OPERATING SYSTEM
IT-41033

CHAPTER – 1
Q&A

1.1 How are network computers different from traditional personal computers? Describe some usage scenarios in which it is advantageous to use network computers.

A network computer relies on a centralized computer for most of its services. It can therefore have a minimal operating system to manage its resources. A personal computer on the other hand has to be capable of providing all of the required functionality in a stand-alone manner without relying on a centralized manner. Scenarios where administrative costs are high and where sharing leads to more efficient use of resources are precisely those settings where network computers are preferred.

1.2 What network configuration would best suit the following environments?

a. A dormitory floor
b. A university campus
c. A state
d. A nation

1.3 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?

Caches are useful when two or more components need to exchange data, and the components perform transfers at differing speeds. Caches solve the transfer problem by providing a buffer of intermediate speed between the components. If the fast device finds the data it needs in the cache, it need not wait for the slower device. The data in the cache must be kept consistent with the data in the components. If a component has a data value change, and the datum is also in the cache, the cache must also be updated. This is especially a problem on multiprocessor systems where more than one process may be accessing a datum. A component may be eliminated by an equal-sized cache, but only if: (a) the cache and the component have equivalent state-saving capacity and (b) the cache is affordable, because faster storage tends to be more expensive.

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

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.

1.6 How does the distinction between kernel mode and user mode function as a rudimentary form of protection (security) system?

The distinction between kernel mode and user mode provides a rudimentary form of protection in the following manner. Certain instructions could be executed only when the CPU is in kernel mode. Similarly, hardware devices could be accessed only when the program is executing in kernel mode. Control over when interrupts could be enabled or disabled is also possible only when the CPU is in kernel mode. Consequently, the CPU has very limited capability when executing in user mode, thereby enforcing protection of critical resources.

1.10 Distinguish between the client-server and peer-to-peer models of distributed systems.

The client-server model firmly distinguishes the roles of the client and server. Under this model, the client requests services that are provided by the server. The peer-to-peer model doesn't have such strict roles. In fact, all nodes in the system are considered peers and thus may act as either clients or servers—or both. A node may request a service from another peer, or the node may in fact provide such a service to other peers in the system. For example, let's consider a system of nodes that share cooking recipes. Under the client-server model, all recipes are stored with the server. If a client wishes to access a recipe, it must request the recipe from the specified server. Using the peer-to-peer model, a peer node could ask other peer nodes for the specified recipe. The node with the requested recipe could provide it to the requesting node. Notice how each peer may act as both a client and as a server.

1.16 How do clustered systems differ from multiprocessor systems? What is required for two machines belonging to a cluster to cooperate to provide a highly available service?

Clustered systems are typically constructed by combining multiple computers into a single system to perform a computational task distributed across the cluster. Multiprocessor systems on the other hand could be a single physical entity comprising of multiple CPUs. A clustered system is less tightly coupled than a multiprocessor system. Clustered systems communicate using messages, while processors in a multiprocessor system could communicate using shared memory. In order for two machines to provide a highly available service, the state on the two machines should be replicated and should be consistently updated. When one of the machines fails, the other could then take over the functionality of the failed machine.

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

Symmetric multiprocessing treats all processors as equals and I/O can be processed on any CPU. Asymmetric multiprocessing has one master CPU and the remainder CPUs are slaves. The master distributes tasks among the slaves, and I/O is usually done by the master only. Multiprocessors can save money by not duplicating power supplies, housings, and peripherals. They can execute programs more quickly and can have increased reliability. They are also more complex in both hardware and software than uniprocessor systems.

1.23 The issue of resource utilization shows up in different forms in different types of operating systems. List what resources must be managed carefully in the following settings:

a. Mainframes: memory and CPU resources, storage, network bandwidth

b. Workstations: memory and CPU resources

c. Handheld computers: power consumption, memory resource.