Design -

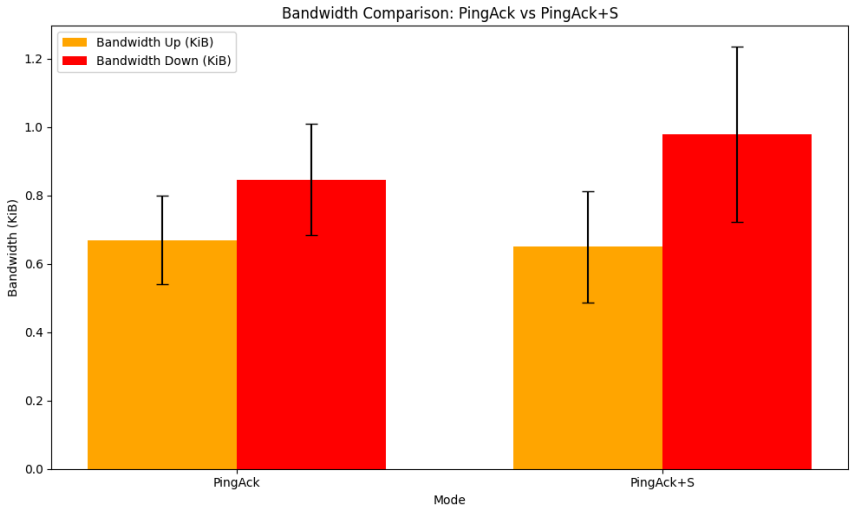
We have a fixed introducer. Unless it has joined first no members are able to join, since only the introducer shares the membership list

Then, for the commands, we have list_mem, list_self, join, leave, enable_sus, disable_sus, status_sus. These all are passed through standard input to run on any machine.

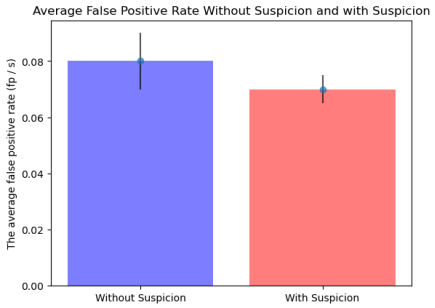
Ping Ack - Pings are sent randomly as per a time interval, pings expect an Ack in return. If Ack is not received within the timeout period, node is marked as failed, removed from membership list and everyone is told about this.

Ping-Ack-S In addition to the membership list, there is a suspect list. If the node doesn't send back an Ack to the original node, then the node is marked as 'suspect'. Everyone is told when a node suspects someone. A node can be refuted if it receives its own 'suspect' message. Here, it also updates it's incarnation number. If an ack is received from a suspect, it is removed from the local suspect list.

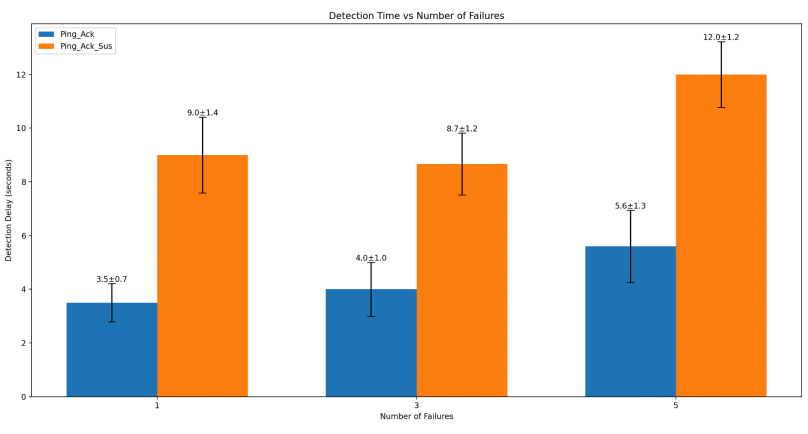
Q1 a)



b) Using the fact that the false positive rate is (FP / (FP + TN)), then using an artificial packet loss rate of 10%, after 10 seconds, there was an average false positive rate of 80% without suspicion, and an average false positive rate of 70% with suspicion



c) Here we notice that as we have suspicion enabled, the time to detect failures increases. This is because we wait the additional time to declare a failure



Q2 To get same bandwidth on both mechanisms, we changed the intervals when suspicion was enabled/disabled.

a) We expect the detection time for failures, as a function of the number of simultaneous failures to have a positive correlation. With more failures, it would take more time due to the fact that there are more messages to send.

b) Using the same false positive rate formula in 1b, and an artificial packet loss rate of 1%, there were no false positives. On an artificial packet loss rate of 2%, there were no false positives. With these changes we expected there to be fewer packet drops since we changed the interval for pings to be higher.

We were unable to plot the graphs on time.

c) To estimate bandwidth usage, we made use of the tool bandwhich - https://github.com/imsnif/bandwhich
First, we started the all the daemons with suspicion disabled and waited for 10 seconds -

This output was copied from terminal output of bandwhich (in backticks)-
```
Output (no suspicion) -
<UNKNOWN>                    11              736.00B / 804.00B

Then we enabled suspicion and waited for 10 seconds -
<UNKNOWN>                    10              707.00B / 780.00B
```

Total for No Sus - 736 + 804 = 1540B
Total for Sus = 707 + 780 =1487B
Difference = 1540 - 1487 = 53B