Architecture of the Super NES and its Peripherals

A journey into one of the greatest gaming consoles of all time

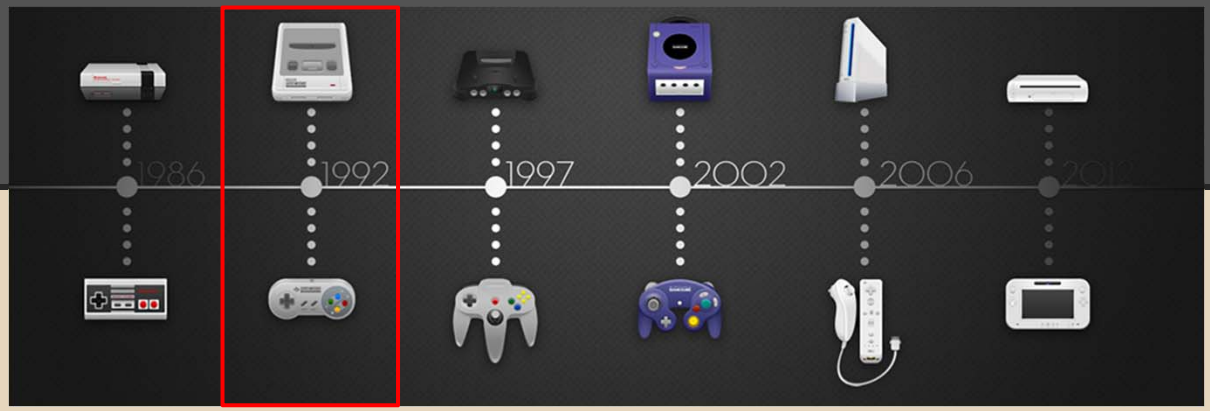
Patrick Shuman
Maximilian Brown

Overview

- History
- CPU
- PPU
- APU
- Cassettes
- Controllers
- Official Nintendo Extra Hardware

image: http://upload.wikimedia.org/wikipedia/commons/8/82/USA-SNES_-_JPN-SuperFamicom.png

History

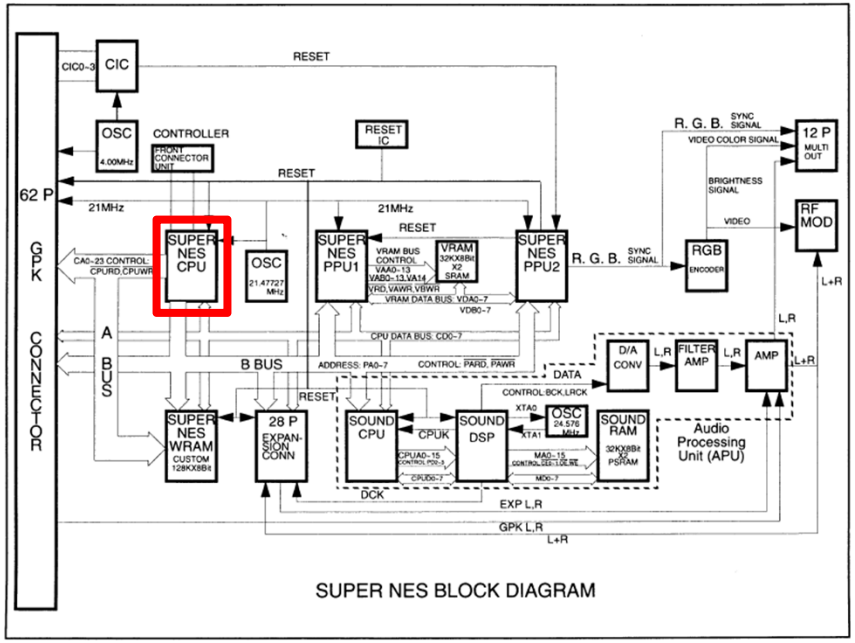


- Manufactured 1991 - 1999
- 49.1 million units sold worldwide
- Most popular game: Super Mario World
- Successor to the Nintendo Entertainment System
- Predecessor to the Nintendo 64

