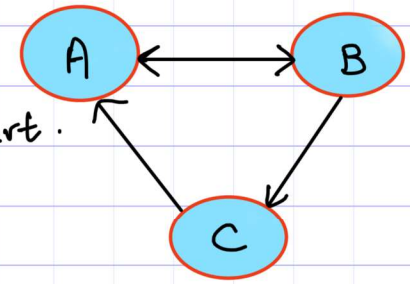
# Consistent Global State Recording Protocol

Lamport & Chandy

Any node can start the algorithm.
(Assume here A starts)




**Send :**

(i) integrate msg. on channel & start.
(ii) Sends a marker message M thro' all outgoing channels.

(Starting the algorithm is done by a leader election method)

**Receive :**

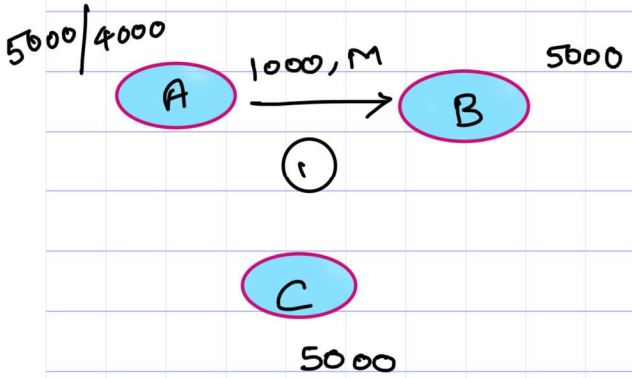
(i) Record States.
(ii) Follow send rule.

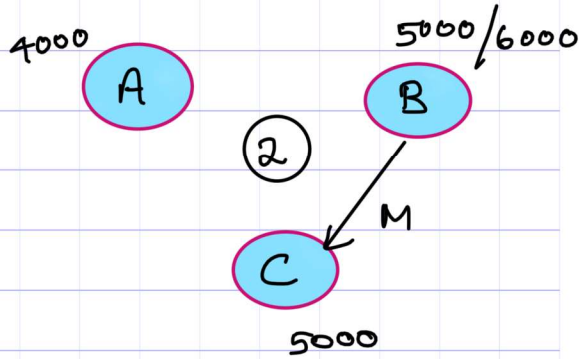
**Termination :**

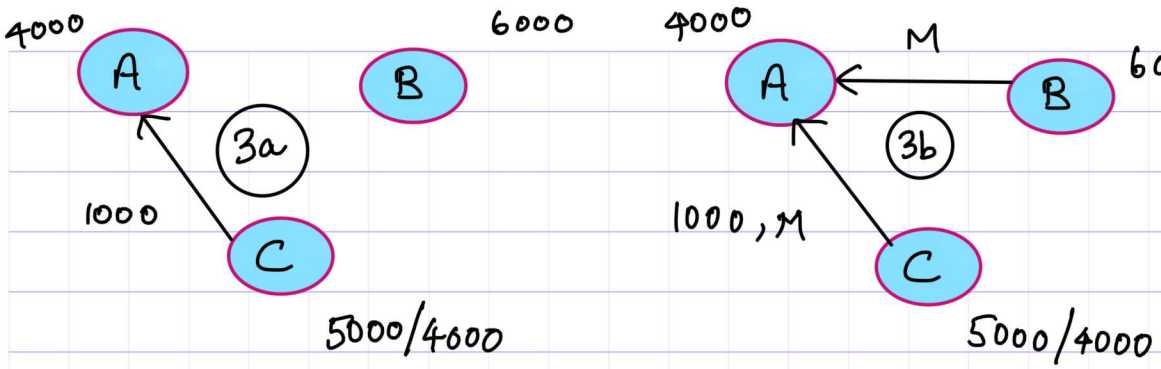
Once all incoming nodes receive the marker message M.

**Assumptions :**

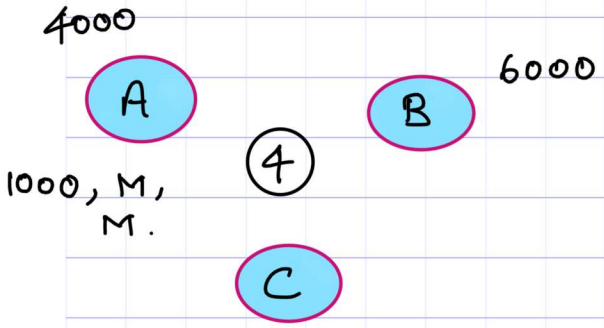
Reliable channel.
Ordering is FIFO (inherently causal order).



