

# HOMEWORK 2 - LEONARDO SERILLI (4/10/2021)

- To ensure that a process  $i$  delivers messages to Application Layer in strictly increasing order of TS, is used an ARRAY for each  $P_j$ , which buffers all incoming couples  $(M, TS_u)$ ; In the pseudocode those m arrays are represented in a matrix with  $M$  Rows and  $m = \infty$  columns.
- When a not null message is sent to  $P_i$  also a NULL one (with same  $TS_u$ ) is sent to each  $P_z | z \neq i + 5$ .
- When a message is received from  $P_j$  it is directly buffered in the  $j^{\text{th}}$  Row of  $V$ . Then  $P_i$  check if exist a strictly increasing order from 1 to the maximum TS among all TS of elements  $(M, TS_u) \in V$ . If TRUE,  $P_i$  deliver to application layer all not-null messages  $M$ . Lastly all sent  $M$  are set to null in  $V$ , representing the fact that the message is DELIVERED.

## - $P_i$ CODE:

$V[m][m] | V[i][z] = (M, TS_u)$

$V[i][m] = \text{NULL}$

//  $M$  is the number of Processes,  
 $m = \infty$  represent the BUFFER CAPACITY of each process

{ Send  $(M, TS_u)$  to  $P_j$   
Send  $(\text{NULL}, TS_u)$  to  $P_z | z \neq i + 5$

{ Receiving  $(M, TS_u)$  from  $P_j$  } //  $M$  can be null

Append  $(M, TS_u)$  to  $V[i][\text{TAIL}]$

IF ( $\exists$  STRICTLY INCREASING ORDER from 1 to  $\max\{TS_u\}$  among  $(M, TS_u) \in V[m][m]$ )

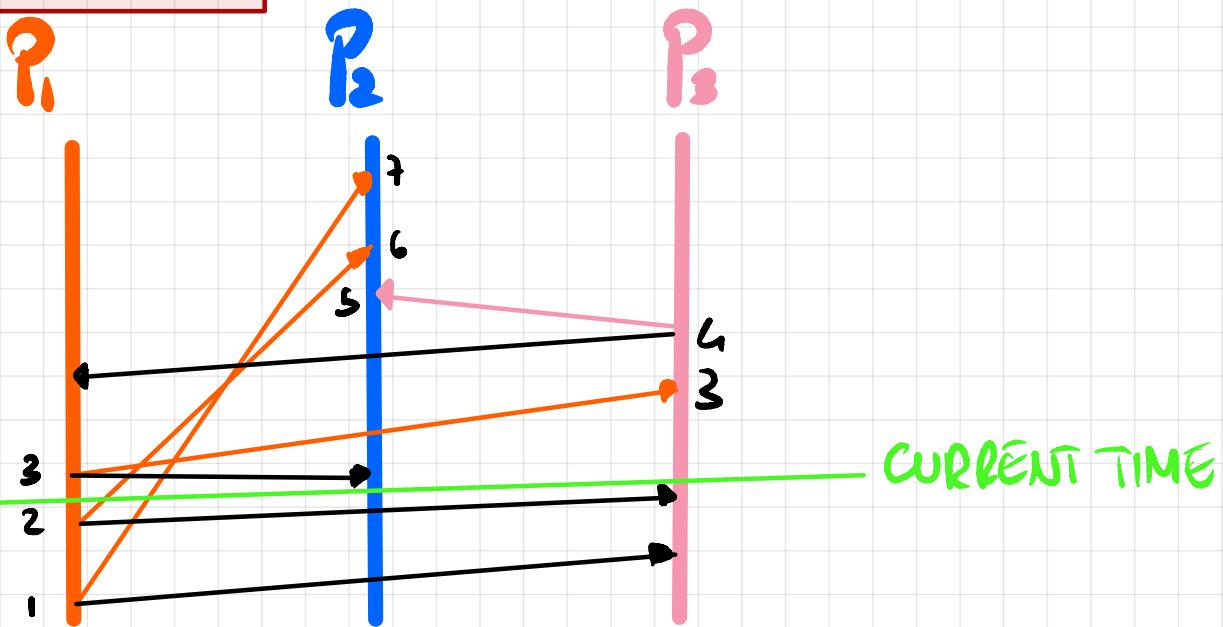
FOREACH  $((M, TS_u) \in V[m][m])$

IF ( $M \neq \text{NULL}$ )

