

Distribuované systémy a výpočty

X36DSV

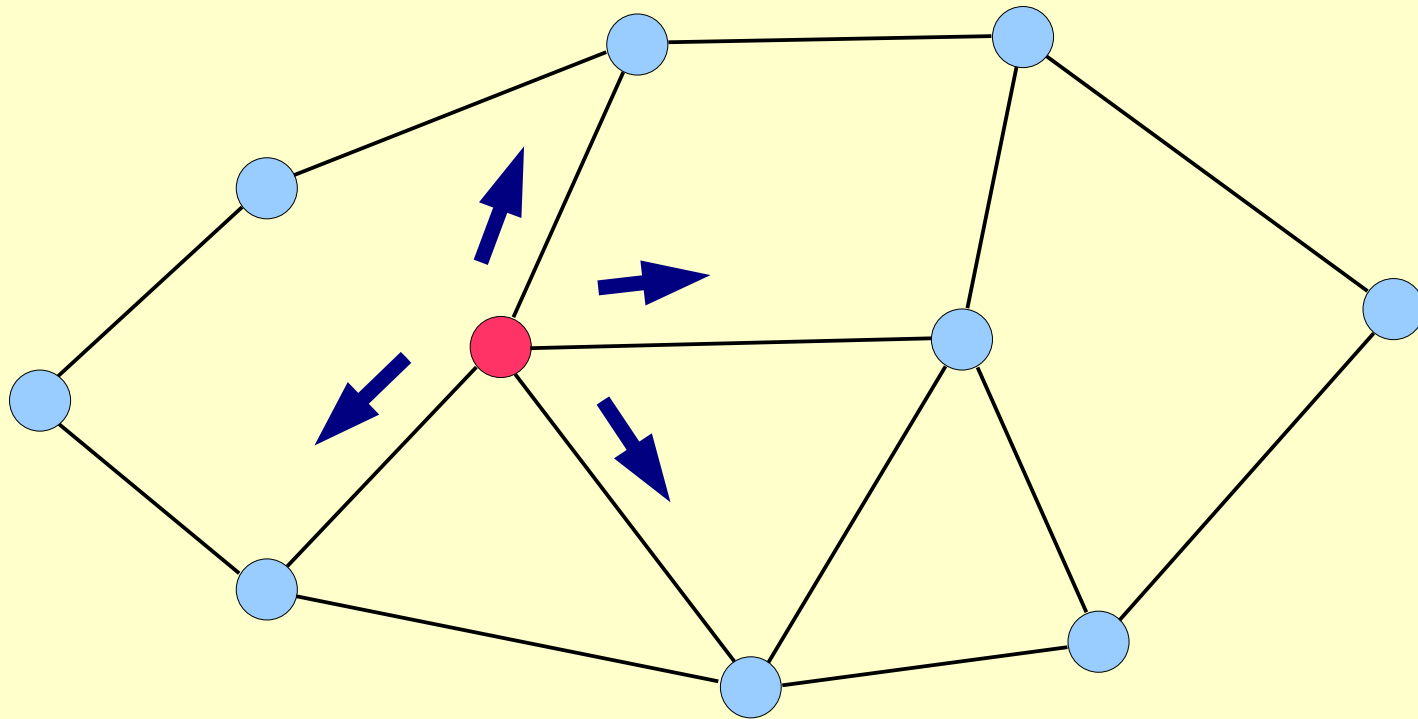
Jan Janeček
(zastupuje Peter Macejko)



