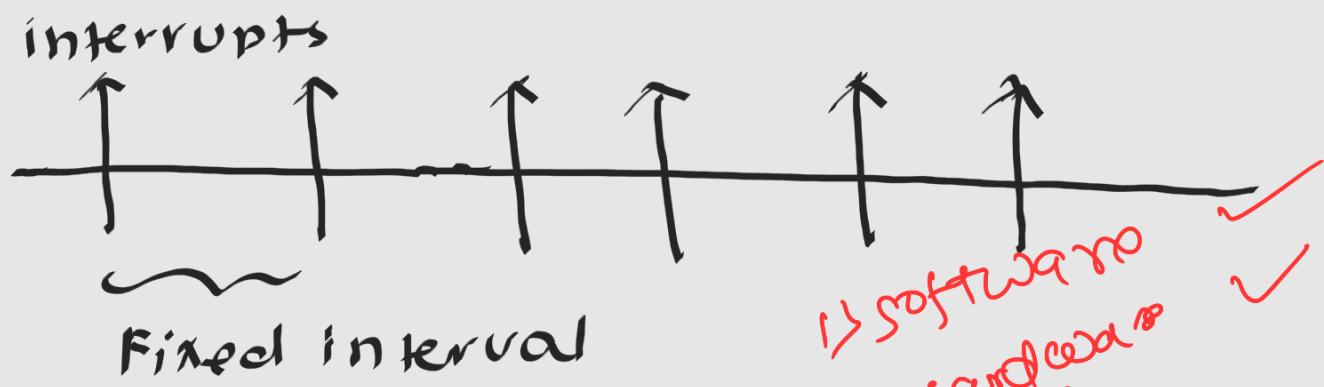


Systick (System Timer)



Example :

- Delay function measuring time elapsed
- Execute tasks periodically polling,
CPU scheduling

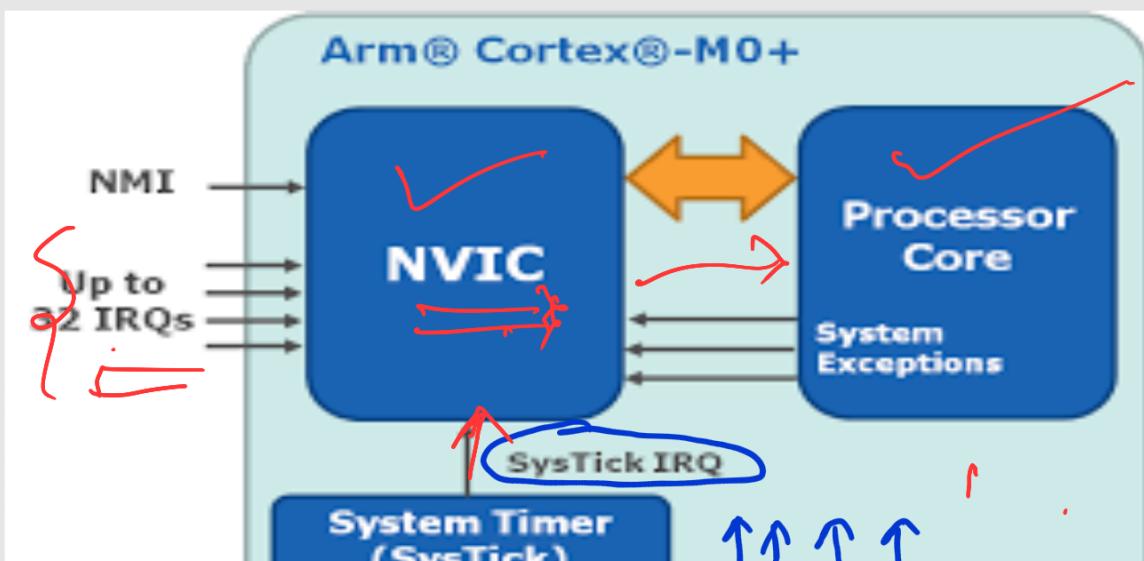
RTOS

- ① Standard hardware component built in +
arm Cortex M4
- ② Periodically forces the processor to execute following ISR.