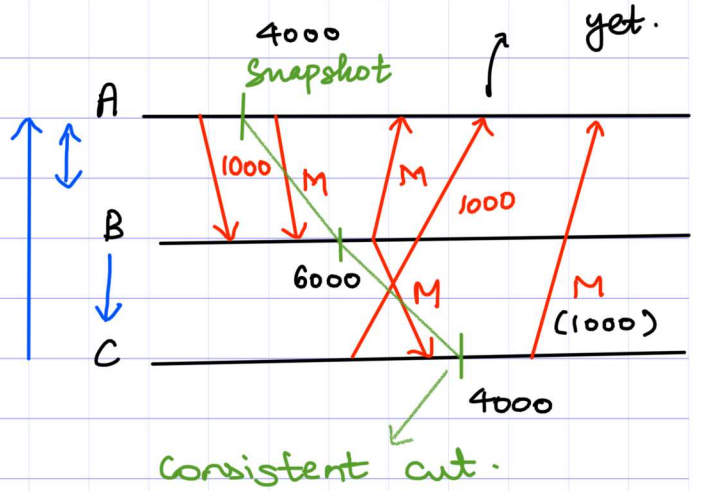





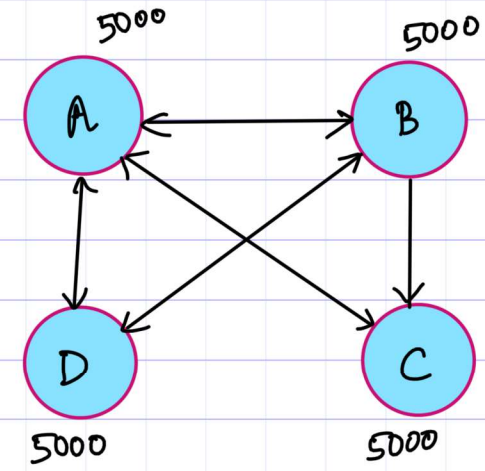

3a & 3b are concurrent events (happens parallelly)

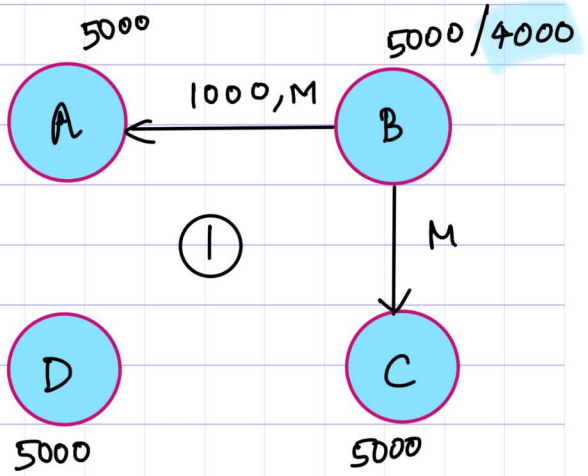



this 1000 has not been recorded yet.

