QUACKPACK
A GAMEBOY EMULATOR

HALEY WHITMAN   TRACE ANDREASON

RUI TU   ANDREW HILL

THE CPU

- Called the SHARP LR35902, released in 1989

- A mixture between Intel's 8080 and Zilog's Z80

- 8-bit 4 MHz Clock, 8kB Video/Work RAM

- It's predecessor, Intel 8080 (1974) known as the first truly usable microprocessor

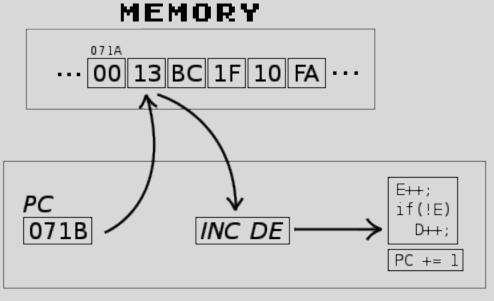- Could handle up to 64kB of memory

THE REGISTERS

- Contained 8 8-bit registers "A" through "L"
- Could be combined to create 4 16-bit registers
- 16-bit Stack Pointer
- 16-bit Program Counter
- "A" is the Accumulator register
- "F" is the Flag register
- "HL" is a pointer to memory

A	F	->	AF
B	C	->	BC
D	E	->	DE
H	L	->	HL

SP   PC

INSTRUCTION SET

- **256 regular instructions (0x00 -> 0xFF)**

- **0xCB extends this instruction set, adding 256 more instructions**

MEMORY

```
        071A
··· 00 13 BC 1F 10 FA ···
```

```
PC                                    E++;
071B           INC DE  ———→   if(!E)
                                      D++;
                                   PC += 1
```

CPU INSTRUCTION

GAMEBOY MEMORY

CARTRIDGE ROM 32KB	GPU VRAM 8KB	EXT. RAM 8KB	WORKING RAM <16KB	SPRI TES	I/O

64KB

THE TILES
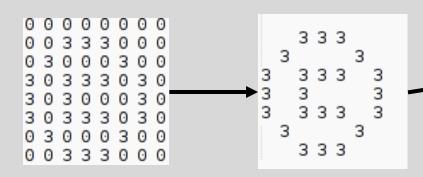
- **8x8 Matrices of 0s, 1s, 2s, and 3s**

- **Represents 8x8 blocks of pixels**

0:White | 1:lightGray | 2:darkGrey | 3:Black

```
0 0 0 0 0 0 0 0
0 0 3 3 3 0 0 0
0 3 0 0 0 3 0 0
3 0 3 3 3 0 3 0
3 0 3 0 0 0 3 0
3 0 3 3 3 0 3 0
0 3 0 0 0 3 0 0
0 0 3 3 3 0 0 0
```

```
    3 3 3
  3       3
3   3 3 3   3
3   3     3
3   3 3 3   3
  3       3
    3 3 3
```

NINTENDO
LOGO

THE BOOTSTRAP

- **100 Byte Program that runs on on boot**

- **Contains instructions to scroll down and double the size of the Nintendo Logo**

BOOTSTRAP DESIGN

0X0000

GAME CART

0X0104

NINTENDO LOGO

0X0133

GAME CART

0X3000+
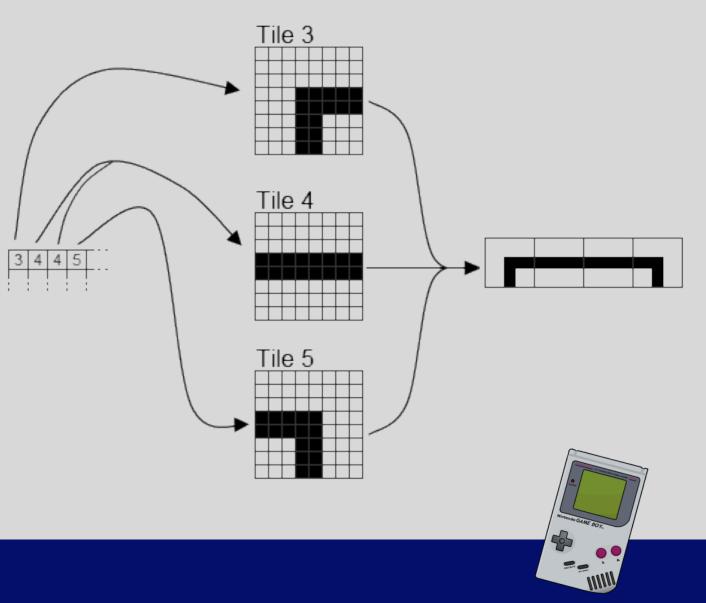
0X0000

BOOTSTRAP

0X0100

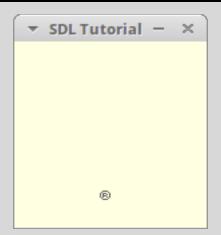The bootstrap has to run over 65,000 Instructions to start the Gameboy
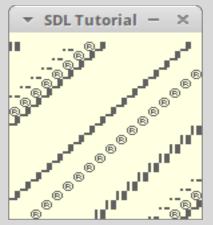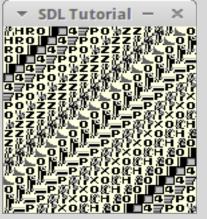
THE GPU

- **Syncing the CPU and GPU**

- **Rendering Scanlines:**

  - **Find position on screen**

  - **Check what needs to be rendered**
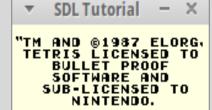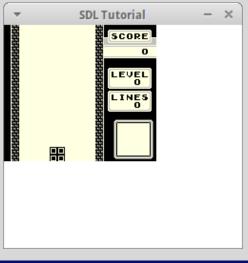
  - **Render the line pixel by pixel**

Tile 3

Tile 4

Tile 5

3 4 4 5

THE MAPPING

THE DEMO

THANK YOU