Assignment NO: 4

Page: 1
Date: / /

Title :- Implement Berkeley algorithm for clock synchronization.

Theory :-

1) What is physical clock?

→ • physical clocks :-
The physical clocks are needed to adjust the time of nodes. All the nodes in the system can share their local time with all the other nodes in the system. Basically, in physical synchronization, physical clocks are used to time stamp an event on that computer.

2) Why clocks need to be synchronized?

→ • In DCS, all the computers share their own data. In order to access updated data from each computer, time stamp of all computers must be same. So we have to make sure that all the computer's clocks should be synchronized.
• In distributed systems, hardware & software components communicate & coordinate their actions by message passing. Each node in distributed systems can share its resources with other nodes. So, there is a need for proper allocation of resources to preserve the state of resources & help coordinate between the several

processes. To resolve such conflicts, synchronization is used.
- Synchronization is achieved via clocks.
- The physical clocks are used to adjust the time of nodes.

3] Explain clock synchronization Algorithms?
→ There are 2 types of clock synchronization algorithms: centralized & Distributed.

1) Centralized is the one in which a time server is used as a reference. The single time-server propagates it's time to the nodes, & all the nodes just adjust the time accordingly. It is dependent on a single time-server, so if that node fails, the whole system will lose synchronization.
- Examples, Berkeley algorithm, Active time server, passive time server etc.

2) Distributed is the one in which there is no centralized time-server present. Instead, the nodes adjust their time by using their local time & then, taking the average of the differences in time with other nodes.
- Distributed algorithms overcome the issue of centralized algorithms like scalability & single point failure.
- Examples - Global Averaging algorithm, localized averaging algorithm, NTP.

4) What is event ordering ?

→ • In a centralized system, we can always determine the order in which two events occurred, since the systems has a single common memory & clock.
• Many applications may require us to determine order. For example, in a resource allocation scheme, we specify that a resource can be used only after the resource has been granted.
• A distributed systems, however, has no common memory & no common clock. Therefore it is sometimes impossible to say which of two events occured first.
• The happend-before relation is only a partial ordering of the events in distributed systems

5) Explain Berkeley algorithm.

→ • Berkeley's Algorithm is a clock synchronization technique used in distributed systems. The algorithm assumes that each machine node in the network either doesn't have an accurate time source or doesn't possess a UTC server.
• Algorithm :-
i) An individual node is chosen as the master node from a pool node in the network. This node is the main node in the network which acts as a master & the rest of the nodes acts as a slaves. The master node is chosen using an election process/ leader election algorithm.

2) Master node periodically ping slaves nodes & fetches clock time at them using Cristian's algorithm.

3) Master node calculates the average time difference between all the clock times received & the clock time given by the master's system clock itself. This average time difference is added to the current time at the master's system clock & broadcasted over the network.

6) a) Co-ordinated Universal time

→ • Coordinated Universal Time or UTC is the primary time standard by which the world regulates clocks and time. It is within about one second of mean solar time (such as UT1) at 0° longitude & is not adjusted for daylight saving time.
• It is effectively a successor to Greenwich Mean Time (GMT).

b) Drifting of clocks

→ • The difference of clock rate is called clock drift. Ordinary quartz clock drifts by ~1 second in 11-12 days.

→ c) Clock skew (OFFSET)
• The difference between the time on two clocks is called clock skew.