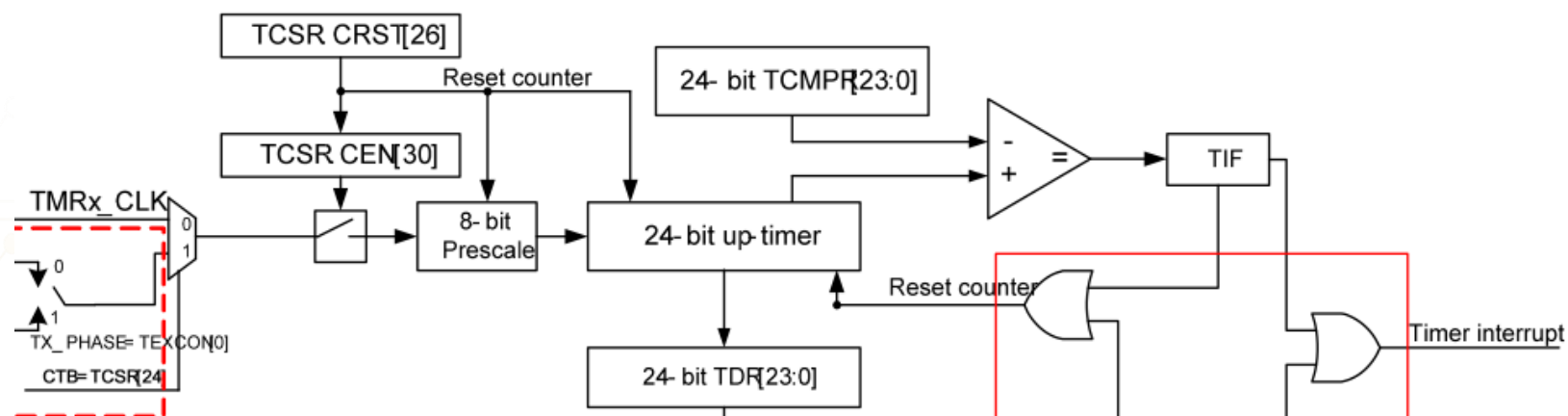


微處理機系統與介面技術

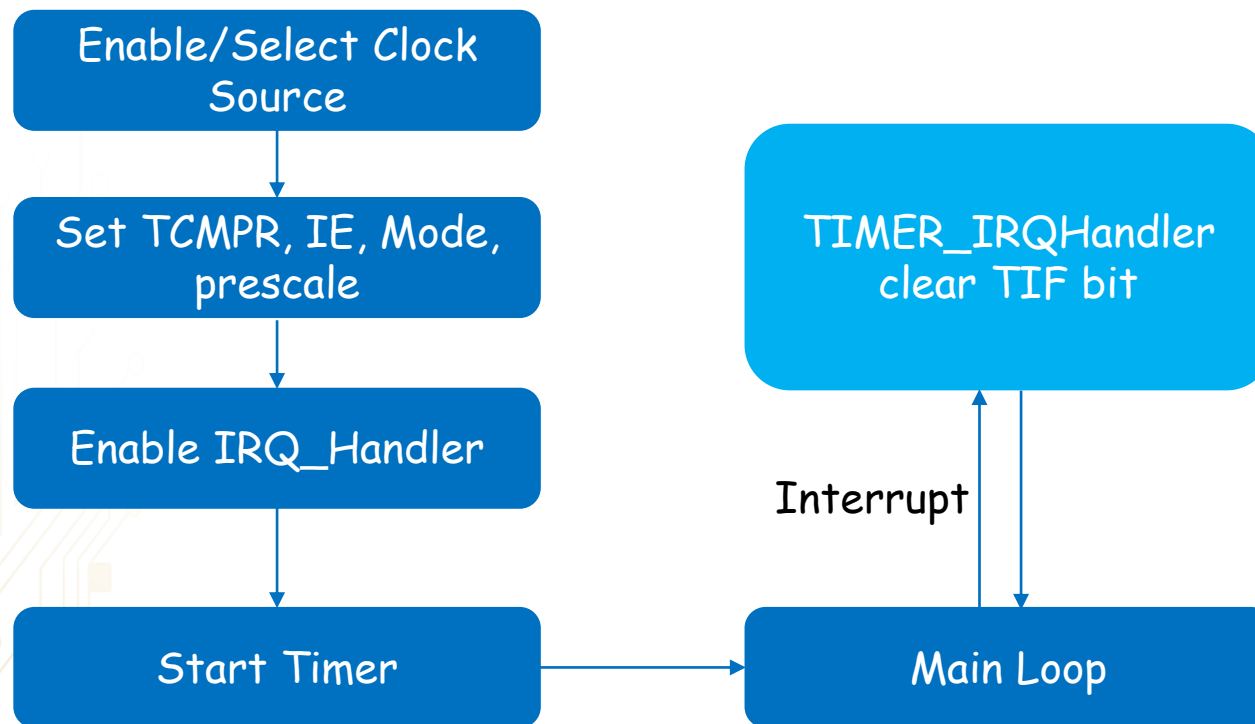
LAB 4 – TIMER

Timer

- NUC140 has 4 sets of 32-bit timers(TIMER0~TIMER3)
- Timer mode:
 - One-Shot mode
 - Periodic mode
 - Continuous mode



