Global States

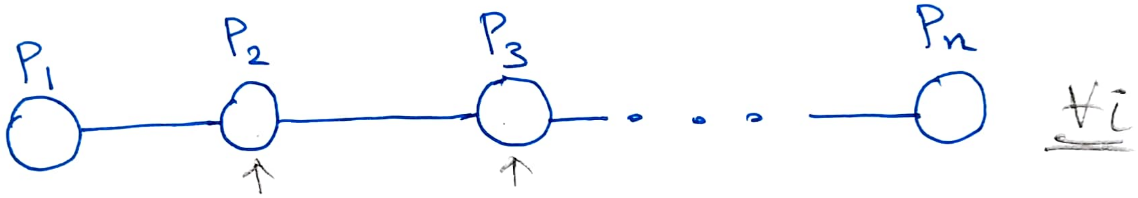
03 FEB 2022

2-3 PM

Recap:

CO: Processes: P_i, P_j, and P_K

$$\boxed{\begin{array}{l} \text{if send}(m_{ij}) \longrightarrow \text{Send}(m_{kj}) \\ \text{then receive}(m_{ij}) \longrightarrow \text{Receive}(m_{kj}) \end{array}}$$



$\left.\begin{array}{l} \rightarrow \text{no shared memory} \\ \rightarrow \text{no common clock} \\ \rightarrow \text{transmission (message passing)} \end{array}\right\}$

Local (Internal event) → State of the process

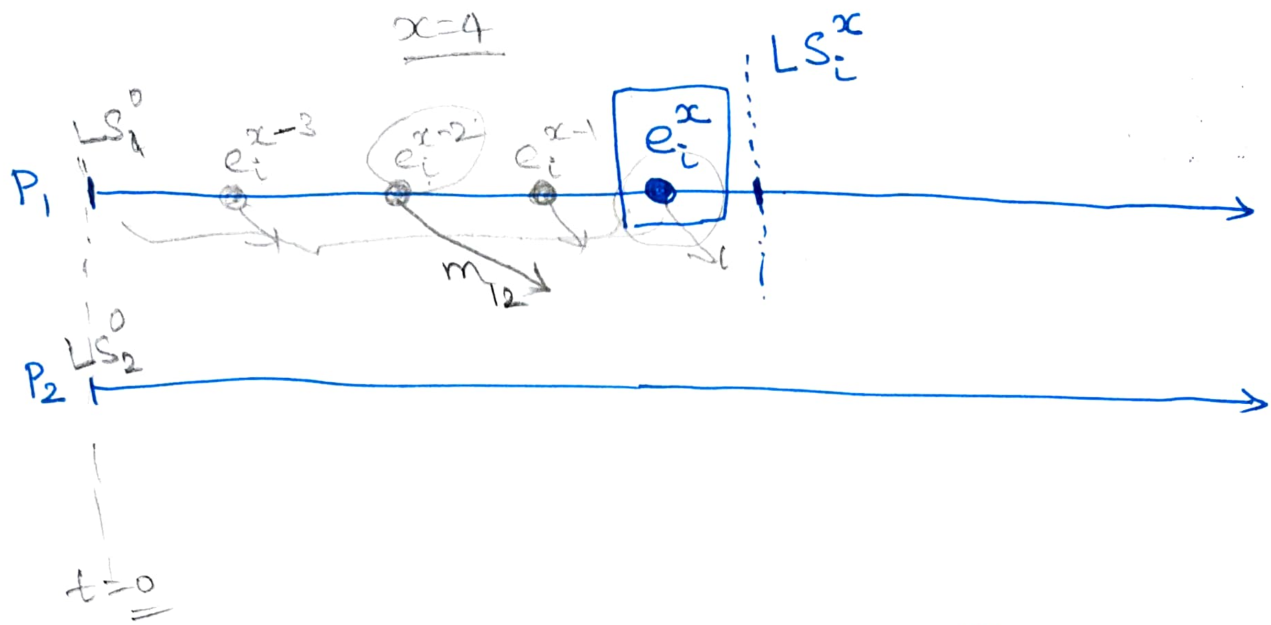
external events → states of the processes and channels.

$\boxed{LS_i^x} \longrightarrow$ @ P_i (before e_i^{x+1})

$\leftarrow e_i^{x-2} \dots e_i^{x-1} \leftarrow \boxed{e_i^x} \longrightarrow$ state?! LS_i^x

$\boxed{LS_i^0} \rightarrow$ Initial state.

$\text{send}(m) \leq LS_i^x, \exists y, 1 \leq y \leq x$ s.t $e_i^y = \text{Send}(m)$



receive(m) ($\cancel{\notin}$) (not $\leq$) LS_i^x .