Heart - beat

Broadcast

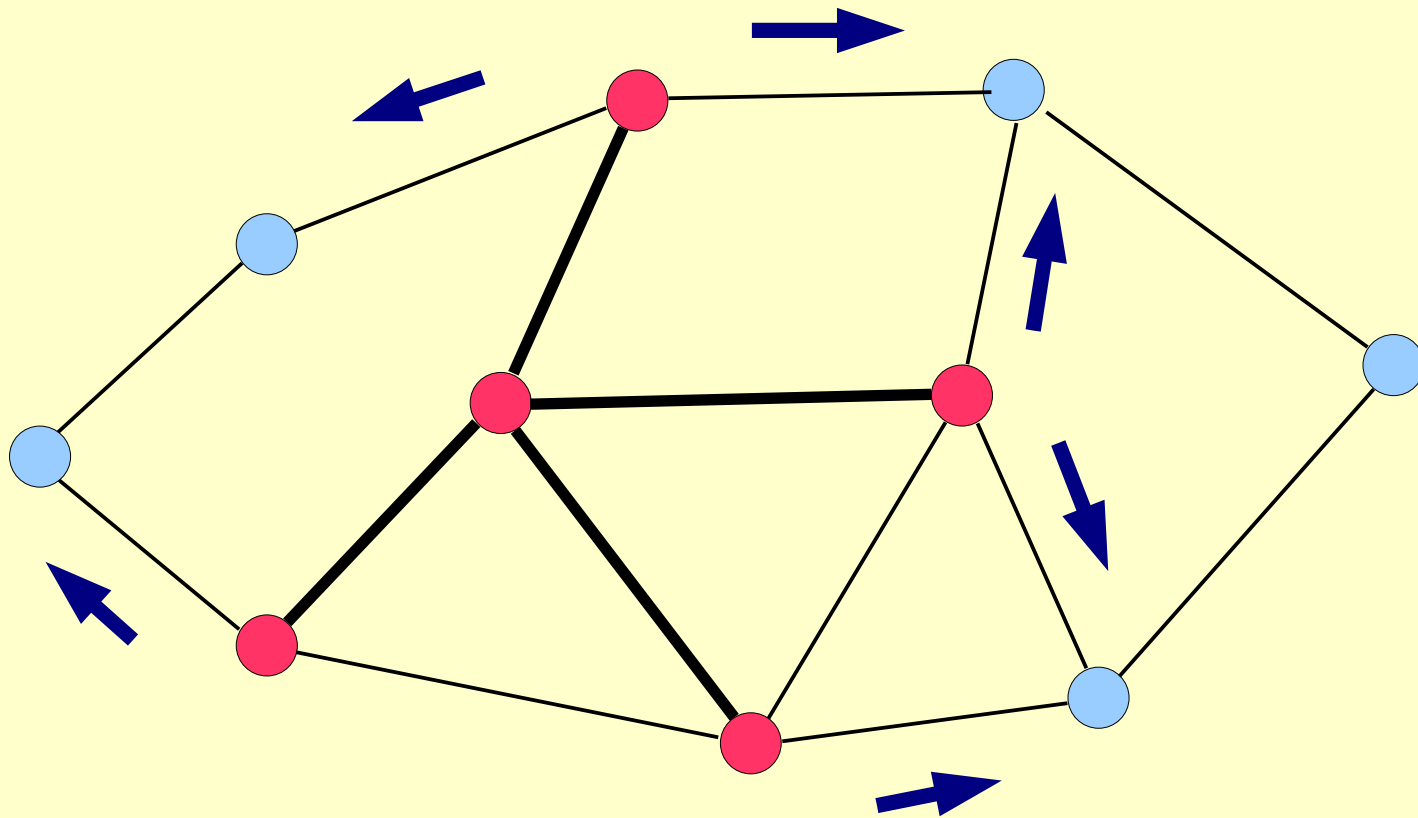
Convergecast



Heart - beat

Broadcast

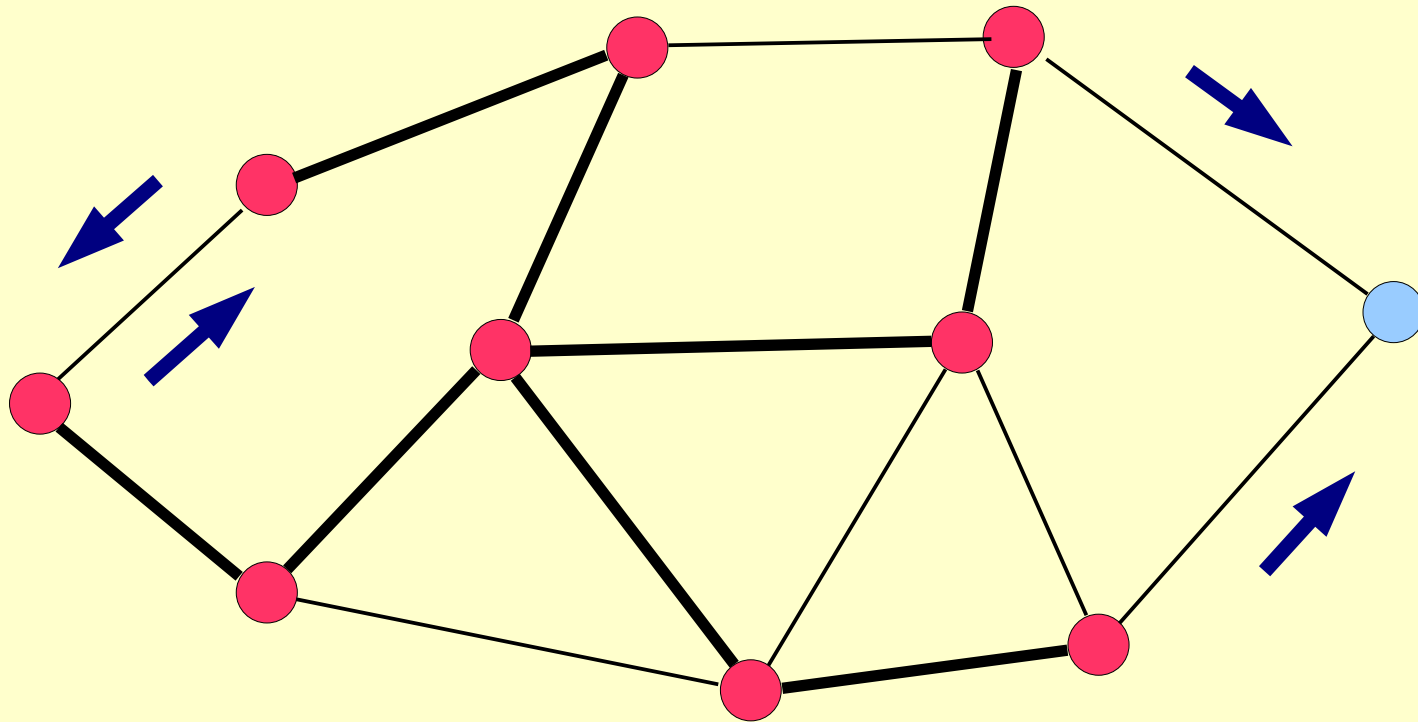
Convergecast



Heart - beat

Broadcast

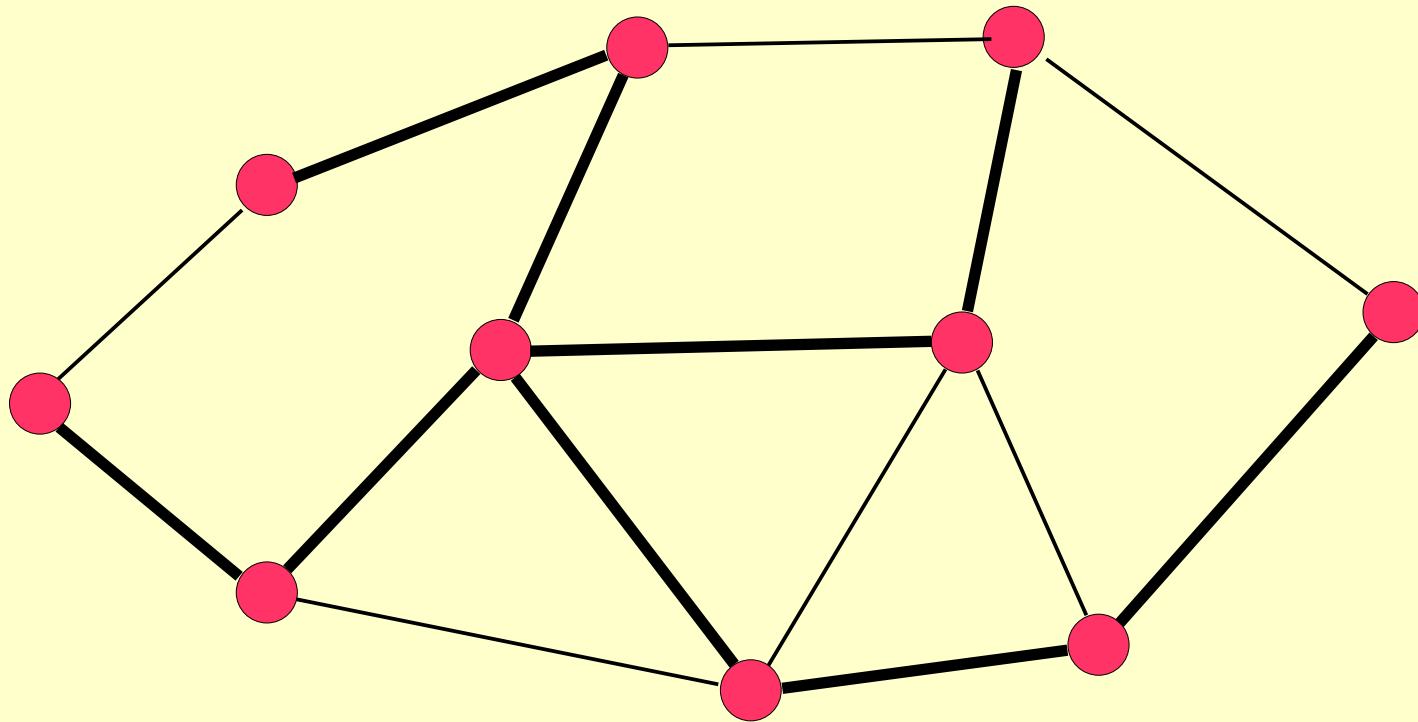
Convergecast



Heart - beat

Broadcast

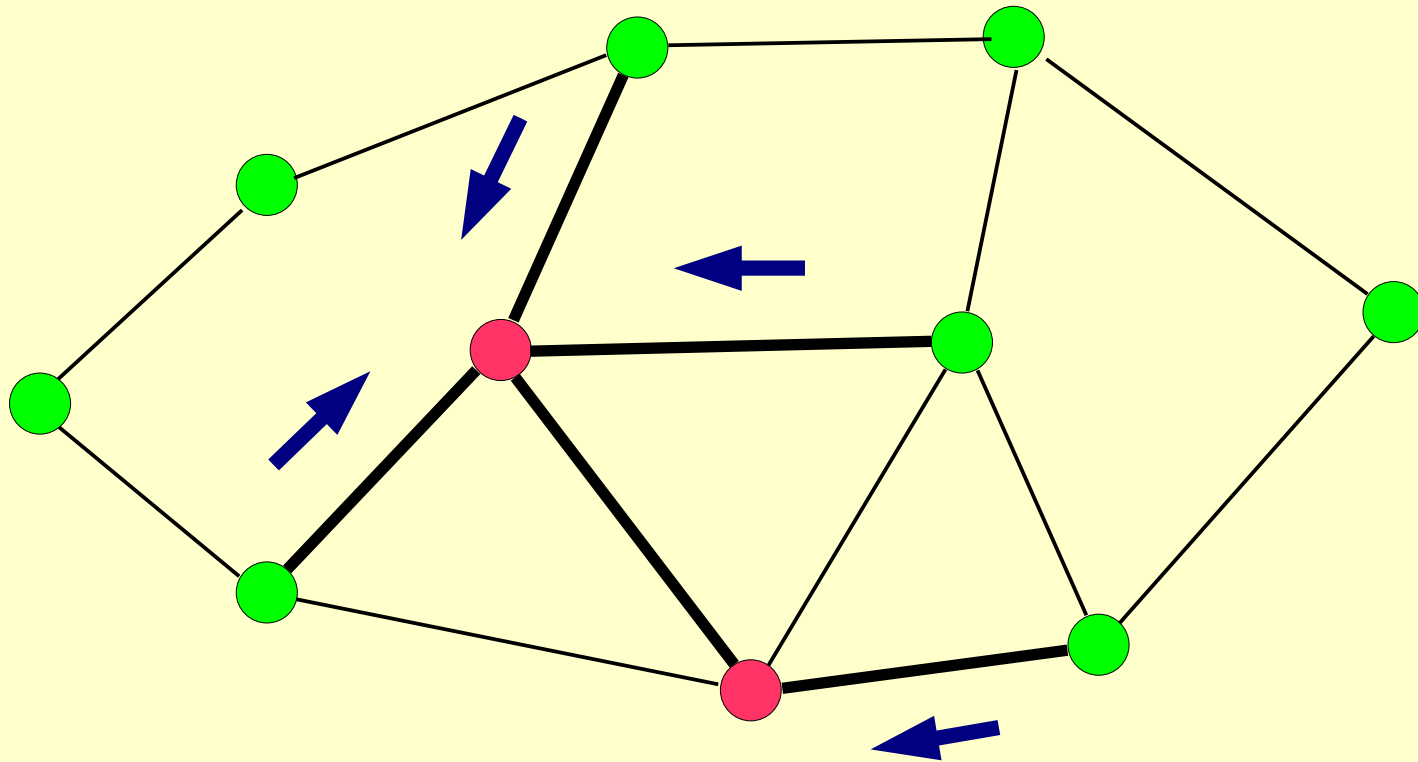
Convergecast



