

# Final project presentation

## Rate-monotonic on FreeRTOS

Group 10

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# Outline

- ▶ 動機
- ▶ 系統架構
- ▶ 成果展示

# 動機

- ▶ 之前在OS課程有學到real-time system的scheduling policy 有這個rate-monotonic，但發現FreeRTOS上並不是用這個policy，因此有了好奇心。
- ▶ 我們想試試看不同的CPU scheduling policy 在FreeRTOS上有甚麼效果？

## 系統架構 (Rate-monotonic)

- ▶ Static priority and preemptive.
- ▶ Assumption:
  - ▶ Periodic tasks
  - ▶ Priority (period time越低priority越大)
- ▶ Work: 讓user task 可以periodic 的執行。

# Work

- ▶ TCB增加2個欄位: **xPeriodTime**、**xPeriodCounter**。
- ▶ 新增 **xTaskCreatePeriod**，讓使用者create task時可以自己輸入period time.
- ▶ 為使用者加code，使用者可以放心寫好自己欲執行的period task，由我們在上面加上**while**迴圈和最底下做**vtasksuspend**。

# Work

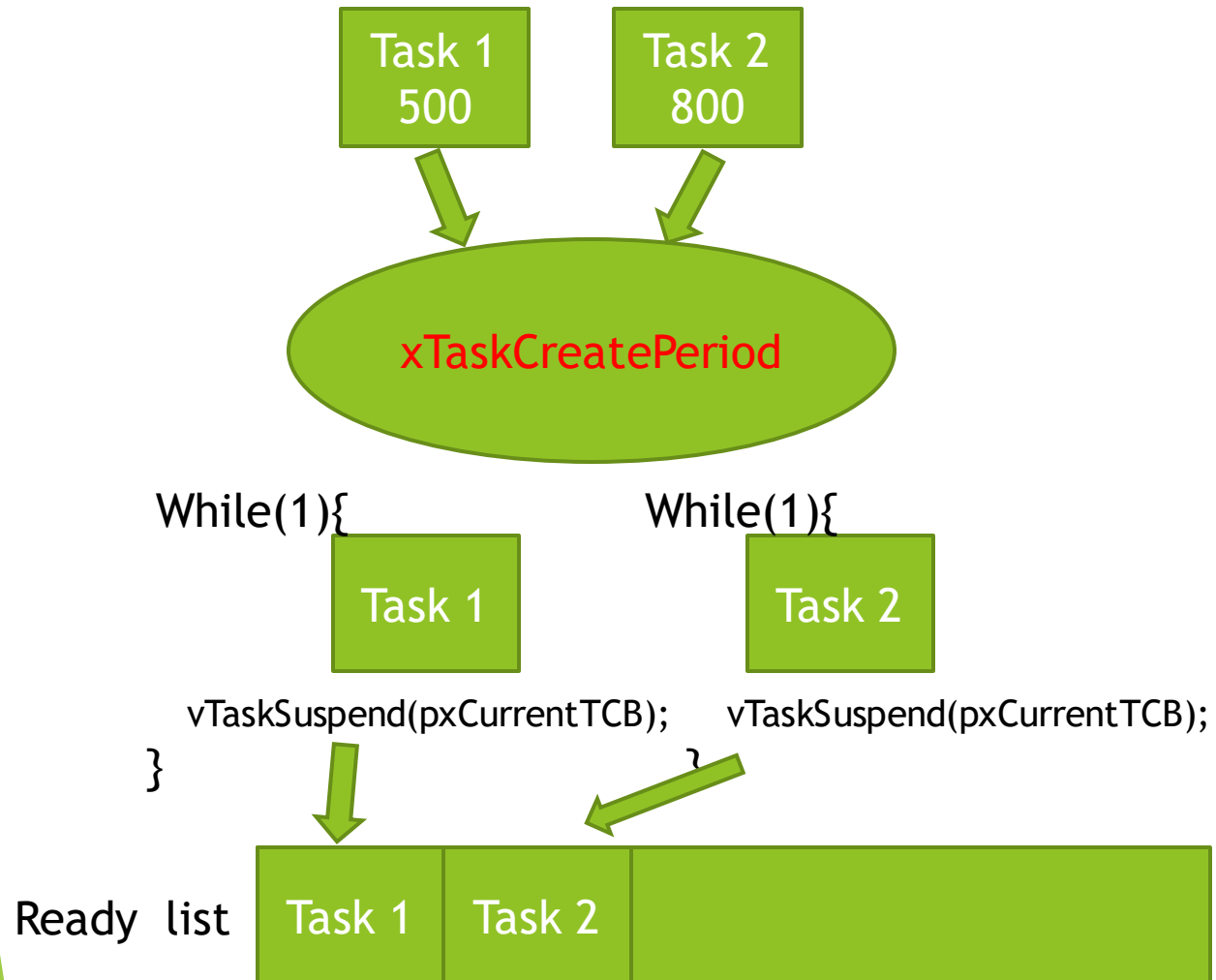
- ▶ 新增 **vListInsertAscent**，修改每次**insert ready list**的code，以period time越低的task排越前面。
  - ▶ e.g. Create task的時候 和 resume task的時候。
- ▶ 關掉time-slicing configuration，避免做RR。

