The complexity of the problem is hidden by the simplicity of the solution.
CUDA Development

2007

CUDA public beta

CUDA in production

2008

CUDA 2.0
CUDA Compiler Downloads

- July: 0
- August: 10000
- September: 20000
- October: 30000
- November: 40000
- December: 50000
- January: 60000
- February: 70000
- March: 80000
- April: 90000
CUDA 2.0: Many-core + Multi-core support

C CUDA Application

NVCC

Many-core PTX code

PTX to Target Compiler

Many-core

NVCC

--multicore

Multi-core CPU C code

gcc and MSVC

Multi-core
Compiling CUDA for Multi-Core

- NVCC generates code for multi-core
- Alpha in July
- More cores = more performance

C CUDA Application

NVCC --multicore

Multicore CPU C Code

gcc and MSVC

Multi-Core Optimized Application
What’s Next for CUDA

- Fortran
- C++
- Multiple GPUs
- Debugger
- Profiler
- GPU Cluster
Building a 100TF datacenter

CPU 1U Server
- 4 CPU cores
- 0.07 Teraflop
- $2000
- 400 W
- 1429 CPU servers
- $3.1 M
- 571 KW

Tesla 1U System
- 4 GPUs: 960 cores
- 4 Teraflops
- $8000
- 700 W
- 25 CPU servers
- 25 Tesla systems
- $0.31 M
- 27 KW

10x lower cost
21x lower power
Beyond Gaming

- Interactive visualization of volumetric white matter connectivity (146X)
- Ionic placement for molecular dynamics simulation on GPU (36X)
- Transcoding HD video stream to H.264 for portable video (11X)
- Simulation in Matlab using .mex file CUDA function (17X)
- Astrophysics N-body simulation (100X)

- Financial simulation of LIBOR model with swaptions (149X)
- GLAME@lab: An M-script API for linear Algebra operations on GPUCUDA Tutorial (47X)
- Ultrasound medical imaging for cancer diagnostics (20X)
- Highly optimized object oriented molecular dynamics (24X)
- Cmatch exact string matching to find similar proteins and gene sequences (30X)
Design: CAD Design For Apparel Cloth Physics
CUDA Accelerates MATLAB®
17x Faster with GPU Compute

Pseudo-spectral simulation of 2D Isotropic turbulence

1024x1024 mesh, 400 RK4 steps, Windows XP, Core2 Duo 2.4Ghz vs GeForce 8800GTX

http://www.amath.washington.edu/courses/571-winter-2006/matlab/FS_2Dturb.m
CUDA Advantage on MATLAB® Image Toolbox

MATLAB Image Deblur using CUDA
1024 x 1024

21x Faster!

Time (sec)
0 20 40 60 80 100 120
A,PSF A,PSF,20,DAMP A,PSF,20 DAMP,WT
CPU CUDA

Using MATLAB Lucy-Richardson Deconvolution: deconvlucy( )
Results have max pixel difference of no more than 1 grey level

Dual Xeon Core 2 Quad 5320 1.86GHz (8 cores) 4GB
NVIDIA Quadro 5600 1.5GB
70M CUDA GPUs

CUDA

Heterogeneous Computing

Oil & Gas  Finance  Medical  Biophysics  Numerics  Audio  Video  Imaging