Heart - beat

Broadcast

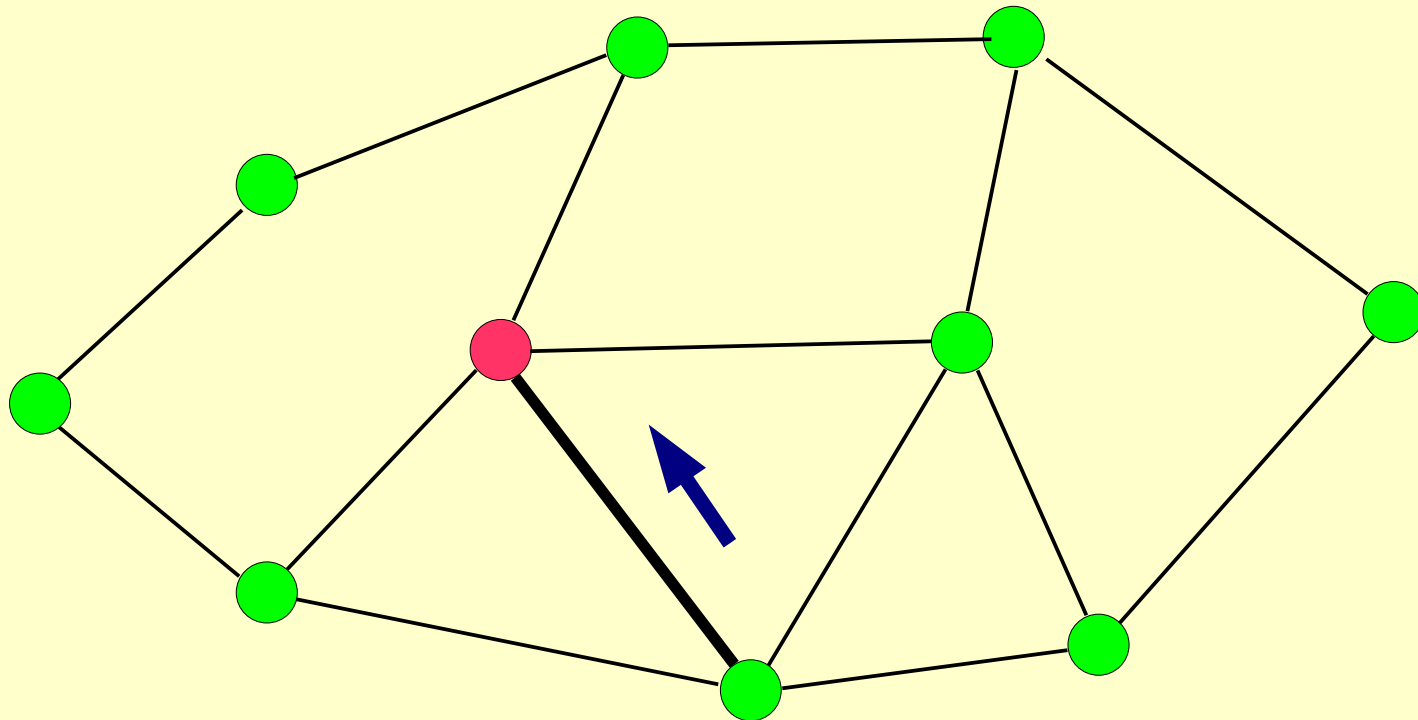
Convergecast



Heart - beat

Broadcast

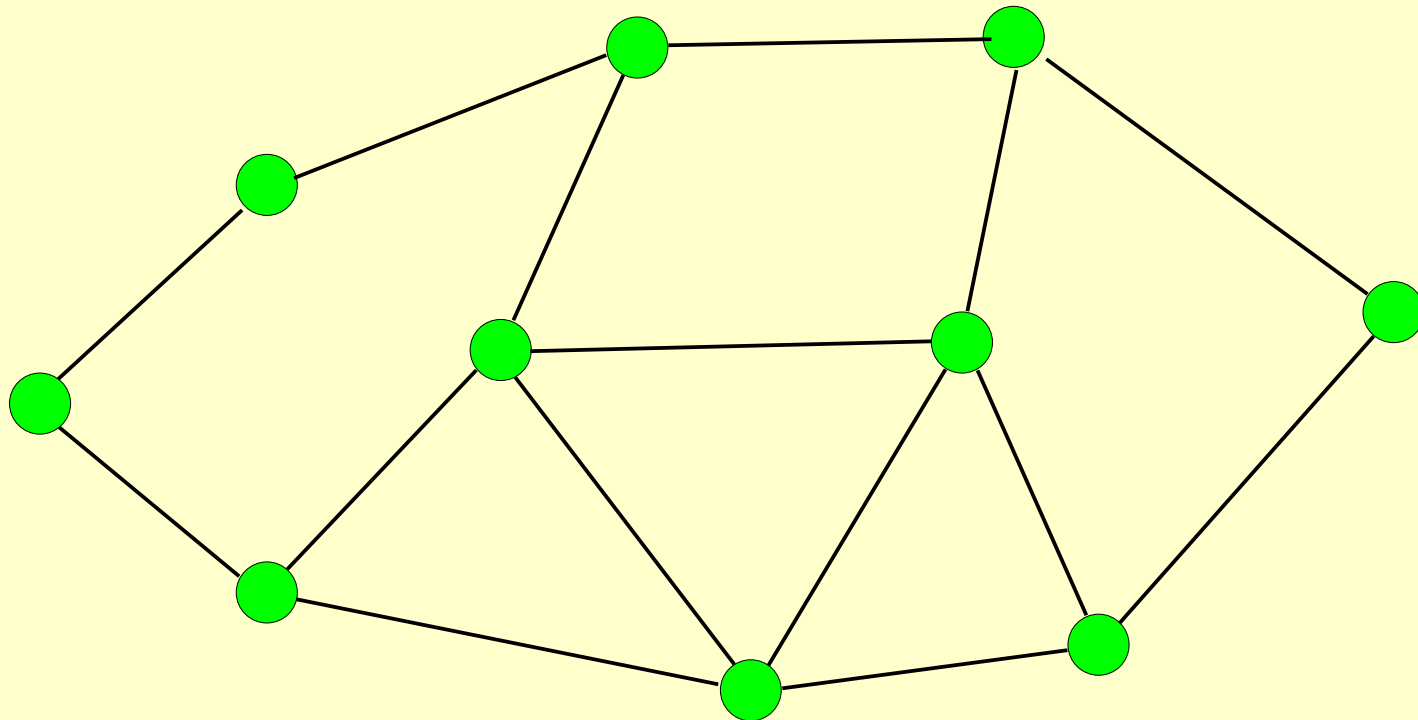
Convergecast



Heart - beat

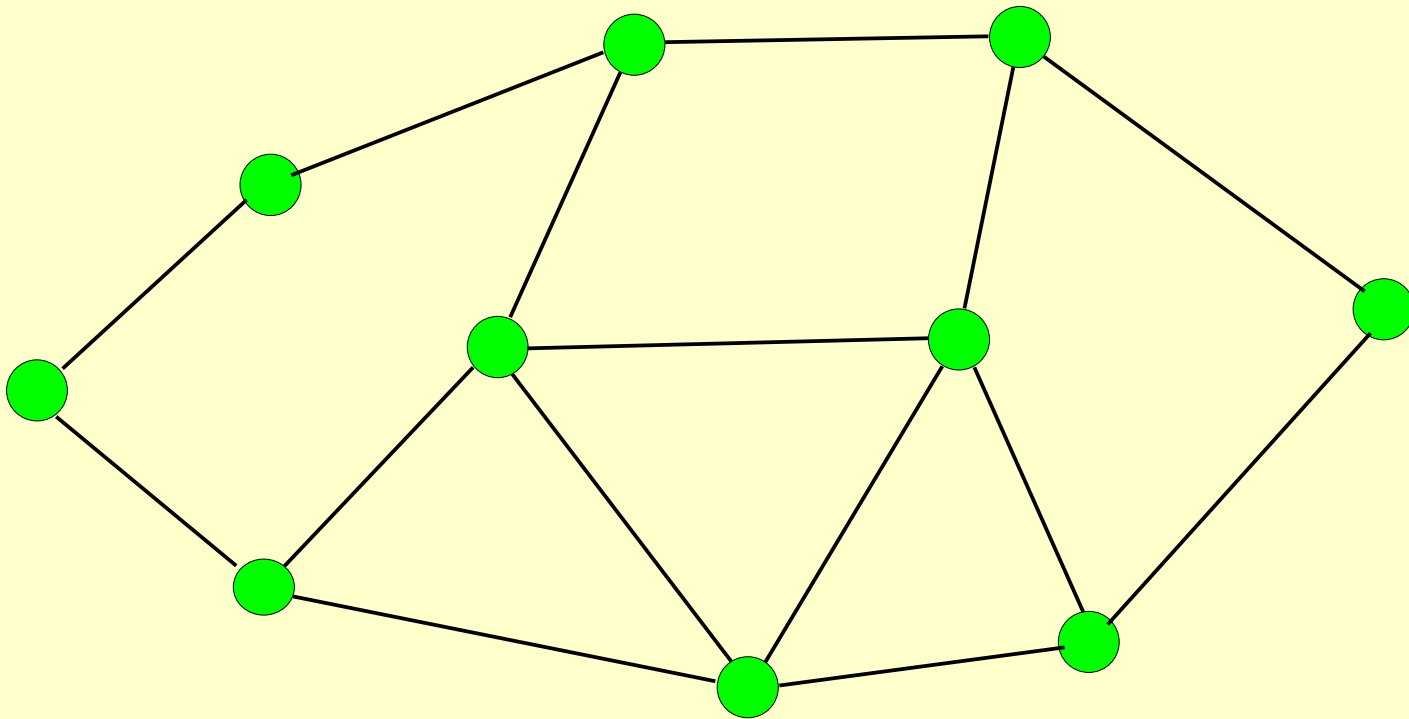
Broadcast

Convergecast



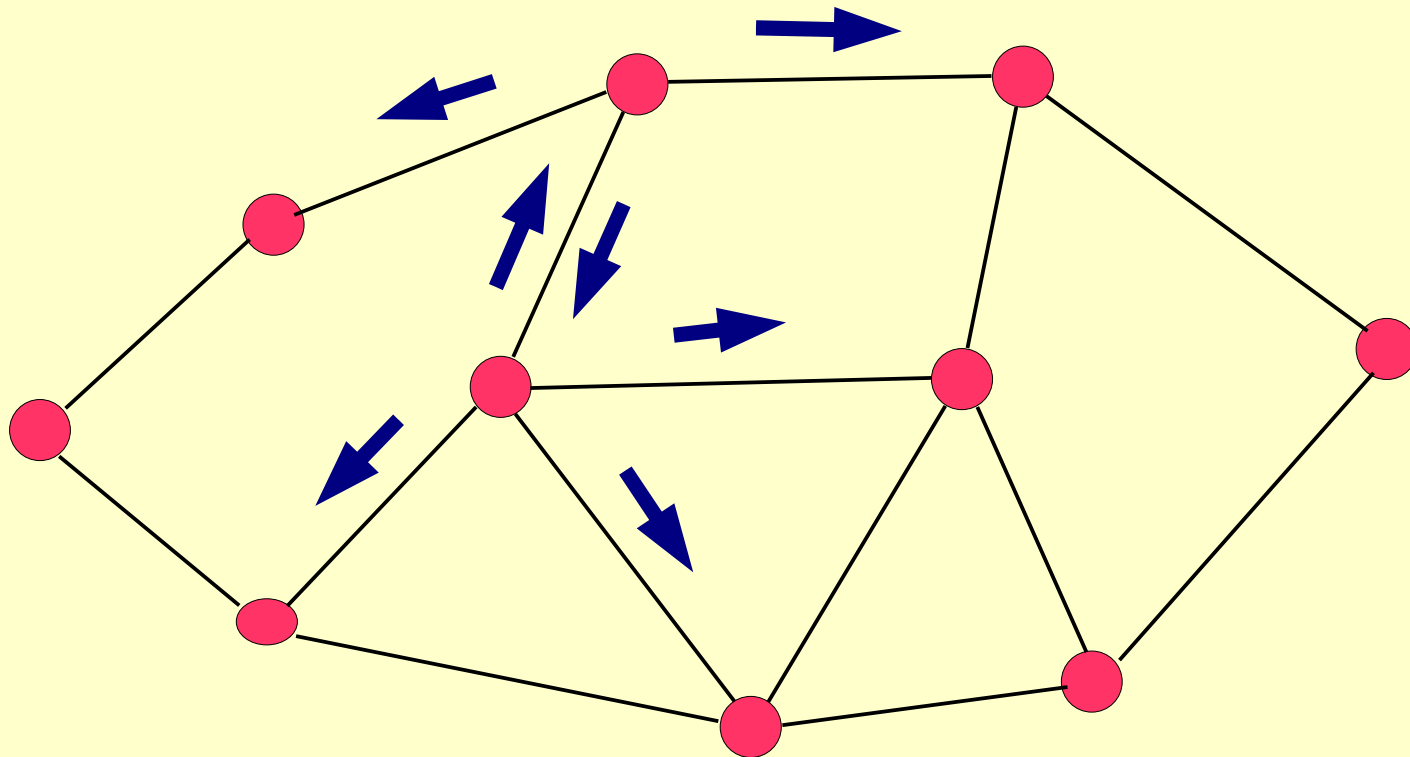
Diffusion

synchronní varianta - RIP



