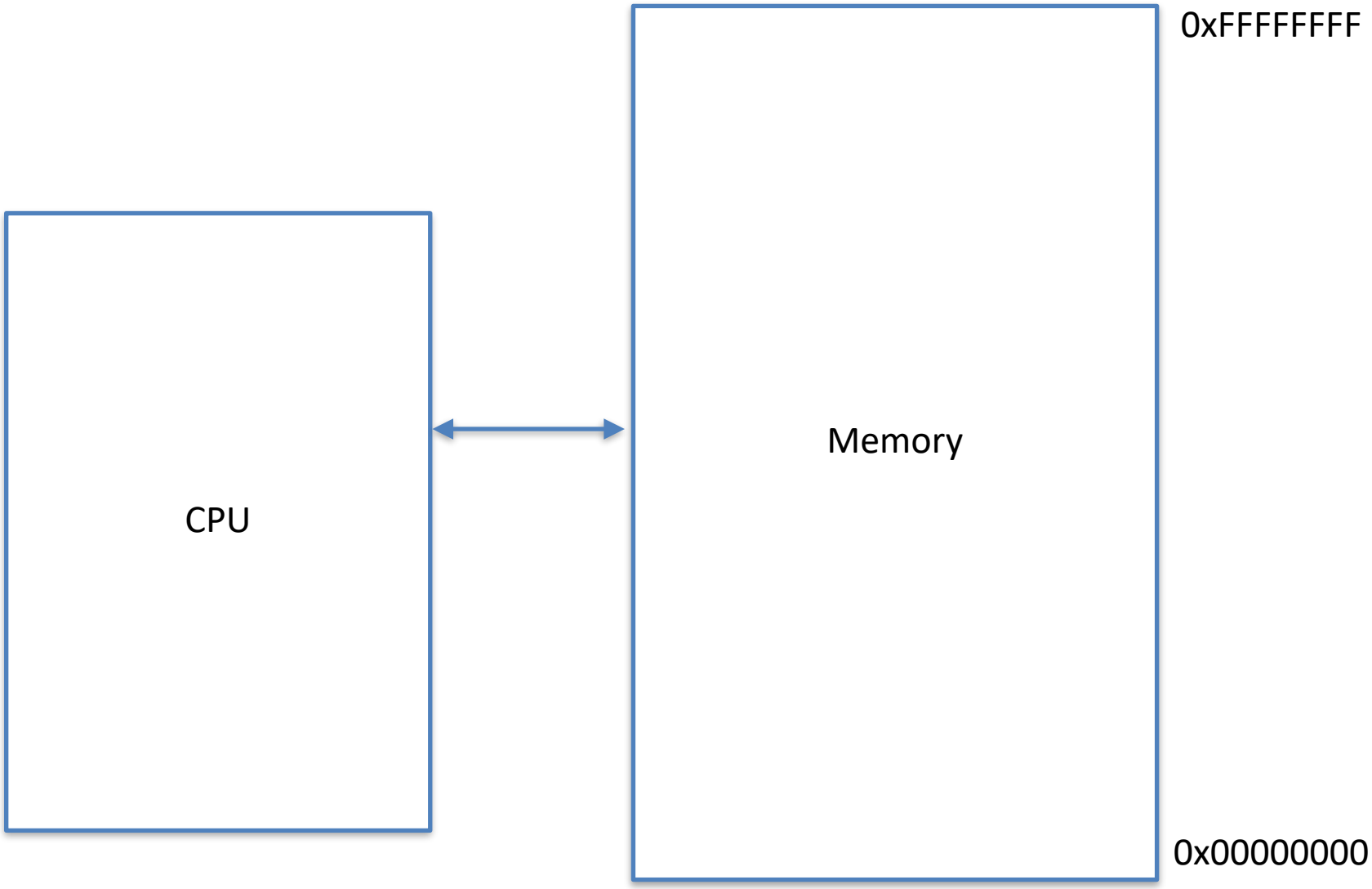
