Chapter 1

13

The issue of resource utilization shows up in different forms in different types of operating systems. List what resources must be managed carefully in following settings: Mainframe or minicomputer systems, Workstation connected to servers and Mobile computers.

a)

**Memory resources:** Main memory (RAM) is an important part of the mainframe systems that must be carefully managed, as it is shared amongst a large number of users.

**CPU resources:** Again, due to being shared amongst a lot of users it is important to manage CPU resources in mainframe and minicomputer systems.

**Storage:** Storage is an important resource that requires to be managed due to being shared amongst multiple users.

**Network bandwidth:** Sharing of data is a major activity in systems shared by multiple users. It is important to manage network bandwidth is such systems.

b)

**Memory resource:** When workstations are connected to servers, multiple applications run on multiple workstations on a single server. This is an important factor due to which memory management is required in workstations connected to servers.

**CPU resources:** Multiple workstations requests to access resources to accomplish the tasks assigned to them. To ensure the fair and efficient completion of tasks, it is important to manage CPU resources in workstations connected to servers.

c)

**Power consumption:** Handheld computers use compact, portable and small batteries as a source of power. It is important to manage power consumption in such device to be able to make their use efficient easy.

**Memory resources:** Due to small in size, the memory devices used in such computers are also small, thus deteriorating its storage capacity. This makes memory resource management an important requirement in handheld devices.

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Under what circumstances would a user be better off using a time sharing system than a PC or single user workstation?

Answer:

When there are few other users, the task is large, and the hardware is fast, time-sharing makes sense. The full power of the system can be brought to bear on the user’s problem. The problem can be solved faster than on a personal computer. Another case occurs when lots of other users need resources at the same time. A personal computer is best when the job is small enough to be executed reasonably on it and when performance is sufficient to execute the program to the user’s satisfaction.

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Consider a computing cluster consisting of two nodes running a database. Describe two ways (**asymmetric clustering** and **parallel clustering)** in which the cluster software can manage access to the data on the disk. Discuss the benefits and disadvantages of each.

Answer:

Consider the following two alternatives: **asymmetric clustering** and **parallel clustering**. With asymmetric clustering, one host runs the database application with the other host simply monitoring it. If the server fails, the monitoring host becomes the active server. This is appropriate for providing redundancy. However, it does not utilize the potential processing power of both hosts. With parallel clustering, the database application can run in parallel on both hosts. The difficulty in implementing parallel clusters is providing some form of distributed locking mechanism for files on the shared disk.

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Describe some of the challenges of designing operating systems for mobile devices compared with designing operating systems for traditional PC?

Answer:

a. Besides a core kernel, middleware must be designed in mobile operating systems to support a set of software frameworks that provide additional services to application developers.

b. Different from using a physical keyboard and mouse, mobile devices need to features a touch screen and let user interact with the system by pressing and swiping fingers across the screen.

c. Mobile operating system must balance the performance with the battery life.

d. Mobile operating system must have a good support for external peripheral devices like GPS, HDMI which is essential for mobile devices.

e. Mobile operating system must consider the limited resources since the mobile devices is much smaller compared with PC.

f. The mobile devices are more and more related to people's privacy, so the security of the operating system for the mobile devices counts even more than the traditional PCs and harder to prevent malicious code and access.

Chapter 2

15

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

Answer:

Creation and deletion of files

Creation and deletion of directories

Supporting primitives of manipulating files and directories

Mapping the files onto secondary storage

Backing up files on nonvolatile storage media

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What are the two models of inter-process communication? What are the strengths and weaknesses of the two approaches?

Answer:

Shared-memory model.

*Strength:*

1. Shared memory communication is faster the message passing model when the processes are on the same machine.

*Weaknesses:*

1. Different processes need to ensure that they are not writing to the same location simultaneously.

2. Processes that communicate using shared memory need to address problems of memory protection and synchronization.

Message-passing model.

*Strength:*

1. Easier to implement than the shared memory model

*Weakness:*

1. Communication using message passing is slower than shared memory because of the time involved in connection setup

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Why is the separation of mechanism and policy desirable?

Answer:

Mechanism and policy must be separate to ensure that systems are easy to modify. No two system installations are the same, so each installation may want to tune the operating system to suit its needs. With mechanism and policy separate, the policy may be changed at will while the mechanism stays unchanged. This arrangement provides a more flexible system.

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What is the main advantage of the microkernel approach to system design? How do user programs and system services interact in a microkernel architecture? What are the disadvantages of the microkernel approach?

Answer:

An OS has been developed called Mach that modularized the kernel using the microkernel approach. This method structures the OS by removing all non-essential components from the kernel and implementing them as system and user-level program. Micro kernel provides minimal process and memory management with communication facility. The communication is done indirectly via the method called Message passing. All new services are added to user space and consequently do not require modification of the kernel. Micro kernel provides more security and reliability, since most services are running as user rather than kernel.