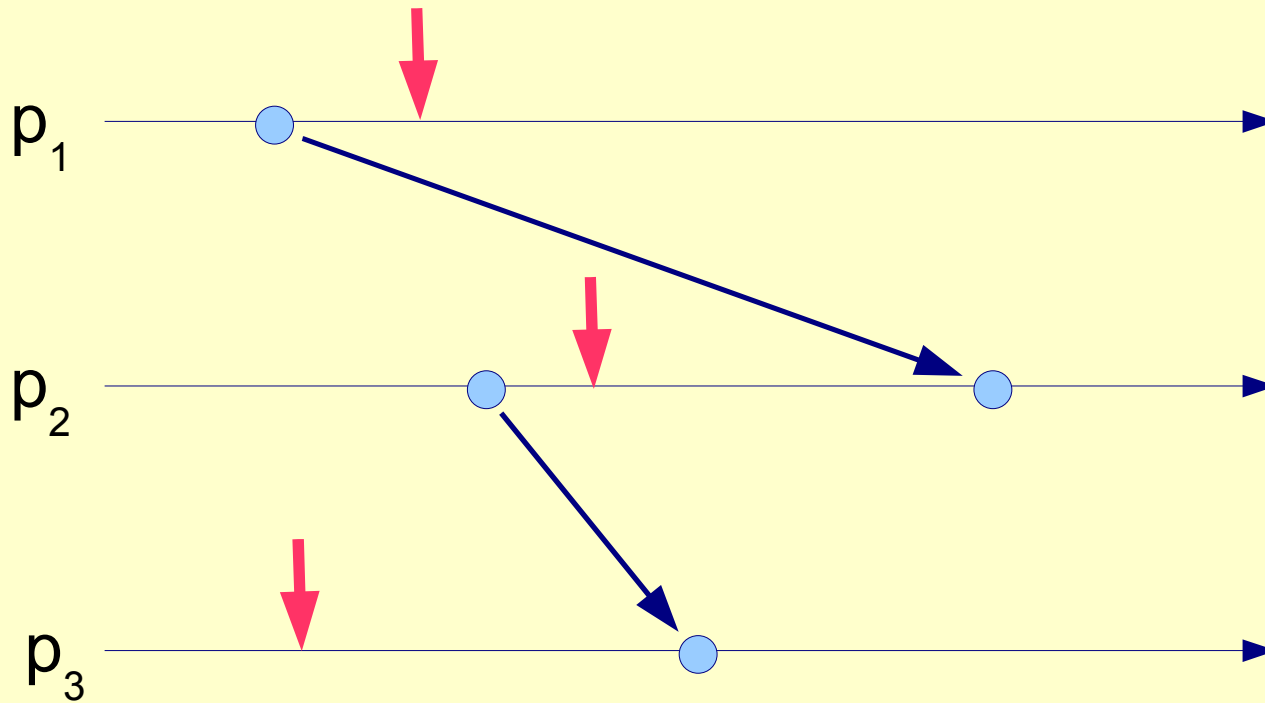
Diffusion

synchronní varianta - RIP



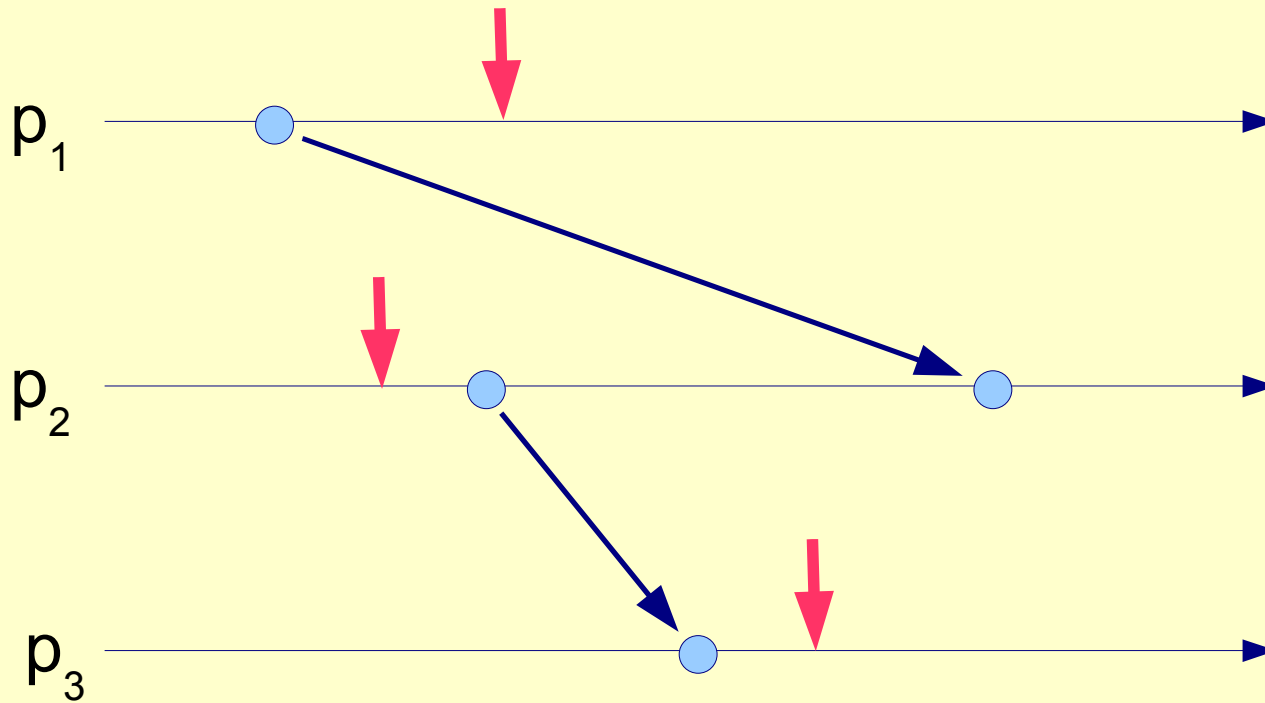
Snímek výpočtu - snapshot

Consistent



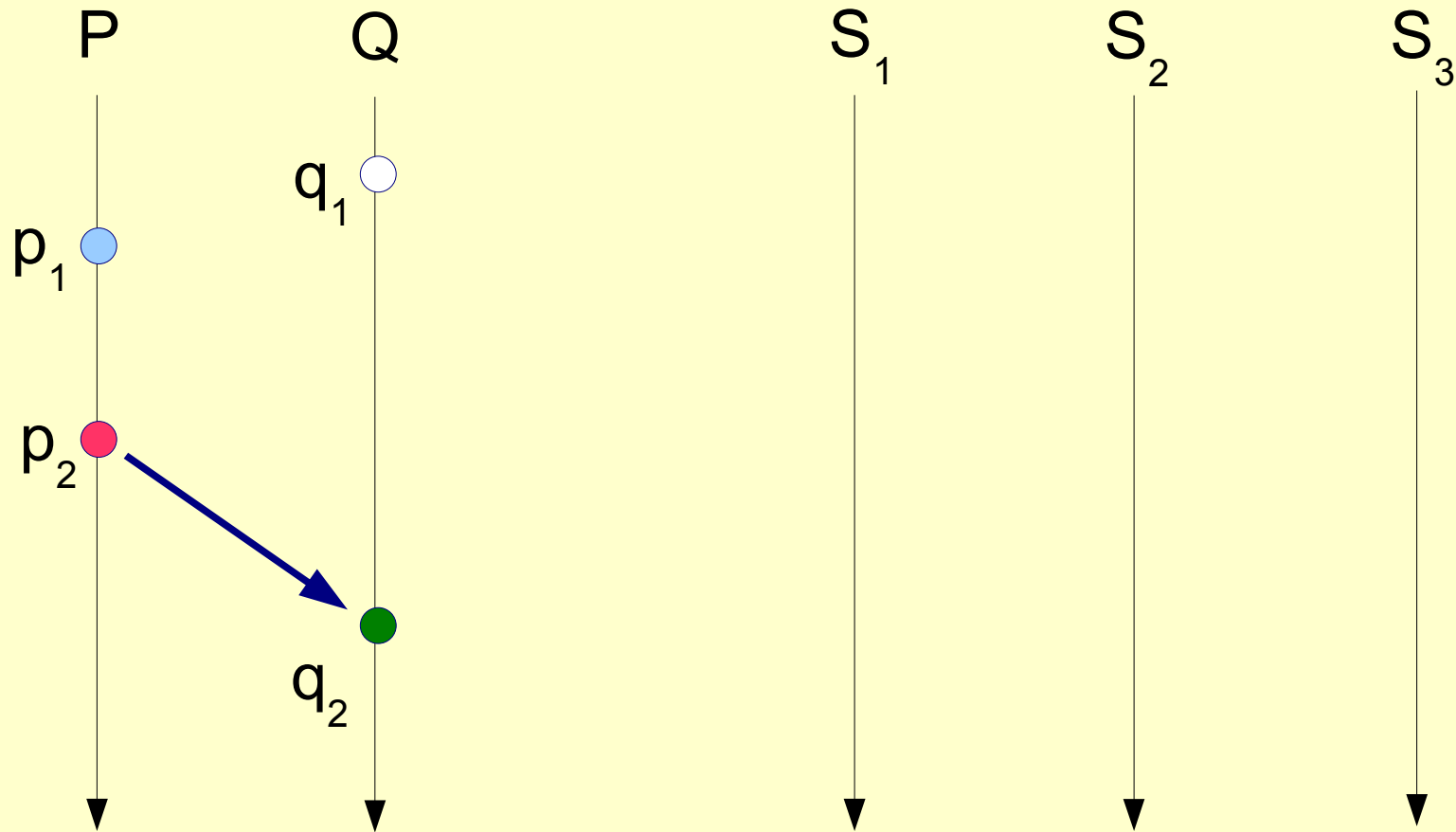
Snímek výpočtu - snapshot

Inconsistent



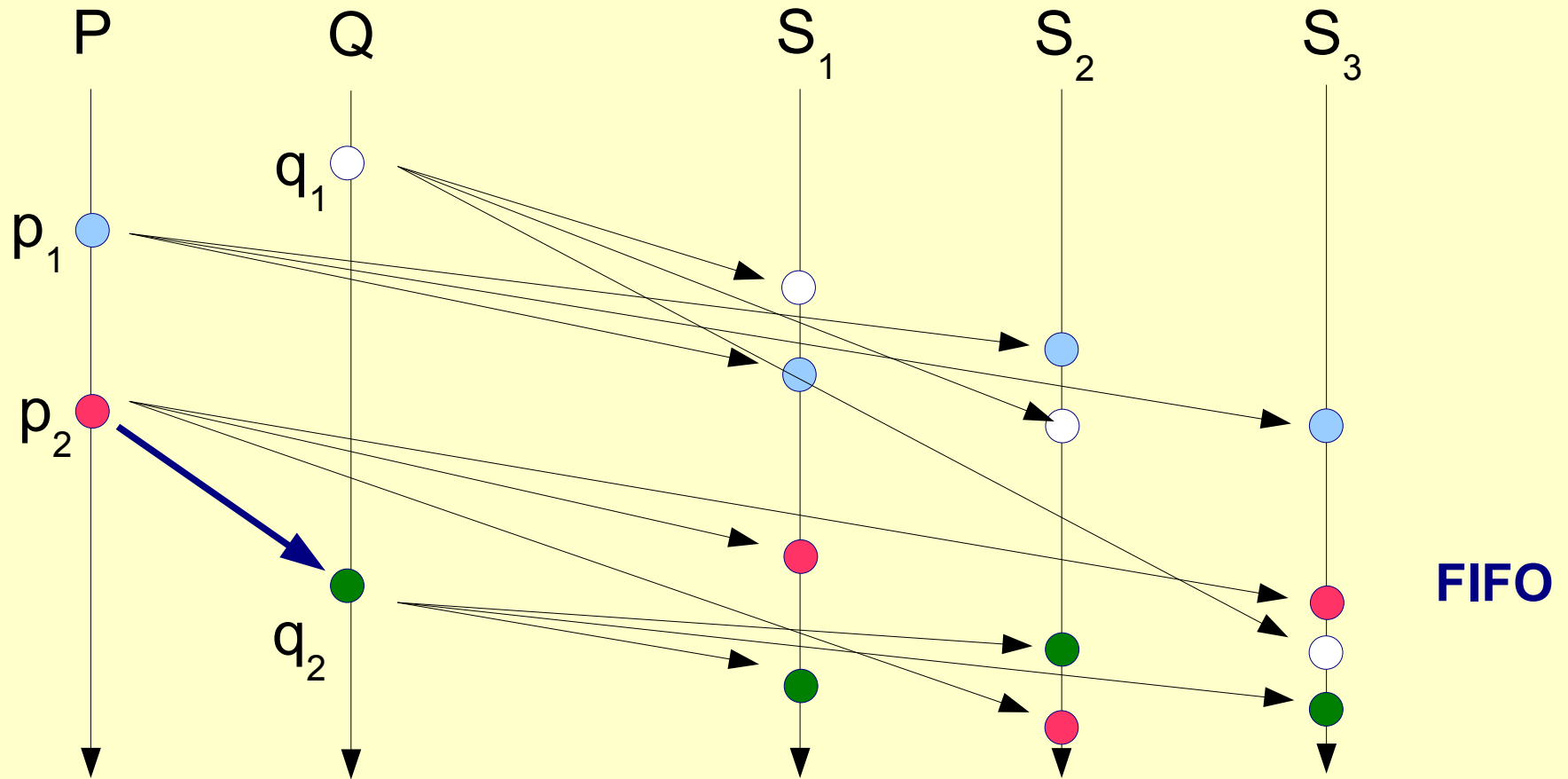
Uspořádání událostí