# Work

- ▶ 在每次timer interrupt中的tick handler，幫ready list和 suspend list中 每個task的 **xPeriodCounter++** 計數，並去判斷該 **xPeriodCounter** 是否  $\geq$  **xPeriodTime**:

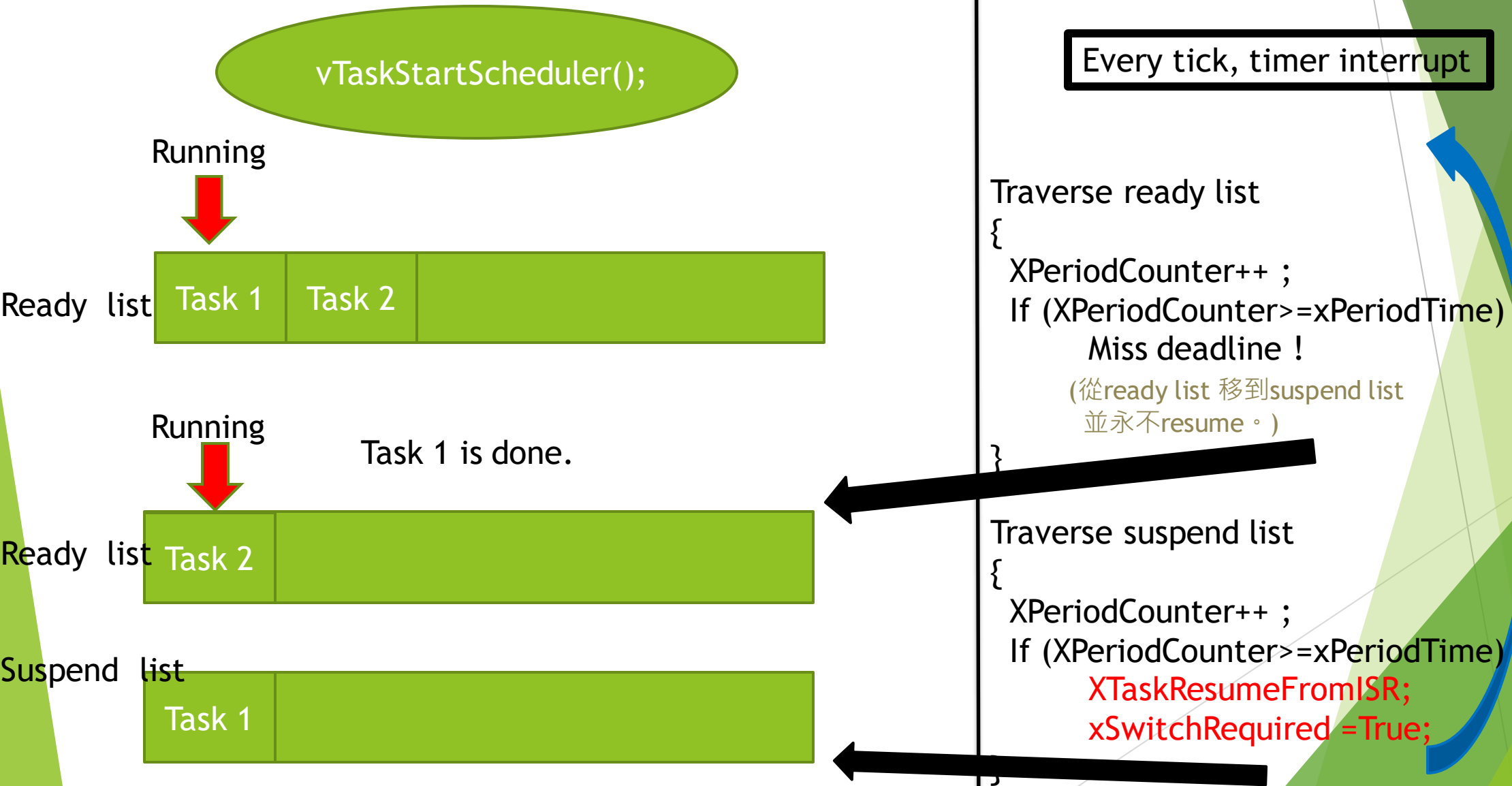
- [** 如果在ready list 發生 -> 代表該task **miss deadline!**
- ]** 如果在suspend list 發生 -> 代表已過一個period了，透過**xTaskResumeFromISR** 叫醒該task。