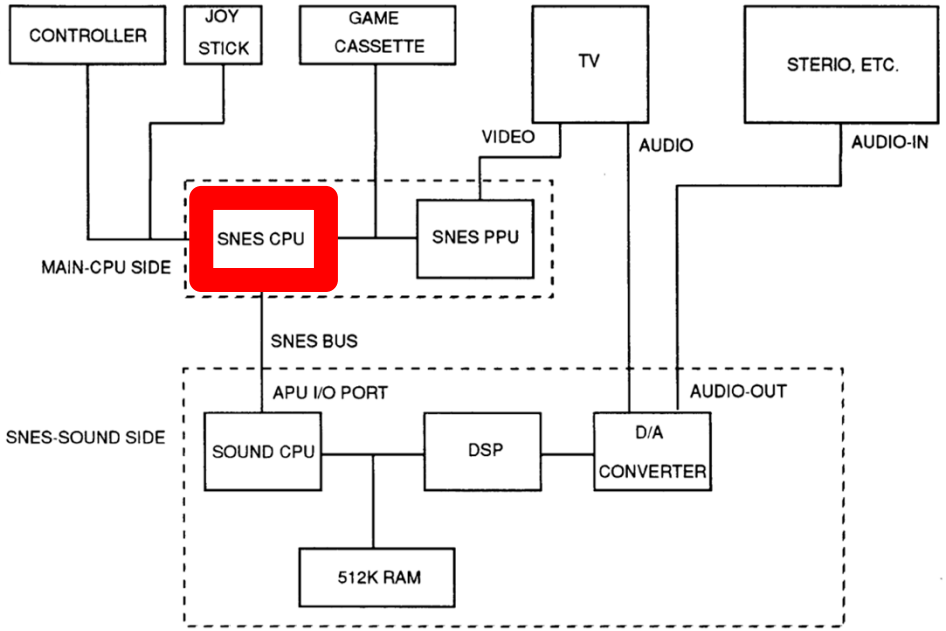
NES vs SNES

Specification	NES	SNES
Production dates	1983 - 1995	1991 - 1999
CPU Speed	1.79 MHz	2.86 MHz (up to 10.74 MHz)
Number of bits	8 bits	16 bits
Units sold	61.91 Million	49.1 Million

Central Processing Unit (CPU)



SUPER NES BLOCK DIAGRAM



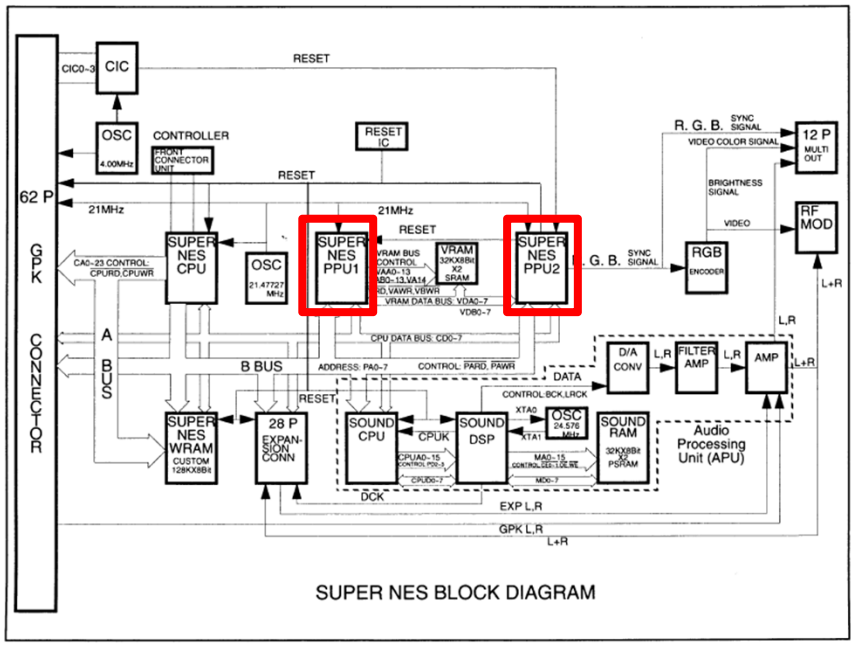
SNES CPU

- Custom CPU based on a 16-bit 65c816 core
- Input clock rate: 21.47727 MHz
- Bus clock rate: 3.58 MHz (High Speed mode), 2.86 MHz (normal mode)
- 24 bit bus - used for general accesses
- 8 bit bus - used for APU and PPU register accesses

