

## Non Token Based

- a site communicates with set of other sites to arbitrate who should execute the CS next.
- uses timestamps to order requests for the CS & to resolve conflicts between simultaneous requests for the CS.
- Logical clocks are maintained & updated according to Lamport's scheme.

### I. Lamport's Algorithm

$$\forall i : 1 \leq i \leq N :: R_i = \{s_1, s_2, \dots, s_N\}$$

- Every site keeps a queue, request-queue<sub>i</sub>, which contains mutual exclusion requests ordered by their timestamps.
- Algo requires messages to be delivered in the FIFO order between every pair of sites.

### Algo

Requesting the Critical Section (CS)

1. When a site  $S_i$  wants to enter CS, it sends a REQUEST  $(ts_i, i)$  message to all the sites in its request set  $R_i$  & places the request on request-queue<sub>i</sub>.  
↓ Timestamp of the request.
2. When a site  $S_j$  receives the REQUEST  $(ts_i, i)$  message from site  $S_i$ , it returns a timestamped REPLY message to  $S_i$  & places site  $S_i$ 's request on request-queue<sub>j</sub>.

### Executing the Critical Section

Site  $S_i$  enters the CS when 2 conditions hold:

- $S_i$  has received a message with timestamp larger than  $(ts_i, i)$  from all other sites.
- $S_i$ 's request is at the top of request-queue.

### Releasing the CS

- Site  $S_i$ , upon exiting the CS, removes its request from the top of its request queue & sends a timestamped RELEASE message to all sites in its request set.
  - When a site  $S_j$  receives a RELEASE message from site  $S_i$ , it removes  $S_i$ 's request from its request queue.
- \* Algo executes CS requests in the increasing order of timestamps.