Timer Flow Chart



Register Description

- TCSR
 - Timer Control Register
 - CEN, IE, MODE, PRESCALE
- TCMR
 - Timer Compare Register
- TISR
 - Timer Interrupt Status Register
 - TIF

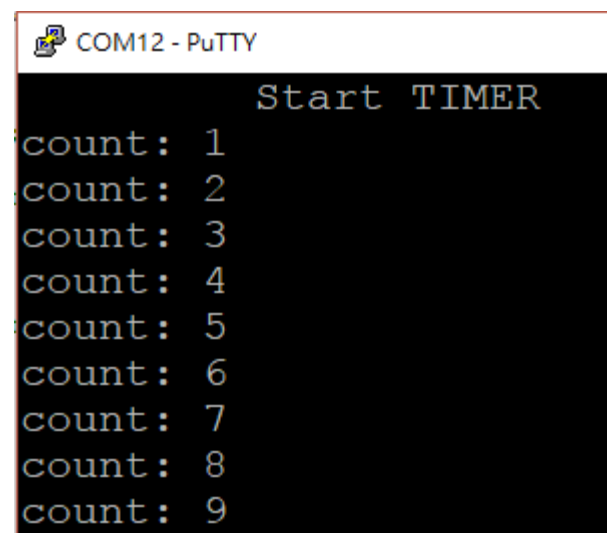
Timer Control Register (TCSR)

| Register | Offset | R/W | Description | Reset Value |
|----------|---------------|-----|------------------------------------|-------------|
| TCSR0 | TMR_BA01+0x00 | R/W | Timer0 Control and Status Register | 0x0000_0005 |
| TCSR1 | TMR_BA01+0x20 | R/W | Timer1 Control and Status Register | 0x0000_0005 |
| TCSR2 | TMR_BA23+0x00 | R/W | Timer2 Control and Status Register | 0x0000_0005 |
| TCSR3 | TMR_BA23+0x20 | R/W | Timer3 Control and Status Register | 0x0000_0005 |

| 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 |
|----------------|-----|----|-----------|----|------|------|--------|
| DBGACK_TM R | CEN | IE | MODE[1:0] | | CRST | CACT | CTB |
| 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 |
| Reserved | | | | | | | TDR_EN |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 |
| Reserved | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| PRESCALE[7:0] | | | | | | | |

Basic

- Make a counter(計數器), and print on putty for every second
- Use periodic mode



```
COM12 - PuTTY  
Start TIMER  
count: 1  
count: 2  
count: 3  
count: 4  
count: 5  
count: 6  
count: 7  
count: 8  
count: 9
```

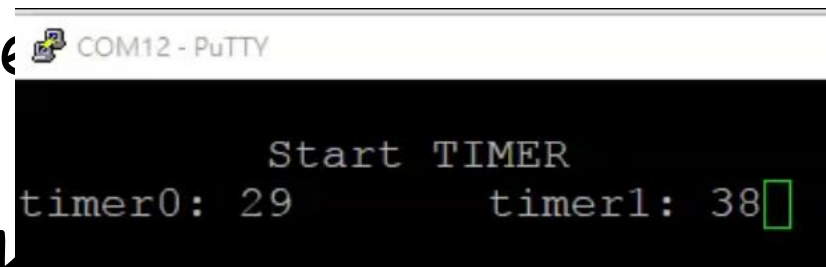
- Note:
- It is **not recommended to print in the IRQ Handler**, because it will take too much cycle in the IRQ, but we just for test

Bonus

- Implement two counter, count 2 times per second and 3 times per second
- Use two GPIO to suspend counter
 - Key1 press, suspend counter1
 - Key2 press, suspend counter2
- counter1,2 are independent, key1 only affect on counter1 and so does

• Demo影片

- Note: use "\r" let putty see like a clock
ex. printf("\rXXXXXX")



```
COM12 - PuTTY  
Start TIMER  
timer0: 29      timer1: 38
```

Tips

- 範例程式: TIMER_PeriodicINT
- 只需要看TIMER0的部分就好,要看懂timer是如何計數TCMPR, prescale 是怎麼算出1秒
ex. Timer clock source = 12MHz , prescale = 0
TCMPR = 12000000 → 1 interrupt per second
- Remember to clear the timer interrupt flag
- 在計算如何計數前也別忘了要看指定的CLOCK SOURCE是哪個唷

```
/* Select Timer 0~3 module clock source */  
CLK_SetModuleClock(TMR0_MODULE, CLK_CLKSEL1_TMR0_S_HXT, NULL);  
CLK_SetModuleClock(TMR1_MODULE, CLK_CLKSEL1_TMR1_S_HCLK, NULL);  
CLK_SetModuleClock(TMR2_MODULE, CLK_CLKSEL1_TMR2_S_HIRC, NULL);  
CLK_SetModuleClock(TMR3_MODULE, CLK_CLKSEL1_TMR3_S_HXT, NULL);
```


Demo

- Place: 創新大樓515 找助教 林子華(進門最後一排最裡面)
- Demo Time: (二)(三)下午三點~五點
- Report deadline: 11/13(五)
- Report title format: LABx_ID_Name.c & .doc
- Demo必須在Report deadline前完成
- Demo前須先上傳程式碼(上傳main所在的.c檔即可)

Graded

- Basic : 70%
- Bonus : 15%
- Report & Code : 15%