computer Vision
- Biomedical Informatics
- Electronic Design Automation
- Statistical Modeling
- Numerical Methods
- Ray Tracing Rendering
- Interactive Physics

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