DELIVER  $M$  to application layer

$M = \text{NULL}$

## STEP 1

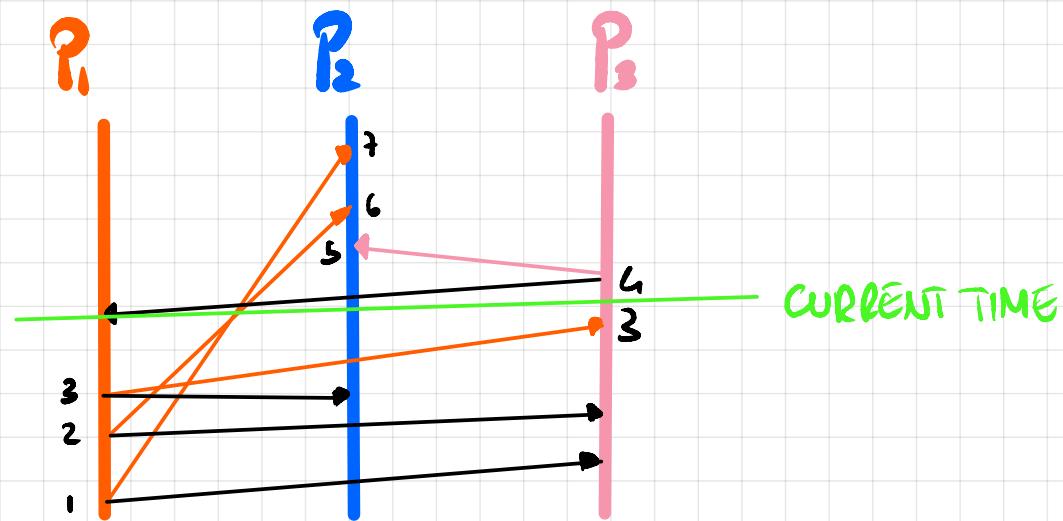


P <sub>1</sub>
P <sub>1</sub>
P <sub>2</sub>
P <sub>3</sub>

P <sub>2</sub>
P <sub>1</sub>
P <sub>2</sub>
P <sub>3</sub>

P <sub>3</sub>
P <sub>1</sub> (NULL, 1), (NULL 2)
P <sub>2</sub>
P <sub>3</sub>

## STEP 2



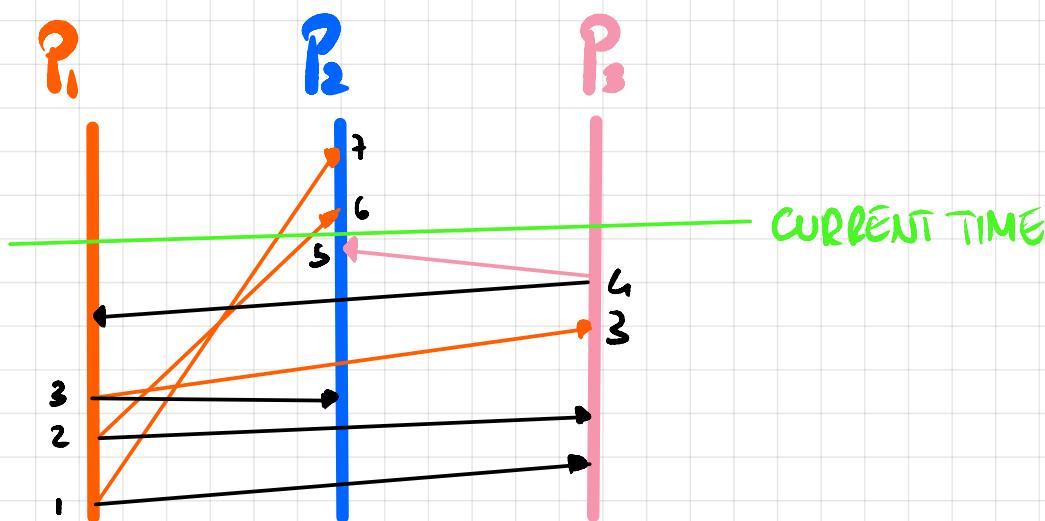
P <sub>1</sub>
P <sub>1</sub>
P <sub>2</sub>
P <sub>3</sub>

