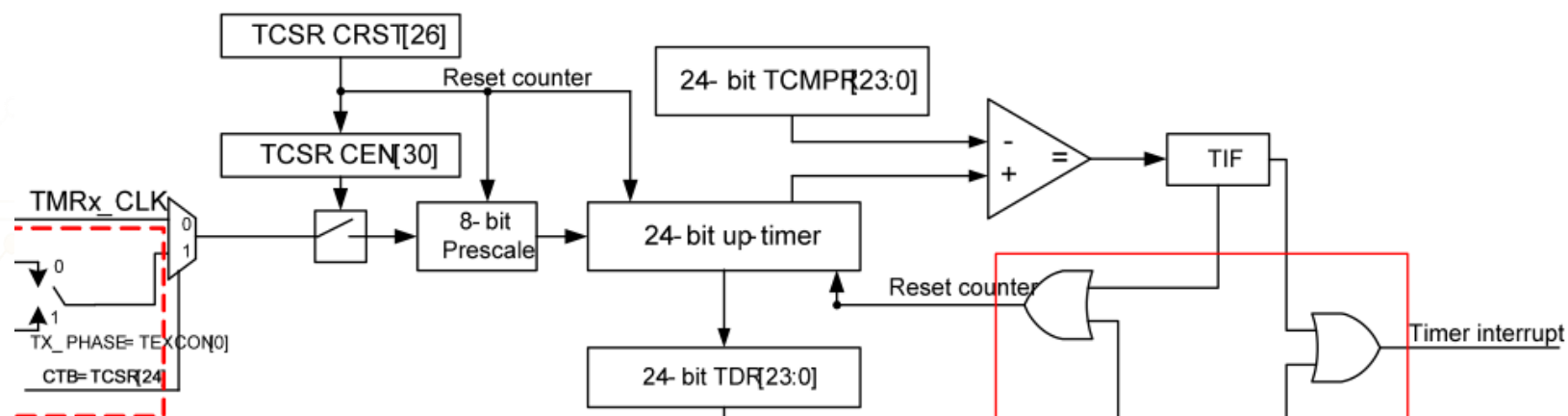


微處理機系統與介面技術

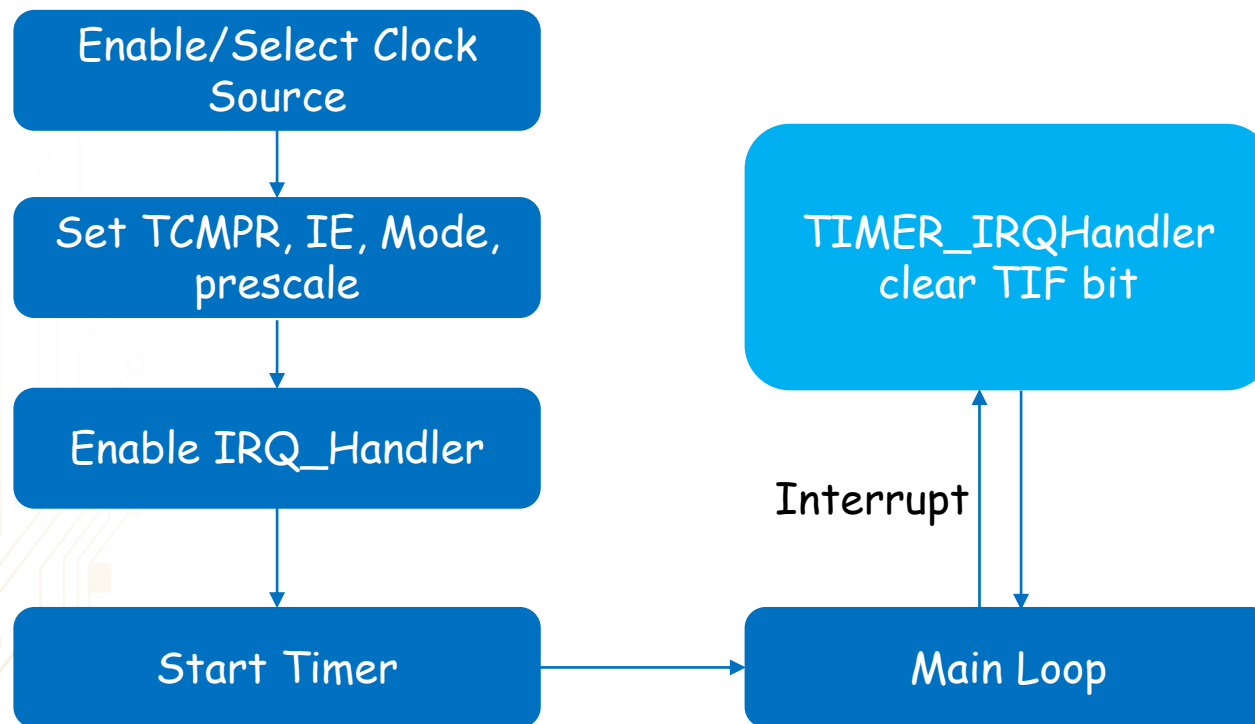
LAB 4 – TIMER

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

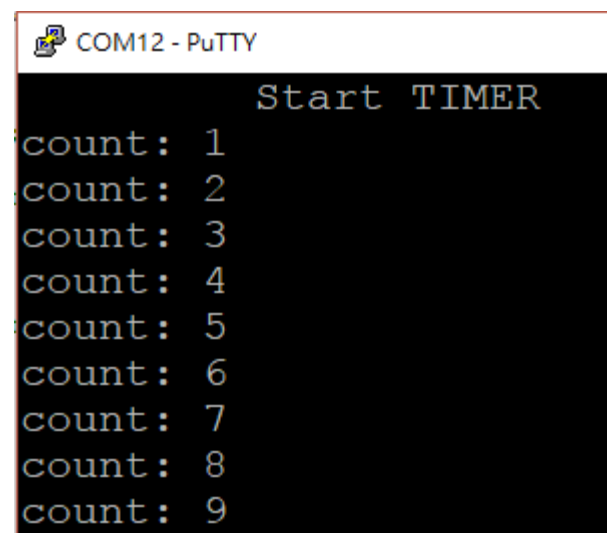
Timer Control Register (TCSR)

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

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

- 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 key2
- Note: use "\r" let putty see like a clock
ex. printf("\rXXXXXX")

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 宋皓天
- Demo Time: (二)(三)下午四點~五點
- Report deadline: 11/19(五)
- Report title format: LABx_ID_Name.pdf
- 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%