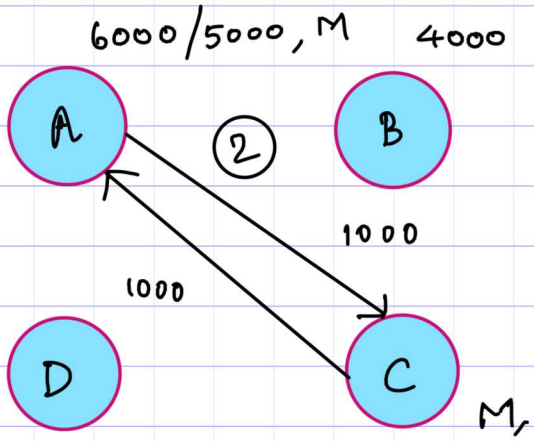


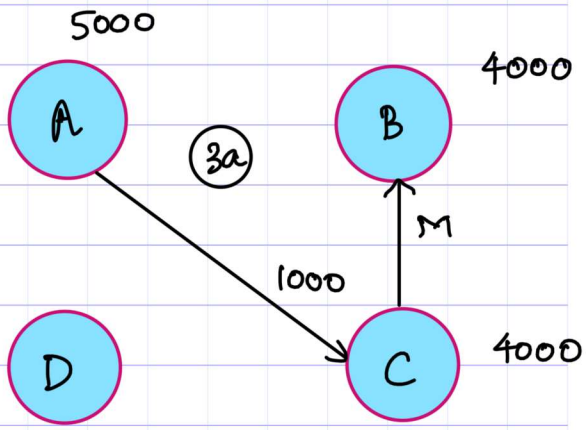
## Example:



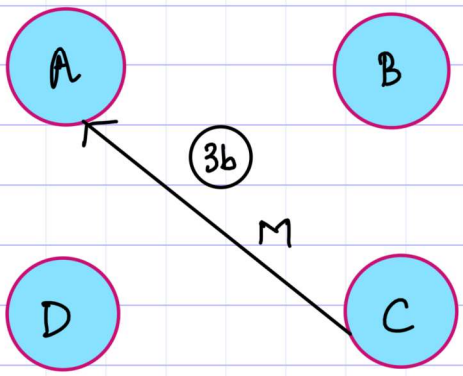



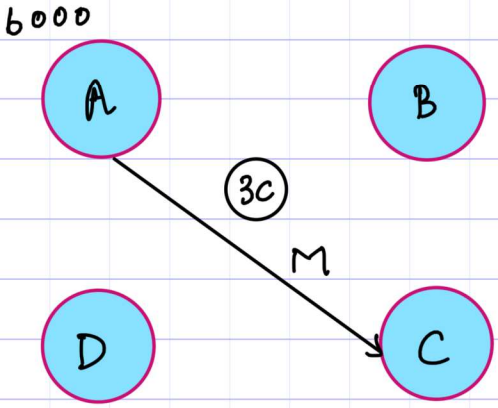

Leader was chosen to be B.
B starts the algorithm

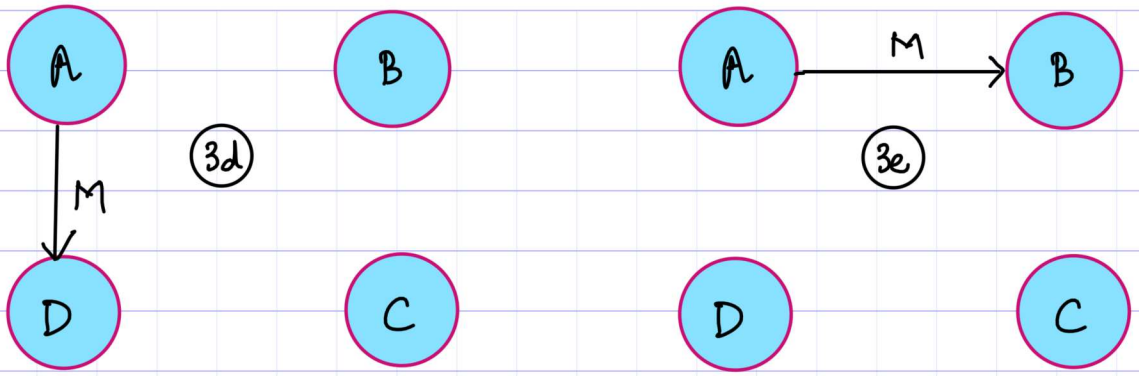


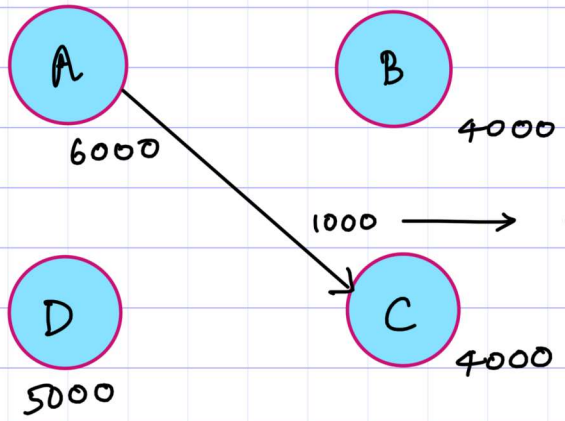

(C sends 1000 by the time it receives M from B)





