NETS3304/3604 Operating System Internals

Tutorial 4

1. What resources are used when a thread is created? How do they differ from those used when a process is created?

Answer:
Because a thread is smaller than a process, thread creation typically uses fewer resources than process creation. Creating a process requires allocating a process control block (PCB), a rather large data structure. The PCB includes a memory map, list of open files, and environment variables. Allocating and managing the memory map is typically the most time-consuming activity. Creating either a user or kernel thread involves allocating a small data structure to hold a register set, stack, and priority.

2. Provide two programming examples of multithreading giving improved performance over a single-threaded solution.

Answer:
 (1) A Web server that services each request in a separate thread. (2) A parallelized application such as matrix multiplication where different parts of the matrix may be worked on in parallel. (3) An interactive GUI program such as a debugger where a thread is used to monitor user input, another thread represents the running application, and a third thread monitors performance.

3. Provide two programming examples of multithreading that would not improve performance over a single-threaded solution.

Answer:
(1) Many sequential programs are not good candidates to be threaded. An example of this is a program that calculates an individual tax return. (2) Another example is a "shell" program such as the C-shell or Korn shell. Such a program must closely monitor its own working space such as open files, environment variables, and current working directory.

4. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:

Process	Arrival time	Burst time
P1	0	10
P2	2	1
P3	4	2
P4	6	1
P5	8	5

a. Draw three Gantt charts illustrating the execution of these processes using FCFS, non-preemptive SJF and SRTF scheduling.
b. What is the turnaround time of each process for each of the scheduling algorithms in part a?
c. What is the waiting time of each process for each of the scheduling algorithms in part a?

Answer:

a. The two Gantt charts are: (omitted)

b. Turnaround time:

Process	FCFS	SJF	SRTF
P1	10	10	19
P2	9	9	1
P3	9	10	2
P4	8	6	1
P5	11	11	5

c. Waiting time (turnaround time minus burst time):

Process	FCFS	SJF	SRTF
P1	0	0	9
P2	8	8	0
P3	7	8	0
P4	7	5	0
P5	6	6	0