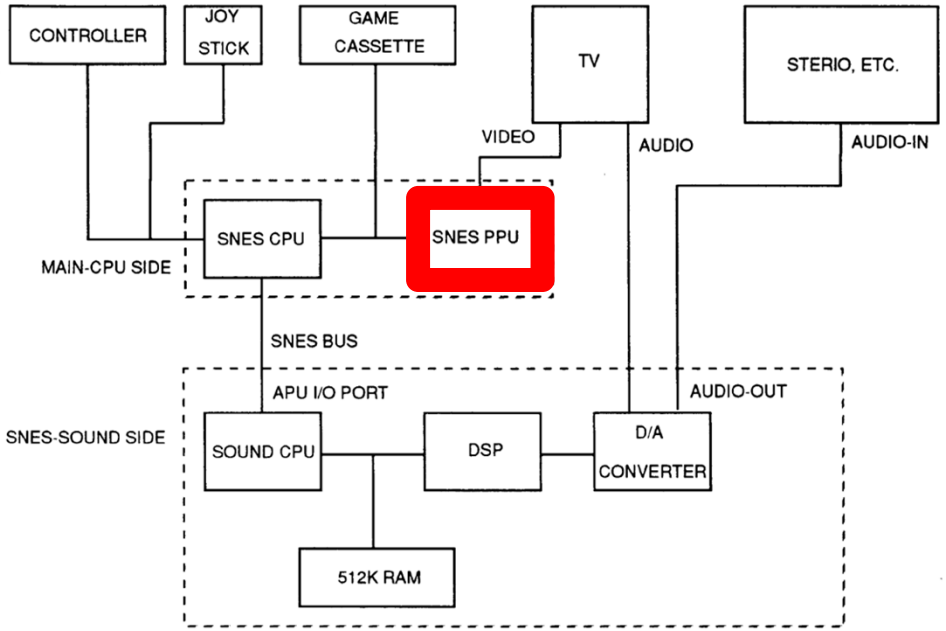
SNES CPU

CPU Specification	SNES	Sega Genesis
Max Clock Rate	3.58 MHz	7.6 MHz
Number of bits	16	16/32
Peak Instructions per second	1.79 MIPS	1.4 MIPS

Picture Processing Unit



SUPER NES BLOCK DIAGRAM



Picture Processing Unit (PPU)

- Comprised of 2 units: PPU1 and PPU2
- PPU1 generates background character data, rotation, and scaling
- PPU2 performs special effects

Picture Processing Unit (PPU)

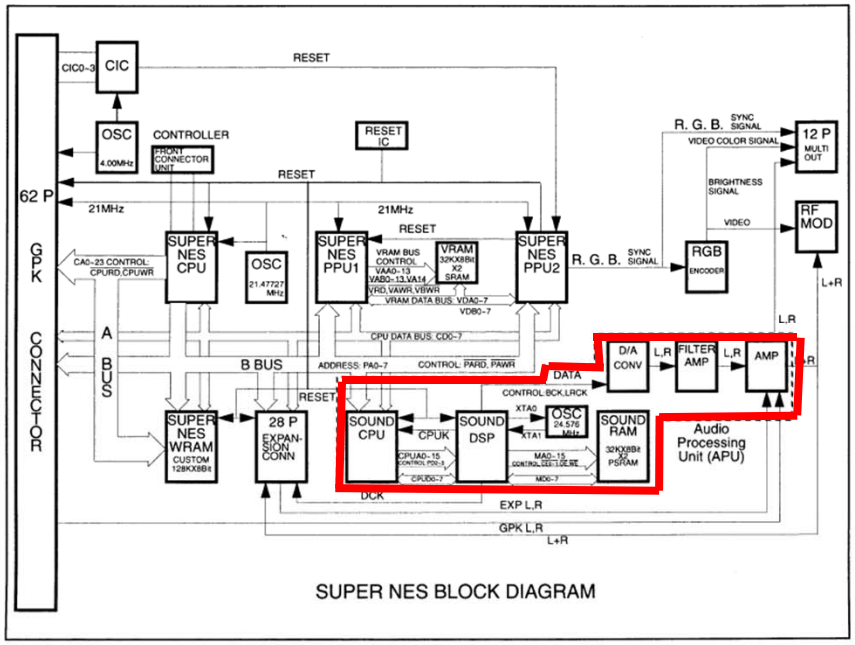
- 64 kB of SRAM
- 32,768 colors (15 bit RGB color space)
- Clocked with the same signal as CPU
- 7 different video modes
- Supported resolutions: 256x224, 512x224, 256x239, 512x239, 512x448, 512x478