Void systick_Handler (void)

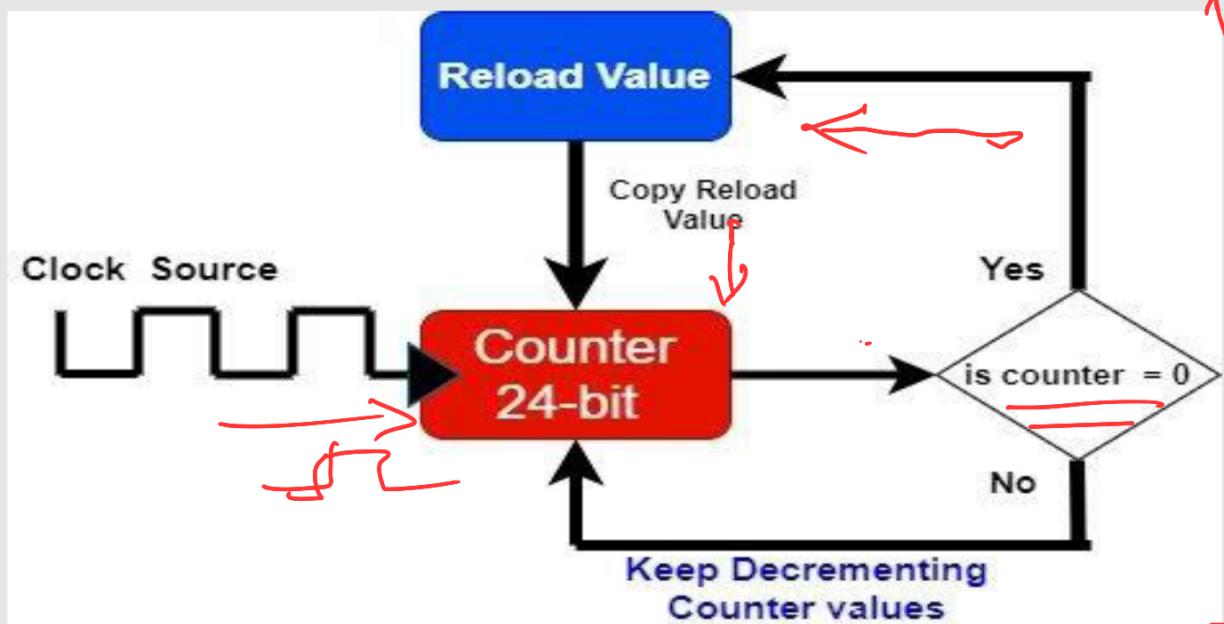
{

}



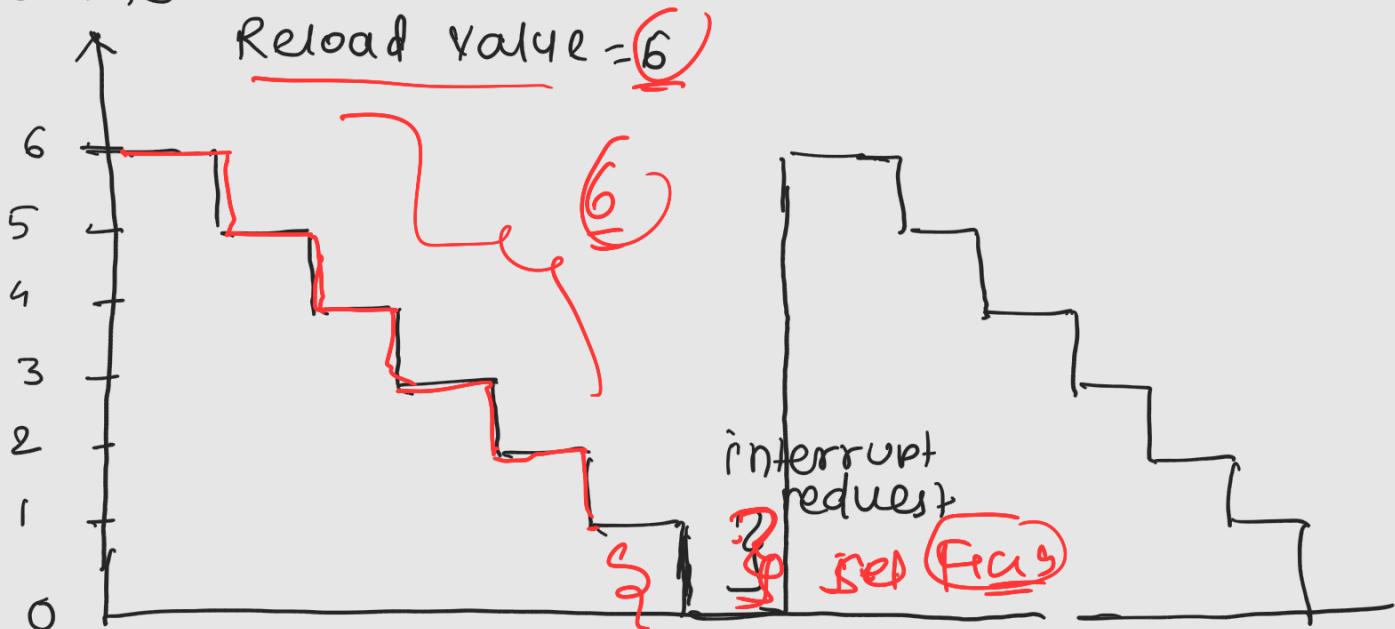
when enabled

Systick
Timer



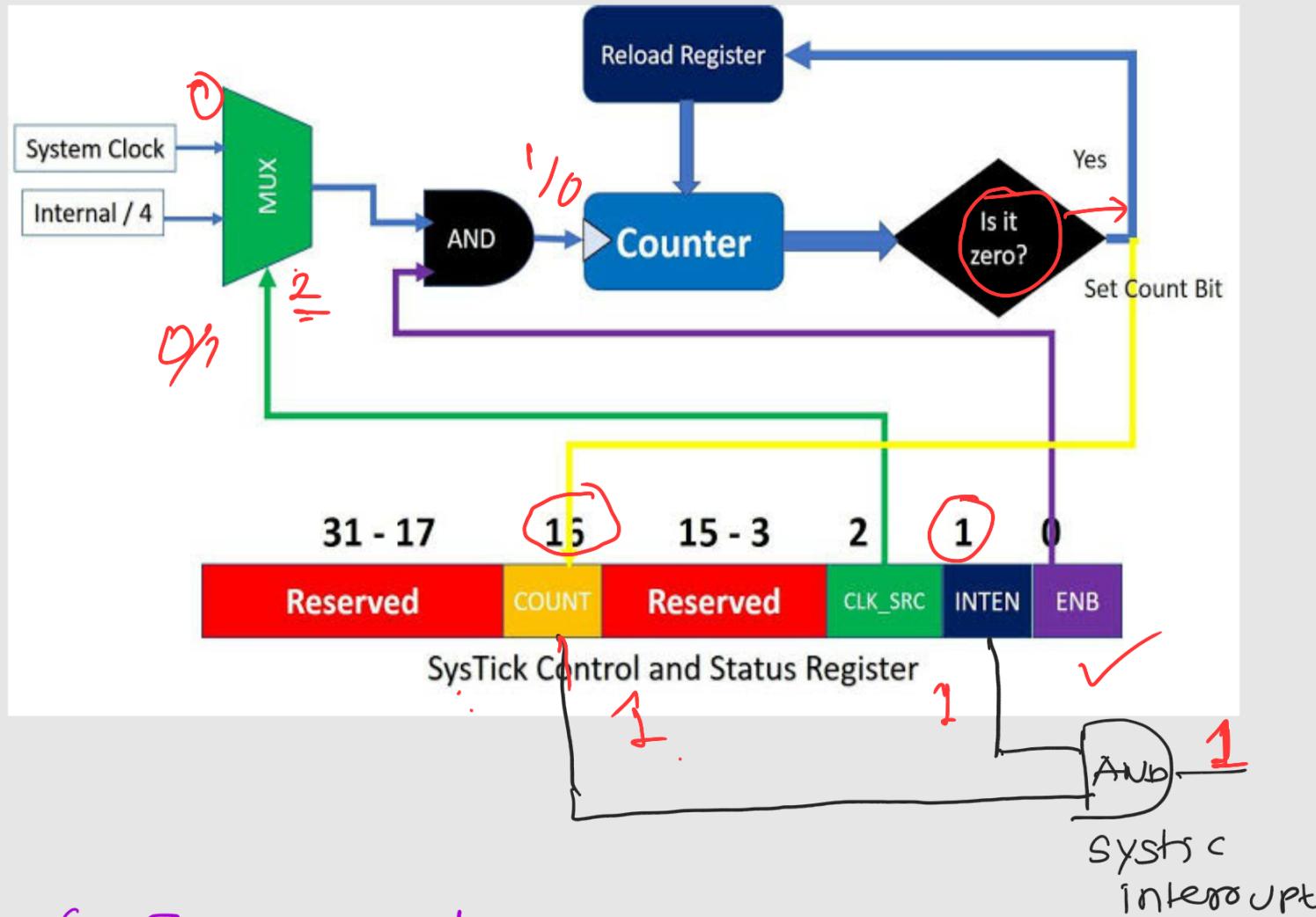
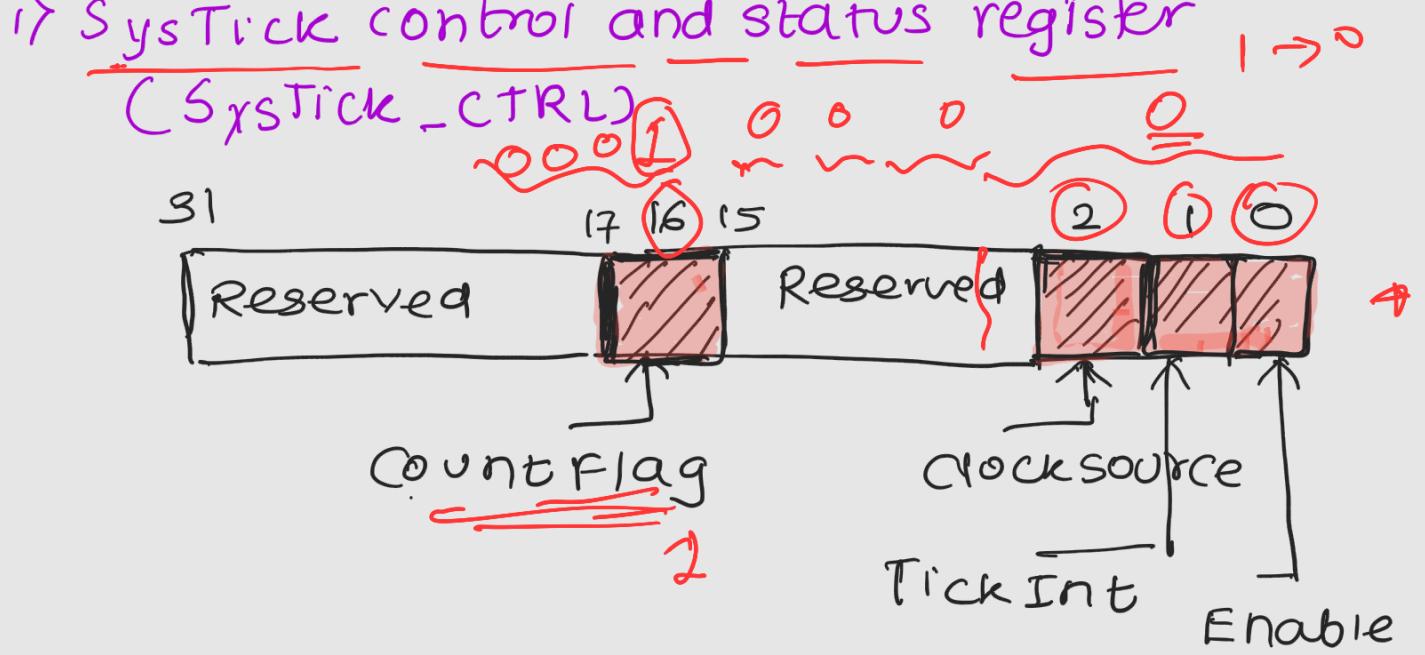
- 24 bit
- Counter decrement from reload to 0
- when 0 - fill reload from reload value register

Counter



Systic interrupt Time period = $(Load + 1) \times \text{clock period}$
OR source

Registers :- & &



2) Systick Reload value register
 (SysTick_LOAD)



→ 24 bit value

↔ maximum value → 0x0FFF FFFF → hex

(16,777,215) → dee

$$\underline{\text{Interval}} = (\text{RELOAD} + 1) \times \frac{\text{SOURCE_CLOCK}}{\text{period}}$$

