



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
1

TOPIC 7: Task Specifications & Schedulability Analysis



Task Specifications & Schedulability Analysis



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



Task Specifications & Schedulability Analysis



•Definition of Real-Time Systems

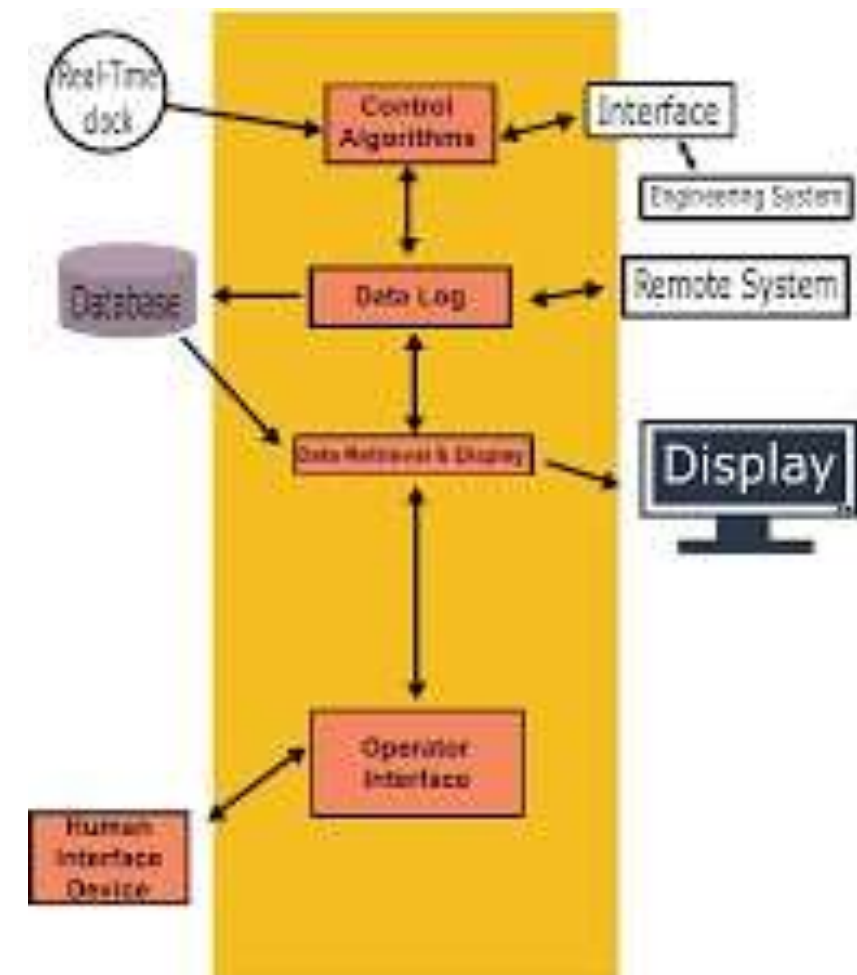
- Real-time systems are those that must respond to inputs or events within a specified time frame, often with strict timing constraints.

•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 Specifications & Schedulability Analysis



- **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



Task Specifications & Schedulability Analysis



- **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.



Task Specifications & Schedulability Analysis



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



Task Specifications & Schedulability Analysis

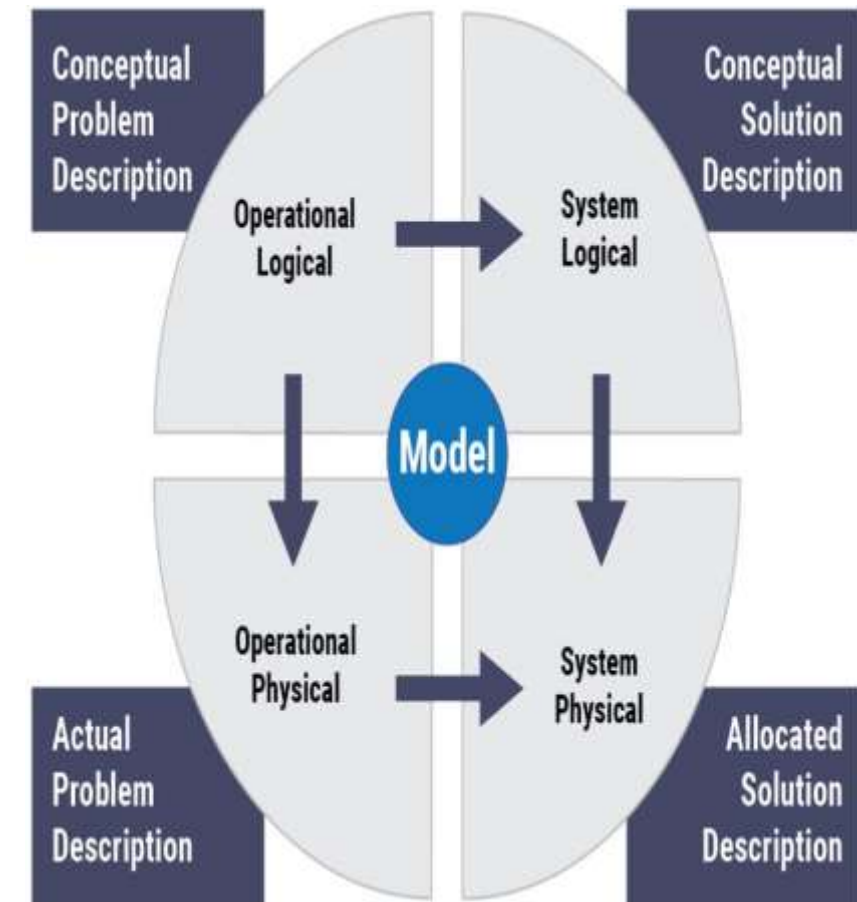


Model-Based Analysis:

- **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 real-time systems.





Task Specifications & Schedulability Analysis



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



Task Specifications & Schedulability Analysis



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