GOA COLLEGE OF ENGINEERING

"Bhausaheb Bandodkar Technical Education Complex"

Tutorial No: 1

Q1) Discuss the limitations/challenges in designing a Distributed Operating System

Transparency

Transparency ensures that the distributes system should be perceived as a single entity by the users or the application programmers rather than the collection of autonomous systems, which is cooperating. The user should be unaware of where the services are located and the transferring from a local machine to a remote one should be transparent.

Scalability

Scalability of the system should remain efficient even with a significant increase in the number of users and resources connected.

Failure Handling

When some faults occur in hardware and the software program, it may produce incorrect results or they may stop before they have completed the intended computation so corrective measures should to implemented to handle this case.

Heterogeneity

Heterogeneity is applied to the network, computer hardware, operating system and implementation of different developers. A key component of the heterogeneous distributed system client-server environment is middleware. Middleware is a set of services that enables application and end-user to interacts with each other across a heterogeneous distributed system.

Security

Security of information system has three components Confidentially, integrity and availability. Encryption protects shared resources, keeps sensitive information secrets when transmitted.

Q2) A DOS employs switched multiprocessor hardware system. Discuss the number of switches and switching stages needed to connect 128 CPU's and 128 memories using

i) Crosspoint switches

for n switches and n memories n2 crosspoint switches are needed

- 128 CPU and 128 memories = 128128 switches needed
- n/n switching stages ie 128/128 = 1

ii) 2x2 omega switches

n CPU's and n memories (log2 n) switching stages , (n log2 n)/2 switches

• switching stages = (log2 128) = 7

• number of switches = (n log2 n)/2 = (128 * log2 128) /2 = (128*7)/2 = 448 Q3) What are the advantages of Grid multicomputer systems vs a hypercube

- Switched multicomputers do not have a single bus over which all traffic goes. Instead, they have a collection of point-to-point connections. Two of the many designs that have been proposed and built are a grid and a hypercube
- A grid is easy to understand and easy to lay out on a printed circuit board or chip as compared to a hypercube
- The complexity of wiring in a hypercube is very complex as compared to grid computers
- Messages in hypercube take more hops to reach the destination ie logarithmic path size as compared to grid where path size grows as a square root

Q4) List the differences between multiprocessors and multicomputers

Multiprocessor

A multiprocessor system is a single computer that operates with multiple CPUs.
Construction of multiprocessor is difficult and costly.

Programming multiprocessor is easier Support parallel computing.

Multicomputer

multicomputer system is a cluster of computers that operate as a singular computer. Construction of multicomputer is easier and cost effective.

Programming multiprocessor is difficult. Support distributed computing.

Multiprocessor is a system with two or more central processing units (CPUs) that is capable of performing multiple tasks.	multicomputer is a system with multiple processors that are attached via an interconnection network to perform a computation task.

Q5) A bus based multiprocessor system uses snoopy caches to achieve a coherent memory. Will semaphores work on this machine?

- Yes semaphore would work
- Incase of a snoopy cache when a write occurs in a memory address that is already present in a machines cache the machine either removes that entry from its cache or updates the entry to maintain coherency
- Semaphores also work in a similar fashion, they make sure that when a write is occurring in the memory no other machine is reading it to maintain coherency

Q6) Crossbar switches allow a large number of memory sequences to be processed at once, giving excellent performance. Why are they rarely used?

- The downside of crossbar switches is that with n CPU's and n memories n2 crosspoint switches are needed
- For large n this number can be prohibitive hence they are rarely used and people have found alternatives like the omega network

Q7) A multicomputer with 256 CPU's is organised as a 16x16 grid. What is the worst case delay that the messages might have to take?

No. of hops is 2*(N-1) = 2*(16-1) = 30 hops

Q8) Now consider a 256 CPU hypercube, what is the delay in hops?

- A 256 hypercube can be represented by 8 bits.
- With a 256-CPU hypercube, each node has a binary address, from 00000000 to 11111111.
- A hop from one machine to another always involves changing a single bit in the address.
- Thus from 00000000 to 00000001 is one hop. From there to 00000011 is another hop.
- In all, 8 hops are needed.