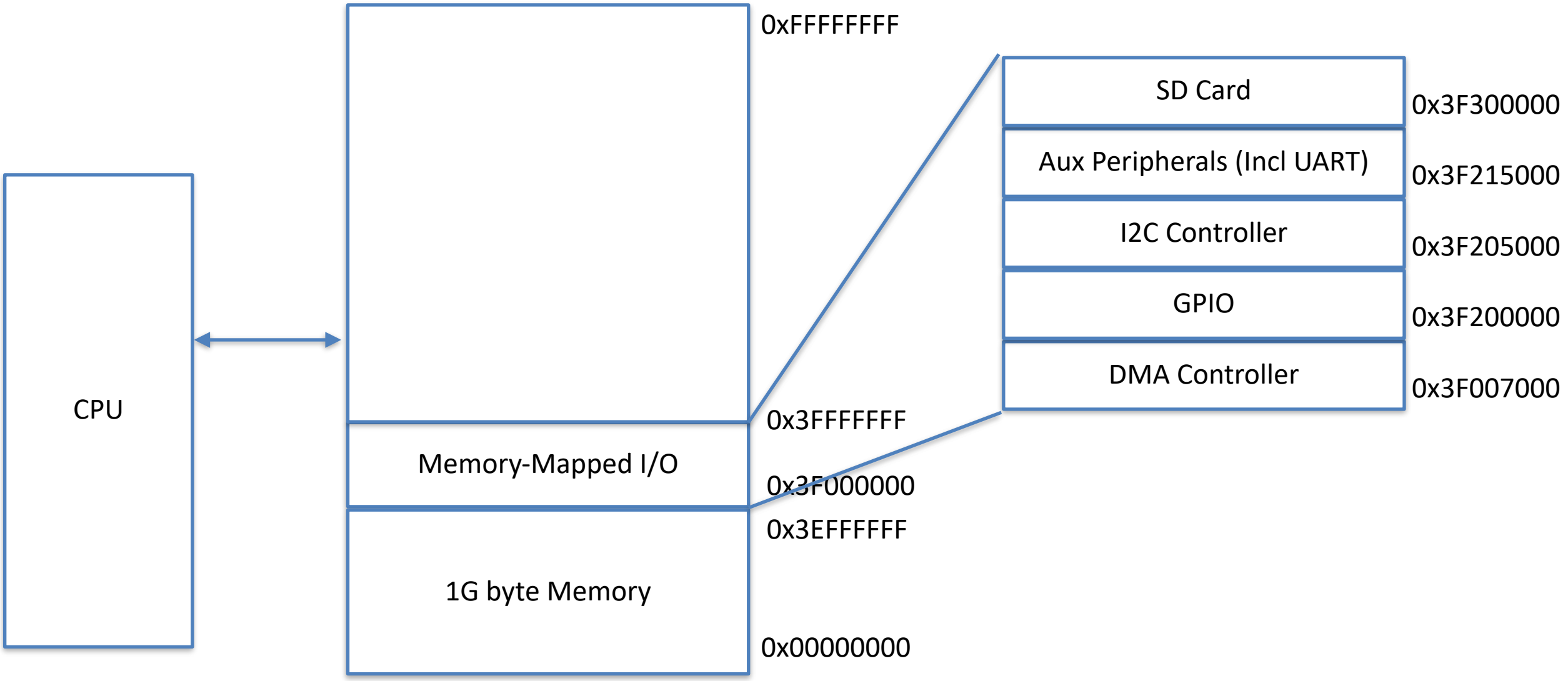
CS 310