($\not\leq$)

$\forall y,\ 1 \leq y \leq x$ s.t $e_i^y \neq$ receive(m)

A global state GS is defined as.

$$GS = \left\{ \bigcup_{i} LS_i^x \, , \bigcup_{\boxed{j,k}} SC_{jk}^{y_j, z_k} \right\}$$

local state of $\boxed{P_i}$ till e_i^x

state of the channels connecting P_j and P_k

e_j^y e_k^z

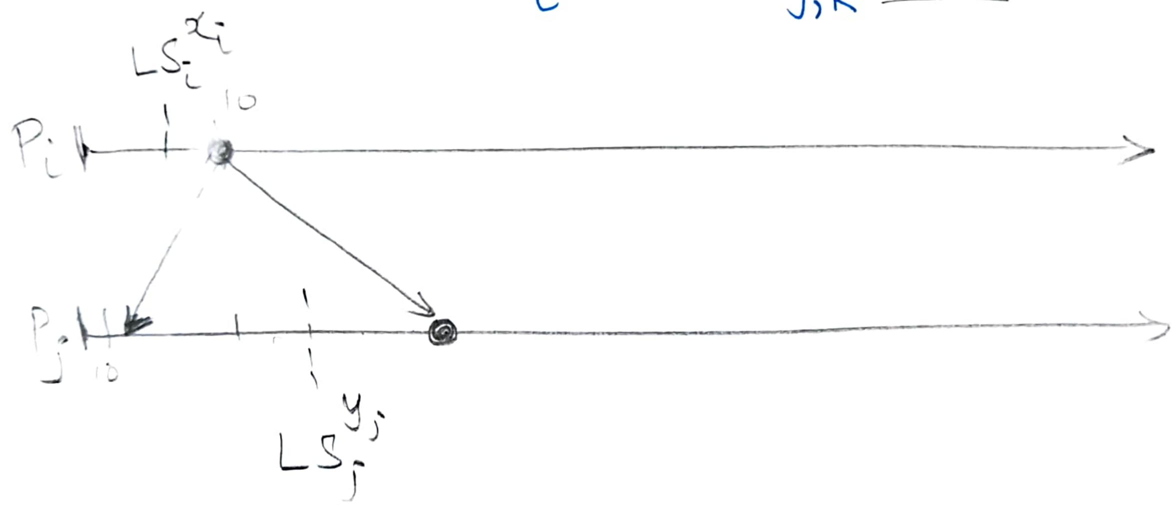
Q: Whether the global state captured is consistent or not?

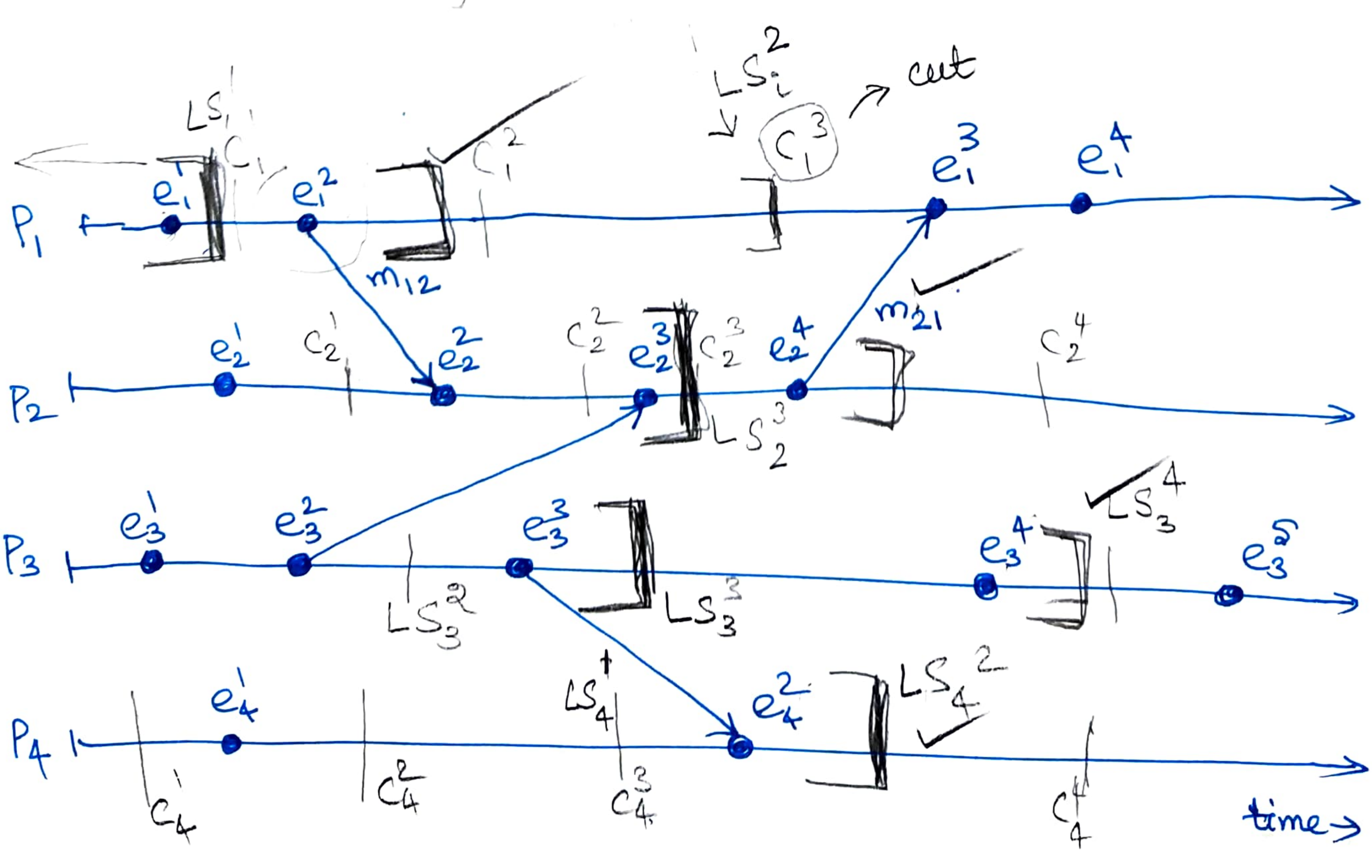
A global state is a $\boxed{\text{Consistent GS}}$ iff

