

COEN383
Advanced Operating System
Project 3 Report
Group No. 5

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Overview

This project is a multi-threaded simulation of a concert ticket booking system. The system includes different types of ticket sellers, each with its own queue of customers. The goal is to efficiently sell concert tickets to customers while tracking response times, turnaround times, and overall system statistics, employing the main thread to orchestrate clock ticks and child threads to manage ticket sales processes within critical sections.

Key Assumptions:

1. Time Quanta: Child threads execute tasks in discrete time intervals, with the smallest unit being one minute. These intervals encapsulate various activities such as customer service and sales finalization.
2. Seller Thread States: Seller threads transition through distinct states during each time quanta, encompassing Waiting, Serving, Processing, and Completing.
3. Time Synchronization: Each completed transaction initiates a new clock time interval, ensuring coherence across diverse sales.
4. Concert Seating: Seating arrangements are represented in a 2D matrix, and access to this matrix is controlled through mutex locks.

Workflow:

1. Initialization: Initialization involves setting up mutex locks, the concert seat matrix, customer queues, and threads.
2. Waiting Phase: All threads are initialized and placed in a waiting state, anticipating the next clock tick.
3. Clock Tick Simulation: Rigorous control mechanisms guarantee the transmission of the clock tick signal only after all threads conclude their tasks. The main thread intelligently delays synchronizing with ongoing processes.
4. Matrix Access Control: Seller threads engage in a competition for access to the concert seat matrix triggered by the main thread's clock tick signal, contingent on their current states.
5. Customer Service: Seller threads navigate through potential clients based on arrival time, providing service one customer at a time.
6. Sales Simulation: Time delays are strategically introduced and decremented with each clock tick, emulating the gradual completion of sales. Upon the arrival of new customers, a random time delay is generated, culminating in the finalization of the sale when the delay reaches zero.

Project Structure

concert.c

This file contains the main simulation logic, including the definition of ticket sellers, customers, and the overall simulation flow. It utilizes pthread for multi-threading and includes the necessary functions for creating and managing threads.

utility.h **and** utility.c

These files provide utility functions for managing linked lists and queues. The linked list and queue data structures are used to organize customers and facilitate their processing by the ticket sellers.

Important Note:

The project's design ensures a serialized approach to seat allocation while allowing concurrent processing. The ability to serve all 10 customers simultaneously, demonstrated in the output, underscores the project's efficacy (considering $n = 10$ customers per ticket seller).

Simulation Details

The simulation progresses through time slices, and each ticket seller type (High, Medium, Low) operates independently, serving customers and selling tickets. The simulation tracks response times, turnaround times, and updates the concert seating chart as tickets are sold.

Results and Statistics

After the simulation completes, the program outputs detailed statistics on the ticket sellers' performance, including the number of customers served, seats sold, returned tickets, and throughput. Additionally, average turnaround time and response time for each ticket seller type are provided.

How to Read the Output

The output is organized into sections, including the simulation start, the main time-sliced simulation loop, the concert seating chart, and final statistics. Each section provides detailed information about the ongoing simulation and its results.

Conclusion

This multi-threaded concert ticket booking system simulation demonstrates the efficient sale of tickets by different types of sellers. The project helps in understanding the concurrency aspects of a real-world scenario and provides insights into the performance metrics of the ticket selling process.