P <sub>2</sub>
P <sub>1</sub> (NULL, 3)
P <sub>2</sub>
P <sub>3</sub>

P <sub>3</sub>
P <sub>1</sub> (NULL, 1), (NULL 2), (M, 3)
P <sub>2</sub>
P <sub>3</sub>

P<sub>3</sub> Deliver M!

## STEP 3



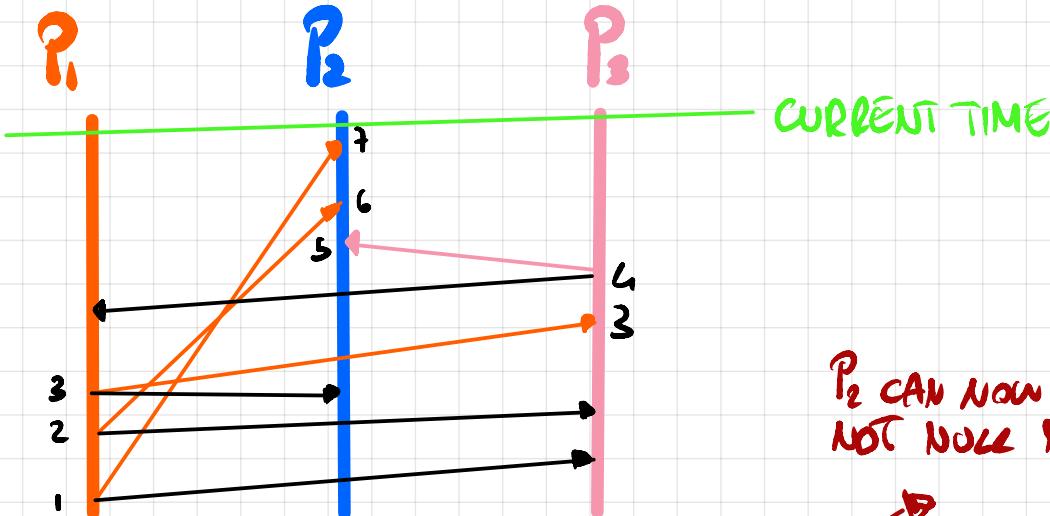
P <sub>1</sub>	
P <sub>1</sub>	
P <sub>2</sub>	
P <sub>3</sub>	(NULL, 4)

P <sub>2</sub>	
P <sub>1</sub>	(NULL, 3)
P <sub>2</sub>	
P <sub>3</sub>	(M, 4)

P <sub>3</sub>	
P <sub>1</sub>	(NULL, 1), (NULL, 2), (NULL, 3)
P <sub>2</sub>	
P <sub>3</sub>	

M<sub>1</sub> is set to m<sub>0</sub> after the delivery

## STEP 4



P <sub>1</sub>	
P <sub>1</sub>	
P <sub>2</sub>	
P <sub>3</sub>	(NULL, 4)

P <sub>2</sub>	
P <sub>1</sub>	(NULL, 3), (M, 2), (M, 1)
P <sub>2</sub>	
P <sub>3</sub>	(M, 4)

P <sub>3</sub>	
P <sub>1</sub>	(NULL, 1), (NULL, 2), (NULL, 3)
P <sub>2</sub>	
P <sub>3</sub>	

P<sub>2</sub> CAN NOW DELIVER EVERY NOT NULL MESSAGE.