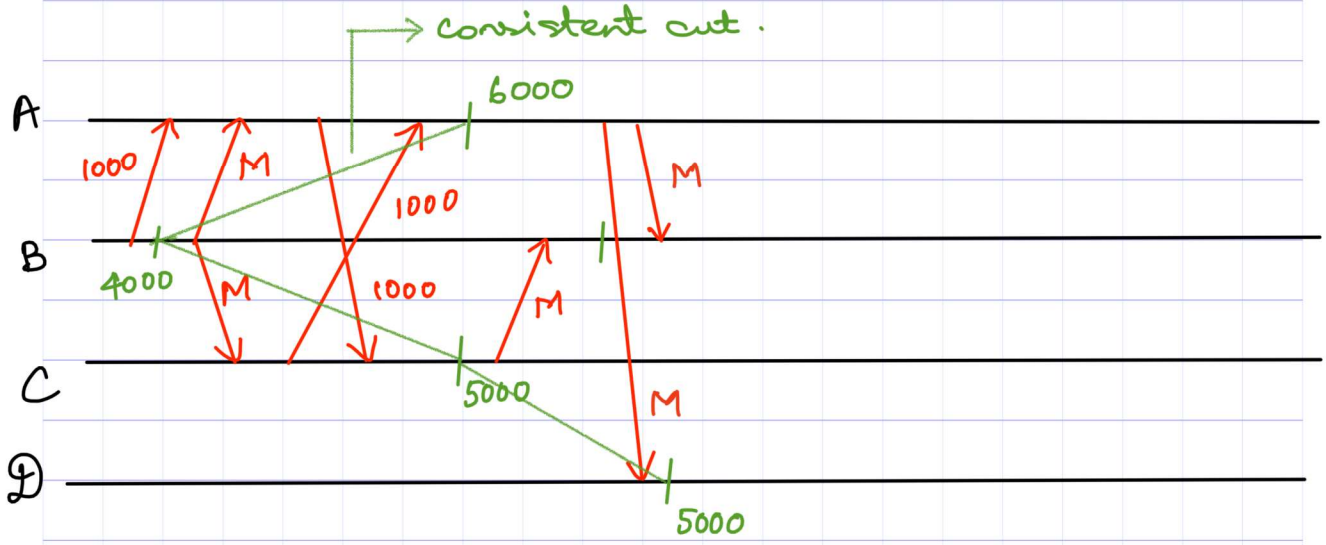

Sender receives marker M from all the incoming nodes, state is consistent.



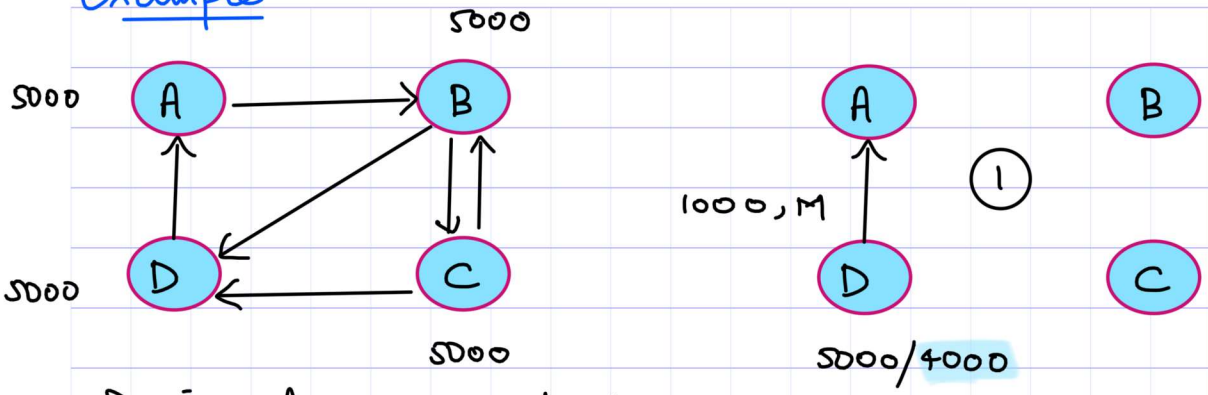

Final snapshot

1000 → still in the channel, not yet accepted.
(because the marker M was received before this 1000 in C)