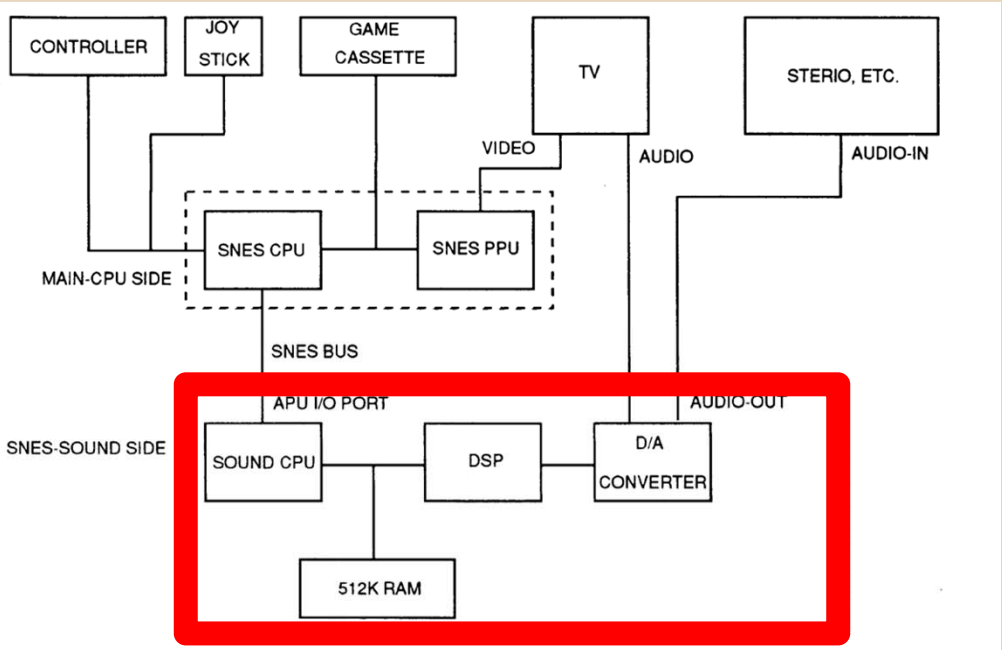
Video Modes

Mode 0: 4 layers, all using 4-color palettes. Each BG uses its own section of the SNES palette.
Mode 1: 3 layers, two using 16-color palettes and one using 4-color palettes.
Mode 2: 2 layers, both using 16-color palettes. Each tile can be individually scrolled.
Mode 3: 2 layers, one using the full 256-color palette and one using 16-color palettes. The 256-color layer can also directly specify colors from an 11-bit (RGB443) colorspace.
Mode 4: 2 layers, one using the full 256-color palette and one using 4-color palettes. The 256-color layer can directly specify colors, and each tile can be individually scrolled.
Mode 5: 2 layers, one using 16-color palettes and one using 4-color palettes. Tile decoding is altered to facilitate use of the 512-width and interlaced resolutions.
Mode 6: 1 layer, using 16-color palettes. Tile decoding is as in Mode 5, and each tile can be individually scrolled.
Mode 7: 1 layer of 128x128 tiles from a set of 256, which may be interpreted as a 256-color one-plane layer or a 128-color two-plane layer. The layer may be rotated and scaled using matrix transformations. HDMA is often used to change the matrix parameters for each scanline to generate perspective effects.

