CPU Scheduling Algorithm Metrics

Based on Average Arrival Rate

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Introduction

This report summarizes the findings of a study on the simulation of four different CPU scheduling algorithsm. Given increasing average arrival rates (λ), as well as quantum values (q) for Round Robin we monitor the changes in the following metrics:

1) Average turnaround time (Tq)

2) Total throughput

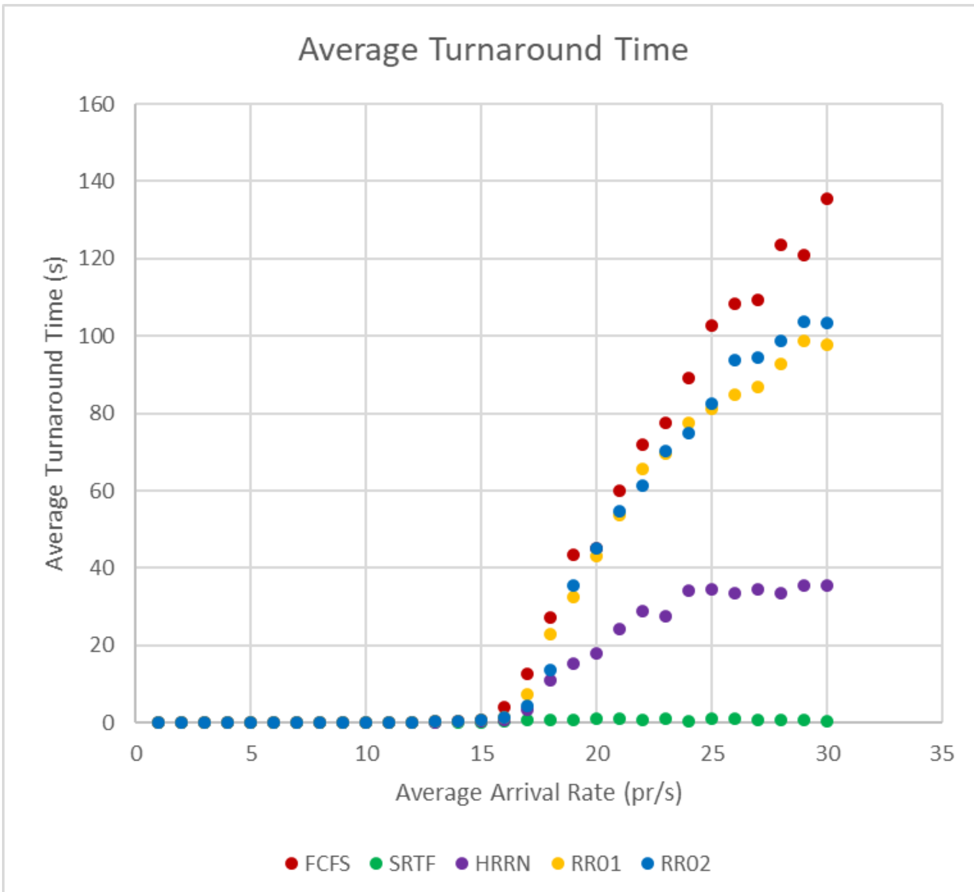
3) CPU utilization (P)

4) Average number of processes in ready queue (w)

With all algorithms, the CPU overloads at around $\lambda = 16$, as the average service rate (Ts) is 0.06, which results in a process service rate of 1 / 0.06 = 16.67. In this simple single-CPU system, if the service rate is less than the arrival rate, overflow is inevitable.

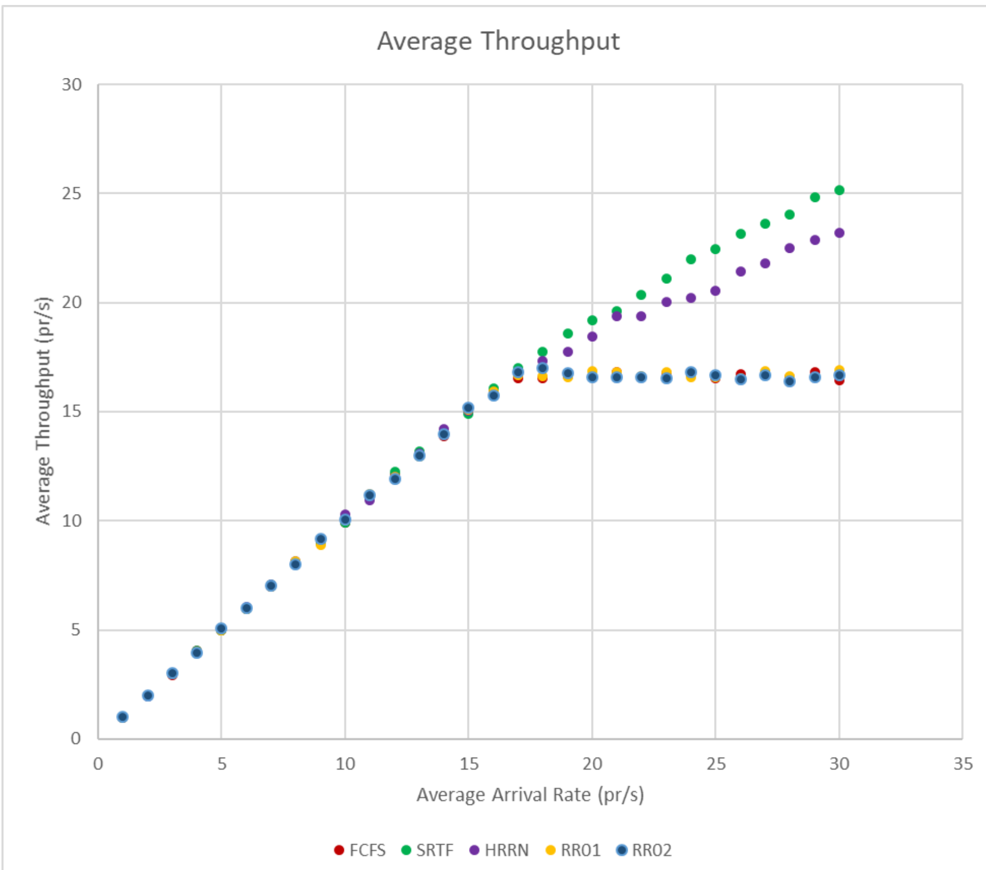
Average Turnaround Time (Tq)