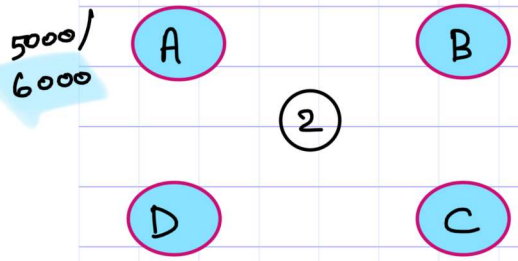
This 1000 can be a part of the next global snapshot.



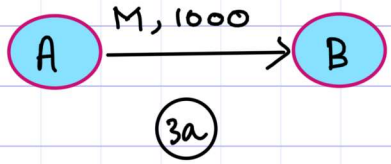
## Example



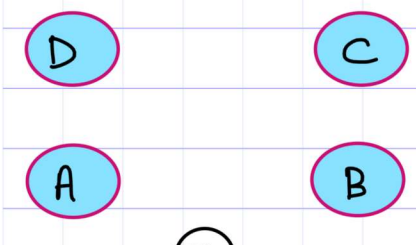

D is chosen as leader.
1000, Marker is sent in order by D.
Since D sends M, D records state as well.



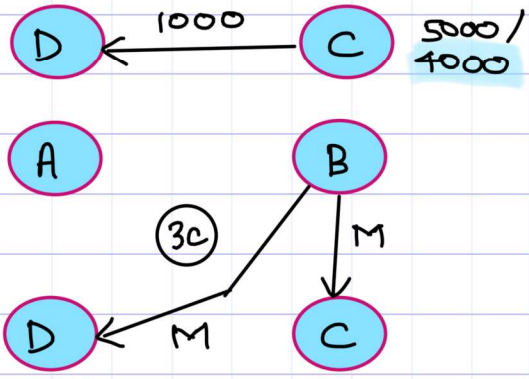

Marker rcvd. by A, state recorded.




B rcvs. M, B snapshots @ 5000, then rcvs. 1000 from A.

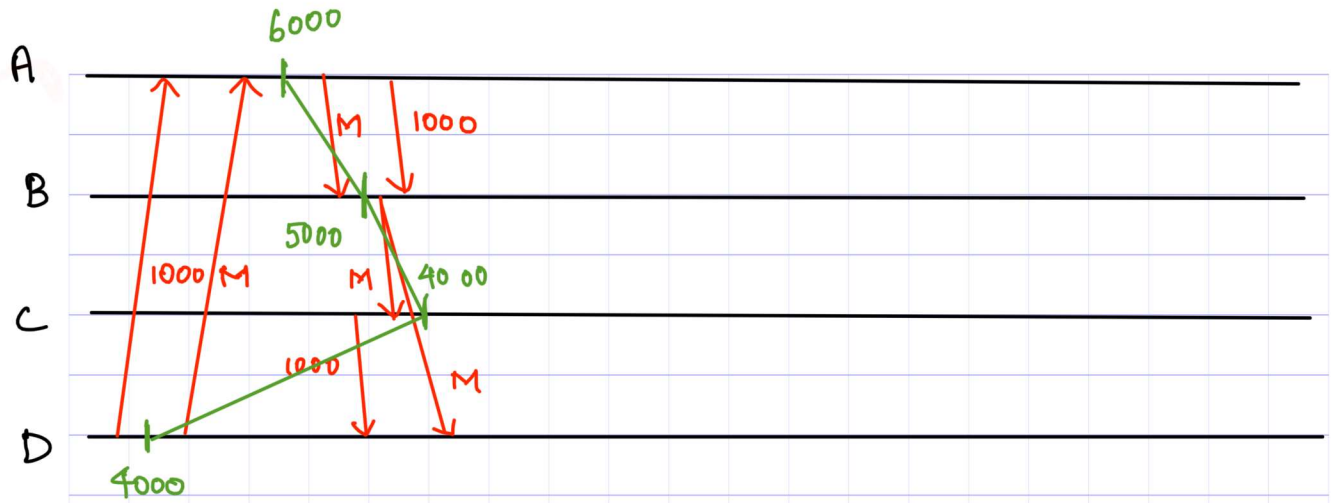



C concurrently sends 1000 to D before getting M from B.

