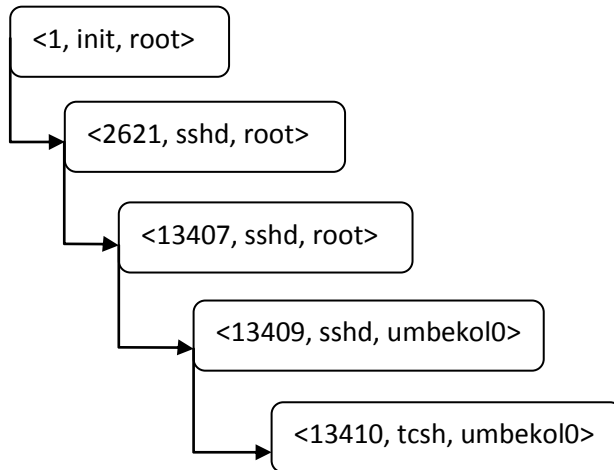# COMP3430 Assignment 1

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1) The sshd process is running the shell. The shell is tcsh - C shell with file name completion and command line editing.
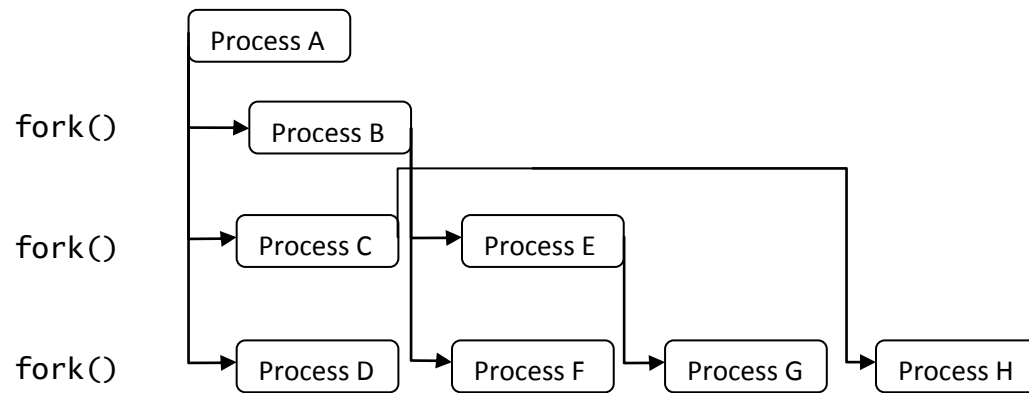
Process tree <Process-ID, Process Name, User>

<1, init, root>

<2621, sshd, root>

<13407, sshd, root>
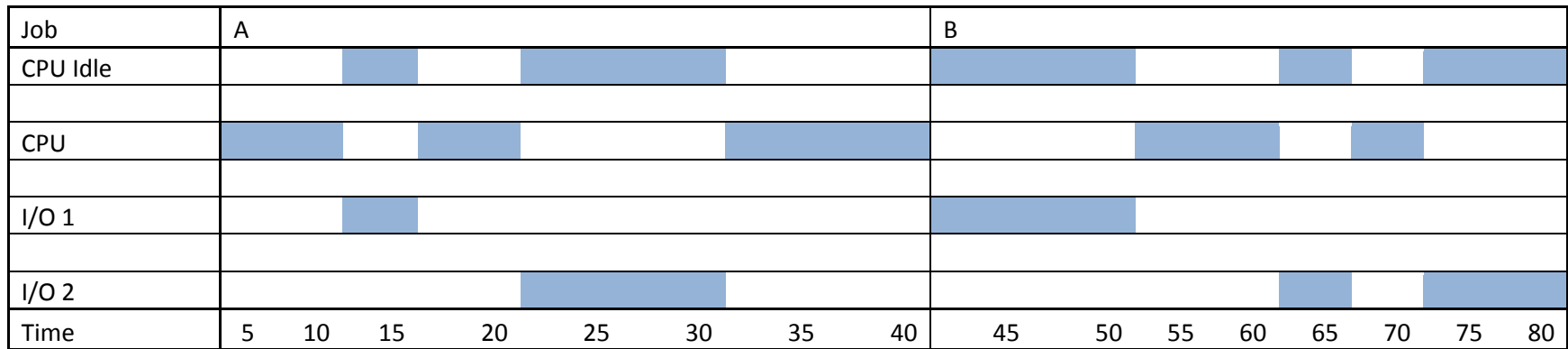
<13409, sshd, umbekol0>

