



Real-Time Operating System Project

Implementing EDF Scheduler Report

And verifying the system implementation

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Verifies system implementation with the EDF (Earliest Deadline First) scheduler using:

1. using analytical methods:

A- System Hyperperiod:

Task	Periodicity
Button 1 Monitor	50
Button 2 Monitor	50
Periodic Transmitter	100
UART Transmitter	20
Load 1 Simulation	10
Load 2 Simulation	100

Hyperperiod = Least Common Multiplier of all tasks periodicities

Hyperperiod = *LCM* (50, 50, 100, 20, 10, 100)

Hyperperiod = 100

B- CPU Load:

Task	Execution Time	Occurrence During Hyperperiod
Button 1 Monitor	29 us	2
Button 2 Monitor	29 us	2
Periodic Transmitter	93 us	1
UART Transmitter	30 us	5
Load 1 Simulation	5 ms	10
Load 2 Simulation	12 ms	1

Utilization = Total Execution Time During Hyperperiod / Hyperperiod

$$U = [(29\mu * 2) + (29\mu * 2) + (93\mu * 1) + (30\mu * 5) + (5m * 10) + (12m * 1) / 100m] * 100\% = 62\%$$

C- System Schedulability:

- Using Rate Monotonic Utilization Bound

$$U \leq n[2^{1/n} - 1]$$

$$U = 0.623 \quad \&\& \quad U_{rm} = 0.734$$

Therefore $U < U_{rm} \quad \rightarrow \quad \underline{\text{The system is feasible (Schedulable).}}$

- Using Time Demand Analysis

$$W_i(t) = e_i + \sum_{k=0}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k$$

In our case, critical instant = 100ms

Task	Periodicity	Execution Time
Button 1 Monitor	50	29 us
Button 2 Monitor	50	29 us
Periodic Transmitter	100	93 us
UART Transmitter	20	30 us
Load 1 Simulation	10	5 ms
Load 2 Simulation	100	12 ms

For Task 1: Button 1 Monitor (E: 29us, P: 50ms, Provided Time=50ms)

$$w_3(50) = 29\mu + (50/10) 5m + (50/20) 30\mu = 25.059 \text{ ms}, w(50) = 25.059 < 50$$

Therefore, Button 1 Monitor task is schedulable

For Task 2: Button 2 Monitor (E: 29us, P: 50ms, Provided Time=50ms)

$$w_4(50) = 29\mu + (50/10) 5m + (50/20) 30\mu + (50/50) 29\mu = 25.087 \text{ ms}, w(50) = 25.087 < 50$$

Therefore, Button 2 Monitor task is schedulable

For Task 5: Periodic Transmitter (E: 93 us , P: 100ms, Provided Time=100ms)

$$w_5(100) = 93\mu + (100/10) 5m + (100/20) 30\mu + (100/50)29\mu + (100/50)29\mu = 50.359 \text{ ms}$$

$$w(100) = 50.359 < 100$$

Therefore, Periodic Transmitter task is schedulable.

For Task 4: UART Receiver (E: 30us, P: 20ms, Provided Time=20ms)

$$w_2(20) = 30\mu + (20/10) 5m = 10.03 \text{ ms}, w(20) = 10.03 < 20$$

Therefore, UART Receiver task is schedulable.

For Task 3: Load 1 Simulation (E: 5ms, P: 10ms, Provided Time=10ms)

$$w_1(10) = 5m + 0 = 5, w(10) = 5 < 10$$

Therefore, Load 1 Simulation task is schedulable.

For Task 6 : Load 2 Simulation (E: 12ms , P: 100ms, Provided Time=100ms)

