HW1

1.1

What are the three main purposes of an operating system?

(1) To provide an environment in which a user can execute programs in a convenient and efficient manner.

(2) To manage the computer hardware.

(3) To provide a basis for application programs and acts as an intermediary between the computer user and the computer hardware.

1.17

Describe the differences between symmetric and asymmetric multiprocessing. What are three advantages and one disadvantage of multiprocessor systems?

A: In asymmetric multiprocessing, each processor is assigned a specific task. The relationship between all the processors is master-slave because a master processor controls over rest processors and schedules and allocates work to them. But in symmetric multiprocessing, each processor performs all tasks within the operating system so it’s peer-peer relationship.

Three main advantages:

1. **Increased throughput**. By increasing the number of processors, computer is able to process more works in less time.
2. **Economy of scale.**  Multiprocessor system cost less than equivalent multiple single processor system because they can share peripherals, mass storage, and power supplies
3. **Increased reliability.**  If one task failed a processor; the failure of one processor would not halt the system but just slow it done.

One disadvantage:

1. Multiprocessing adds CPUs to increase computing power. If the CPU has an integrated memory controller, then adding CPUs can also increase the amount of memory addressable in the system. Either way, multiprocessing can cause a system to change its memory access model from uniform memory access (UMA) to non-uniform memory access (NUMA). UMA is defined as the situation in which access to any RAM from any CPU takes the same amount of time. With NUMA, some parts of memory may take longer to access than other parts, creating a performance penalty.

1.25

Give two reasons why caches are useful. What problems do they solve? What problems do they cause? If a cache can be made as large as the device for which it is caching (for instance, a cache as large as a disk), why not make it that large and eliminate the device?

1. Caches can be installed to improve performance where a large access-time or transfer-rate disparity exists between two components.
2. Most systems have an instruction cache to hold the instructions expected to be executed next. With this cache, the CPU does not need to wait for several cycles while an instruction is fetched.
3. Caches provide the efficiency to access data needed by a program comparing to access data from main memory.
4. In a multiprocessor environment, each of the CPUs contains a local cache. Hence, a copy of data may exist simultaneously in several caches. Since the various CPUs can all be executed concurrently, we must make sure that an update to the value of data in one cache is immediately reflected in all other caches where same data resides. This problem is a hardware problem called cache coherency.
5. Cache is more expansive than hard disk so making a cache as large as a disk costs more. Moreover, cache is temporary memory; in other words, it is volatile storage. When the power is off, information in cache is gone. But for hard disk, the storage is lone-term and when power is off, the data is still stored in.

1.27

Define the essential properties of the following types of operating systems:

* Batch

In a batch system, jobs are processed in bulk with predetermined input and run without human interaction until completed.

* Interactive

Interactive system provides direct interaction between user and computer.

* Time sharing

In time-sharing systems, the CPU executes multiple jobs by switching among them, but the switches occur so frequently that the users can interact with each program while it is running.

* Real time

In real time system, it is often used as a control device working with sensors and analyzing data gathered from sensors. Possibly, it may adjust controls to modify sensor inputs.

* Network

A network system is a virtual bridge that connects two or more computer systems and share data and resources.

* Parallel

In parallel system, a program is divided into separate components that run in parallel on individual computers in the cluster.

* Distributed

In distributed environment, several copies of the same file can be kept on different computers that are distributed in space.

* Clustered

A clustered system gathers together multiple CPUs to accomplish computational work as multiprocessor system but they are composed of two or more individual systems.

* Handheld

A handheld system includes personal digital assistants (PDAs), such as Palm and Pocket-PCs, and cellular telephones, many of which use special-purpose embedded operating systems.

2.2

What are the five major activities of an operating system with regard to  process management?

1. creation and deletion (starting and terminating a program execution)
2. suspension and resumption (letting a program wait for I/O operation or a next run)
3. synchronization (letting a program wait for another program’s termination)
4. communication (allowing a program to send/receive data from another executing program)
5. deadlock handling

2.6

What system calls have to be executed by a command interpreter or shell in order to start a new process?

First, use an exec system call and then use a fork system call in order to start a new process.

2.15

What are the five major activities of an operating system with regard to file management?

1. file creation and deletion
2. directory creation and deletion
3. support of primitives for manipulating files and directories
4. mapping files to secondary storage and tertiary storage
5. file back up on stable storage media

2.25

What is the relationship between a guest operating system and a host operating system in a system like VMware? What factors need to be considered in choosing the host operating system?

An operating system host can create the illusion that a process has its own processor with its own (virtual) memory. The virtual machine provides an interface that is identical to the underlying bare hardware.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Process Management | File Management | I/O Management |
| Commands | Ps: list running processes  Who: display a list of all the users currently logged in to system  Kill: terminate a process  Top: gives information on the processes that currently exist | Cd: change the current working directory  Copy: make a copy of a file  Dir: display information about all files in a directory  Mkdir: make a new directory  Delete: deletes a file | Find: returns files with filenames that match the argument passed  Grep: returns the text that matches the string pattern passed to grep  Tee: tee redirects standard input to both standard output  Tr: find and replace one string with another  Wc: counts characters, lines, and words |
| System calls | End: end a program  Abort: abort a program  Wait: wait for another program  Execute : execute a new program  Create process: create a new process | Create file: create a new file  Delete file: delete a file  Open: open a file  Close: close an opened file  Read : read in a file | Open: open a file  Close: close a file  Read: read data from a file  Write: write data to a file  Lseek: moves pointer |