3) systic current value

Register (SysTick_VAL) -



→ Reading current value of time

→ when transit from 1 to 0, generates an interrupt

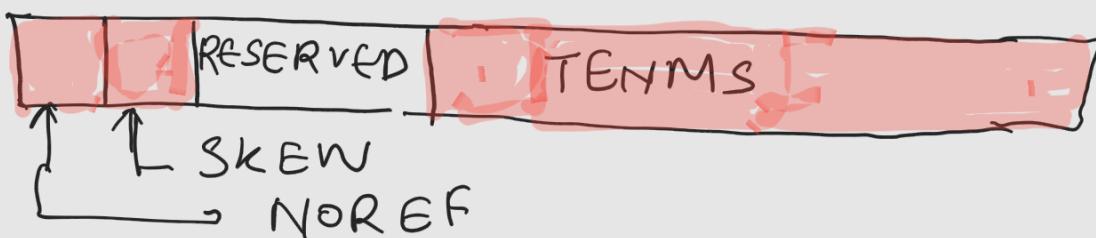
→ writing SysTick_VAL clears the counter & CFlag = 0

- reload value on next timerclock
- does not trigger interrupt

→ random value on reset

→ so always clear it

4) SysTick calibration register:



→ A read-only

→ TENMS - hold reload value yes 10ms perio

→ May not be implemented or may be defined diff. by chip designers.

Calculation of Reload value:-

Clock source = 80MHz ✓ clock⁶

SYSTICK interval = 10ms ✓

Reload value = ??

$$\Rightarrow \text{Reload value} = \frac{10\text{ms}}{\text{clock period}} - 1$$

$$= 10\text{ms} \times \text{clock freq} - 1$$

$$= 10 \times 10^{-3} \times 80 \times 10^6 - 1$$

$$= 8000.00 - 1$$

$$= 7999.99$$

External clock = 16MHz ✓

$$\frac{1}{XTAL} = \frac{1}{16 \times 10^6} = 62.5 \text{ ns} \rightarrow 62.500$$

$$\frac{253}{252} \rightarrow \underline{252} \Rightarrow 62.5 \text{ ns}$$

$$252 \rightarrow 251 \Rightarrow 62.5 \text{ ns}$$

Reload value = XTALEX time delay

$$= (XTALE \times \text{time delay}) - 1$$

So, for generating 1sec delay

$$\text{Reload value} = (XTALE \times \text{Time delay}) - 1$$

$$\text{Reload value} = \left(\frac{16 \times 10^6}{\text{1 sec}} \right) - 1$$

$$= \boxed{15999999} \text{ ISR}$$

Systick timer initialization :-

- 1) Turn off systick during initialization
→
- 2) Set the Reload value in Reload register
→
- 3) Write to NVIC_ST_CURRENT_R value to clear the counter
- 4) Set mode to the control register, NVIC_ST_CTRL_R

$$\begin{aligned}
 \text{CLK_SRC} &= 0/1 & 2 \\
 \text{INTEN} &= 0/1 & \downarrow \\
 \text{ENABLE} &= 0/1
 \end{aligned}$$

Pseudo code :-

void SysTick_wait (uint32_t delay)

disables NVIC-ST-CTRL_R = disable $\underline{\underline{0}}$
 Read 2) NVIC-ST-RELOAD.R = 15 99 999 0
 current 3) NVIC-ST-CURRENT = 0x00
~~start~~ 4) NVIC-ST-CTRL_R += $\boxed{0 \ 1 \ 1}$

~~2x3~~
~~2x2~~
~~2x3~~ while (NVIC-ST-CTRL-R
~~≤ 0x00000000~~ = 0'1)
~~{ ;~~

~~2x3~~
~~↓~~
~~2x2~~
~~↓~~
~~2x1~~
~~↓~~
~~1~~
~~↓~~
~~2~~
~~↓~~
~~1~~
~~↓~~
~~0~~
 } (sec)

~~1~~ ~~↓~~ $\Rightarrow \underline{\underline{1}}$ CTRL-R
~~1 -~~ $\boxed{0 - }$ coordinate
 $\underline{\underline{16}} \rightarrow \underline{\underline{0}}$

NVIC-ST-CTRL = $\underline{\underline{0}}$

~~1~~ $\Rightarrow \underline{\underline{0}} \Rightarrow 1$

$\underline{\underline{0x00010000}}$
 $\underline{\underline{16}} \quad \underline{\underline{4}} \quad \underline{\underline{4}} \quad \underline{\underline{0000}}$

