Time

What is time?

- Time is a measurable period in terms of events moving from past, present and future.
- We derive the idea of time from the order of occurrence of the event/process.
- It is used to describe the observation of the event.
- Time is one of the seven Fundamental Units.
- The SI unit of time is second.

How to measure time?

Time can be measured using a clock based on the atomic physics mechanism, gravity, spring mechanism etc.

Time and Architecture

Monolithic System:

- They are centralised units existing in a single location/machine.
- For mapping the time of occurrence of different events we can therefore use physical clocks.
- The use of logical time is not mandatory.

Distributed System:

- Since a distributed system is a spatial distribution of nodes and they can be present in different parts of the world.
- Multiple issues are encountered by the distributed systems while using physical clocks.
- Logical time should be used.

Issues encountered while using the physical clock to measure time in the case of Distributed Systems:

1. No concept of Global Physical Time.
2. Problem in finding the precise ordering of the events.
3. Network delays can change the original sequence of events.
4. Nodes in different geographical locations would follow different time zones.

Let’s learn more about logical time.

What is the logical time?

For a logical clock, two data structures are used to solve the problem of ordering and different time zones. It has two major concepts: Process marks its own event and the protocol updates after each local event.
The data structures used are separate for a logical global time and logical local time.

1. Logical Local time: Logical Local time carries information about the events of the system. Local time uses a Process that marks its own event and a protocol to update after each regional event.
2. Logical Global time: Logical Global time carries the local information about the global time. It stores the local knowledge about the global time and uses a protocol to update when processes exchange data.

Lamport Logical Clock

- It was developed by Leslie Lamport in 1978.
- It is a method of finding out the order of events in a distributed system.
- Because of the absence of a global time concept in a distributed system, Lamport logical clock is essentially required.
- It is used to provide the partial order of events and the numerical measure of what happened before the relationship.

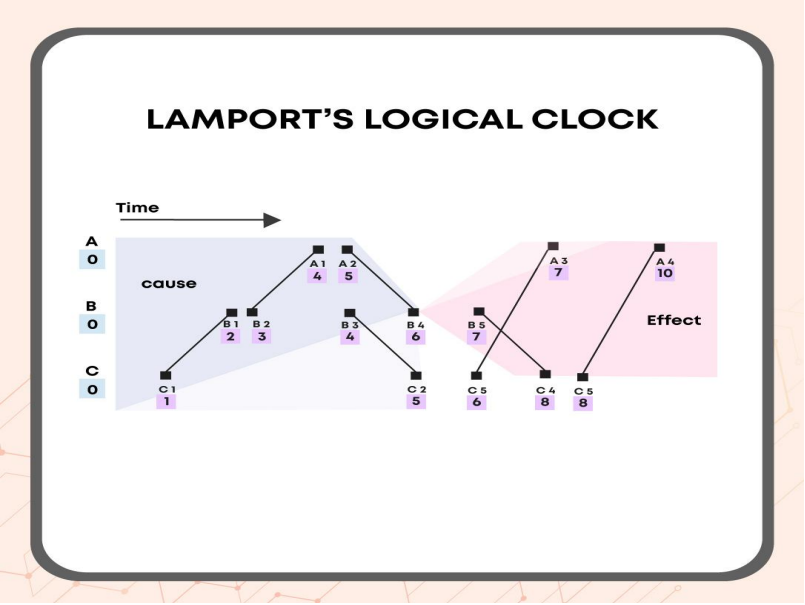

Fig: Lamport Logical Clock

Algorithm of Lamport Logical Clock:

1. Each process uses a local counter of the integer data type, which is initialised to zero.
2. Whenever an event(send or receive event) occurs, the process increments the counter.
3. The counter is assigned as the time stamp for each event.
4. Send event carries its own timestamp/counter.
5. For a receive event, the timestamp would equal the mathematical max of the local clock and message timestamp plus one.