Ordering of events



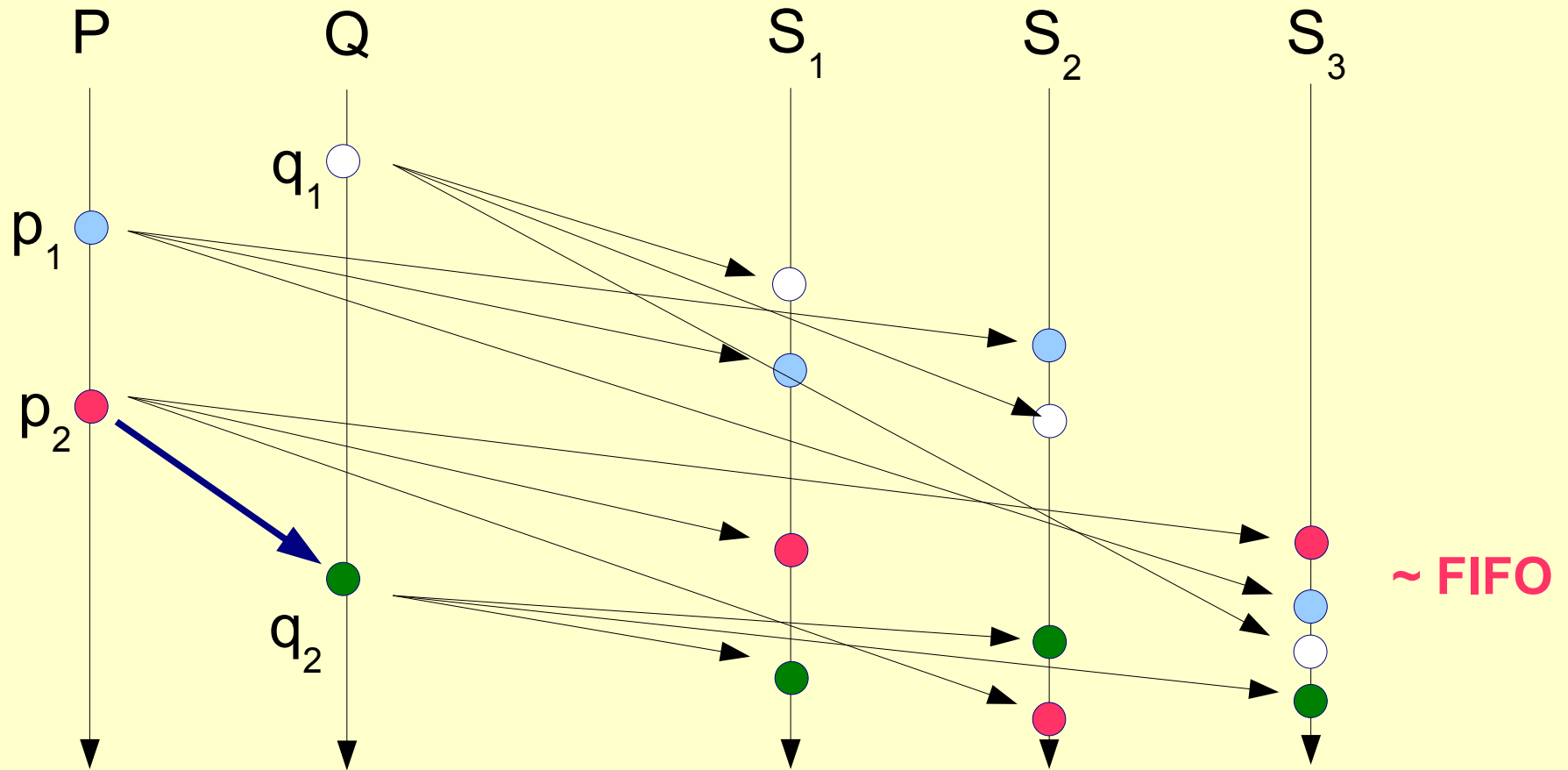
Uspořádání událostí

Communication effect



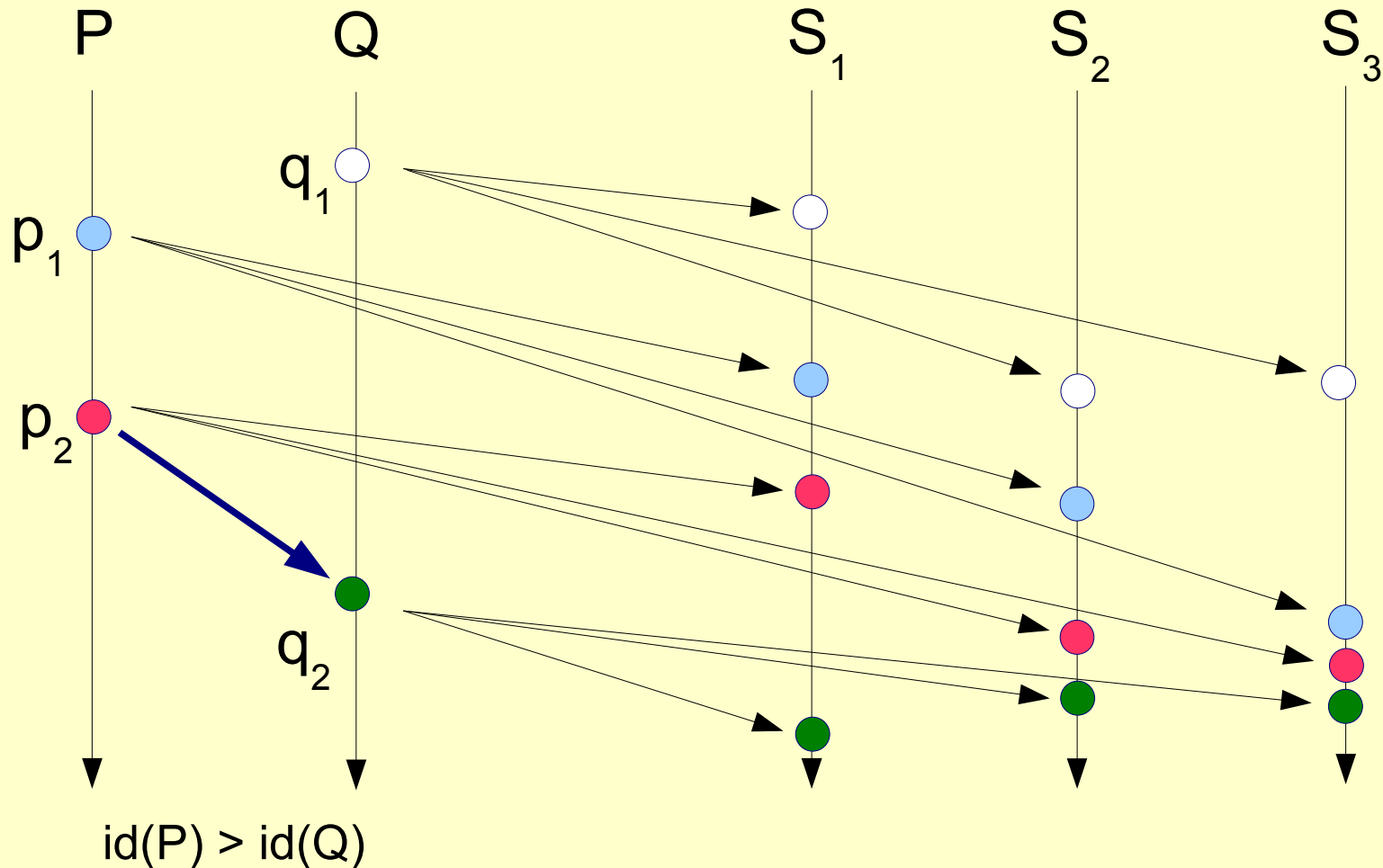
Uspořádání událostí

Communication effect



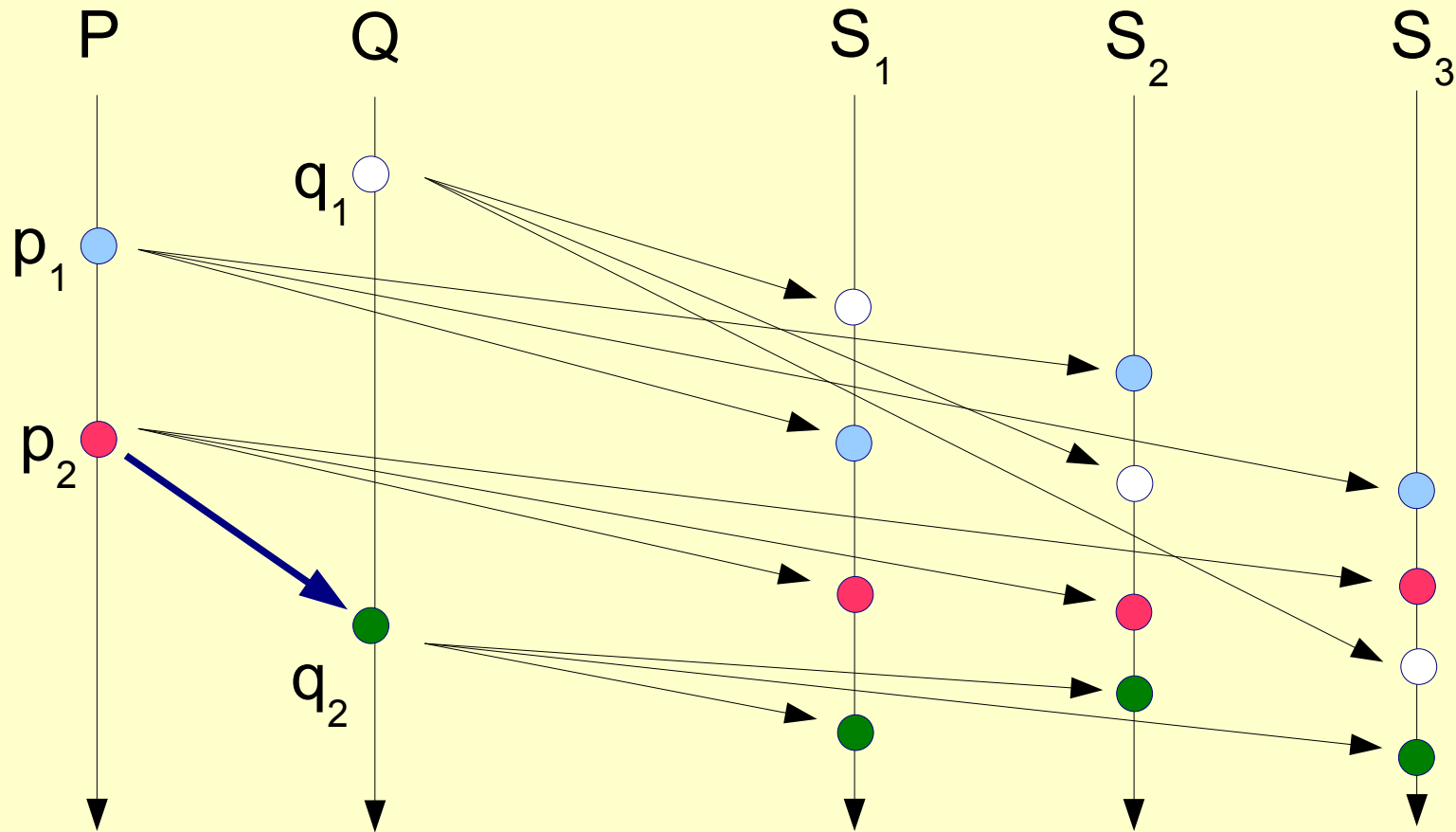
Uspořádání událostí

Total ordering



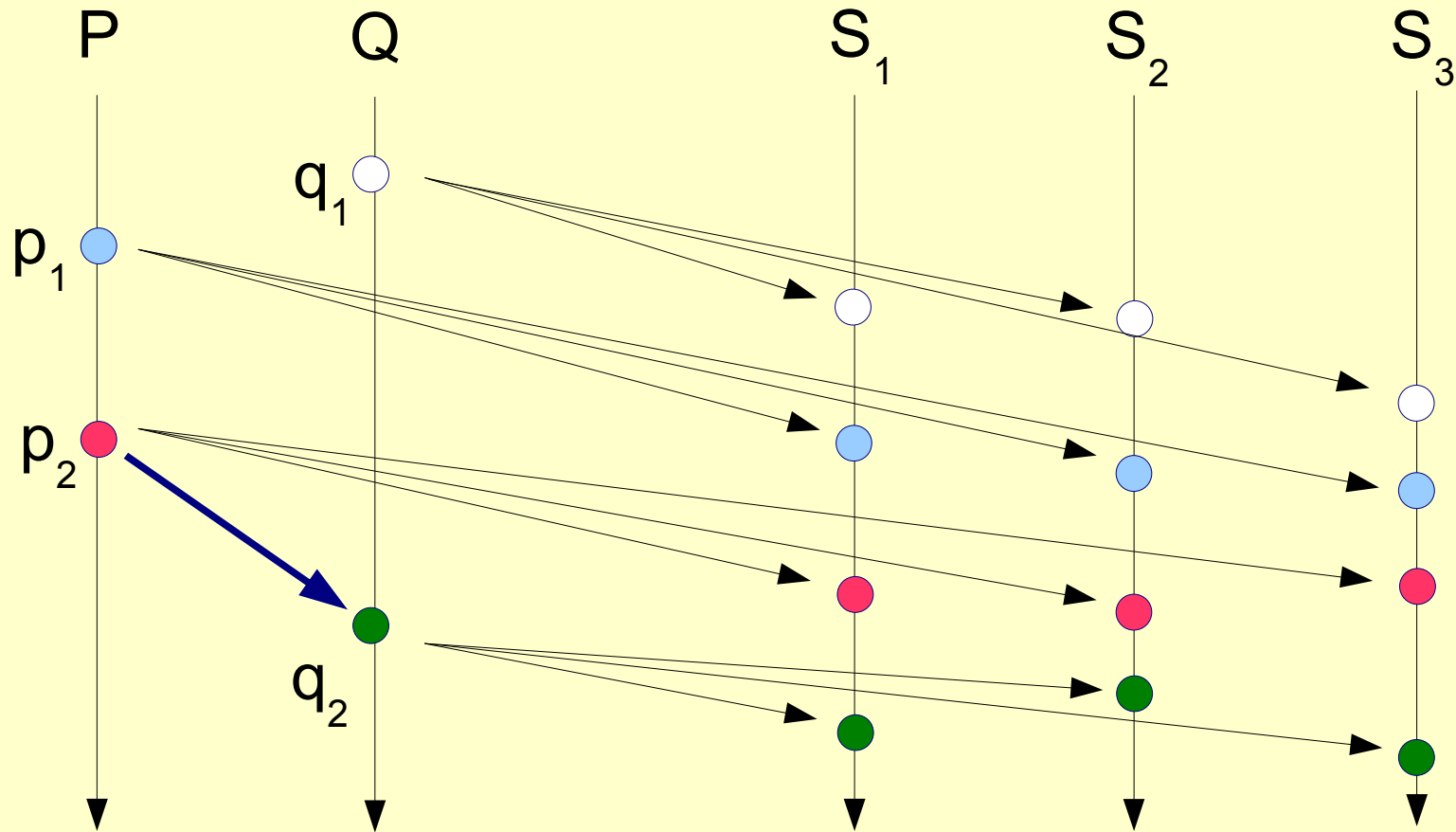
Uspořádání událostí

