NVIDIA Nexus - Application Development Environment for Heterogeneous Platforms

GPU Technology Conference | September 30th 2009
Windows Development Environment

Visual Studio

- Edit
- Build
- Debug
- Profile

CPU Tools

- Languages
- Compiler
- Shader Debugger
- Compute Debugger
- Compute Profiler
- Graphics Debugger
- Graphics Profiler

GPU Tools
... what developers really want
NVIDIA Nexus

Enables Seamless Co-Processing Development

• Full-featured debugging on GPU

• Platform-wide activity analysis

• Visual Studio 2008 integration
Nexus Overview

Microsoft Visual Studio 2008 SP1

Nexus

Build
- CUDA C Project System

Debug
- DirectX Frame
- HLSL Source
- CUDA

Profile
- DirectX Frame
- DirectX HUD and Experiments
- System Trace: OS, CUDA, DirectX, OpenCL, OpenGL/Cg, and User events

User Application

C/C++
- CUDA Driver API, OpenCL and DirectCompute
- DirectX10/DirectX11 and OpenGL
- CUDA C, OpenCL C, and HLSL
- HLSL

CPU
- GPU
Native GPU Debugging

• No emulation
• No arithmetic discrepancy
• GPU pauses at the breakpoint
• Inspect GPU state and memory
• Faster programmer productivity
CUDA Architecture

- Thread
- Block
- Per-thread local memory
- Per-block shared memory
- Kernel 0
- Kernel 1
- Global barrier
- Local barrier
- Per-device global memory
My Heterogeneous Computing Sample...

CPU

- DeviceToDevice memcpy
- Fancy initialization

GPU

- Sinesoid
- High_frequency_sinesoid
- glDrawArray(…)

GPU Memory

- Patch of 3D vertices

Time
Nexus C-CUDA Debugger Demo
Developing for Heterogeneous Platforms

- CPU and GPU cooperation
- PCI-E / memory transfers
- Latency
Platform Analysis

• Collect platform activity
  – OS - process, thread, thread switch, and module events
  – CPU API Trace - CUDA driver API, DirectX, OpenGL, OpenCL, Cg2.2 and User Events
  – GPU Task Trace - C-CUDA and OpenCL launches and memory copies

• Display summary pages, timeline, API call logs, and GPU task logs
Nexus Platform Analysis Demo
CUDA Profiling

• Kernel tuning basic
  – Memory coalescing
  – Branch divergence
  – Instructions executed
  – Warp serialization

• Use of hardware performance counters
Nexus CUDA Profiler
Nexus Build

• C++ project system
  – Nexus options: launch, sync,…
  – CUDA vsprop files

• CUDA project system
  – NVCC build integration
  – Error reporting
  – Debugger session
# Nexus Products

<table>
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<tr>
<th></th>
<th>Nexus Standard</th>
<th>Nexus Professional</th>
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<tbody>
<tr>
<td><strong>Price</strong></td>
<td>Free</td>
<td>$349</td>
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<tr>
<td><strong>Platforms</strong></td>
<td>Windows Vista SP1, Windows 7</td>
<td>Windows Vista SP1, Windows 7</td>
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<tr>
<td><strong>IDE Integration</strong></td>
<td>Visual Studio 2008 SP1 Standard and above</td>
<td>Visual Studio 2008 SP1 Standard and above</td>
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<tr>
<td>CUDA - C debugging and profiling</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>DirectCompute debugging and profiling</td>
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<tr>
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<td>Memory Checker</td>
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<td>Data breakpoints</td>
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<td>Buffer Visualizer</td>
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<tr>
<td>System Trace (CPU + GPU)</td>
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<tr>
<td>Priority Ticket Support</td>
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Supported Operating Systems

- Windows Vista SP1
  - 32bit
  - 64bit
  - 32-on-64

- Windows 7
System Requirements

Remote Debugging

Desktop

Mobile
System Requirements

Local Debugging

SLI Multi-OS

Multi-GPU

Full GPU acceleration

Parallels
Optimized Computing

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GPU Requirements

• CUDA 1.1 capable GPU
• GeForce 9 and GTX series
• QuadroFX x700 and x800 series
• Tesla C1060
• Fermi architecture-based products
• Non-NVIDIA DirectX 10 and 11 GPUs (with reduced feature set)
# Roadmap and Schedule

<table>
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<th>Beta2 January ‘10</th>
<th>Release Q1’10</th>
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<tr>
<td>C-CUDA</td>
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Conclusion and Recap

• Revolutionizing GPU development
  – GPU is now a first-class development target
  – All Compute and Graphics languages and APIs

• Co-Processing Development Solution
  – Clear view of the overall platform activities
  – Deep analysis of specific workloads

• Visual Studio 2008 SP1 Standard and Above
• Windows Vista SP1 and Windows 7
Q&A

• 1-hour Nexus Labs @ Piedmont Room:
  – Friday (2pm-5pm)

• Register for the Beta program today:

• For Linux - CUDA-gdb talk
  – Friday, Gold Room at 2h30pm