
Embedded Systems Programming

RT Task Model (Module 22)

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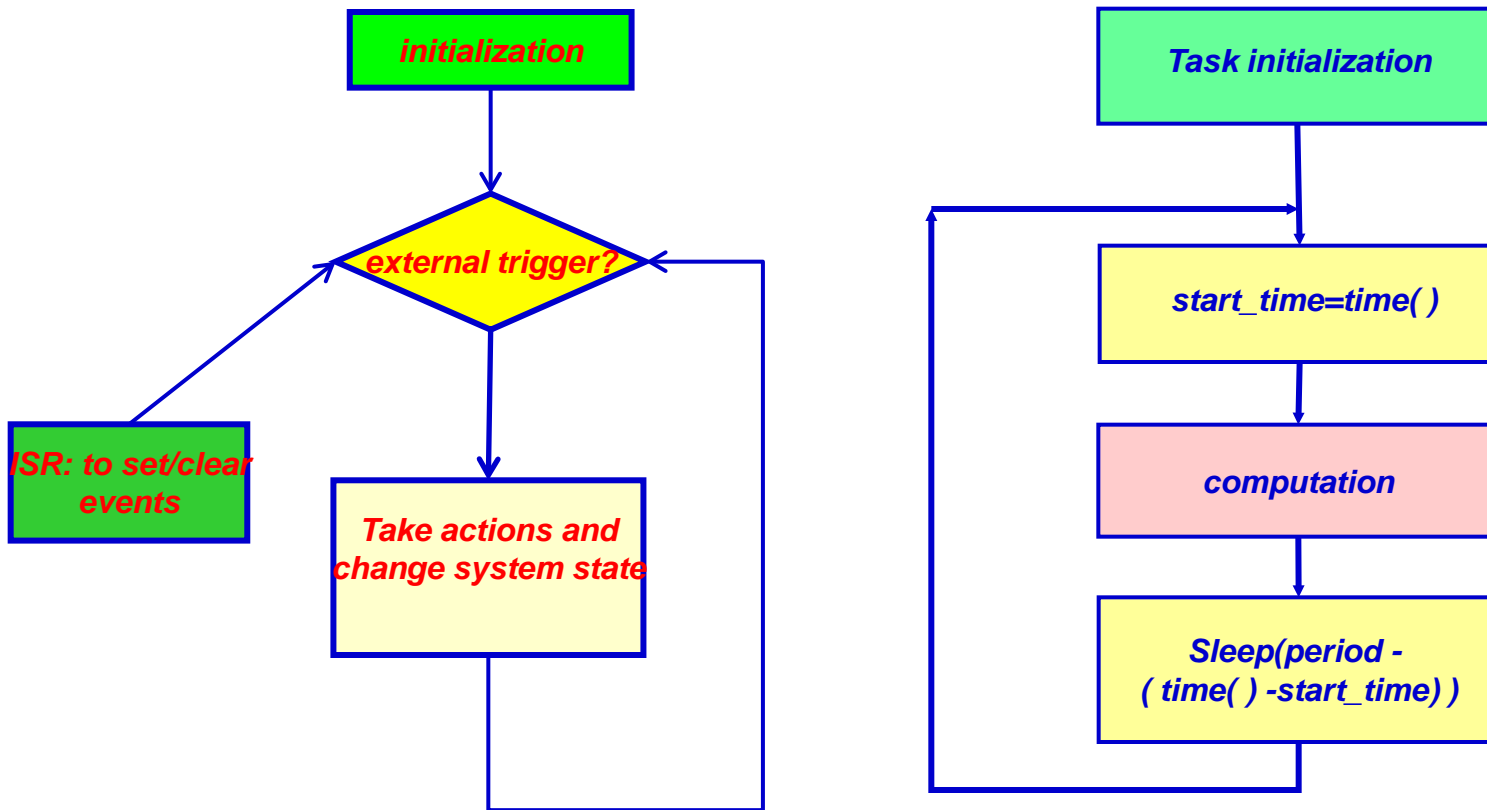
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Event and Time-Driven Threads

`pthread_create (...)`

`taskSpawn (name, priority, options, stacksize, main, ...)`



Multiple Events in One Thread

```
void compute()  
{  
    if (event1) then action1;  
    if (event2) then action2;  
    if (event3) then action3;  
    .  
}
```

```
or  
{  
    for (i=0, i<n, i++)  
        if event[i] then action[i];  
}
```

```
void compute()  
{  
    if (event1) then action1;  
    else if (event2) then action2;  
    else if (event3) then action3;  
    .  
}
```

```
or  
{  
    for (i=0, i<n, i++) {  
        if event[i] then {  
            action[i];  
            break; }    }  
}
```



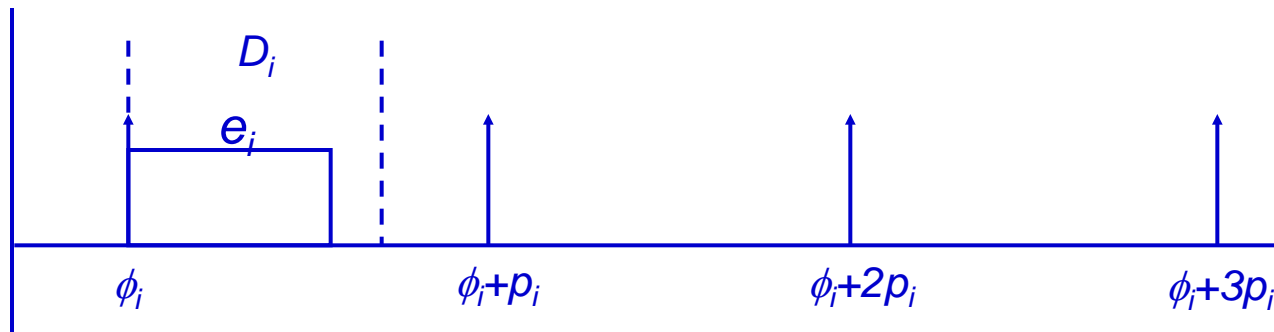
Task model

□ Periodic task T_i : (examples ??)

- ❖ constant (or bounded) period, p_i : inter-release time between two consecutive jobs
- ❖ phase ϕ_i , utilization $\mu_i = e_i / p_i$, deadline (relative) D_i

□ Aperiodic and sporadic: (examples ??)

- ❖ uncertain interarrival times but with a minimum separation
- ❖ aperiodic: with a soft or no deadline
- ❖ sporadic: with a hard deadline



Terminology: Temporal Parameters

□ Release time:

- ❖ fixed (r), jitter $[r-\Delta, r+\Delta]$, sporadic or aperiodic

□ Execution time:

- ❖ uncertainty from memory refresh, contention due to DMA, cache misses, interrupts, OS overhead
- ❖ execution path variations

□ WCET: a “deterministic” parameter for the worst-case execution time

- ❖ a conservative measure
- ❖ an assumption to make scheduling and validation easier
- ❖ how can you measure the WCET of a job?



Terminology

- ❑ **Hard deadline: late result is little or no value, or may lead to disaster**
 - ❖ need to validate (can you guarantee it?)
- ❑ **Soft deadline: late result may still be useful**
 - ❖ probability of missing deadlines
 - ❖ 95% of telephone switch connects in 10 seconds
- ❑ **How serious is serious ?**
- ❑ **Tardiness:**
 - ❖ $\min\{0, \text{deadline} - \text{completion time}\}$
- ❑ **Usefulness:**
 - ❖ function of tardiness

