Report - Operating Systems

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1 Introduction

CPU scheduling is an operating system (OS) process that assist in the management of active processes occurring within the Central Processing Unit(CPU) at any given time. CPU Schedulers ensure that efficient use of the CPU by minimizing idle time and avoiding bottle necks. The following are two CPU Scheduling I chose to take a deeper look at for various reasons

2 CPU Scheduling Algorithms

2.1 First Come, First Served(FCFS)

This scheduling algorithm is the simplest scheduling algorithm. As the name implies, this algorithm executes processes in the order they arrive in the ready queue and is similar to the First In, First Out (FIFO) queue. It is also non - preemptive meaning, once a process executes, it can be interrupted until it is complete.

2.1.1 Characteristics of FCFS(Strengths and Weaknesses)

- It is a simple and fair algorithm
- There is no starvation during the implementation of this algorithm as every process will eventually be executed.
- It has a relatively high waiting time as sometimes there are cases where short processes are waiting after long one since the longer process arrived to the queue first.

2.1.2 Performance Analysis

Example : For a process set with burst times [5, 8, 3]

- Waiting time for each process : [0, 5, 13]
- Average Waiting Time: (0 + 5 + 13) / 3 = 6 units
- Turnaround Time: [5, 13, 16]

2.2 Round Robin (RR)

Unlike FCFS, Round Robin (RR) is a preemptive scheduling algorithm where each process is assigned, a fixed slice time(Quantum) and once the time slice expires, the process is moved back to the ready queue if it hasn't finished executing

2.2.1 Characteristics of RR(Strengths and Weaknesses)

- Though not as simple as FCFS, it is fair when it comes to the sharing of CPU time
- This algorithm is designed to prevent starvation
- Context switching can be costly if the time slice is too short
- Choosing an optimal time quantum is challenging. If it's too large, RR behaves like FCFS; if too small, the overhead increases.

2.2.2 Performance Analysis

Example : For a process set with burst times [P1: 5, P2:8, P3] and quantum = 4

- Execution order P1 (4) -¿ P2 (4) -¿ P3 (3) -¿ P1 (1) -¿ P2 (4)
- Waiting time for each process : [4, 5, 0]
- Average Waiting Time: (4 + 5 + 0) / 3 = 3 units
- Turnaround Time: [5, 13, 16]

3 Summary of Metrics Comparison

Metrics	FCFS	Round Robin
Fairness	High, but long jobs may delay others	High, every process gets equal time
Complexity	Low	Moderate (requires context switching)
Average Waiting Time	Can be high due to convoy effect	Generally better with the right quantum
CPU Utilization	May be low if long jobs dominate	Higher due to preemption
Best Use Case	Batch systems, simple queues	Interactive systems, time-sharing OS

Table 1: CPU Scheduling Metrics Summary for FCFS and RR.