<13410, tcsh, umbekol0>

The reason that there are two sshd processes after the listener process (2621) is for security and stability. Some parts of sshd need superuser privileges, but it is dangerous to let remote users operate under a privileged user. OpenSSH forks two separate processes: a privileged parent to perform necessary functions, and an unprivileged child to interface across the network and perform simple functions, a concept known as privilege separation. The impetus for separating functions by privilege is to protect against bugs and deliberate attacks on the child process that communicates with remote users. The unprivileged child and privileged parent communicate through a well-defined interface, so that if the unprivileged child is compromised, it cannot do significant damage to the system.

2) If all fork calls are successful, there will be eight processes in the end.
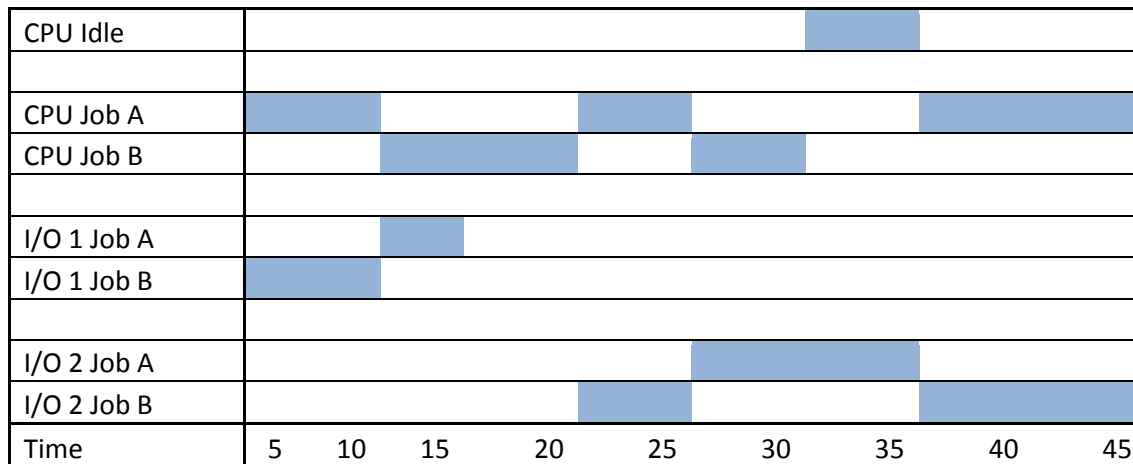
Process A

fork()   → Process B

fork()   → Process C   → Process E

fork()   → Process D   → Process F   → Process G   → Process H

3) a) Uniprogramming system

Job	A							B							
CPU Idle			▨		▨				▨		▨		▨		
CPU	▨		▨			▨				▨		▨			
I/O 1			▨						▨						
I/O 2					▨							▨		▨	
Time	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80

Jobs A and B end at 80 ms. CPU is utilized 50% of the total time (40ms of 80ms total).

a) Pure multiprogramming system

CPU Idle							▨		
CPU Job A	▨			▨				▨	
CPU Job B		▨			▨				
I/O 1 Job A		▨							
I/O 1 Job B	▨								
I/O 2 Job A					▨				
I/O 2 Job B				▨				▨	
Time	5	10	15	20	25	30	35	40	45

Jobs A and B end at 45 ms. CPU is utilized 89% of the total time (40ms of 45ms total).