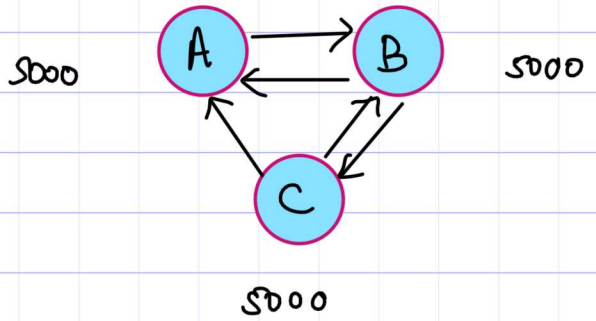


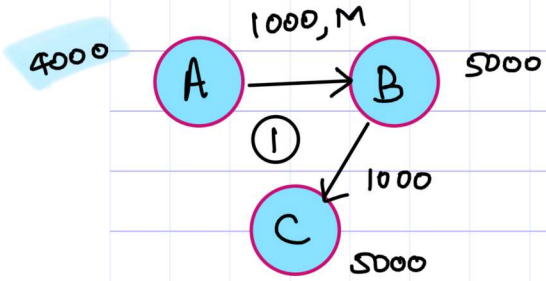

D receives 1000 followed by M from C. But D doesn't snapshot because it is the initiator.

1000 from C→D is waiting in channel.

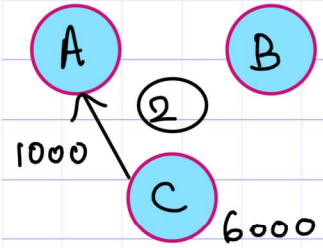


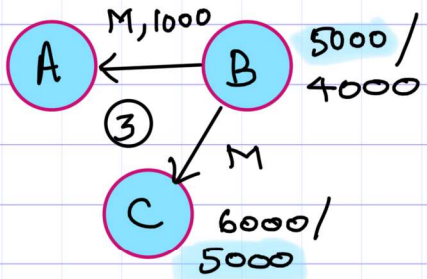

Example :

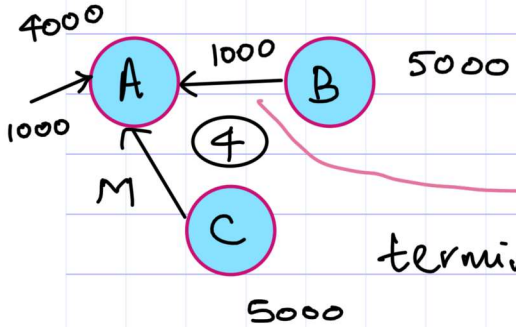



A sends 1000, M to B.
B concurrently sends 1000 to C.