INPUT & OUTPUT

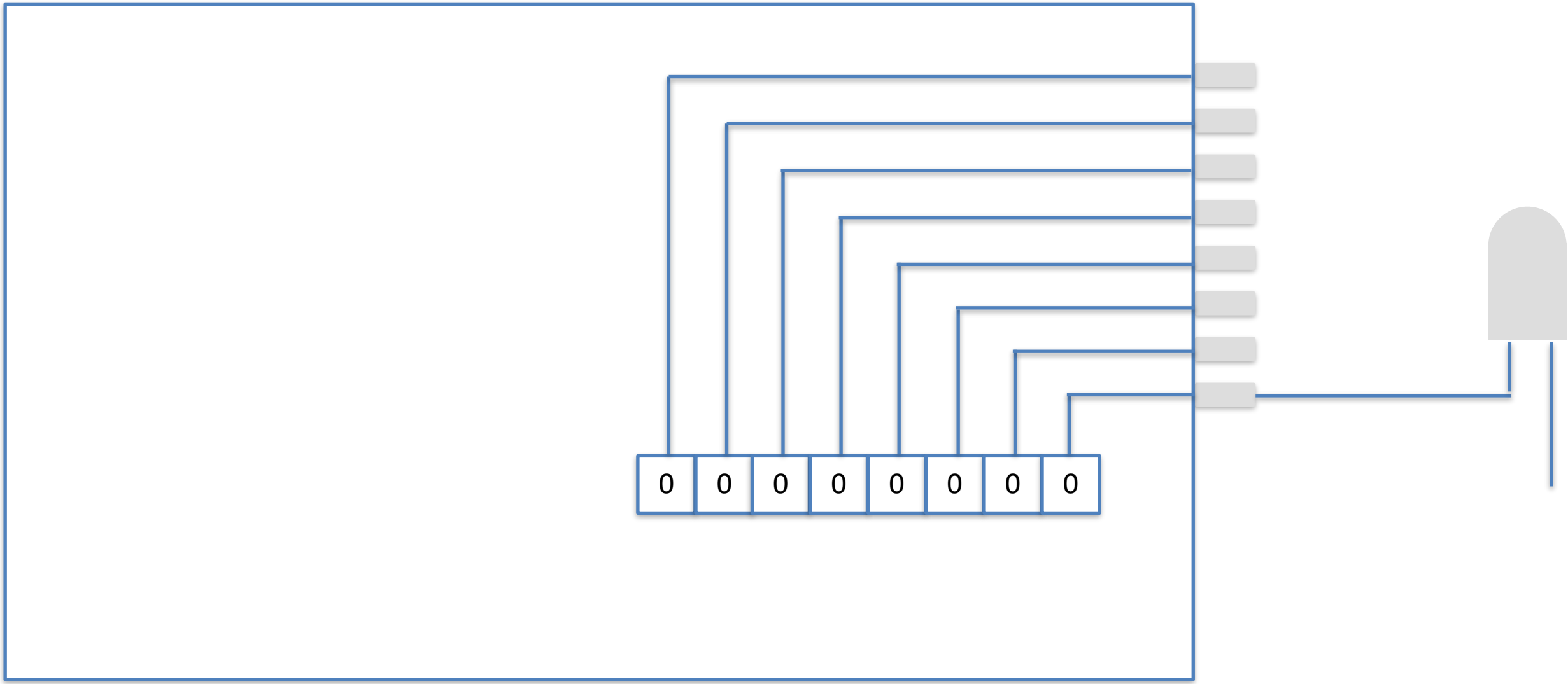
LAST TIME: CPU STORES DATA IN MEMORY



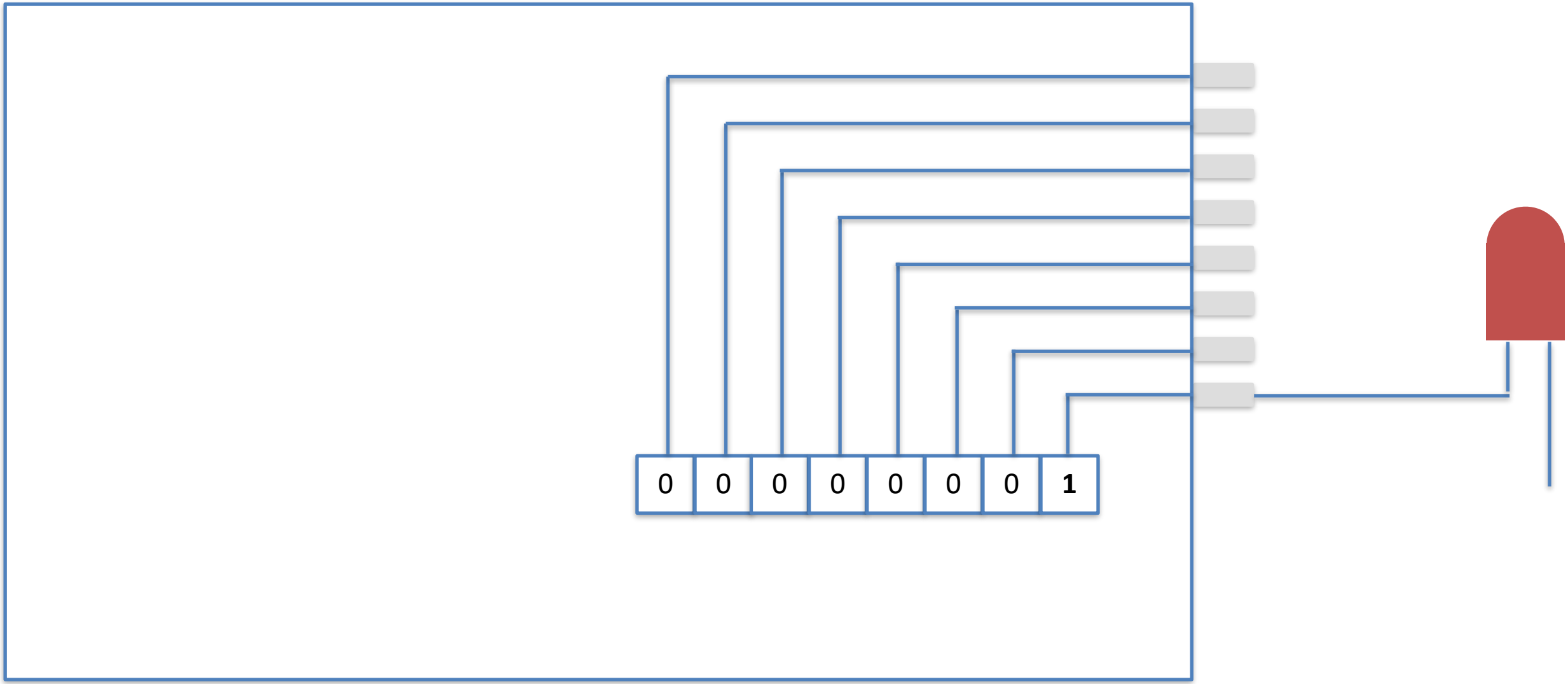
THIS TIME: MEMORY-MAPPED I/O



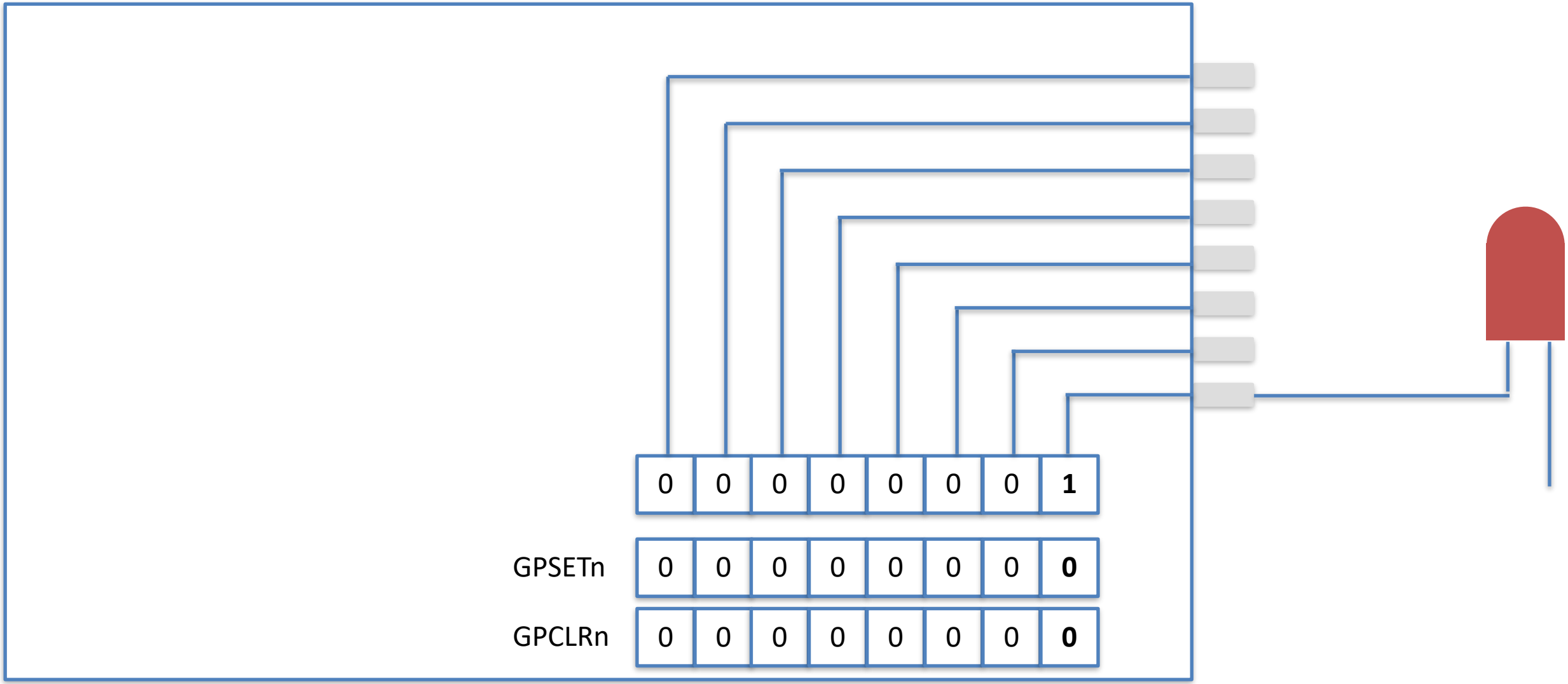
