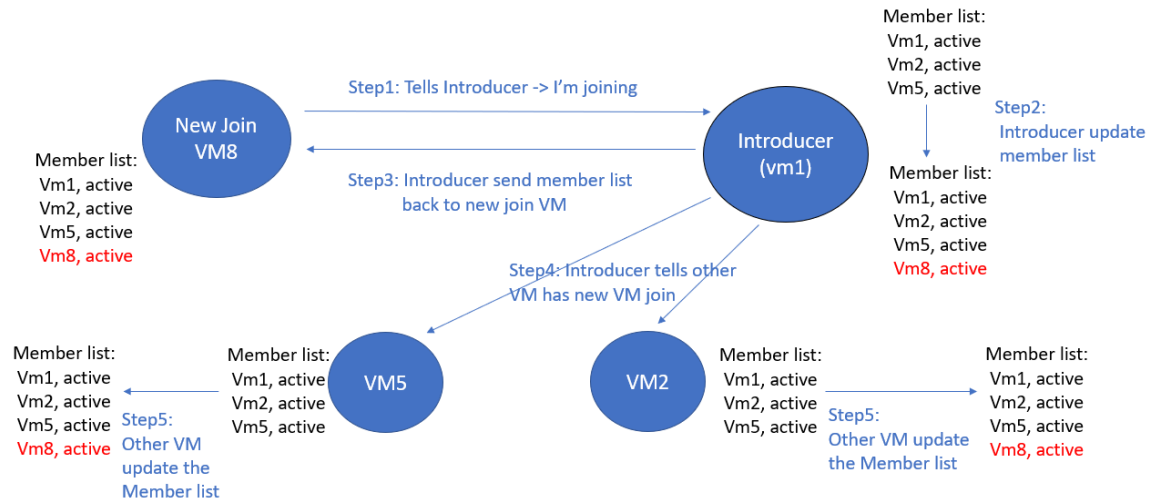


## Machine Programming 2 – Distributed Group Membership

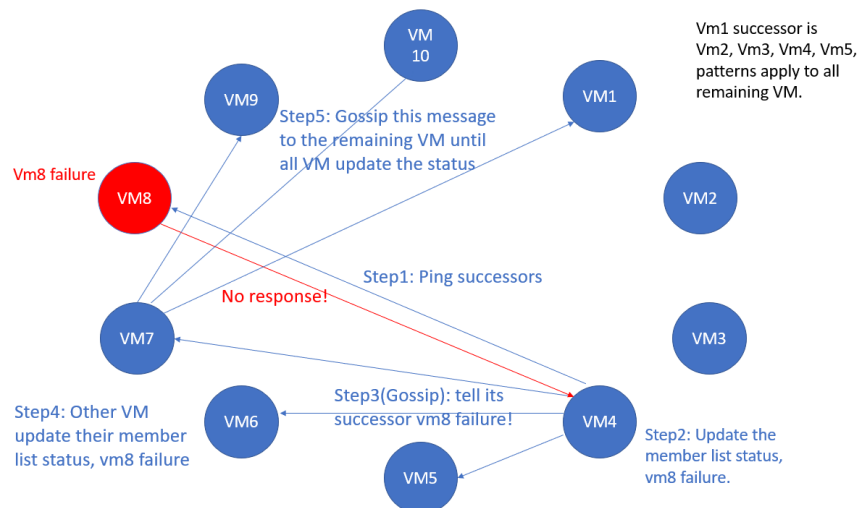
### Algorithm

For joining, we utilize an introducer to listen to each process joining the group, and the introducer would send the current membership status back to new join processes, and tell other older members has new process joining. The flow chart is shown on Fig(1).



Fig(1) Processes Joining Diagram

For the failure detector, we used the gossip style. Each process has its successor (We set up the value as 4). When ping has no response, it would mark the successor as failure and send the newest membership status to its successor processes, and its successors would gossip this message to their own successors as well, the flow chart is shown on Fig(2).



Fig(2) Failure Detector Diagram

This algorithm is scalability since it equals load on each member and network message load. And for the marshaled message format, we designed it as a “VM number, IP, status, timestamp” format, the status contains inactive, active, and failure. Lastly, use our MPI programming to debug by sending a grep command to all the machines and check whether the destination process is active or not.

## Measurements

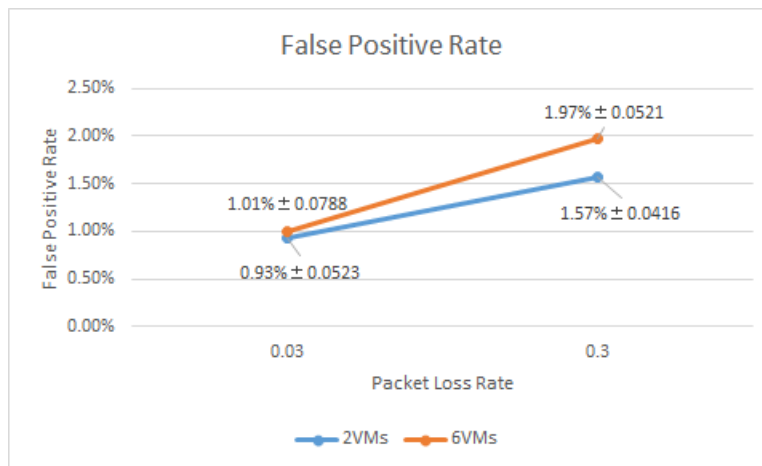
### 1. Bandwidth

	6 machines(no membership changes)	Node join	Node leaves	Node fails
Bps/second	8.342kbps	9.526Kbps	12.38Kbps	13.008Kbps

The background bandwidth usage is 8.342kbps for 6 machines, the average bandwidth for node join is 9.52kbps, the average bandwidth for node leaves is 12.38kbps, the average bandwidth for node fails is 13.008kbps.

### 2. False positive rate

	N = 2 Loss Rate 3%	N = 2, Loss Rate 30%	N = 6 Loss Rate 3%	N =6 Loss Rate 30%
Averages False Positive Rate	0.928%	1.572%	1.005%	1.972%
Standard Deviations	0.0523	0.0416	0.0788	0.0521



Fig(3) False Positive Rate

Overall, the loss rate has more influence on the false positive rate than the number of machines, we think the reason is the loss rate is dropping messages, which include all the member list status, it would directly cause all other machines cannot get the newest member list status. By contrast, the number of machines just influences the scalable of all the systems.