Causal ordering

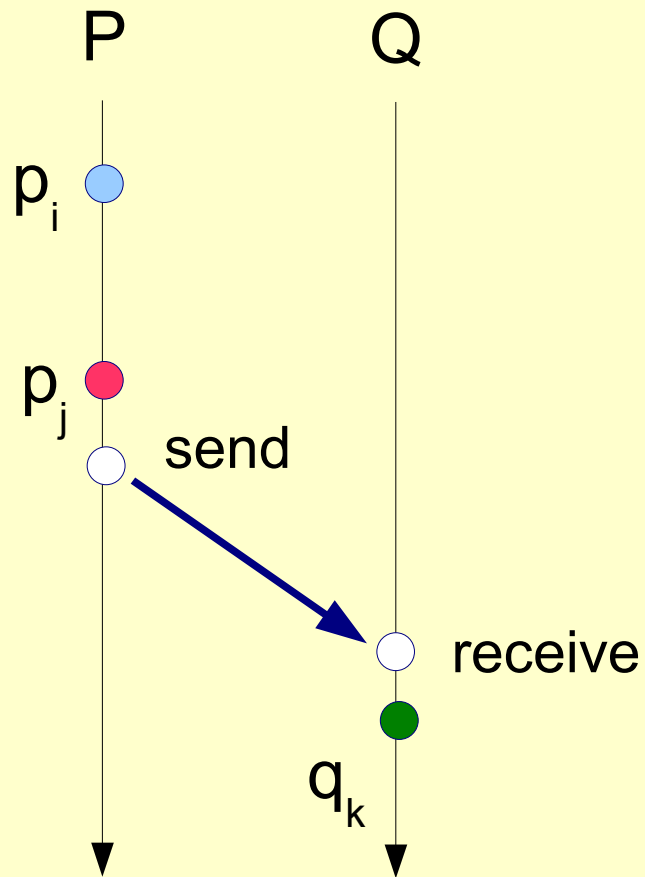


Uspořádání událostí

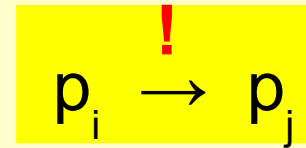
Total and causal ordering



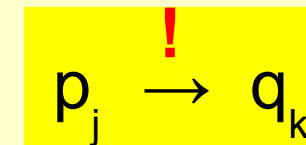
Precedence



Interprocess



communication



Precedence

tranzitivní

$$(a \rightarrow b) \wedge (b \rightarrow c) \Rightarrow (a \rightarrow c)$$

