Optimization Study for Multicores

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Memory Wall

- Limited Shared Resources
- Sloooow Memory
- Limited Bandwidth
Case Study - LBM
Multicore Performance

- Has extremely bad reputation for high bandwidth demand and low throughput
The Data Model

- Source and Destination data consists of more than 1 Million points in 3D space

  - Source and Destination datasets are identical
  - 1.34 Million cells in XYZ plane
  - Each cell consists of 19 properties
  - 205 MB in size
Algorithm

Variables:
\{a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t\}
The Problem

- Accesses a huge grid (Array of Structures) almost randomly, with no data reuse.
How do we solve it

• Change the way data is accessed i.e Rearrange data (AoS to SoA)
How do we solve it

• Change the way data is accessed i.e. Rearrange data
Blocking Optimization

• Add blocking to improve hardware prefetching

19 Groups
Fetch Ratio Comparison

From 9% down to 0.9%

10X improvement
Miss Ratio Comparison

From ~8% down to 0.8% ~10X improvement
Utilization Comparison

Cache Utilization

Always 100%

Twice as good
Relative Throughput

 AMD Barcelona 8384

~2X
Relative Throughput

Intel Xeon E5345

~3X
Parallel Speedup

Intel Xeon E5345

~3X
Parallel Speedup

AMD Barcelona 8384

~2X
More details in the paper “Optimization study for Multicores”

Interested to see more - have a look at the Master Thesis Report Google “Optimization Study for Multicores”

Questions?