Nintendo Gameboy Architecture

By Rob Kurst and Andy Madden
Overview

- Game Boy History
- Game Boy to Game Boy Color
- Game Boy Advance to Game Boy Micro
Nintendo’s History

- Founded in 1889.
- Entered the arcade game industry in 1975.
- Began producing their own hardware in 1977.
- First handheld game in 1980.
- Game Boy released in 1989.
Game Boy History

- Game Boy Pocket (1996)
- Game Boy Color (1998)
- Game Boy Advance (2001)
- Game Boy Advance SP (2003)
- Game Boy Micro (2005)
Game Boy Line: Success

- Released in 1989 and GB Advance discontinued in 2005
- Sold 64.42 million Game Boy Originals before Game Boy Color was released
- 118.69 million Game Boy and Game Boy Colors sold
- Over 81.51 million Game Boy Advances sold worldwide
- Tetris sold 30.26 million copies
- Pokemon Red and Blue sold 23.64 million copies combined
- Pokemon Gold and Silver sold 23 million copies combined
- Pokemon Ruby and Sapphire sold 13 million copies combined
<table>
<thead>
<tr>
<th></th>
<th>Original, Pocket, and Light</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>8-bit SHARP LR35902 (Hybrid of Intel 8080 and Zilog Z80)</td>
<td></td>
</tr>
<tr>
<td><strong>Clock Speed</strong></td>
<td>4.194304 MHz</td>
<td>8.4 MHz</td>
</tr>
<tr>
<td><strong>Work RAM</strong></td>
<td>8 KB</td>
<td>32 KB</td>
</tr>
<tr>
<td><strong>Video RAM</strong></td>
<td>8 KB</td>
<td>16 KB</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>DC 6V, 0.7W</td>
<td>DC 3V, 0.6W</td>
</tr>
<tr>
<td><strong>Colors</strong></td>
<td>4 grayshades</td>
<td>32,768 colors</td>
</tr>
<tr>
<td><strong>Sound</strong></td>
<td>4 Channels with Stereo Sound</td>
<td></td>
</tr>
</tbody>
</table>
Intel 8080

- 16-bit address bus.
- 8-bit data bus.
- 64K of byte-addressable memory.
- 8 8-bit registers.
- 16 bit stack pointer.
- 16 bit program counter.
- 256 I/O ports.
Zilog Z80

- Binary Compatible with 8080.
- Addition of Index Registers.
- Addition of a second register file.
- Improved Interrupt System.
- Enhanced Instruction Set.
Sharp LR35902

- Hybrid of Intel 8080 and Zilog Z80
  - 8080 Characteristics
    - Single Register file
  - Z80 Characteristics
    - Coding syntax
    - Instruction Extender (0xCB)
  - New Characteristics
    - I/O Scheme
    - Flag Register
**Game Boy Advance: Hardware**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CPU</td>
<td>32-bit ARM7TDMI + Sharp LR35902</td>
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<tr>
<td>Clock Speed</td>
<td>16.8 MHz + 8 MHz</td>
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<tr>
<td>Work RAM</td>
<td>256 KB</td>
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<tr>
<td>Video RAM</td>
<td>96 KB</td>
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<tr>
<td>Power</td>
<td>DC 6V, 0.7W</td>
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<tr>
<td>Colors</td>
<td>4 grayshades</td>
</tr>
<tr>
<td></td>
<td>32,768 colors</td>
</tr>
<tr>
<td>Sound</td>
<td>6 Channels with Stereo Sound</td>
</tr>
</tbody>
</table>
ARM7TDMI

- Based on Reduced Instruction Set Computer (RISC) principles.
- Three-stage pipeline
- 32-bit data bus
- 2 instruction sets
  - 32-bit ARM
  - 16-bit Thumb
Game Boy Cartridges

- 32kB - 1MB for GB Original
- 2MB - 32MB for GB Advance
- 32 pin
- 8 kB of RAM
- ROM split into 16kB blocks
Questions????
Works Cited

http://fms.komkon.org/GameBoy/Tech/
http://realboyemulator.wordpress.com/
http://marc.rawer.de/Gameboy/docu_1.htm#1.1
http://www.devrs.com/gb/hardware.php#hardgb
http://gameboy.mongenel.com/dmg/asmmemmap.html
http://nocash.emubase.de/gbatek.htm