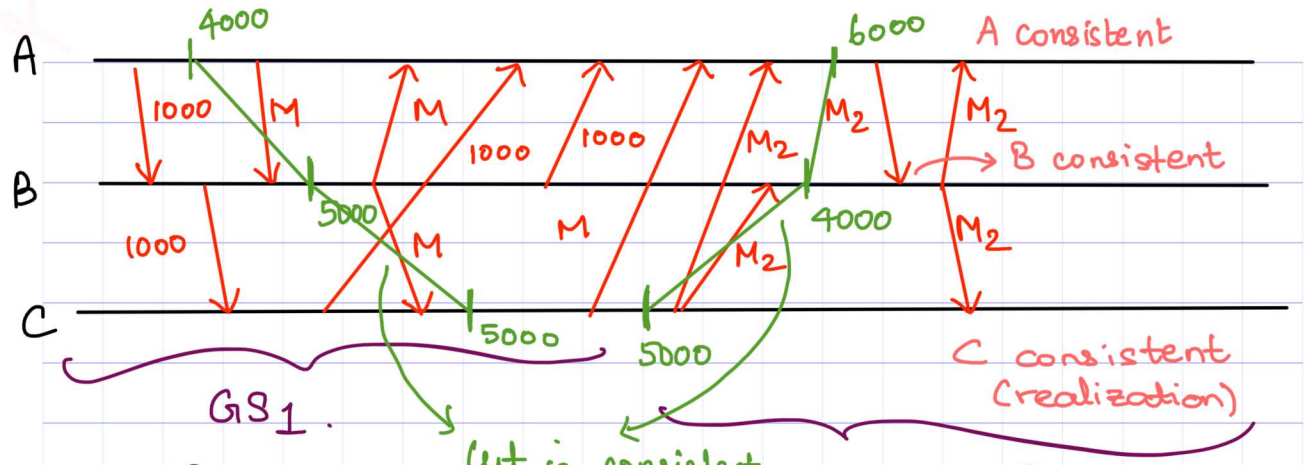


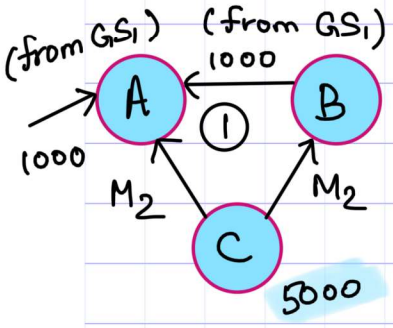




terminate.

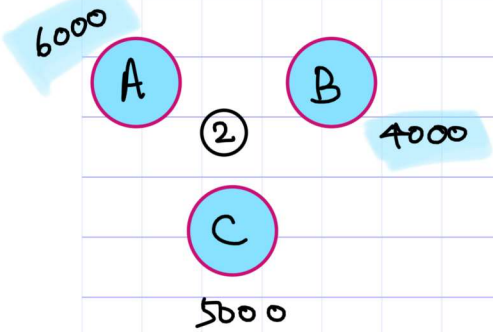
both send & receive are not recorded in snapshot yet because B already sent the marker.




C initiates Marker.

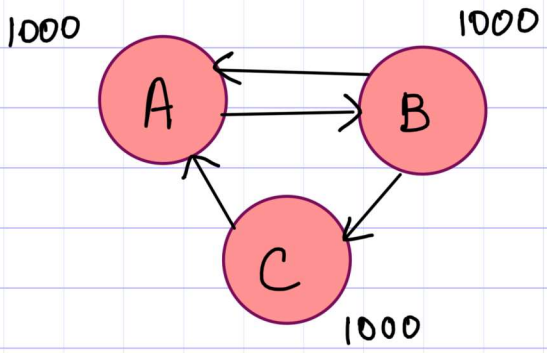
AS SOON AS MARKER IS RECEIVED TAKE A SNAPSHOT!

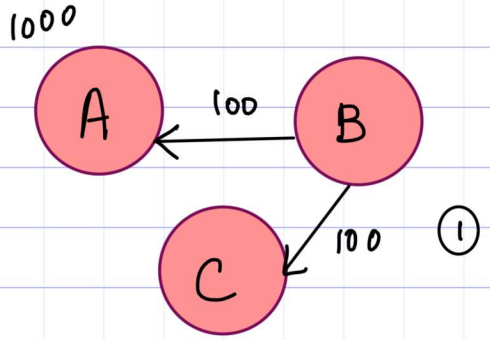



Both cuts are not strongly consistent because the receive & send of 1000 from C → A are recorded in 2 separate snapshots.

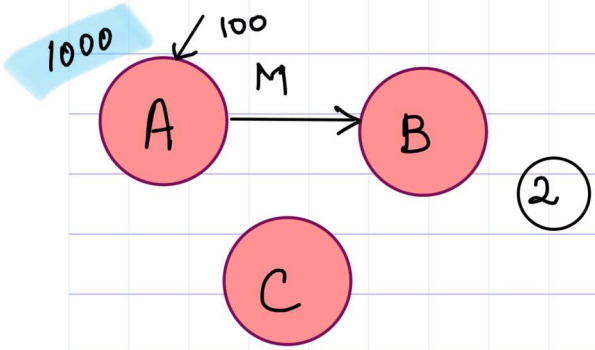
$send_B(1000)$ to A and $receive_A(1000)$ from B will be recorded as part of $GS_2$.

