REAL TIME OPERATING SYSTEMS

Lesson-23: Performance Metrics
1. Models for Performance Measures
Three types of tasks for finding performance

- Scheduler must take into account (aperiodic, periodic and sporadic) separately.
- (i) An aperiodic task needs to be run only once.
- (ii) A periodic task needs to run after the fixed periods and it that must be executed before its next preemption is needed.
- (iii) A sporadic task needs to be checked for run after a minimum time period of its occurrence.
Predictably response to the event and minimum interrupt latency as Performance Measures

- An RTOS should quickly and predictably respond to the event.
- It should minimum interrupt latency and fast context switching latency.
Three Models for Performance Measures

- (i) Ratio of the sum of latencies of the tasks and Interrupt with respect to the sum of the execution times.
- (ii) CPU load for how much time CPU not idle
- (iii) Worst-Case Execution time with respect to mean execution time.
Interrupt latencies as Performance Metric

- Interrupt and task execution latencies with respect to the sum of the execution times must be very small.
- There must be fast context switching.
CPU Load as Performance Metric

- Each task gives a load to the CPU that equals the task execution time divided by the task period.
- CPU load or *system load* estimation in the case of multitasking is as follows. Suppose there are $m$ tasks. For the multiple tasks, the *sum* of the CPU loads for all the tasks and ISRs should be less than 1.
CPU Load

- CPU load equal to 0.1 (10%)—means the CPU is underutilized and spends its 90% time in a waiting mode.
- Since the execution times can vary or and the task periods vary, the CPU loads can also vary.
Sporadic Task Model Performance Metric

- $T_{\text{total}} = \text{Total length of periods for which sporadic tasks occur}$
- $e = \text{Total Task Execution Time}$
- $T_{av} = \text{Mean periods between the sporadic occurrences}$
- $T_{\text{min}} = \text{Minimum Period between the sporadic occurrences}$
Sporadic Task Model Performance Metric

- Worst-Case Execution-time performance metric, $p$ is measured calculated as follows for a tasks worst case of a task in a model.

$$p = p_{\text{worst}} = \frac{(e \ast T_{\text{total}} / T_{\text{av}})}{(e \ast T_{\text{total}} / T_{\text{min}})}.$$  

- Because average rate of occurrence of sporadic task $= (T_{\text{total}} / T_{\text{av}})$ and maximum rate of sporadic task burst $= T_{\text{total}} / T_{\text{min}}$. 

Summary
We learnt

- Various models to define a performance metric.
- Three performance metrics for schedule management by the RTOS
  - (i) interrupt latencies with respect to the execution times
  - (ii) CPU load.
  - (iii) Worst case execution time.
End of Lesson 23 of Chapter 8