GPIO



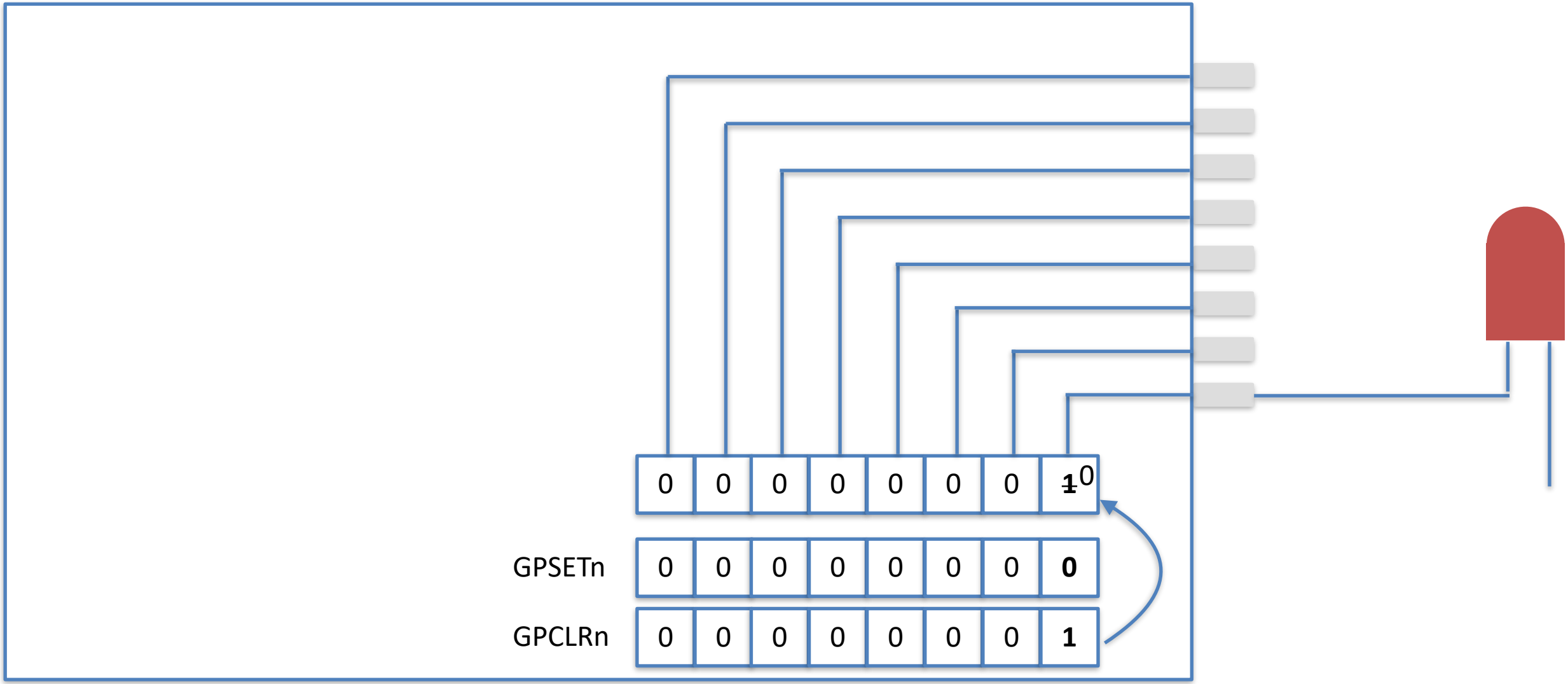
GPIO



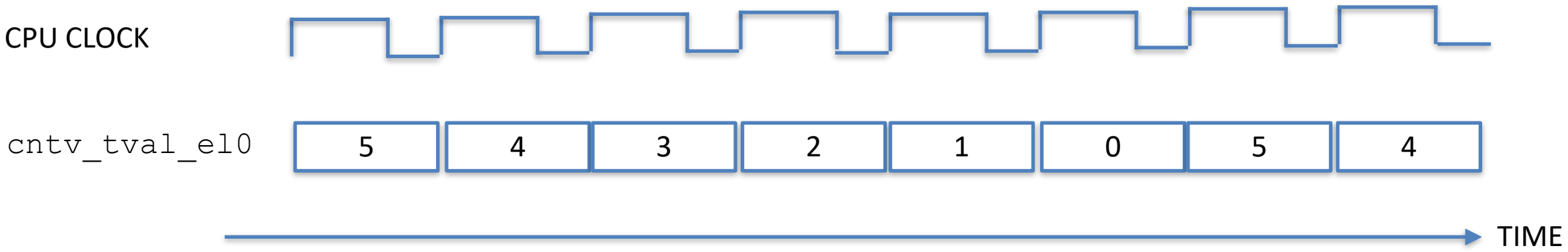
GPIO



GPIO



RASPBERRY PI VIRTUAL TIMER



ACCESSING THE VIRTUAL TIMER

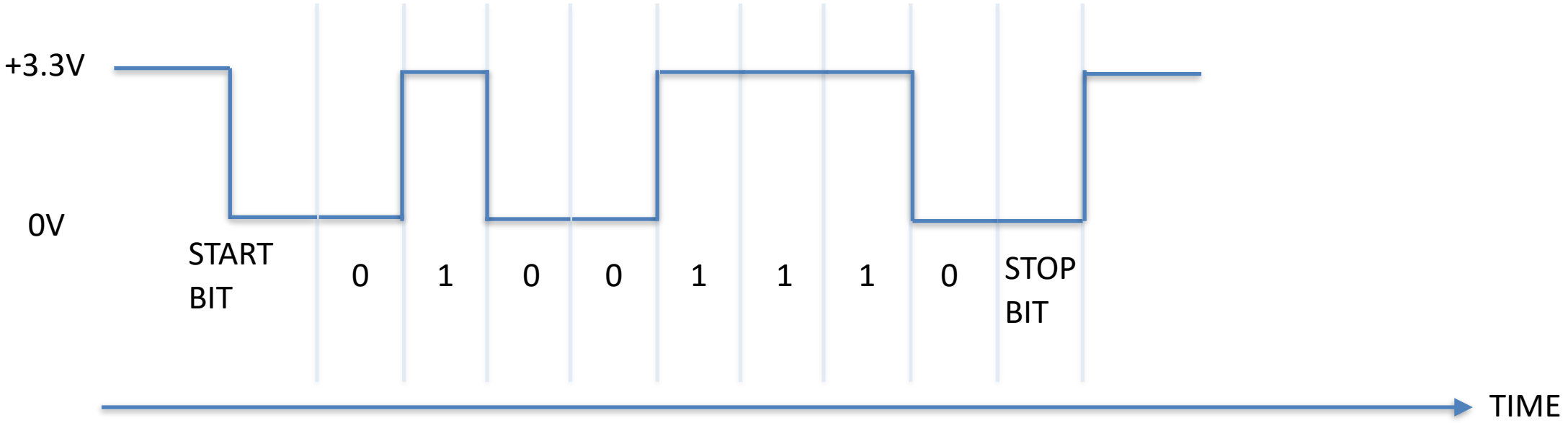