# 系統架構圖(Rate-monotonic)





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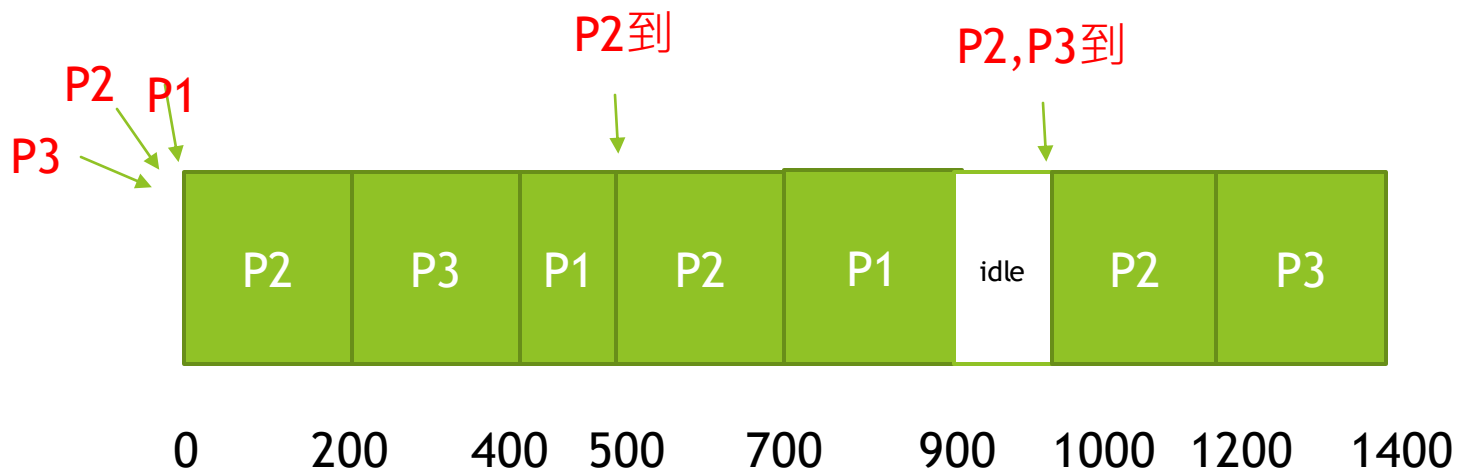


# 成果展示 (never miss deadline)

► Example:

Process	Period time(ticks)	CPU time(ticks)
P1	2000	300
P2	500	200
P3	1000	200

因為P2之period time最低，所以 statically priority  $P2 > P3 > P1$



-----  
Start scheduling~  
-----

P2 is End  
The tick is 200

P3 is End  
The tick is 403

P2 is arrival  
The tick is 500

P2 is End  
The tick is 701

P1 is End  
The tick is 908

P3 is arrival  
The tick is 1000

P2 is arrival  
The tick is 1000

P2 is End  
The tick is 1202

P3 is End  
The tick is 1405

P2 is arrival  
The tick is 1500

P2 is End  
The tick is 1702

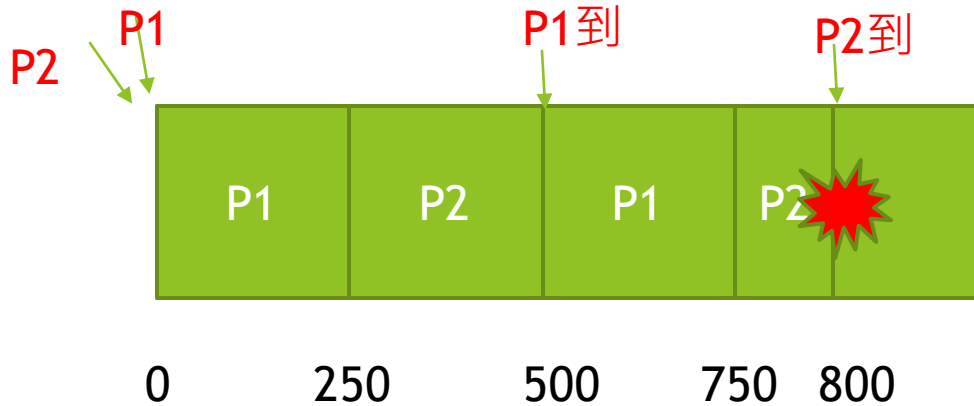
P1 is arrival  
The tick is 2000

# 成果展示 (miss deadline)

► Example:

Process	Period time(ticks)	CPU time(ticks)
P1	500	250
P2	800	350

因為P1之period time較低，所以 statically P1 priority > P2 priority.



**P2 miss its deadline !**

```
PuTTY (inactive)
-----
Start scheduling~
-----
P1 is End
The tick is 250

P1 is arrival
The tick is 500

P1 is End
The tick is 752

P2 MISS DEADLINE !!!!!
The tick is 800

P1 is arrival
The tick is 1000

P1 is End
The tick is 1252

P1 is arrival
The tick is 1500

P1 is End
The tick is 1752

P1 is arrival
The tick is 2000

P1 is End
The tick is 2252
```

# Example user task

```
void Test_T_3(){  
    uint32_t sum = 0;  
    while(sum < 200)  
    {  
        tickone();  
        sum+=1;  
    }  
}
```

```
xTaskCreateTaskPeriod(  
    Test_T_3, //TaskFunction_t  
    "P3",    //pcName  
    512,     //configSTACK_DEPTH_TYPE  
    NULL,    // pvParameters  
    NULL,    //TaskHandle_t  
    1000     //PeriodTime  
);
```

► 謝謝大家！