(http://www.8-bitcentral.com/nintendo/snes.html)

Audio Processing Unit (APU)





SNES APU

Sony SPC700 Series CMOS 8-bit CPU
- 2 8-bit IO ports
- 3 timers

DSP Unit

D/A Converter

64 KB RAM

Cartridges

- Super FX chip
- Super Accelerator System

image : http://www.i64x.com/i6img/sfc25.jpg

Super FX Chip

- RISC CPU
- Used to render graphics the normal CPU couldn’t
- Processed mainly 3D polygons
- Clocked at 10.5 MHz
- Required additional pins in the cartridge

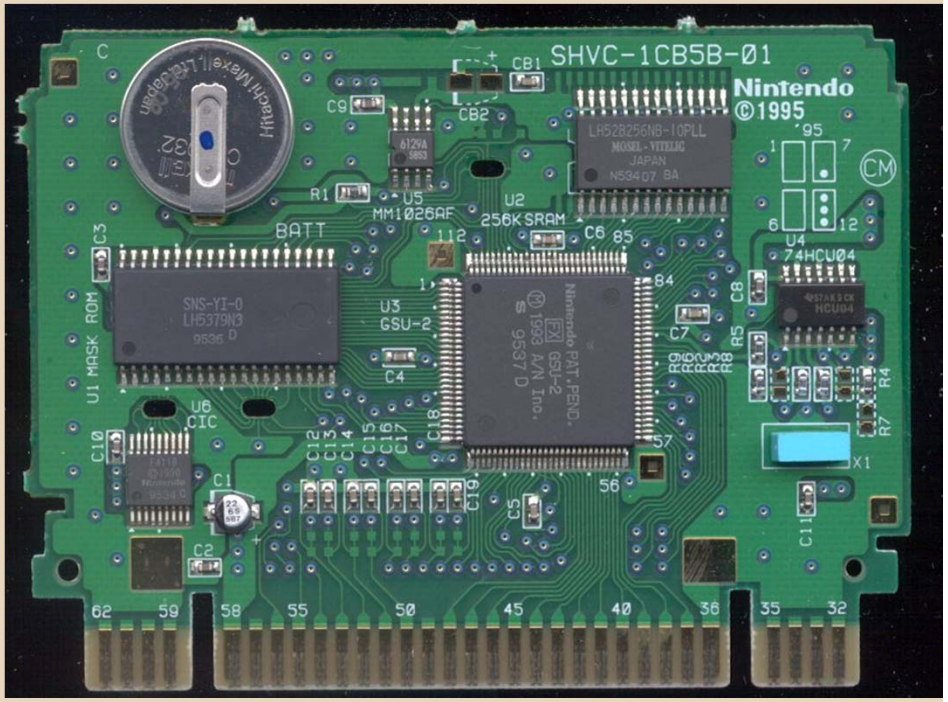


image: http://www.snescentral.com/0/6/7/0674/SNS-YI-0-front.jpg

Super Accelerator System (SA-1)

Image: http://upload.wikimedia.org/wikipedia/commons/thumb/b/b6/SA1_01.jpg/220px-SA1_01.jpg

- Improved CPU that would be placed in the game cartridge
- 16-bit processor
- Clock rate: 10.74 MHz
- Works in parallel with original processor to yield 5x performance
- 2kB of internal RAM, 2MB of external RAM
- 64 MB of external ROM

