SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

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TOPIC 7 : Task Specifications & Schedulability Analysis

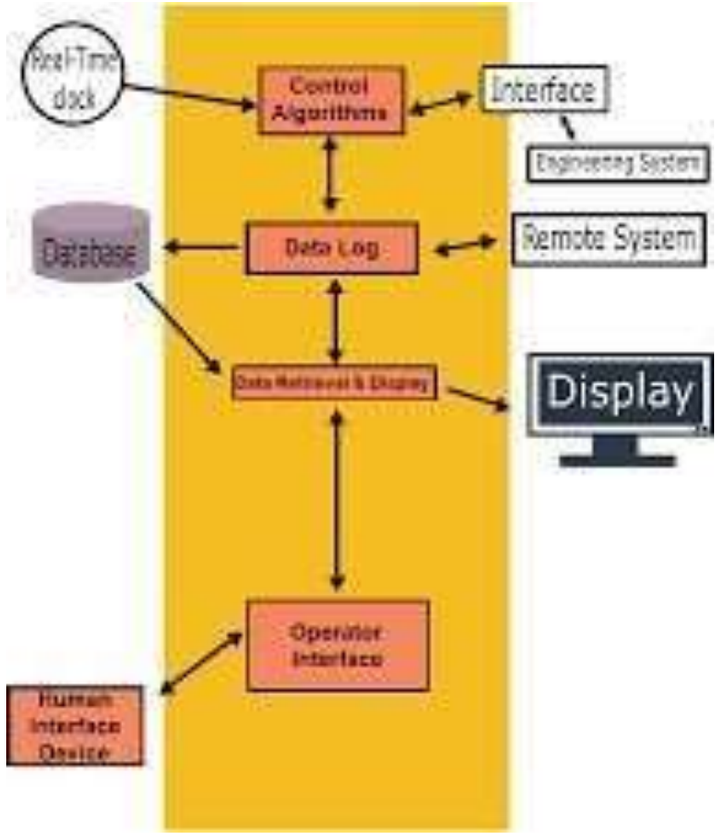
Task Specifications & Schedulability Analysis

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

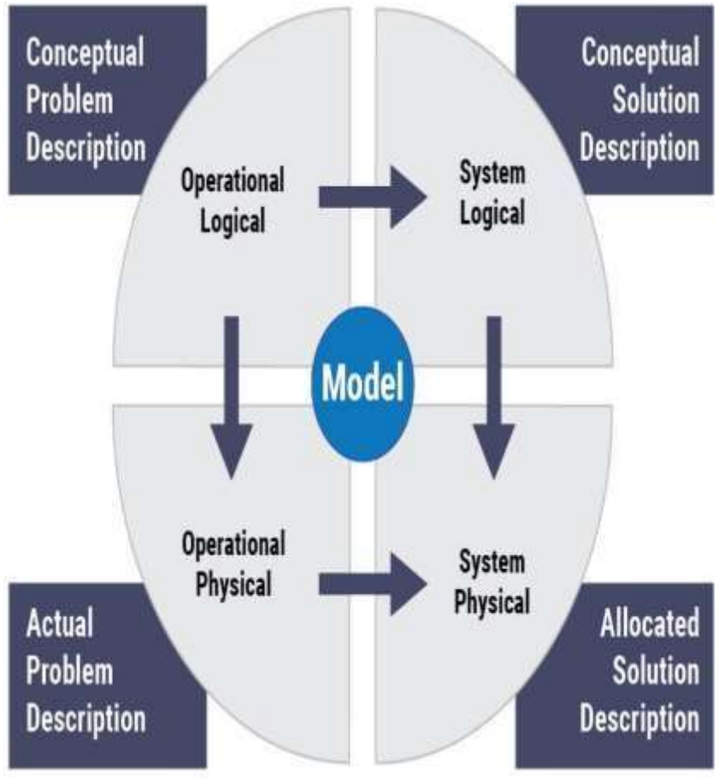
Task Specifications & Schedulability Analysis

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