NVIDIA Quadro Plex VCS

Ian Williams and Mark Harris
Graphics Hardware 2006
NVIDIA’s Businesses
Multiple Growth Engines

GPU
Graphics Processing Units

MCP
Media and Communications Processors

PSG
Professional Solutions Group

Consumer Electronics

Handheld GPU
NVIDIA Quadro Professional Solutions

- Dominant brand of professional graphics solutions
- Powering the most advanced solutions in the world
  - Visualization – Boeing, Porsche, BMW
  - Medical Imaging – Massachusetts General
  - Scientific Computing – Los Alamos, Sandia
  - Film Production – Disney, ILM, Dreamworks
  - Broadcast Graphics – ESPN, CNBC, CNN
- System solutions with NVIDIA technology
A New Category of Visual Computing Systems
NVIDIA Quadro® Plex

- External Dedicated *Visual Computing System*
- Massive Visual Computation Density
- Discontinuity in Desktop Graphics Power
- Complete, configurable, scalable
Massive Visual Compute Density

- Up to 8 NVIDIA Quadro GPUs in a single **VCS node**
  - 2 NVIDIA Quadro Plex attached to a SLI-capable system

- Easily deployed in a wide range of environments
  - Compact, ultra-quiet design fits in any desktop workspace
  - Fits into any standard 19” rack mount environment
Record Desktop Graphics Power

- Vertex Perf (BVertex)
- Fill Rate Perf (Billion Pixel)

1 GPU WS
SLI WS
8 GPU VCS

8x
Server Room Discontinuity
25X Visual Compute Density!

- Vertex Perf (BVertex)
- Fill Rate Perf (Billion Pixel)

Prism 40 RU
VCS (G4) 40 RU

25x
NVIDIA Quadro® Plex

Product Definition

- Compatible with any certified PCI Express x16 system or platform
  - (x8 coming soon)
- NVIDIA Quadro GPUs and option boards
- NVIDIA SLI Multi-GPU technology
NVIDIA Quadro® Plex Interface

- Quadro Plex Interface Card (QPIC)
  - Designed to Fit any Host
  - PCI Express x16
  - <10W Total Power / Passive Cooling
  - Lo-Profile (bracket ships with system)

- Dual Interconnect Cables
  (Host → Quadro Plex)
  - Length: 2m (6.5ft)
  - Bend radius: 18cm (7 in)

- USB
  - Signal from host through QP cables
  - 2 USB 2.0 ports on front of QP
    - USB is FULL SPEED (12Mbit/sec) not Hi-Speed (480 Mbit/sec)
    - i.e. for hardware dongles, etc.
NVIDIA Quadro® Plex

Available in 3 Models:

NVIDIA Quadro Plex 1000
Model I

NVIDIA Quadro Plex 1000
Model II

NVIDIA Quadro Plex 1000
Model III
NVIDIA Quadro® Plex 1000 – Model I

- 2 NVIDIA Quadro FX 5500 GPUs
  - G71, 1GB VRAM
- 1 NVIDIA Quadro G-Sync option boards
- 1 to 4 Channels
- 32X SLI FSAA (max on single channel)
- “Power Desktop” System
NVIDIA Quadro® Plex 1000 – Model II

- 2 NVIDIA Quadro FX 4500 X2 GPUs
  - G71, 512MB VRAM x2
- 2 NVIDIA Quadro G-Sync option boards
- 1 to 8 channels
- 64X SLI FSAA (max on single channel)
- “Viz Center” System
NVIDIA Quadro® Plex 1000 – Model III

- 2 NVIDIA Quadro FX 5500 GPUs
  - G71, 1GB VRAM
- 2 NVIDIA Quadro SDI option boards
- 1 to 4 channels
  - 2 dual-link DVI + 4 single-link HD SDI
  - or
  - 2 dual-link DVI + 2 dual-link HD SDI
- 32X SLI FSAA (max on single channel)
- “HD Broadcast” System

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Rack Mounting

- Quadro Plex Rackmount Kit
  - Orderable as Optional Kit
  - 1 Kit PER Quadro Plex
  - ~ 15 minute operation

- Rack 2 Quadro Plex per 3U
  - Enables 8 GPU per 3U
  - 16 Display Channels per 3U
NVIDIA Quadro® Plex

Target Markets

- **Power Desktop**
  - Oil and Gas, CAE/CFD, High-end MCAD, ...