Super Accelerator System

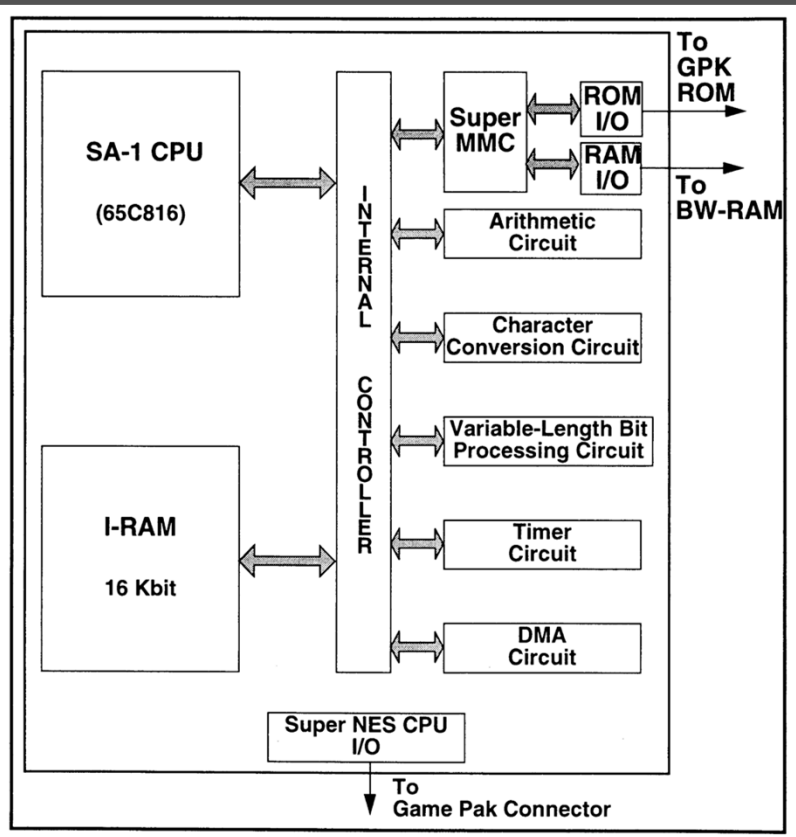


Figure 1-2-1 SA-1 Block Diagram

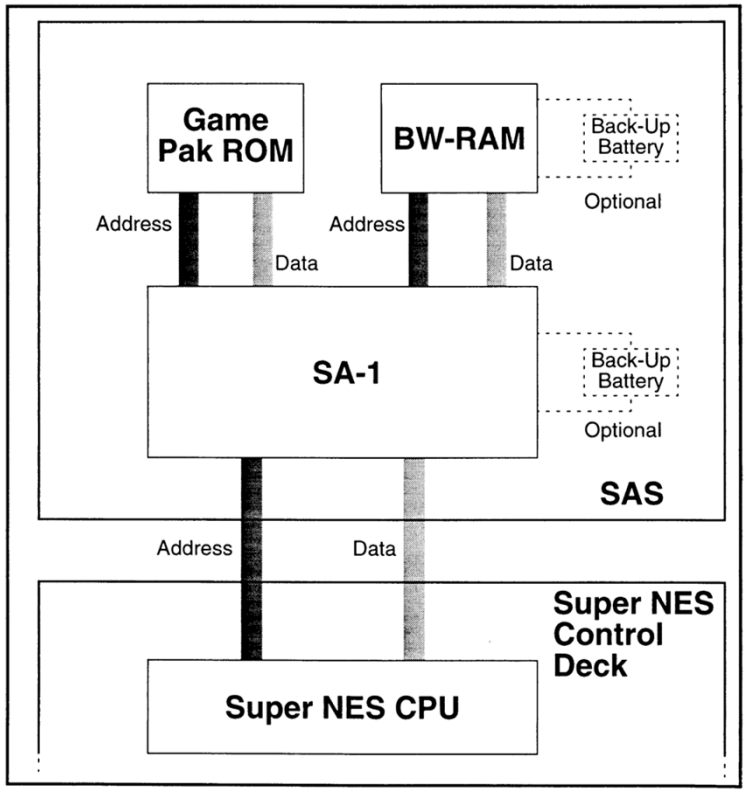


Figure 1-1-1 Super Accelerator System Configuration

Extras

2 extra pieces of hardware were
    Satellaview satellite internet connection
    Super Gameboy cartridge

