Place in Video Game Realm

- Your Childhood
- 22 million consoles sold worldwide

Top 5 Gamecube Games of All Time

<table>
<thead>
<tr>
<th>Game Title</th>
<th>Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Super Smash Bros. Melee</td>
<td>7.09 Million</td>
</tr>
<tr>
<td>Mario Kart Double Dash!!</td>
<td>7 Million</td>
</tr>
<tr>
<td>Super Mario Sunshine</td>
<td>5.9 Million</td>
</tr>
<tr>
<td>The Legend of Zelda: The Wind Waker</td>
<td>3.07 Million</td>
</tr>
<tr>
<td>Luigi’s Mansion</td>
<td>2.64 Million</td>
</tr>
</tbody>
</table>
History

1889 - Nintendo was founded
1980 - Entered gaming industry with GAME & WATCH product line
1984 - Famicom Released
1996 - Nintendo 64 Released
1999 - Signed $1 billion dollar deal with IBM for Project Dolphin
2001 - GameCube Released
2007 - GameCube Discontinued
Nintendo’s Vision

- Customer Requirements
  - last long
  - affordable for families
- Developer Requirements
  - textures
  - custom lighting
  - geometry
- Nintendo Philosophy
  - Efficiency over Raw Power
Overall Design
Gekko

- Gamecube Processor
- PowerPC Derivative
- 21 million transistors
- 485 MHz
- How is Gekko requirements driven?
- Relationship with GPU
Datapath

- 3-issue Superscalar
  - can start up to 3 instructions per cycle
  - branch folding
- 4 Stage Pipeline
  - IF, DE, EX, WB
- Dual 7 Stage FP-Pipeline
  - extra execution stages
- Common Data Bus
Memory Structure

Registers:
- 32 Floating Point registers (FPR)
- 32 General Purpose Registers (GPR)

Gekko Integrated L2 Cache:
- Separate L1 Data/Instruction Caches
- Unified 256KB L2 Cache

Main Memory:
- 24 MB on the motherboard
Memory Structure

1T-SRAM
- better bus efficiency
- DRAM with efficient data refreshing
- developed by MoSys
- unique to the gamecube
- low latency access
Overall Design

Fig. 7
Flipper

- All roads lead to Flipper
- Gamecube’s GPU
- Originally Produced by ArtX
- 480p
- 60 FPS
Flipper

- .18 um technology
- 51 Million transistors
- 162 MHz
- 64-bit interface to Gekko
- 4 Pixel Pipelines
- 2 MB Z-Buffer/Frame Buffer
- 1 MB Texture Cache
- Embedded 1T-SRAM
- DSP, I/O Processor, High-Speed Serial and Parallel Ports
Data Compression

- Gekko compresses graphics data

Upon Load Graphic Element:
- integer ➔ floating point

Upon Store Graphic Element:
- floating point ➔ integer

- uses single precision FP
- 2:1 compression for graphics data
- bandwidth efficiency
Overall Design

Fig. 7
I/O

- 2 Serial Ports (27 Mbps)
- 1 High-Speed Parallel Port (648 Mbps)
- 2 Memory Card Slots
- CAV Disc Drive
  - 8 cm miniDVD discs
  - Reduces I/O loading times
- 4 GameCube Controllers
## Console Comparison

<table>
<thead>
<tr>
<th></th>
<th>Gamecube</th>
<th>Nintendo 64</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RAM</strong></td>
<td>24 MB</td>
<td>4 MB</td>
</tr>
<tr>
<td><strong>Clock</strong></td>
<td>485 MHz</td>
<td>94 MHz</td>
</tr>
<tr>
<td><strong>CPU Brand</strong></td>
<td>IBM</td>
<td>NEC</td>
</tr>
<tr>
<td><strong>Game Media</strong></td>
<td>Disc</td>
<td>Cartridge</td>
</tr>
<tr>
<td><strong>Launch Price</strong></td>
<td>$199.99</td>
<td>$199.00</td>
</tr>
<tr>
<td><strong>Launch Date</strong></td>
<td>September 15, 2001</td>
<td>June 23, 1996</td>
</tr>
<tr>
<td><strong>Units Sold (worldwide)</strong></td>
<td>21.74 million</td>
<td>32.93 million</td>
</tr>
<tr>
<td>Name</td>
<td>Dreamcast</td>
<td>Playstation 2</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Manufacturer</td>
<td>Sega</td>
<td>Sony</td>
</tr>
<tr>
<td>Launch Date (NA)</td>
<td>September 9, 1999</td>
<td>October 26, 2000</td>
</tr>
<tr>
<td>Launch Price</td>
<td>$199.99</td>
<td>$299.99</td>
</tr>
<tr>
<td>CPU</td>
<td>200 MHz SuperH SH-4</td>
<td>294 MHz MIPS “Emotion Engine”</td>
</tr>
<tr>
<td>GPU</td>
<td>100 MHz NEC PowerVR CLX2</td>
<td>147 MHz “Graphics Synthesizer”</td>
</tr>
<tr>
<td>Main RAM</td>
<td>16 MB SDRAM</td>
<td>32 MB RDRAM</td>
</tr>
<tr>
<td>Video RAM</td>
<td>8 MB</td>
<td>4 MB</td>
</tr>
<tr>
<td>Cache Memory</td>
<td>Instruction 8 KB, Data 16 KB</td>
<td>CPU 40 KB, VPU0 8 KB, VPU1 32 KB</td>
</tr>
<tr>
<td>Top-Selling Game</td>
<td>Sonic Adventure (2.5 million)</td>
<td>Grand Theft Auto: San Andreas (20.81 million)</td>
</tr>
<tr>
<td>Worldwide Sales</td>
<td>10.6 million</td>
<td>153.6 million</td>
</tr>
</tbody>
</table>
Lasting Impact

- impact on childhood of this generation
- nostalgic value
- prices today ($40 - $60)
- revolutionary GPU-centered design
- nintendo philosophy realized
http://www.nintendo.co.uk/Corporate/Nintendo-History/Nintendo-History-625945.html
http://www.anandtech.com/show/858/2
http://www.seagatech.com/gamecube/overview/