asymetrická

$$(a \rightarrow b) \not\leftrightarrow (a \rightarrow c)$$

souběžnost - concurrency

$$(a \nrightarrow b) \wedge (b \nrightarrow a)$$



Logické hodiny

Scalar timestamps – Lamport's clock

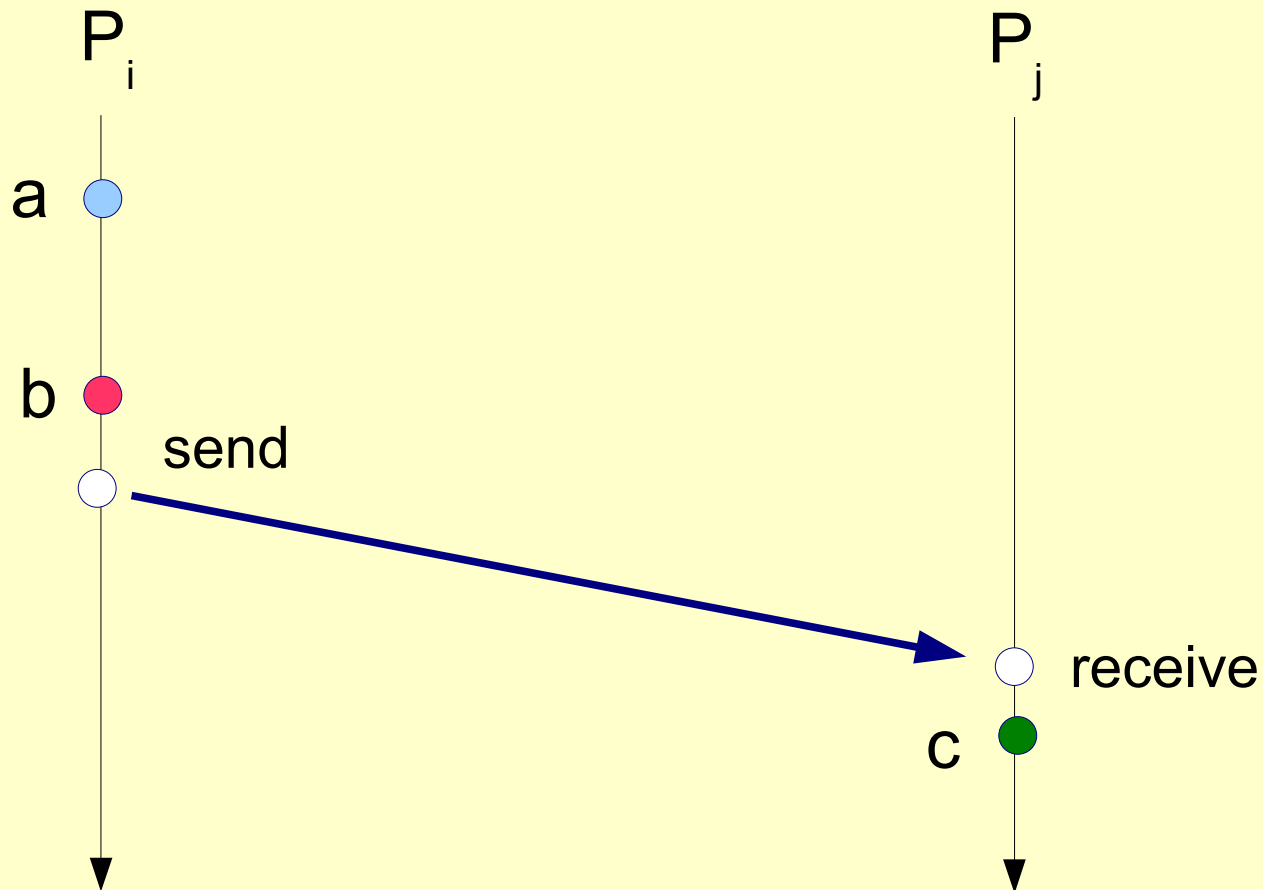
$$C : a \rightarrow C(a)$$

