Advanced Operating System

Assignment -2

By

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Designation

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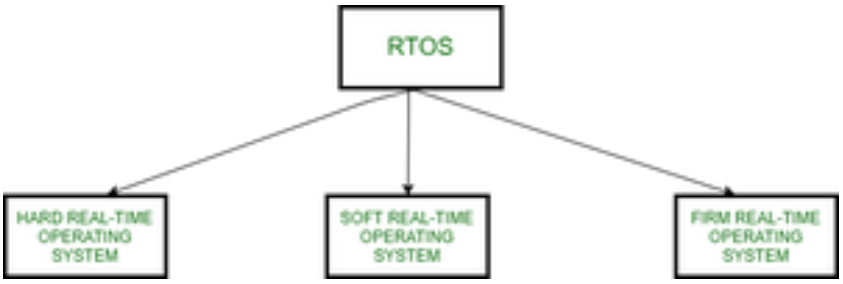
Q1. Write a report on Real Time operating System - RTOS ?

Real-time **operating systems (RTOS)** are used in environments where a large number of events, mostly external to the computer system, must be accepted and processed in a short time or within certain deadlines. such applications are industrial control, telephone switching equipment, flight control, and real-time simulations. With an RTOS, the processing time is measured in tenths of seconds. This system is time-bound and has a fixed deadline. The processing in this type of system must occur within the specified constraints. Otherwise, This will lead to system failure.
Examples of the real-time operating systems: Airline traffic control systems, Command Control Systems, Airlines reservation system, Heart Pacemaker, Network Multimedia Systems, Robot etc.
The real-time operating systems can be of 3 types –



1. **Hard Real-Time operating system:**
   These operating systems guarantee that critical tasks be completed within a range of time.
   For example, a robot is hired to weld a car body. If the robot welds too early or too late, the car cannot be sold, so it is a hard real-time system that requires complete car welding by robot hardly on the time., scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc.

2. **Soft real-time operating system:**
   This operating system provides some relaxation in the time limit.
   For example – Multimedia systems, digital audio systems etc. Explicit, programmer-defined and controlled processes are encountered in real-time systems. A separate process is changed with handling a single external event. The process is activated upon occurrence of the related event signalled by an interrupt.

   Multitasking operation is accomplished by scheduling processes for execution independently of each other. Each process is assigned a certain level of priority that corresponds to the relative importance of the event that it services. The processor is allocated to the highest priority processes. This type of schedule, called, priority-based preemptive scheduling is used by real-time systems.

3. **Firm Real-time Operating System**:
   RTOS of this type have to follow deadlines as well. In spite of its small impact, missing a deadline can have unintended consequences, including a reduction in the quality of the product. Example: Multimedia applications.

Advantages:
The advantages of real-time operating systems are as follows-

1. **Maximum consumption –**
   Maximum utilization of devices and systems. Thus more output from all the resources.

2. **Task Shifting –**
   Time assigned for shifting tasks in these systems is very less. For example, in older systems, it takes about 10 microseconds. Shifting one task to another and in the latest systems, it takes 3 microseconds.

3. **Focus On Application –**
   Focus on running applications and less importance to applications that are in the queue.

4. **Real-Time Operating System In Embedded System –**
   Since the size of programs is small, RTOS can also be embedded systems like in transport and others.

5. **Error Free –**
   These types of systems are error-free.

6. **Memory Allocation –**
   Memory allocation is best managed in these types of systems.

Disadvantages:
The disadvantages of real-time operating systems are as follows-

1. **Limited Tasks –**
   Very few tasks run simultaneously, and their concentration is very less on few applications to avoid errors.

2. **Use Heavy System Resources –**
   Sometimes the system resources are not so good and they are expensive as well.

3. **Complex Algorithms –**
   The algorithms are very complex and difficult for the designer to write on.

4. **Device Driver And Interrupt signals –**
   It needs specific device drivers and interrupts signals to respond earliest to interrupts.

5. **Thread Priority –**
   It is not good to set thread priority as these systems are very less prone to switching tasks.

6. **Minimum Switching –** RTOS performs minimal task switching.

Comparison of Regular and Real-Time operating systems:

Regular OS	Real-Time OS (RTOS)
Complex	Simple
Best effort	Guaranteed response
Fairness	Strict Timing constraints
Average Bandwidth	Minimum and maximum limits
Unknown components	Components are known
Unpredictable behavior	Predictable behavior
Plug and play	RTOS is upgradeable

Q2. Why is ROM characterized as Non-Volatile?

The term "non-volatile" describes ROM due to the following reasons:

- **Permanent Data Storage:** Unlike volatile memory, which loses data upon power loss, ROM retains data even when the computer is turned off. This characteristic makes ROM an ideal choice for storing critical instructions that need to be available every time the computer starts up.

- **Data Retention:** ROM maintains data integrity over extended periods, ensuring that the information stored within it remains intact throughout the lifespan of the computer. This reliability is crucial for preserving essential system-level instructions, such as the BIOS (Basic Input/Output System) or firmware settings.

- **Limited Write Capabilities:** Unlike other types of memory, ROM has limited or no write capabilities. The data programmed into ROM during the manufacturing process remains fixed, and normal computer operations cannot modify or erase this data. This read-only nature ensures that the stored information remains unchanged and prevents accidental alterations or corruption.

- **Importance in Booting Process:** ROM plays a crucial role in the computer's booting process by providing the initial instructions required to start the system. It contains the firmware responsible for initializing hardware components, performing self-tests, and loading the operating system. The nonvolatility of ROM ensures that these instructions are always accessible and unaffected by power cycles.