

SNS COLLEGE OF TECHNOLOGY

Coimbatore-35 An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

TOPIC 7: Task Specifications & Schedulability Analysis

RTOS/19ECT312/Embedded systems Design /M.Pradeepa/AP/SNSCT







Introduction

Schedulability analysis is a crucial aspect of real-time systems design, ensuring that tasks can meet their deadlines within the given system constraints. Here are the specifications and steps typically involved in schedulability analysis





•Definition of Real-Time Systems

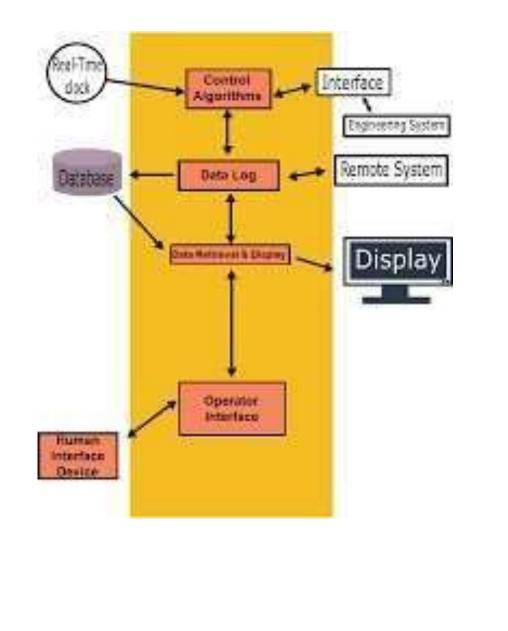
• Real-time systems are those that must respond to inputs or events within a specified time frame, often with strict timing constraints.

•Importance of Timeliness

• Real-time systems are crucial in sectors such as aerospace, automotive, healthcare, and industrial automation where timely responses are critical.

Introduction to Schedulability Analysis

• Schedulability analysis ensures that tasks in a real-time system meet their timing requirements, guaranteeing system reliability.









Task Specification

• Tasks are defined by parameters such as period, execution time, and deadline.

•Scheduling Policies

• Different scheduling policies, such as Rate Monotonic (RM) and Earliest Deadline First (EDF), influence schedulability.

•Utilization Bound

- The maximum allowable CPU utilization to maintain schedulability.
 Schedulability Test
 - Methods to determine if a set of tasks can be scheduled to meet all deadlines



7.



Task Interference

• Concurrent execution of multiple tasks can lead to interference and affect schedulability.

•Resource Contention

• Competition for shared resources may introduce delays, impacting task deadlines.

Dynamic Workloads

• Variations in task arrival rates or execution times challenge schedulability.





Response Time Analysis:

•Description: Calculate worst-case response times of tasks to ensure they meet their deadlines.

•Methodology: Iteratively analyze task response times considering the interference from higher-priority tasks.

•Schedulability Criterion: Ensure that the response time of each task is less than its deadline.

Simulation:

•Description: Evaluate schedulability under varying conditions through simulation. •Advantages: Provides a more realistic assessment of system behavior, accounting for dynamic workload variations and task interactions.

•Applications: Useful in complex systems or when analytical methods are insufficient





Model-Based Analysis:

•**Description:** Develop mathematical models of the system to analyze schedulability.

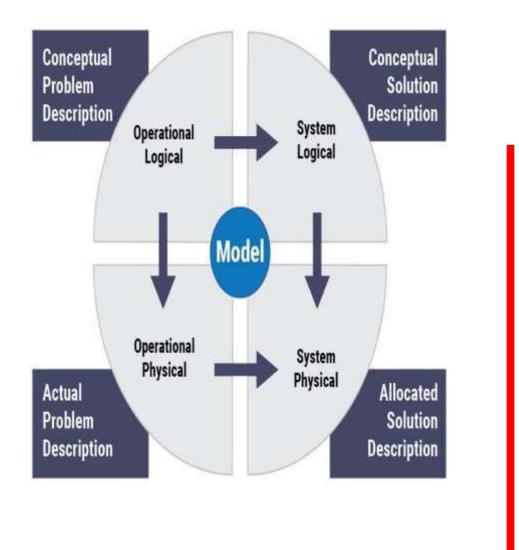
•Approaches: Includes techniques like Petri nets, state-space analysis, and formal verification methods.

•Advantages: Enables rigorous analysis of system behavior and schedulability properties.

Choosing the Right Technique:

•Consider system complexity, task characteristics, and available resources when selecting schedulability analysis techniques.

•Employ a combination of techniques for comprehensive analysis and validation of realtime systems.







Practical Considerations

Resource Sharing and Synchronization

• Addressing challenges related to shared resources and synchronization primitives in schedulability analysis.

•Trade-offs in Scheduling Policies

• Considerations when selecting between RM and EDF scheduling policies based on system requirements.

•Emerging Trends in Schedulability Analysis

• Advancements in scheduling algorithms, formal verification techniques, and integration with machine learning.

•Addressing Complexities in Dynamic Systems

• Strategies to tackle challenges posed by dynamic workloads and evolving system architectures





Conclusion:

•Schedulability analysis techniques play a crucial role in ensuring the timely and reliable operation of real-time systems.

•By applying appropriate analysis methods, designers can optimize system performance and meet stringent timing requirements.





THANK YOU

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