```
asm volatile("mrs %0, cntfrq_el0"    // Read counter frequency from
             : "=r"(counter_freq)); // cntfrq_el0 special register

asm volatile("msr cntv_tval_el0, %0" // Write counter value to
             :                       // cntv_tval_el0 special register
             : "r" (timer_val);

asm volatile("mov x1,#1 \n\t"         // Set counter enable bit in
            "msr cntv_ctl_el0, x1"); // cntv_ctl_el0 special register
```

UART

To send ASCII ’N’ = 0x4E = 0100 1110



UART

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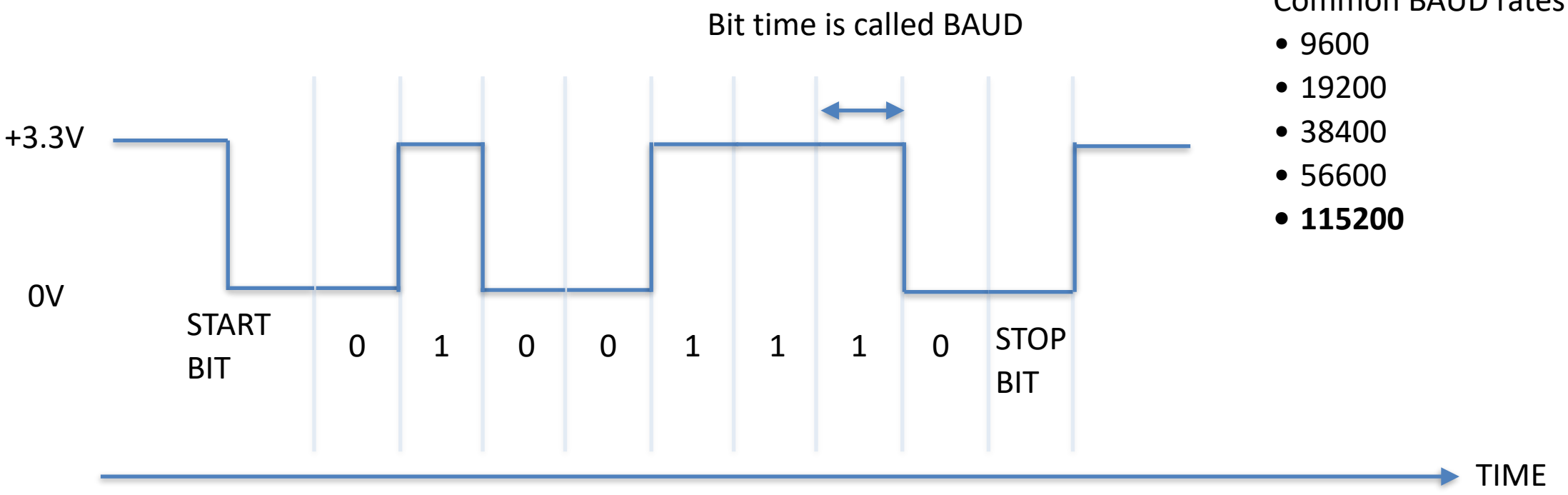

