NVIDIA GeFORCE GPU

EECE 292 and 343
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Introduction

• Why have a GPU (Graphics Processing Unit) in a general purpose computer?
  – Reduce load on CPU (Central Processing Unit)
  – Improve performance on graphics

• Why not just increase the CPU power?
  – Separate memory bus
  – Independent memory bank and cache
  – Specially designed hardware for handling graphical data
The NVIDIA GeFORCE

• NVIDIA became a market leader with the GeFORCE256 in 1999
• Latest chip is the GeFORCE FX 5950 Ultra based on the NV38 Core

NVIDIA GeFORCE 5950 Ultra
## Chip Comparisons

<table>
<thead>
<tr>
<th>Chip</th>
<th>Process (microns)</th>
<th>Transistors (Millions)</th>
<th>Clock (MHZ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeForce256</td>
<td>0.22</td>
<td>23</td>
<td>120</td>
</tr>
<tr>
<td>GeForce 3</td>
<td>0.15</td>
<td>57</td>
<td>200</td>
</tr>
<tr>
<td>GeForce FX 5500</td>
<td>0.13</td>
<td>80</td>
<td>270</td>
</tr>
<tr>
<td>GeForce FX 5950 ULTRA</td>
<td>0.13</td>
<td>135</td>
<td>475</td>
</tr>
</tbody>
</table>

http://www.neeyik.info/3dspecs/
## Chip Comparisons

<table>
<thead>
<tr>
<th>Chip</th>
<th>Basic Pixel Pipelines</th>
<th>Texture Samplers/ pipeline</th>
<th>DirectX Version</th>
<th>Memory Width (bits)</th>
<th>Memory Bandwidth (GB/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeForce 256</td>
<td>4</td>
<td>1</td>
<td>7.0</td>
<td>128</td>
<td>4.8</td>
</tr>
<tr>
<td>GeForce 3</td>
<td>4</td>
<td>2</td>
<td>8.0</td>
<td>128</td>
<td>7.36</td>
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<tr>
<td>GeForce FX 5500</td>
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<td>1</td>
<td>9.0</td>
<td>128</td>
<td>6.4</td>
</tr>
<tr>
<td>GeForce FX 5950 ULTRA</td>
<td>4</td>
<td>2</td>
<td>9.0</td>
<td>256</td>
<td>30.4</td>
</tr>
</tbody>
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http://www.neeyik.info/3dspecs/
Architectural Features of FX 5950 Ultra

- Dual mode pipeline
  - Multiple issue 4-2
  - High speed 8-1
- Based on concept of Stream Processing
  - Eliminates need for load/store
  - Allows for processing of “real time” data much like a DSP chip would handle
Functional Units

- 2 Universal Floating Point/Integer ALUs (Arithmetic Logic Unit) per Pipe
- 2 TMUs (Texture Memory Unit) per Pipe

MSI Graphics Card with GeForce FX 5950 Ultra Chip
Rendering Capabilities

- 8 z pixels per clock
- 8 stencil ops per clock
- 8 textures per clock
- 8 shader ops per clock
- 4 color + z pixels per clock with 4x multisampling enabled
- 128 bit floating point color per pixel

http://tech-report.com/onearticle.x/4785
<table>
<thead>
<tr>
<th></th>
<th>Floating Point (Gflop/s)</th>
<th>Transistors (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GeFORCE FX 5950 Ultra</td>
<td>20</td>
<td>135</td>
</tr>
<tr>
<td>Pentium 4 (1.4 GHZ)</td>
<td>1.8</td>
<td>55</td>
</tr>
</tbody>
</table>
Summary

- GPUs are highly specialized processors designed for graphics
- Extremely high performance, even compared to today’s market leading CPUs
- Easy to access through DirectX or OpenGL, but a general purpose programming interface and knowledge of the ISA is not publicly available
References

• http://www.neeyik.info/3dspecs/
• http://www.theinquirer.net/?article=9217
• http://www.theinquirer.net/?article=9040
• http://www.computer.org/computer/homepage/1003/entertainment/