REAL TIME OPERATING SYSTEMS

Lesson-10:

Real Time Operating System

1. Real Time Operating System Definition

Real Time

- A real time is the time which continuously increments at regular intervals after the start of the system and time for all the activities at difference instances take that time as a reference in the system.

RTOS

- A real time operating system (RTOS) is multitasking operation system for the applications with hard or soft real time constraints

RTOS

- Real-time constraint means constraint on occurance of an event and system expected response and latency to the event.

Basic OS Functions

- Process Management,
- Resources Management,
- Device Management,
- I/O Devices subsystems
- Network Devices and subsystems management

Process Priorities Allocation

- User level priorities allocation, called static priority allocation or real-time priority allocation is permitted.
- The real time priorities are higher than the dynamically allocated priorities to the OS functions and the idle priority allotted to low priority threads.
- The idle priority thread or task is one which runs when no other high priority ones running.

Process Management by Preemption

- RTOS kernel preempts a lower priority process when a message or event for that was waiting is obtained for the higher priority process.
- The RTOS kernel has the preemption points at the end of the critical code and therefore the RTOS can be preempted at those points by a real time high priority task.
- Only small sections in the RTOS functions are non-preemptive

Process Priorities Management by priority Inheritance

- Priorities Inheritance enables a shared resource in low priority task, for example, LCD display, be used by high priority task first.
- An intermediate priority task will not preempt the low priority task when it is locked to run the critical shared resource or code for the high priority task.

Process Priorities Management by priority Inheritance

- Priority sealing in place of priority inheritance option can also be used for a specific system.

Process Predictability

- A predictable timing behavior of the system and a predictable task-synchronization with minimum jitter (difference between best case latency and worst case latency)

Memory Management by Protection

- In RTOS threads can run in kernel space.
- The real time performance becomes high. However, then a thread can access the kernel codes, stack and data memory space, and this could lead to unprotected kernel code

Memory Management: Disabling MMU

- Either disabling use of MMU and virtual memory or using memory locks.
- Memory locking stops page swapping between physical memory and disk disabled. This makes RTOS task latencies predictable and reduces jitter (time between worst case latency and best case latencies for a task or thread).

Memory Allocation

- In RTOS, the memory allocation is fast and there are , fixed length memory block allocationt and system takes predictable time for allocation

Scheduling and Interrupt-latency control functions

- Real time Task-Scheduling and Interrupt-latency control and uses of the timers and system clocks

Timer Functions and Time Management

- Provides for timer functions. There is time allocation and de-allocation to attain best utilization efficiency in given timing constraints

Asynchronous IO Functions

- Permits asynchronous IOs, which means IOs without blocking a task

IPC Synchronization

- Synchronization of tasks with IPCs (Semaphores, mailboxes, message queues, pipes, sockets and RPCs)

Spin Locks

- Spin locks for critical section handling

Hard and soft real time operability

- Hard real-time and soft real-time operations

Time Slicing

- Time-slicing of the processes execution of those processes which have equal priority

Summary

We learnt

- RTOS is an OS for response time controlled and event controlled processes. The processes have predicable latencies and execute by preemptive scheduling
- An RTOS is an OS for the systems having the hard or soft real timing constraints and deadline on the tasks, ISTs and ISRs

End of Lesson 10 of Chapter 8