Common BAUD rates are:

- 9600
- 19200
- 38400
- 56600
- **115200**

UART

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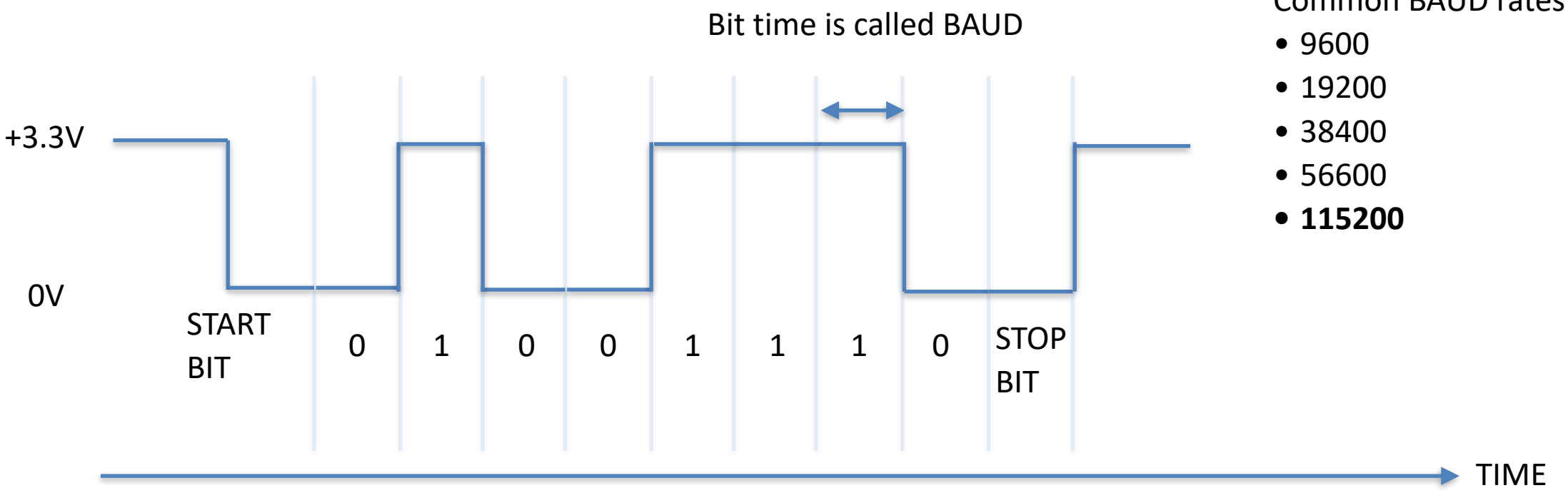

Common BAUD rates are:

- 9600
- 19200
- 38400
- 56600
- **115200**

On the Raspberry Pi 3, serial data register lives at address 0x3F215040.
Any data written to that address will show up on the simulated serial port.