SPRINTS

Report On Scheduling Analysis

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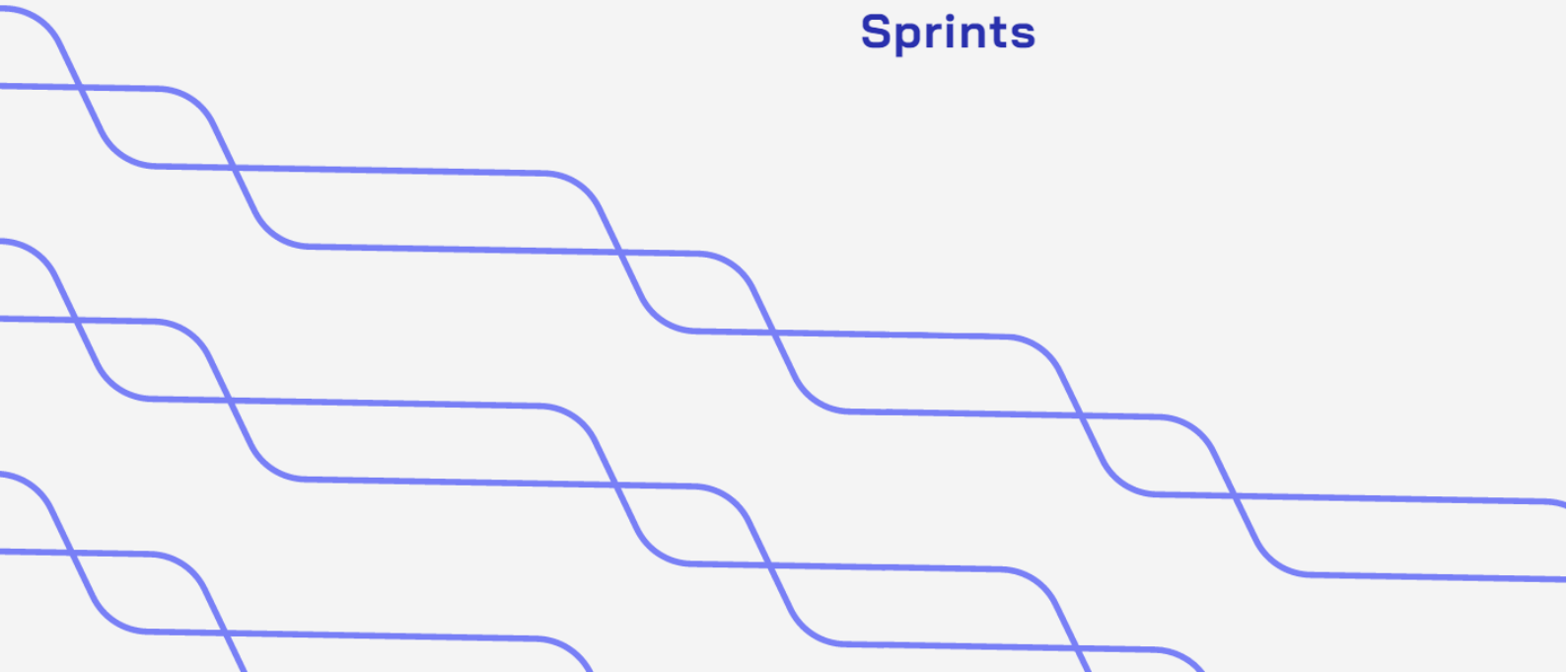
Presented to
Sprints



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1. Introduction

In this report, the task set is scheduled using the Rate Monotonic (RM) algorithm. The task set consists of three tasks: T1, T2, and T3, with their respective periodicity (P), execution time (E), and deadline (D) values provided.

The *first step* in the analysis is to **calculate the Rate Monotonic Utilization** (Urm) for the task set. Urm is determined by summing up the ratios of task execution times to their respective periods. By comparing Urm to the maximum allowable utilization (which is 1 for RM scheduling), we can assess the schedulability of the task set.

The *next step* is to **perform Time-Demand analysis**. This involves analyzing the worst-case execution times of the tasks and checking if they fit within their respective deadlines. If the execution times exceed the deadlines, it indicates a potential deadline miss.

Lastly, the task set is **modeled using the SimSo Simulator**, which provides a simulated environment for scheduling analysis. The simulator allows for the validation of the calculated metrics and provides insights into the scheduling behavior, such as missed deadlines or task conflicts.

2. System Design

2.2. System Analysis

2.2.1. System Data

Task	Task Type	Periodicity (ms)	Deadline (ms)	Execution Time (ms)	Priority
T1 Task	*Periodic*	*5*	*5*	*2.5*	*3*
T2 Task	*Periodic*	*15*	*15*	*4.5*	*2*
T3 Task	*Periodic*	*20*	*20*	*3.5*	*1*

2.2.2. Schedulability Using Rate Monotonic Utilization

Calculations,

- *Since*: **Urm** (Rate Monotonic Utilization) = $U = \sum_{i=1}^{n} \frac{C_i}{P_i} \leq n(2^{\frac{1}{n}} - 1)$

  where, **U =** Total Utilization
  C = Execution time
  P = Periodicity
  N = Number of tasks

- *Therefore*: **U** = (2.5 / 5) + (4.5 / 15) + (3.5 / 20) = **0.975**

  Urm = 3 (2 ^ (1 / 3) - 1) = **0.799**

- *Since*: **U** > **Urm** (i.e. Rate Monotonic Utilization is violated).