$$\forall m_{ij} : \underbrace{send(m_{ij}) \not\leq \boxed{LS_i^{x_i}}}$$

$$\Longleftrightarrow \underbrace{m_{ij} \notin SC_{ij}^{x_i, y_j}} \wedge \underbrace{\boxed{rec(m_{ij})} \not\leq LS_j^{y_j}}$$

where $GS = \left\{ \bigcup_i LS_i^{x}, \bigcup_{j,k} SC_{jk}^{y_j, z_k} \right\}$





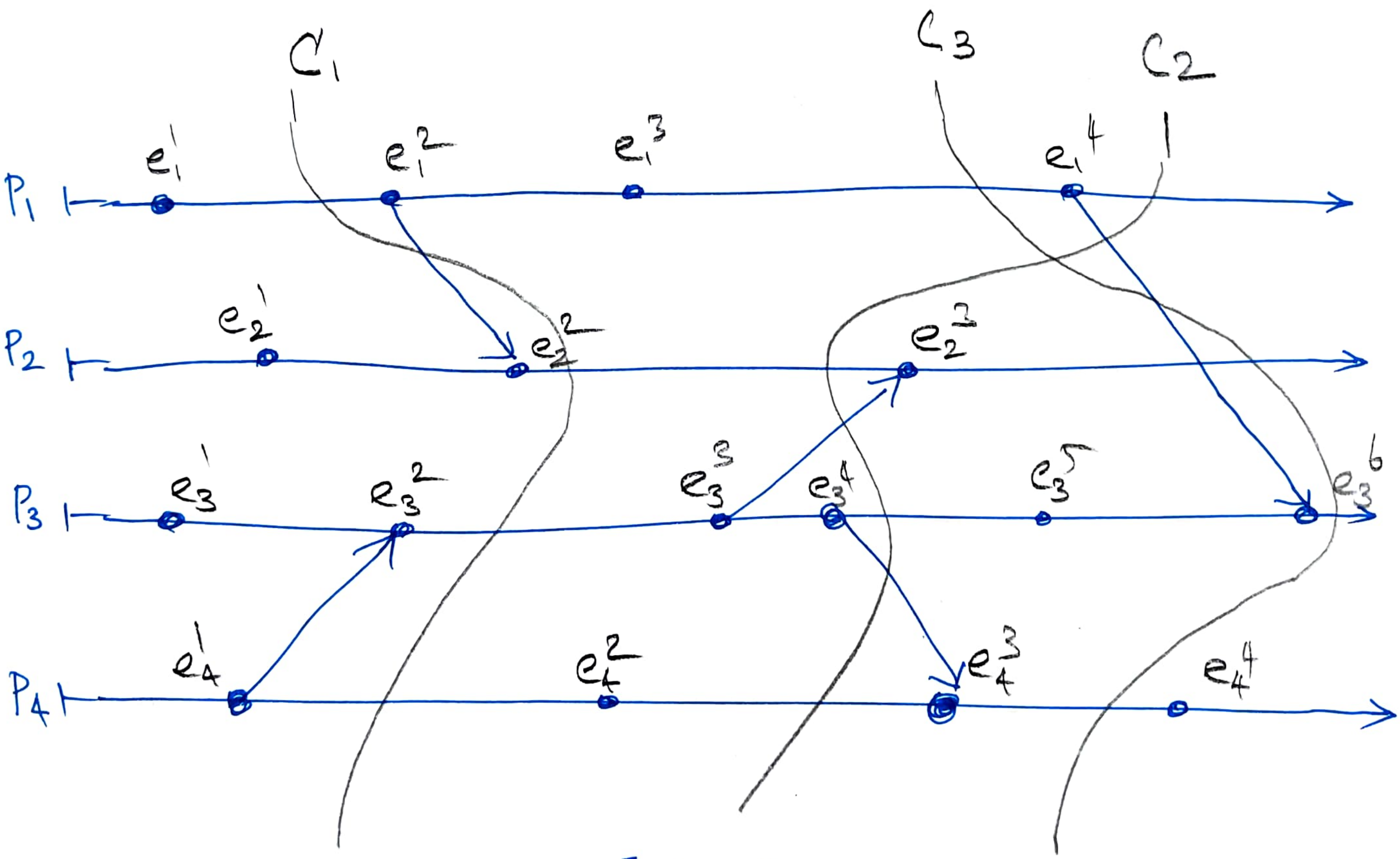
$\boxed{GS1} = \{ LS_1^1, LS_2^3, LS_3^3, LS_4^2 \}$

