Spezialetti–Kearns algorithm for FIFO Channel

Surendra Kumar (20171038)
Lokesh Singh (2019201051)
Divyank Shah (2018101037)

Chandy-Lamport Algorithm

- Uses special marker messages.
- One process acts as initiator, starts the state collection by following the marker sending rule below.
- Marker sending rule for process P:
  - P records its state and
  - For each outgoing channel C from P on which a marker has not been sent already, P sends a marker along C before any further message is sent on C

Chandy - lamport cont.

- When Q receives a marker along a channel C:
  - If Q has not recorded its state then Q records its state and also records the state of C as empty. Q then follows the marker sending rule
  - If Q has already recorded its state, it records the state of C as the sequence of messages received along C after Q’s state was recorded and before Q received the marker along C

Spezialetti-Kearns algorithm

- This is a variation of Chandy-Lamport algorithm.
- It provides two optimizations to the Chandy–Lamport algorithm.
  - combines snap-shots concurrently initiated by multiple processes into a single snapshot.
  - efficient distribution of the global snapshot.

Efficient snapshot recording

Each marker carries an identifier of the initiator of the algorithm.

Each process has a variable master to keep track of the initiator of the algorithm.

Region:

A region encompasses all the processes whose master field contains the identifier of the same initiator.

Efficient snapshot recording cont.

- The state of the channel is recorded just as in the Chandy-Lamport algorithm.
- When the initiator's identifier in a marker received along a channel is different from the value in the master variable, the sender of the marker lies in a different region.
- The identifier of the concurrent initiator is recorded in a local variable **id-border-set** (to know the neighboring regions).

Efficient snapshot recording cont.

- Snapshot recording at a process is complete after it has received a markeralong each of its incoming channels.
- After every process has recorded its snapshot, the system is partitioned into many regions.
- No. of regions = No. of concurrent initiations of the algorithm.

Efficient dissemination of the recorded snapshot

In the first phase, while recording a snapshot, a forest of spanning trees is created in the system.

If P_i receives its first marker from P_j then process P_j is the parent of process P_i in the spanning tree.

The initiator of the algorithm is the root of a spanning tree and all processes in its region belong to its spanning tree.

Efficient dissemination cont.

- Each intermediate process forwards its locally recorded state and the locally recorded states of all its descendent processes to its parent.
- Each initiator receives the locally recorded states of all its descendents from its children processes and assembles the snapshot for all the processes and channels in its region.
- The initiator exchanges the snapshot of its region with the initiators in adjacent regions in rounds.

Time Complexity

1. The message complexity of snapshot recording isO(e) irrespective of the number of concurrent initiations of the algorithm.
2. The message complexity of assembling and disseminating the snapshot is $O(rn^2)$ where r is the number of concurrent initiations.

Thank You