Lecture notes in Real Time systems

Lecture 6

Classical Uniprocessor Scheduling algorithms:

In order to simplify the schedulability analysis, the following hypotheses are assumed on the tasks:

A1. The instances of a periodic task τ_i are regularly activated at a constant rate. The interval T_i between two consecutive activations is the *period* of the task.

A2. All instances of a periodic task τ_i have the same worst-case execution time C_i.

A3. All instances of a periodic task τ_i have the same relative deadline D_i, which is equal to the period T_i.

A4. All tasks in Γ are independent; that is, there are no precedence relations and no resource constraints.

In addition, the following assumptions are implicitly made:

A5. No task can suspend itself, for example on I/O operations.

A6. All tasks are released as soon as they arrive.

A7. All overheads in the kernel are assumed to be zero.

Rate-monotic Scheduling algorithm:

It is a uniprocessor static-priority preemptive scheme. The following assumptions are made in addition to the above:

A8 All tasks are periodic.

A9 The relative deadline of a task is equal to its period.

The priority of a task is inversely related to its period: If task Ti has a smaller period than task Tj, Ti has higher priority than Tj. Higher-priority tasks can preempt lower-priority tasks.

If the total utilization of a tasks is no greater than $n*(2^{1/n} -1)$ where n is the number of tasks to be scheduled then RM algorithm will schedule all the tasks to meet their respective deadlines. This condition is sufficient but not necessary.

Example: Consider you have the following task set. Schedule them using RM algorithm:

Task	Ci oe Exi	Pi or Ti
T1	2	6

T2	3	9
T3	1	15

Solution: Note period of T1 is smaller than P2 and P2 is smaller than P3. So priority of T1 is the highest then T2 then T3. It means when T1 becomes it can preempt T and T2. T2 can preempt T3.

The profile of T1 as the following:

Task T1	Realese	EX	di
$T_{1,1}$	0	2	6
$T_{1,2}$	6	2	12
$T_{1,3}$	12	2	18
$T_{1,4}$	18	2	24
$T_{1,5}$	24	2	30
…			

The profile of Task2 is as the following:

Task2	Release	Ex	di
$T_{2,1}$	0	3	9
$T_{2,2}$	9	3	18
$T_{2,3}$	18	3	27
……			

The profile of task 3 is as the following:

Task3	Release	Ex	di
$T_{3,1}$	0	1	15
$T_{3,2}$	15	1	30
$T_{3,3}$	30	1	45
……			

So the schedule becomes:

T1,1*	T2,1*	T3,1*	T1,2*	Idle	T2,2*	T1,3*	Idle	T3,2*	Idle	….

0 2 5 6 8 9 12 14 15 16 18

The total utilization is 2/6 + 3/9 + 1/15 = 0.7333

While $3 * (2^{1/3} - 1) = 0.7788$

So its schedule for sure.