University of Glasgow | School of Computing Science

Real-time Scheduling of Aperiodic and Sporadic Tasks

Advanced Operating Systems
Tutorial 2

Tutorial Outline

- Review of lectured material
- Worked examples

Review of Lectured Material

- Aperiodic and sporadic tasks; acceptance tests
- Scheduling aperiodic jobs
  - Background execution
  - Periodic servers: polling, deferrable, and sporadic
  - Critical instant analysis for fixed-priority deferrable server; maximum utilisation test for deferrable server in EDF systems
  - Sporadic server budget consumption/replenishment; proofs of correctness
- Scheduling sporadic jobs
  - Acceptance test in EDF systems: density of intervals
  - Acceptance test in rate monotonic systems: maximum usage over periods
- Implementation choices

Key Learning Outcomes

- Understand scheduling of aperiodic jobs using periodic server
- Understand design trade-off between types of periodic server
- Know scheduling guarantees for various types of periodic server
- Know how to accept and schedule sporadic jobs; scheduling tests

Worked Examples

- Deferrable server
- Sporadic tasks – acceptance test
- Sporadic tasks – in hard real-time systems

Example 1(a): Deferrable Server

- Consider a system with three periodic tasks:
  - $T_1 = (6, 1)$
  - $T_2 = (10, 1)$
  - $T_3 = (14, 3)$
- Questions:
  - What does an EDF schedule for this system look like?

Example 1(b): Deferrable Server

- Consider a system with three periodic tasks:
  - $T_1 = (6, 1)$
  - $T_2 = (10, 1)$
  - $T_3 = (14, 3)$
- Questions:
  - What does an EDF schedule for this system look like?
  - A deferrable server with period 4 and budget 1 is added. Can the system be scheduled?

Example 1(c): Deferrable Server

- Consider a system with three periodic tasks:
  - $T_1 = (6, 1)$
  - $T_2 = (10, 1)$
  - $T_3 = (14, 3)$
- Questions:
  - An aperiodic task arrives with $r_A = 6$ and $e_A = 2$. What does the schedule look like? How does the budget of the server vary?

Example 2: Sporadic tasks – Acceptance Tests

- When sporadic tasks are introduced into a priority-scheduled system of periodic tasks, it becomes necessary to incorporate an acceptance test into that system.
- Describe the purpose of an acceptance test, and why is it important for error handling.

Example 3: Sporadic tasks – Hard Real-Time

- Are sporadic tasks incompatible with hard real-time systems?

Discussion

- Should understand how to evaluate the schedules for various types of server
- Should know how to demonstrate correctness of a system with aperiodic or sporadic tasks scheduled using a periodic server

- Exercise 1 is due now
- Exercise 2 is available – due in tutorial 3