Satellaview

- St. Giga Radio
- BS Zelda no Densetsu
  - BSゼルダの伝説
  - (BS Legend of Zelda)
  - SoundLink
- Sore wa Namae o Nusumareta Machi no Monogatari
  - それは名前を盗まれた街の物語
  - (The Story of the Town Whose name was Stolen)
- Ran From April 1995 - March 2000

image: http://en.wikipedia.org/wiki/Satellaview#mediaviewer/File:Satellaview_with_Super_Famicom.jpg

Super Gameboy

Image: http://mco-s2-p.mlstatic.com/super-gameboy-juegos-de-gameboy-en-el-super-nintendo-snes-13286-MCO3023588463_082012-F.jpg

image: http://www.zock.com/8-Bit/SNESSuperGameboy.JPG

End of Life

- Best selling console of its generation
- Games live on through emulation and cartridge mods
- Predecessor to the N64
- Developers continued to release games for SNES through 1998
- One of the best selling consoles of all time
- CNET declared SNES as greatest console of all time (2008)

Any Questions?

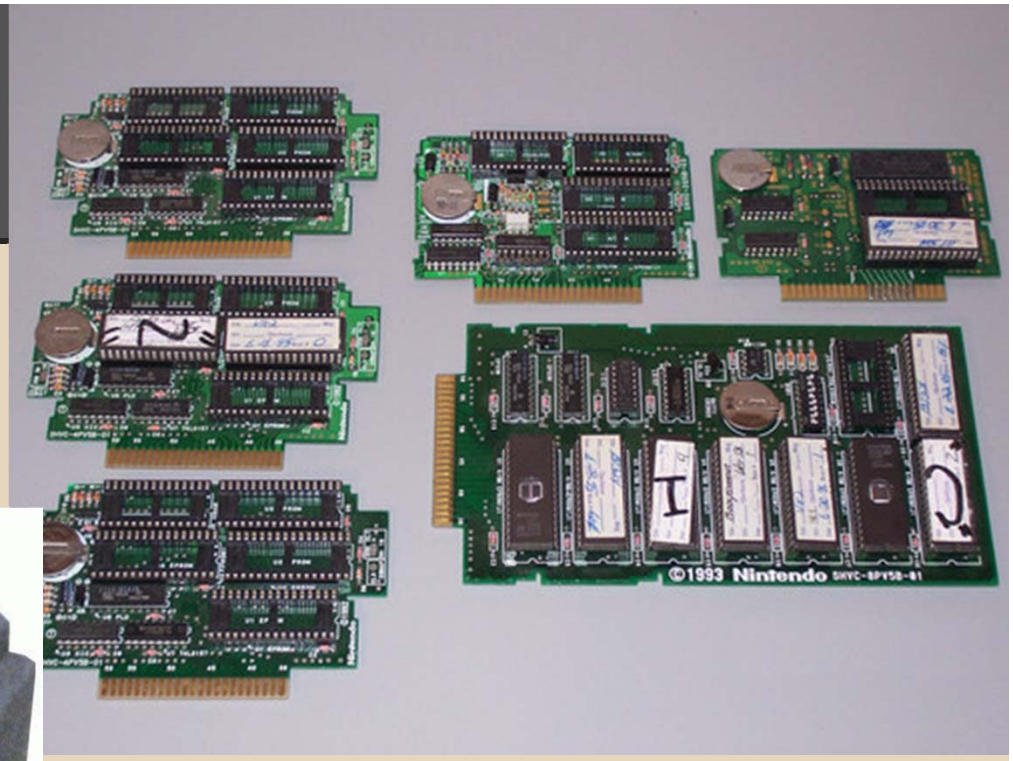


image: http://www.gamesniped.com/wp-content/uploads/2012/05/NINTENDO-SNES-PROTOTYPE-PCB-EPROM-CARTRIDGE-BOARDS-GAME-DEVELOPER-CARTRIDGE-LOT7.jpg

image: http://www.nintendoworldreport.com/media/27668/4/4.jpg

Works Cited

Super Nintendo Development Manual. N.p.: n.p., n.d. Print
"Nintendo SNES Brought NES Fanatics to the next Level W/ a 16-bit Game Console." *8-Bit Central*. N.p., n.d. Web. 08 Dec. 2014.