- **Viz Center**
  - Styling and Design Review, Oil and Gas, ...

- **HD**
  - Broadcast graphics, NLE, Film, ...

- **SuperCluster**
  - Flight Simulation, Visualization Clusters, ...
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Power Desktop

1 GB Volumetric Data

5k x 3k Personal Workspace

Image courtesy of IBM
Electromagnetic Simulation

- 3D Finite-Difference and Finite-Element Modeling of:
  - Cell phone irradiation
  - MRI Design / Modeling
  - Printed Circuit Boards
  - Radar Cross Section (Military)

Large speedups with Quadro GPUs

Pacemaker with Transmit Antenna

Performance (Mcells/s)

<table>
<thead>
<tr>
<th></th>
<th>CPU 3.2 GHz</th>
<th>1 GPU</th>
<th>2 GPUs</th>
<th>4 GPUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speedup</td>
<td>1X</td>
<td>5X</td>
<td>10X</td>
<td>20X</td>
</tr>
<tr>
<td>Processor</td>
<td>Single CPU</td>
<td>3.2 GHz</td>
<td>Quadro FX 4500 GPUs</td>
<td></td>
</tr>
</tbody>
</table>

Commercial, Optimized, Mature Software
NVIDIA Quadro® Plex

Viz Center

- Massive rendering power
- Breakthrough Image Quality
  - 32x, 64x SLI FSAA
- Continuous Canvas

Image courtesy of PSA Peugeot Citroen
NVIDIA Quadro® Plex

HD

- Quad HD SDI
- Native Sony SXRD 4K at 12-bit
- Deployable in back-room & mobile broadcast trucks

Image courtesy of Sportvision
NVIDIA Quadro® Plex

SuperCluster

- Cluster “n” Quadro Plex Nodes for Massive Visual Compute Density
- Up to 148 MPixel per system
- Massive Simultaneous rendering and computing

Image courtesy of Oak Ridge National Labs
NVIDIA Quadro® Plex
Classifying Usage Scenarios

- Scenario 1 - Multiple Channels/Pipelines
- Scenario 2 - Multiple GPUs/Cores
- Combinations of Scenario 1 & 2
- All Driven by need for scalability and high GPU density

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Example Usage Scenarios
Multi-Channel Capability

- Single System Image – reduced programming complexity
- Synchronized scan out and swap buffers via G-sync
- “Cluster in a box”
- Different levels of transparency/complexity:
  - Single “stretched” Application Window
  - Multi-threaded application, multiple contexts
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Example Usage Scenarios

Multi-Channel – Sony SXRD 4K Projector

- Total resolution 4096x2160 @ 60Hz
  - ~531 M Pix/s
- Four separate input channels
  - DVI - 2048x1080@60Hz per input
  - SDI –1920x1080@48Hz per input
- 10bit support

- NVIDIA Quadro® Plex is unique solution to drive all four channels at full resolution
NVIDIA Quadro® Plex & Sony SXRD 4K Projector

Demonstrated driving all four channels at native 4096x2160 resolution and synchronized SIGGRAPH 2006
NVIDIA Quadro® Plex
Example Usage Scenarios
Visual Compute Density

- Multiple GPUs/Core per hosts/CPU(s)
- Off-screen rendering
- Access to additional GPUs combined with Graphics
- GPGPU Clusters
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Example Usage Scenarios

The “GPU Super Computer”

- VCS Node forms the building block
- Massive Computational Density
  - 5U = 4 CPU / 8GPU (3U VCS / 2U server)
  - 7U = 8 CPU / 8GPU (SUN G4 server)
- **1.5 Teraflops / 3U**
  - Only counting pixel shader MAD units
  - Quadro FX 4500 X2
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Summary

- Defines a new category – Visual Computing System
- Represents a massive discontinuity in visual quality, performance and scalability
- Uniquely addresses a wide range of high-GPU density applications
- A significant step forward for the multi-channel advanced visualization market