- *Therefore*: Further tests are required.

2.2.3. Schedulability Using Time Demand Analysis

Calculations,

- *Since*: $\mathbf{w_i(t)}$ (Worst Response Time) = $w_i(t) = e_i + \sum_{k=1}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k \quad for\ 0 < t \leq p_i$

  where, **W =** Worst response time
  E = Execution time
  P = Periodicity
  T = Time instance

- *Therefore*:

  Time Demand for *T1* is **W(5)** = 2.5 + 0 = ***2.5*** ms

  Time Demand for *T2* is **W(15)** = 4.5 + (15 / 5) x 2.5 = ***12*** ms

  Time Demand for *T3* is **W(20)** = 3.5 + (20 / 5) x 2.5 + (20 / 15) x 4.5 = ***22.5*** ms

- *Since*: *T1*: **W(5)** = ***2.5*** ms < **D** = ***5*** ms,
  T2: **W(15)** = ***12*** ms < **D** = ***15*** ms,
  and *T3*: **W(20)** = ***22.5*** ms > **D** = ***20*** ms.

- *Therefore*: *T1* and *T2* are **schedulable** tasks because they meet their deadline, while *T3* is **non-schedulable** because it misses its deadline.

2.2.4. System Simulation

The *SimSo Real-Time Scheduling Simulator* demonstrates that the system is unhealthy and non-schedulable. The calculated **CPU Load** of ***0.920*** aligns closely with the manual calculations. Additionally, the system exhibits non-schedulability as some tasks does not successfully meet its **deadline**.

	Total load	Payload	System load
CPU 1	0.9200	0.9200	0.0000
Average	0.9200	0.9200	0.0000

Figure 1. CPU Load Using SimSo Simulator

Task "T1" and Task "T2" are able to meet their respective deadlines, indicating that they complete their execution within their allotted time frames. However, Task "T3" fails to meet its deadline, indicating that it exceeds the allowed time for execution and misses the specified deadline.

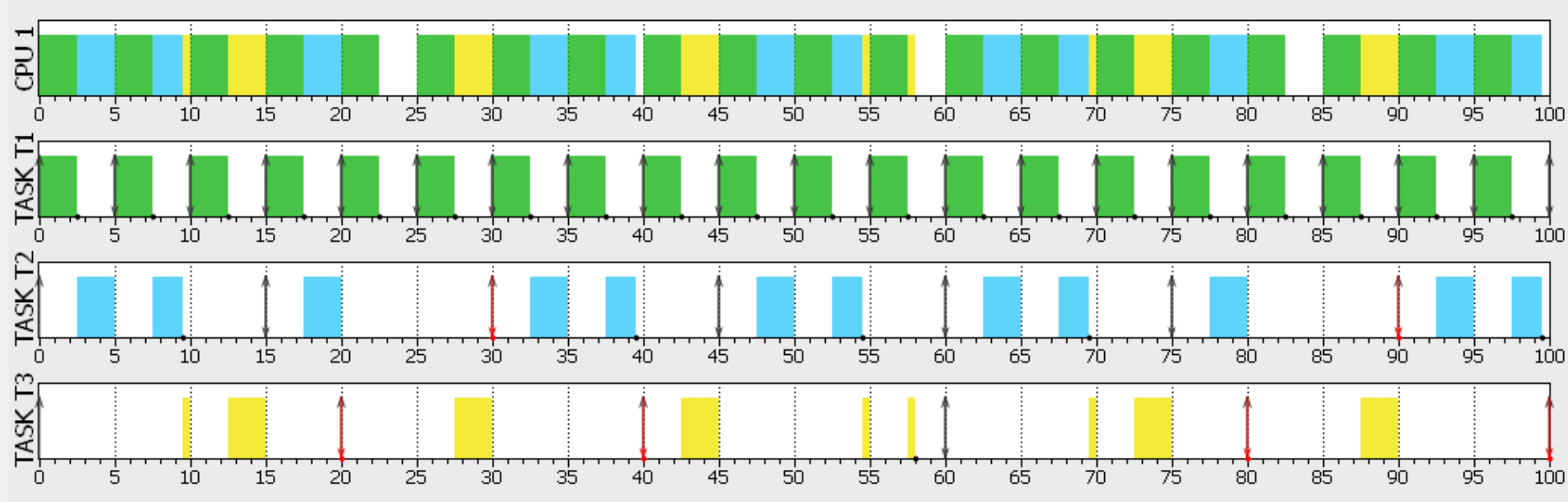

Figure 2. System Timeline Using SimSo Simulator