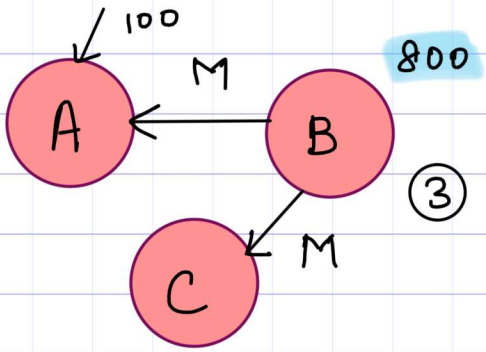
# Global State Recording Algorithm

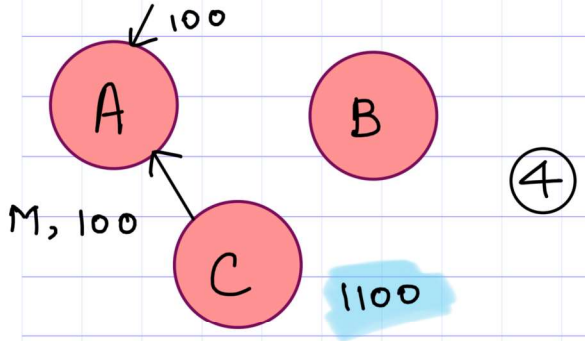


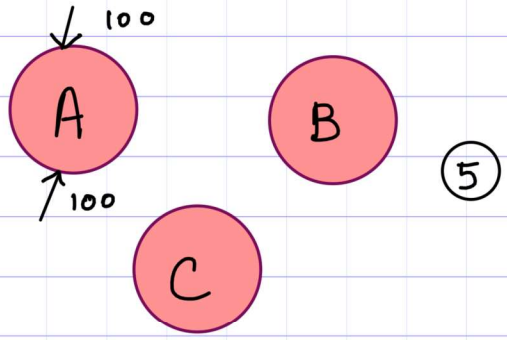




Transactions $B \rightarrow A$
$B \rightarrow C$.



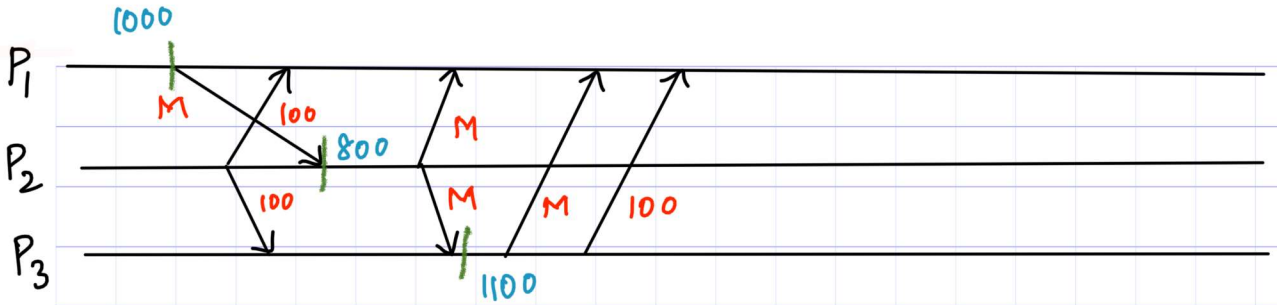




Recording complete.

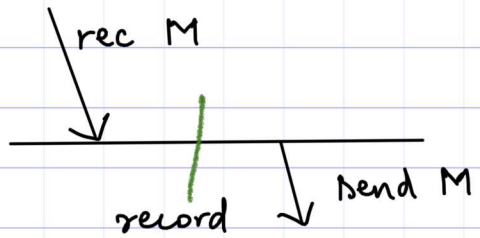
State is consistent.



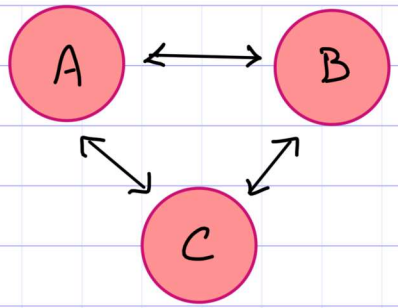

If $P_1$ initiates the algorithm again,

$P_1$'s state is recorded as 1200

(1000 + 100 from $P_2$ + 100 from $P_3$).




general correct procedure.




A initiates algorithm.

5000