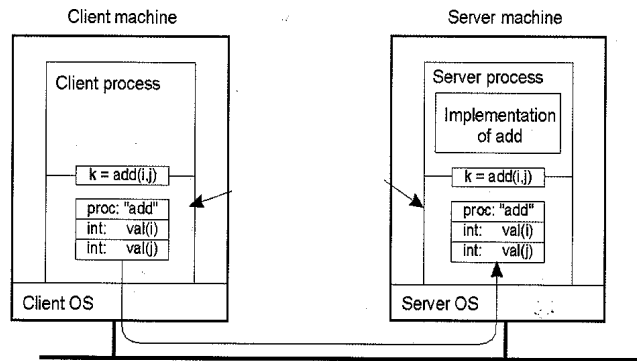


2011 Fall

1. (15pts) I/O devices, memory, and CPU are important physical resources protected by operating systems. Please explain how I/O devices are protected by an operating system. Please also explain the relationship between the idea of the dual-mode operations and how I/O devices are protected by an operating system.
2. (25pts) The emerging of multicore environments provides lots of encouragement to multithread programming and challenges to process scheduling. Please answer questions in process/thread management:
 - a. (5pts) Please give me one signal type that should be sent only to the thread of a process to which the signal applies.
 - b. (10pts) Is the non-preemptive shortest-job-first scheduling algorithm (SJF) always better than the first-come-first-serve scheduling algorithm (FCFS) in terms of the average waiting time? You must provide explanation to get any points.
 - c. (10pts) For the round-robin scheduling algorithm (RR), is RR with a big quantum always better than RR with a small time quantum in terms of the average completion time? You must provide explanation to get any points.
3. (10pts) Deadlock prevention provides a way to violate any one of the four necessary conditions of deadlocks so as to avoid any deadlock. Please answer the following questions:
 - a. (5pts) What is the difference between deadlock prevention and deadlock avoidance?
 - b. (5pts) Which necessary condition is overlapped with "Circular Wait"? If there are more than one, please list all of them.
4. (15 pts) A virtual memory system can be structured on fixed-size pages and variable-size segments.
 - a. (5 pts) Compare the two approaches; describe one scenario the paging approach work better than the segment approach.
 - b. (5 pts) Following the previous question, describe one scenario the segment-based approach works better than the paging approach.
 - c. (5 pts) Describe the tradeoffs involved in having a design of smaller pages versus larger pages?
5. (10 pts) Please compare Cloud Computing and client-server model for distributed computing in terms of computation model and performance.
6. (25 pts) Communication for distributed systems
 - a. (10 pts) Message oriented communication is designed to avoid synchronized communication, which causes blocking, and not to force both sender and receiver to be on at same time. Please discuss how does message oriented communication allows asynchronous communication?

- b. (10 pts) Remote Procedure Call (RPC) is a traditional and widely accepted communication protocol in distributed systems. Please answer the following questions. Please use the following figure to describe how RPC works when a client requests a service from server machine.



- c. (5 pts) RPC is a synchronized communication protocol, which has its own merits. However, it will block the process on the client side. Can you describe an enhanced version of RPC to shorten blocking time for client process? Please describe how the new protocol works and compare it with traditional RPC.