Is this state consistent?!

No, it is inconsistent

$GS2 = \{ LS_1^2, LS_2^4, LS_3^4, LS_4^2 \}$

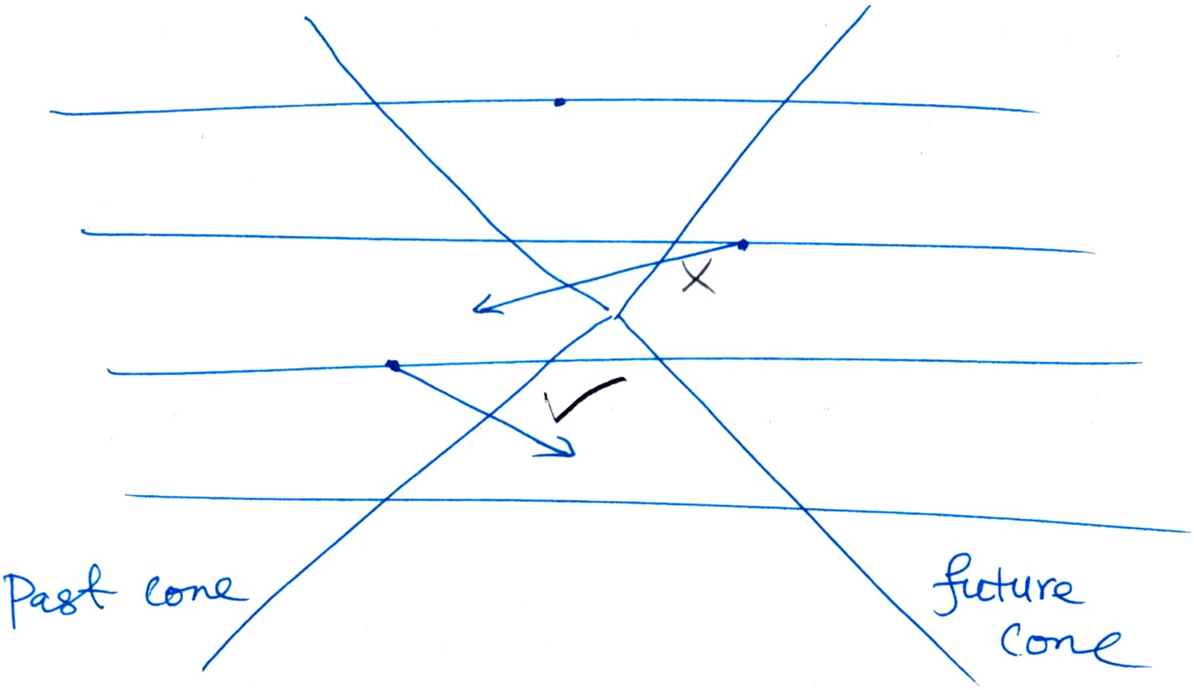
$\Rightarrow$ GS2 is consistent



C_1 – inconsistent

C_2 – Consistent

C_3 – inconsistent


Past cone
future cone