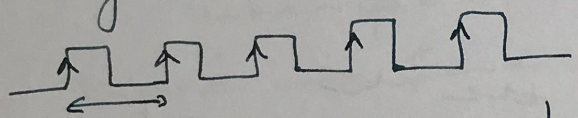
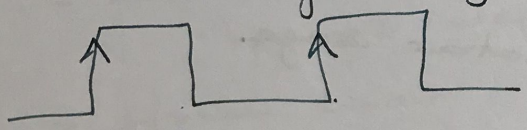
CSE 2037, Week 12

- Clock signals
  - what is a clock signal?
  - oscillators
- Timers
  - Basics
  - Mbed based timing operations
    - ticker
    - timeout
    - real time clock
    - systick
    - watchdog timer
- Mbed Examples

- clock in embedded systems.
- "synchronous"



- At every rising edge, we perform an operation.

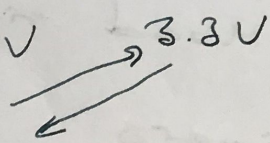


clock, square wave

"clock ticks", pulses

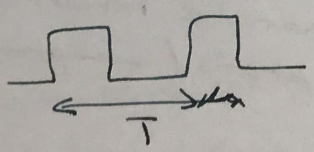
0 → 1

1 → 0



clock ⇒ square wave (periodic)

$f = \frac{1}{T}$



1 MHz. frequency ⇒ $T = 10^{-6}$ sec.

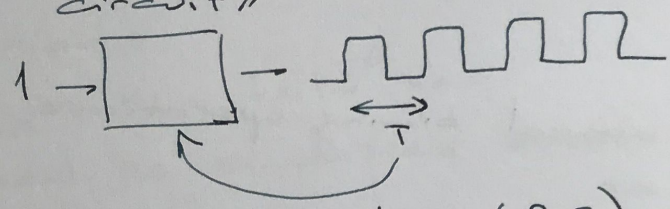
W12, 2

Generating Clock signal

→ Oscillator

↓

"electronic circuit"



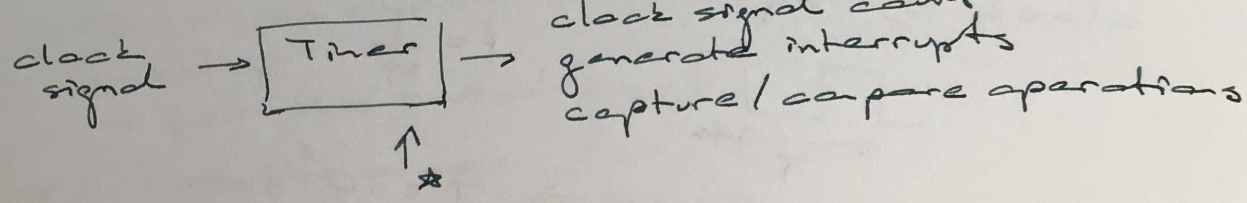
→ Resistive Capacitive (RC) oscillator
  ⇒ Implemented within the microcontroller
  → is not precise, ~ 1, 10%
  → cheap
  → available for general use.

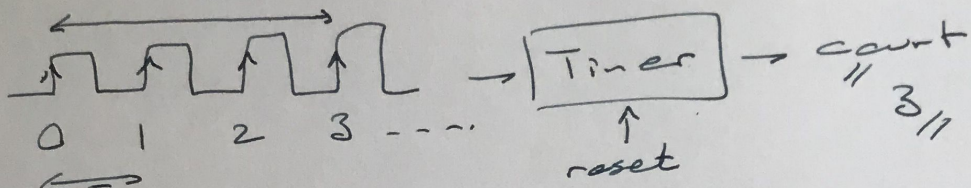
→ Crystal
  → clock pulses, "digital watch"
  → precise, minimum as possible
  → expensive
  → not available on the MC
  → add extra circuitry to the board.

⇒ Mbed "simplifies" oscillator usage.

Timers

Timer is a simple "counter".





count + clock period ⇒ the actual time.

3 periods

3×10^{-6} sec.

$3 \times T$

⇒ Mbed os simplifies these calculations.

→ Interrupt generation.
  → generate periodically.
  → execute commands periodically.

→ Capture operation.
  → "capture" time at a specific operation.

→ Compare operation.
  → "compare" the captured time, generate interrupt afterwards.

→ There are "several timers" in the STM32L0

→ base timers
  → works independently
  → $2^{32}-1$, $2^{16}-1$
  ⇒ overflow
  → reset.

→ system timer
  (sys tick)
  → works by itself
  → RTOS,
  → 1 sec, wake up the CPU

→ Real-Time clock (RTC)
  → set up
  → get the "actual time"

→ Watchdog timer