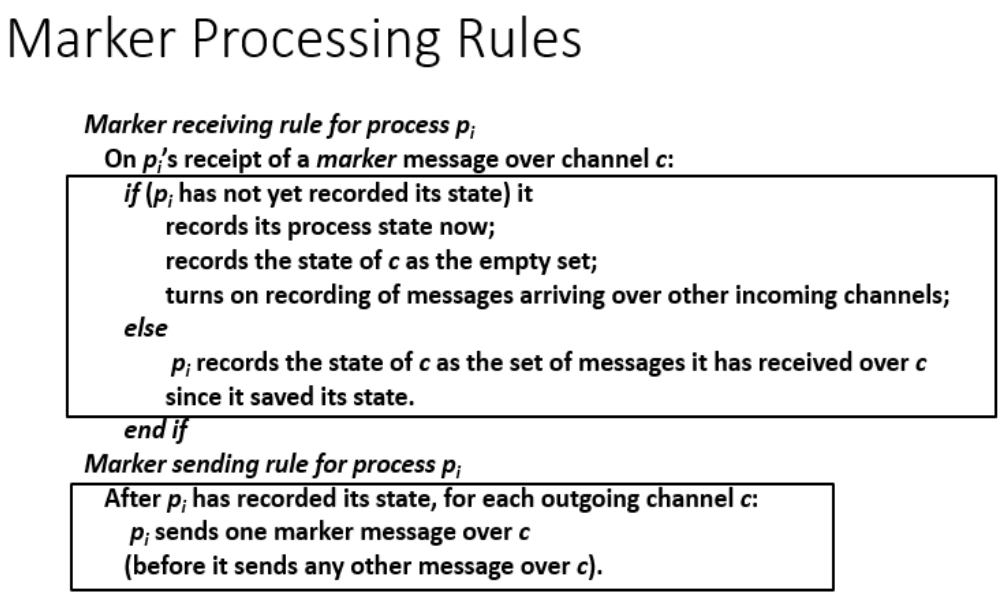
Lab#4 – Global States

Objective

In this lab you will implement the snapshot algorithm of Chandy and Lamport you learned in class, and use it to determine the consistent global states of a distributed system.

The snapshot algorithm and global states

As we have learned in class, the snapshot algorithm can be used to determine global states of distributed systems. It does so by recording the states of a set of processes and channels such that the recorded global state is consistent. Recall that a consistent global state is one that preserves the "happened-before" relations between events, so that even though the recorded global state might have never occurred in the actual execution in real time, it could have occurred between the "before" state and the "after" state, meaning that it is reachable from the "before" state and also the "after" state is reachable from it. The snapshot algorithm is defined through two rules, the marker receiving rule and the marker sending rule, given below.



You will implement this algorithm to record global states of a distributed banking system. There are a number of bank branches (processes) in this system, and they each keep a balance and send money to each other from time to time.

Tasks

Task #1:

Implement a bank branch class. You will instantiate a number of these and have them send random amounts of money to each other at random times. A bank branch object has the following properties:

- it keeps a balance which is initialized to a number greater than zero
- for the sake of simplicity, it maintains a connection with each of the other branches
- it sends random amount of money at random times to randomly chosen branches
- to make marking easier, print to screen every time money is received or sent, with the updated balance.

Presentation to the TA:

Show the TA the running bank branch processes.

Task #2:

Implement the snapshot algorithm to record the global states of your system. A global snapshot will consist of the local state (balance) of each bank branch and the money that is in transit in the communication channels. Each branch reports its own local state and the amount of money in transit on any of its incoming connections. To check for correctness, compare the total amount of money in the recorded global state (local balances and in transit) with the original total amount of money at the initialization of the system, they should be equal.

Presentation to the TA:

Show the TA the running programs. You should show the execution of the snapshot algorithm and the reported states from each bank branch process. You should show the original total amount of money in the system and show that the recorded global state has the same total amount.