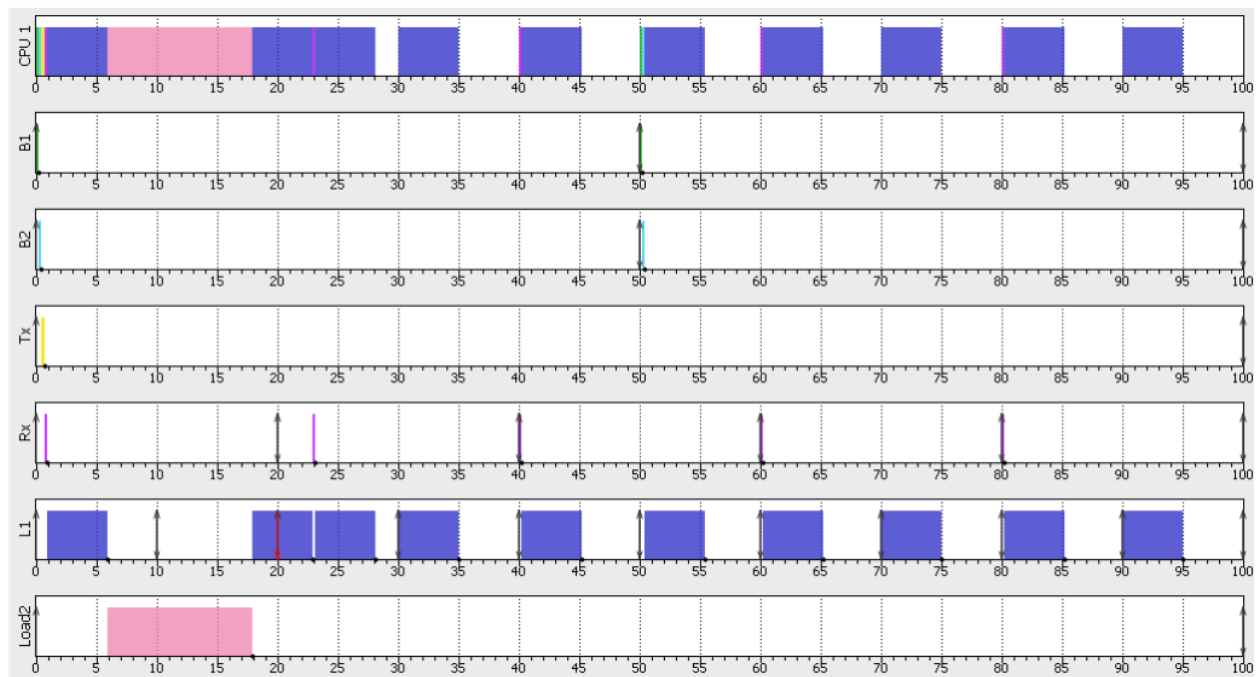
$$w_6(100) = 12m + (100/10)5m + (100/20)30\mu + (100/50)29\mu + (100/50)29\mu + (100/100)93\mu$$

$$w(100) = 62.452 < 100$$

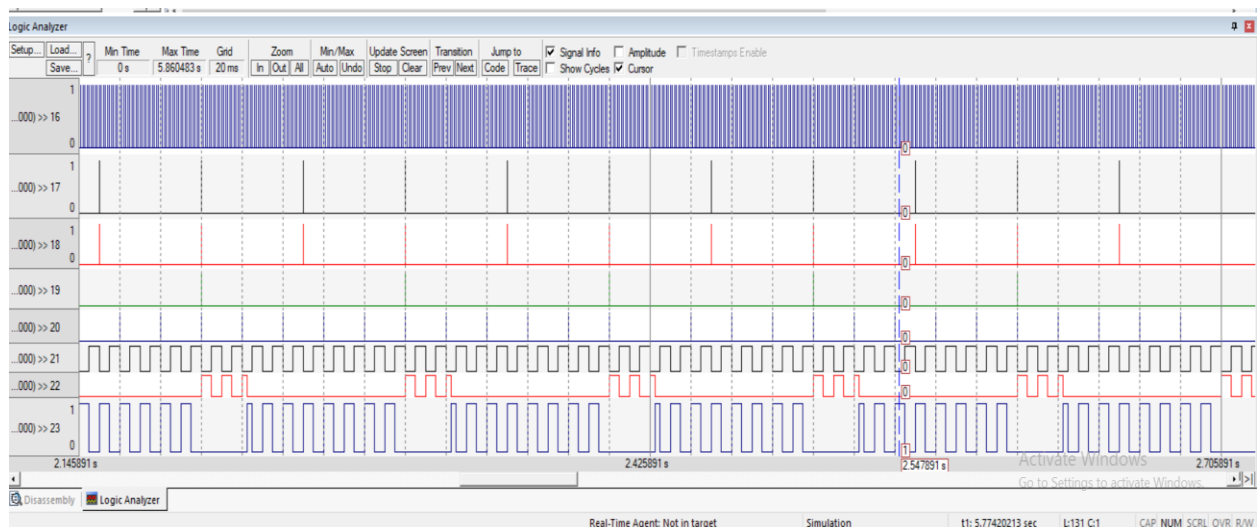
Therefore, Load 2 Simulation Task is schedulable.

((System is Schedulable))

2. SIMSO Offline Simulator



3. Kiel Simulator



Watch 1		
Name	Value	Type
L1_inTime	0x0013570F	uint
L2_inTime	0x0013526B	uint
Rx_inTime	0x00135713	uint
Tx_inTime	0x00134DBD	uint
cpu_load	63	uint
total_exeTime	0x000C37D2	uint
T1TC	0x001357C0	ulong
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