Tq was computed by summing each process' unique turnround time and then dividing that sum by the total handled processes. Note that at λ = 16 is when the values begin to diverge from one another significantly. This is due to the start of the arrival rate beginning to outpace the service rate.



Average Throughput

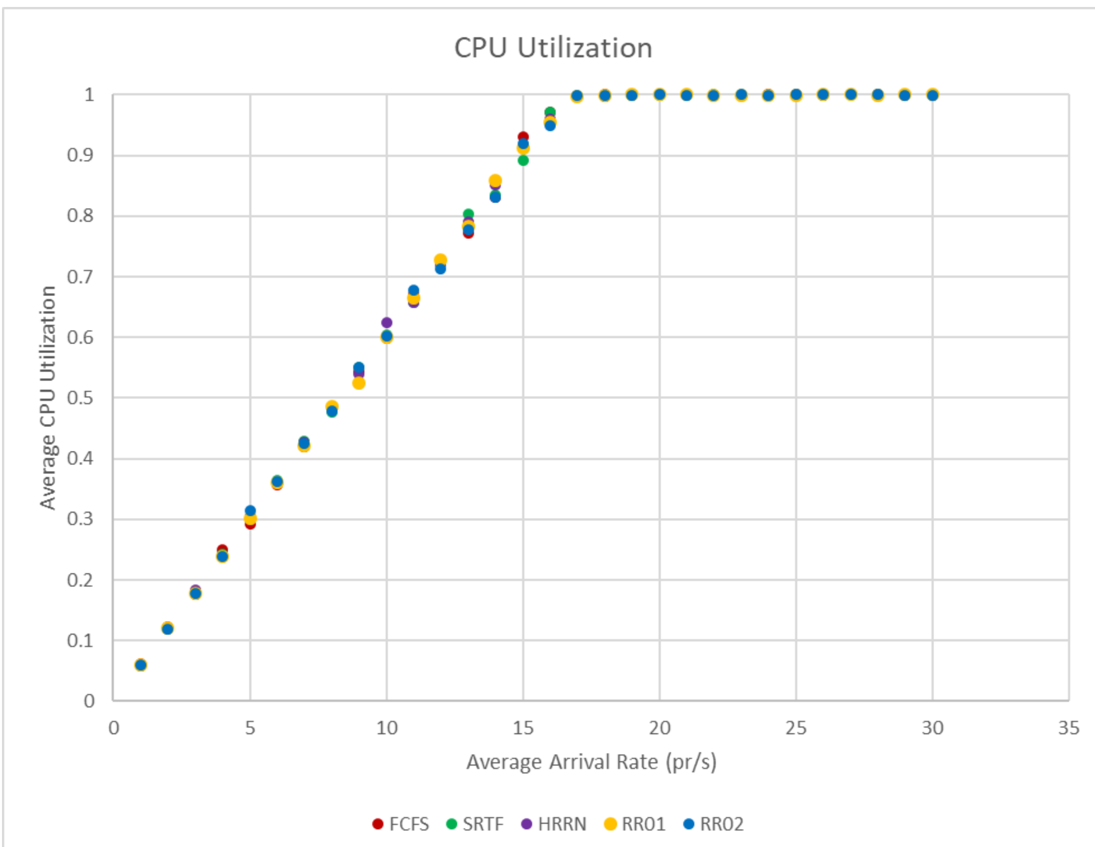
The average throughput was calculated by counting the total number of handled processes (default of 10,000 processes), and dividing by the final system clock (i.e. the end of the program). This resulted in process / time = average throughput.



CPU Utilization

The utilization was measured by monitoring the CPU's activity. A timer summed all the cumulative durations in which the CPU was active (i.e. computing a process). When the CPU was idle, the duration was not added. At the end of the program, the CPU utilization was obtained by:

totalActiveTime / totalProgramTime



Average Waiting Count

The average number of processes in the ready queue (w) was acquired in a multi-step process. First the wait time of each process was found as each process left the system.

waitTime = departureTime – arrivalTime = burstTime

At the end of each processes' lifespan, its unique wait time was summed into a cumulative total wait time of all processes. Then the average wait time was acquired by:

averageWait = totalWaitTime / totalProcessCount

The total process count considered only processes that had finished their life cycle, not processes that were sitting in ready queue. Finally, Little's Law was employed to find the average number of processes waiting in the ready queue.

$w = \lambda * Tw$

w = (average arrival rate) * (averageWait)