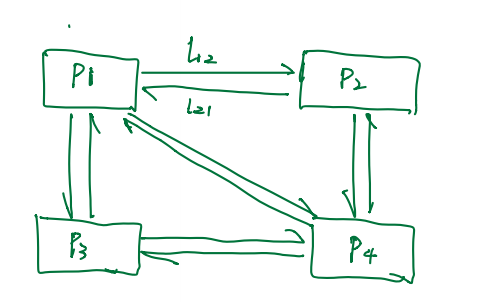
**Architecture**

**System**

All processes are fully connected and each pair is connected with uni-directional links.

According to the Byzantine fault tolerance, the amount of faulty processes is 3f+1.()

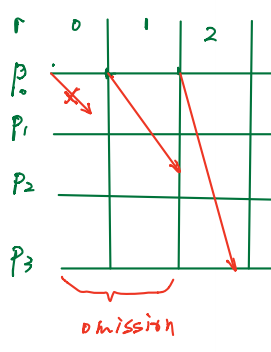


In this figure, if there are four processes in this system, one process could suffer from byzantine failure.

**Time**

A non-byzantine clock sets the count of the round r and the duration of each round is maximum delay donated by d.

In order to reach real-time and reliable, the loss and delay of a message leads to omission.



**Functions**

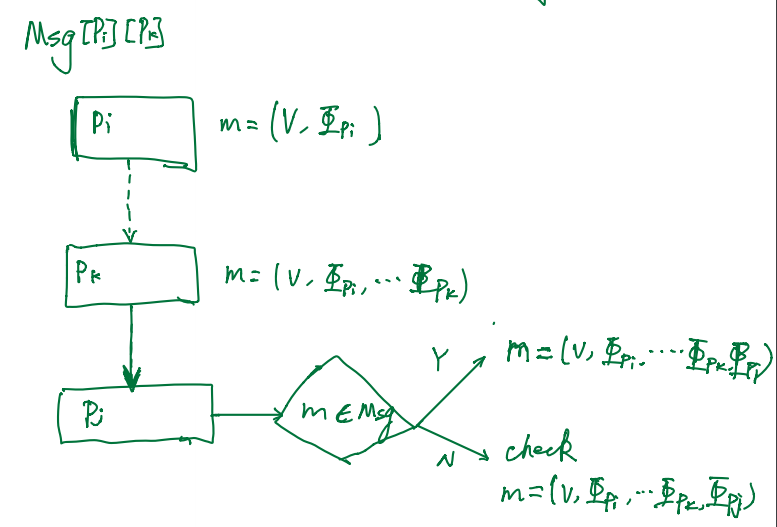
**Aggregates signature**

In this function, a process will verify each process before indeed signed a given message and append its signature on it.

At the beginning, there would be an initialized data set Msg[][] to store the message sent by the first process and checked by the last process

When a message received by process matches the value in Msg[][], will append a signature on this message and update Msg[][].

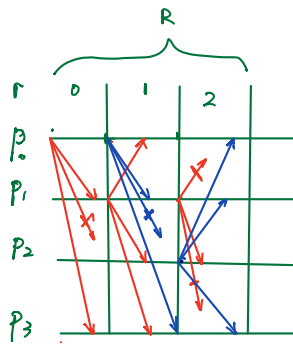
When a message received by process does not matches the value in Msg[][], will first check the pervious process received the message or not and then append a signature on this message and update Msg[][].



**Proof of life**

A process sends its own heartbeats which contains a value and ’s signature in each round to all other processes.

When process receives process heartbeat at round r, it will aggregate signatures and appends its own signature, then periodically echoes the heartbeat by sending it to all other processes. If failed to receive 2f+1 echoes at the end of the period R, it will crash itself.



**Broadcast**

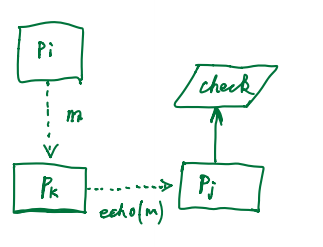
All processes are executing proof of life function before a process sends a message contains a specialized value v with its signature.

*#When receives an echo from ,*

*# If is not echoing, If it has echoed and the number of signatures >2f, it will it will deliver the broadcast message(check ? Broadcast?) for . If has not echoed and the number of signatures <2f+1, it will echo .*

When receives an echo from ,

If the number of signatures >2f, it will it will deliver the broadcast message(check ? Broadcast?) for . If the number of signatures <2f+1, it will echo .



When receives the delivered message from ,

it will signature the message and then broadcast.

