Operating System Design

Homework:

- Operating System Review 1

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Questions

1. What is the purpose of interrupts? What are the differences between a synchronous and an asynchronous interrupt? Give examples of each type.

The interrupt is the signal to the processor, emitted by software or hardware, to indicate an event that needs immediate attention.

Synchronous interrupt
* generated by software
* triggered via system calls to CPU
* example: keystroke, mouse movement

Asynchronous interr
* generated by hardwar
* triggered via system bus to CPU
* example: exceptions, trap, or page faults

2. What is the purpose of system calls?

System call is a software interrupt, caused by user program to request the Operating System to perform some tasks in the kernel

3. What is the purpose of system programs?

The system programs provides the environment for user app development & execution. It allows system calls and API for file management, communication & synchronization between processes or computer

4. List five services provided by an operating system. Give a short description about what each service provides.

1) Printing service: for printing purpose
2) RDP Services: for remote screen sharing & control.
3) Time Service: for time viewing & synchronization
4) RPC Service: allow remote call & communication accross different computers
5) Bluetooth Service: allow communicate / pairing via Bluetooth

5. Describe the microkernel approach to system design? How do user programs and system services interact in a microkernel architecture? What are the disadvantages of using the microkernel approach?

Microkernel is designed to move all non-essential components out of the kernel, keeping only the core ones. User programs send messages to microkernel to communicate with Operating System services.

Disadvantage: Since the communication is via message passing, performance degradata is unavoidable

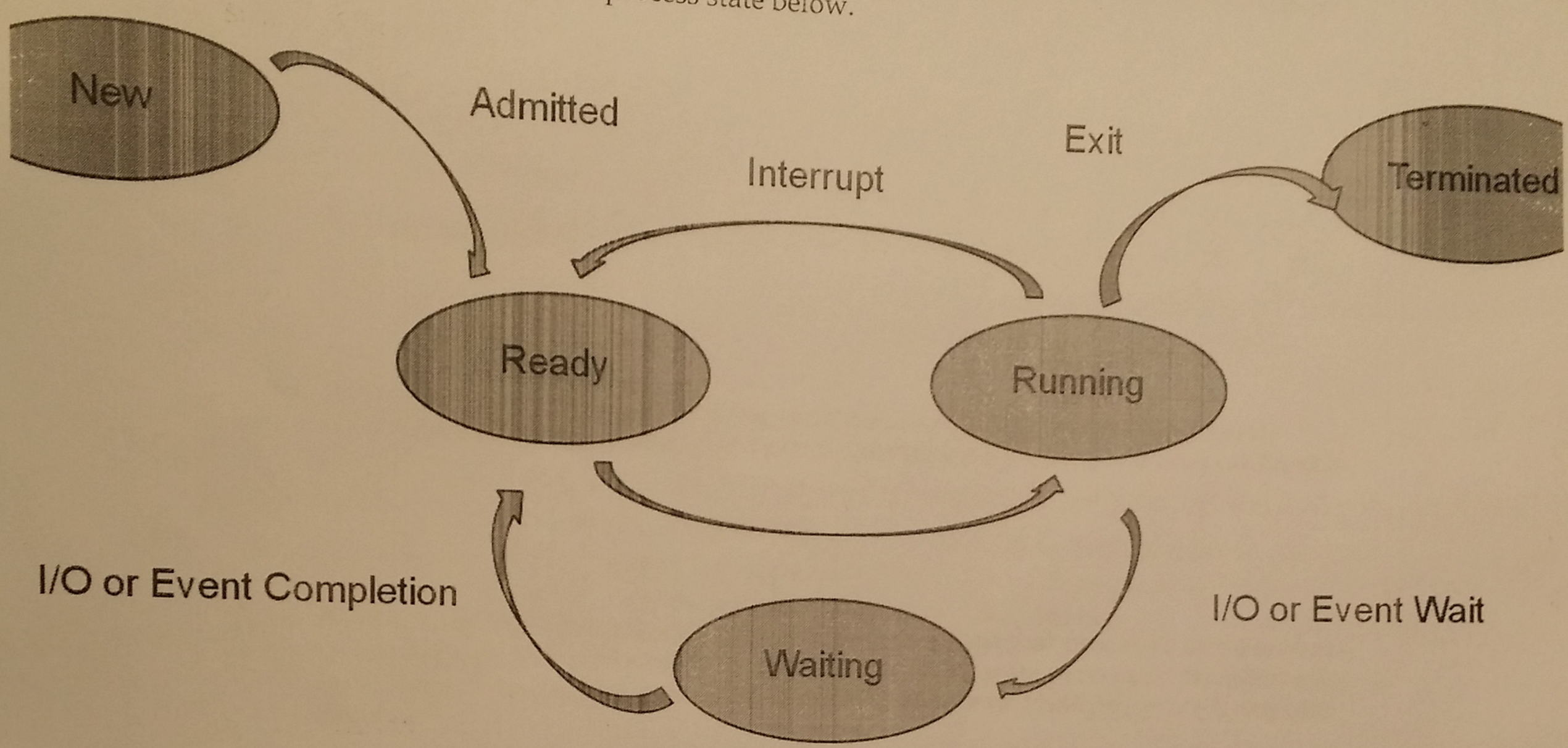
6. What is the relationship between a guest operating system and a host operating system in a system like VMware? Name 3 benefits in using Virtual Machines in your computer system.

The host OS has direct communication to the hardware, kernel & all devices on the physical machine. The guest OS runs on top of the virtualization layer provided by the host OS & virtualization software

Benefits: (a) run several execution environments with shared hardware. (b) Isolation (& protection) of host & guest VMs. (c) Convenient & fast for packaging & deployment (web server, db, app)

7. When a process creates a new process using the fork() operation, which of the following states is NOT shared between the parent process and the child process after the parent and child process is executing?
   a. Stack
   b. Heap
   c. Shared memory segments

8. Describe each of the process state below.



The states have the following meaning:

New = the process is being created but not loaded to memory yet, only PID create

Ready = the process is waiting for proccessor to run.

Waiting = the process is waiting for some events to occur (e.g. I/O completion)

Running = the process is being executed

Terminated = the process has finished execution. or terminated

9. Describe the following Client-Server communications:

Sockets = allows interprocess communication between the client & server via p

Remote Procedure Calls (RPC) = allows procedure call (abstract) between client & serv

Pipes = conduit allowing 2 processes to communicate in a unidirectional way

Named Pipes = similar to pipes, but bidirectional, & pipe remains after process exits

10. Which of the following components of program state are shared across threads in a multithreaded process?

a. Register

b. Heap Memory

c. Global Variables

d. Stack Memory

Both heap memory & global vars are shared across threads

11. Can a multithreaded solution using multiple user-level threads achieve better performance on a multiprocessor system than on a singleprocessor system? Explain.

Ans: NO. A multithreaded system comprising of multiple user level threads cannot make use of the different processors simultaneously. The OS only sees a single process & will not schedule a different thread of the process on seperate processor. Consequently, there is no performance benefit associated with executing multiple user-level threads on a multiprocessor system

12. Multicore or Multiprocessor Computer Systems means that processes or threads can run in parallel, as the Operating System assigns a separate process or thread to each core. Name 3 challenges in programming a Multicore or Multiprocessor Computer System.

1). Today's programming languages do not have good abstraction & framework for a multicore environment

2). Compiler is not yet optimized for all multicore architecture.

3). Most programmers like to use OOP, which is stateful & sequential. Instead, functional programming can be paraleligable as we dont have any global mutable variables