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Distributed Operating Systems

Exercise 2: Real-Time Systems

In the tutorial, all solutions will be presented by students. Please be prepared for the questions as the exercise will focus on discussion.

Terminology

Briefly explain the following terms:

a) Real-time system

b) Hard, firm, and soft deadlines

Scheduling Strategies: Static Priorities

In a single processor real-time system, two periodic tasks T_1, T_2 are to be scheduled with the following values (p_i period length, t_i execution time, period end = deadline):

$$p_1 = 5\,\text{s}, \quad t_1 = 2\,\text{s}$$

$$p_2 = 3\,\text{s}, \quad t_2 = 1\,\text{s}$$

There are no dependencies between the tasks and they can be interrupted anywhere. The tasks are to be planned with a scheduling algorithm using static priorities.

a) Analyse whether this is possible. Draw a visualisation of the resulting schedule.

b) Review the proof sketch for the optimality of rate-monotonic scheduling.

c) After a while, a new task T_3 arrives with the following parameters. Discuss the situation.

$$p_3 = 5\,\text{s}, \quad t_3 = 1\,\text{s}$$

d) What if T_1 has an execution time of $2.1\,\text{s}$? Discuss consequences for schedulability.

Scheduling Strategies: Dynamic Priorities

In a single processor real-time system, three periodic tasks T_1, T_2, T_3 are to be scheduled with the following values (p_i period length, t_i execution time, period end = deadline):

$$p_1 = 6\,\text{s}, \quad t_1 = 2\,\text{s}$$

$$p_2 = 3\,\text{s}, \quad t_2 = 1\,\text{s}$$

$$p_3 = 4\,\text{s}, \quad t_3 = 1\,\text{s}$$

a) The scheduling algorithm EDF is to be used. Analyse the schedulability of the task set and draw a visualisation of the schedule.

b) Task T_3 should execute longer. What is the maximum execution time such that the system remains schedulable?