$$\forall a, b : a \rightarrow b \Rightarrow C(a) < C(b)$$



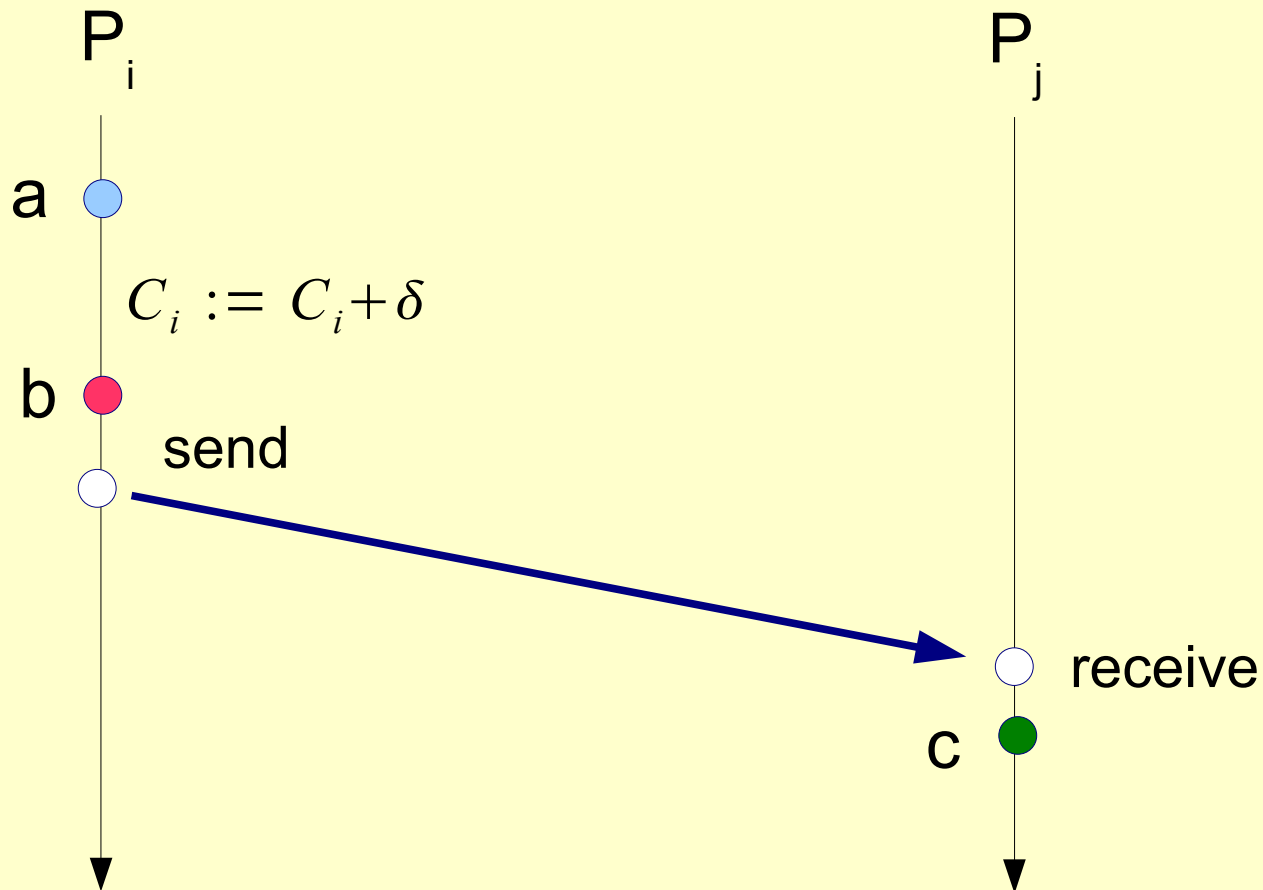
Logické hodiny

Scalar timestamps – Lamport's clock



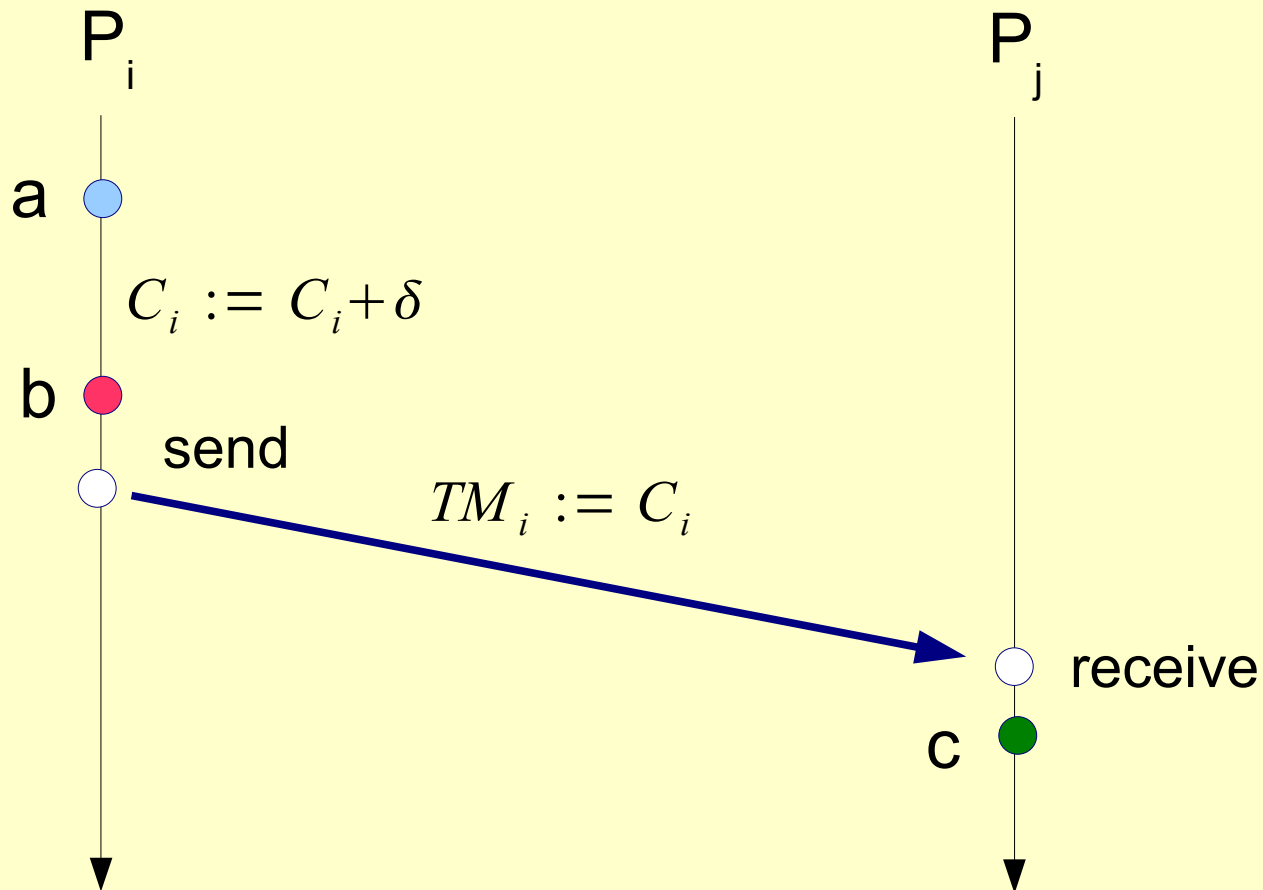
Logické hodiny

Scalar timestamps – Lamport's clock



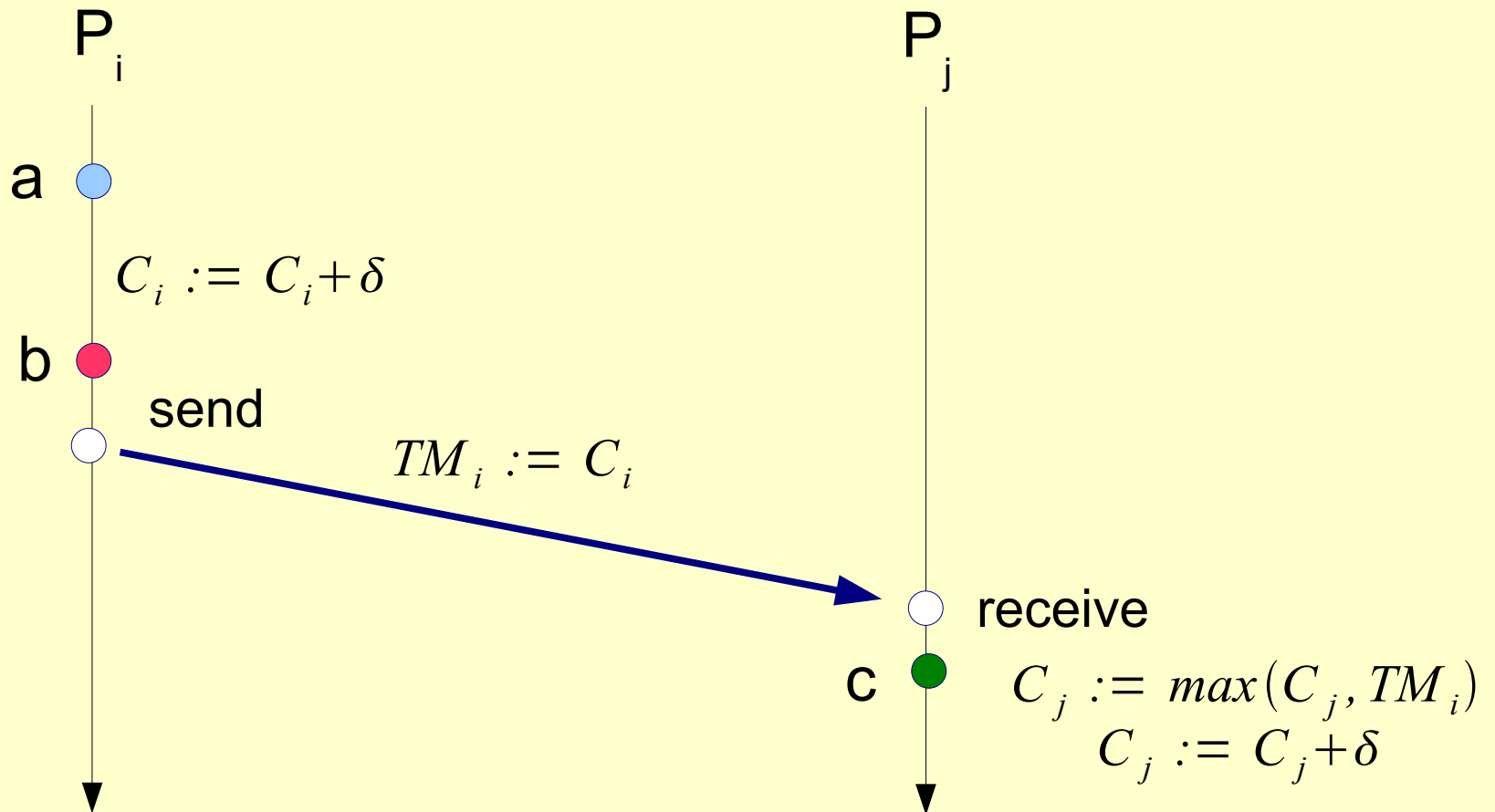
Logické hodiny

Scalar timestamps – Lamport's clock



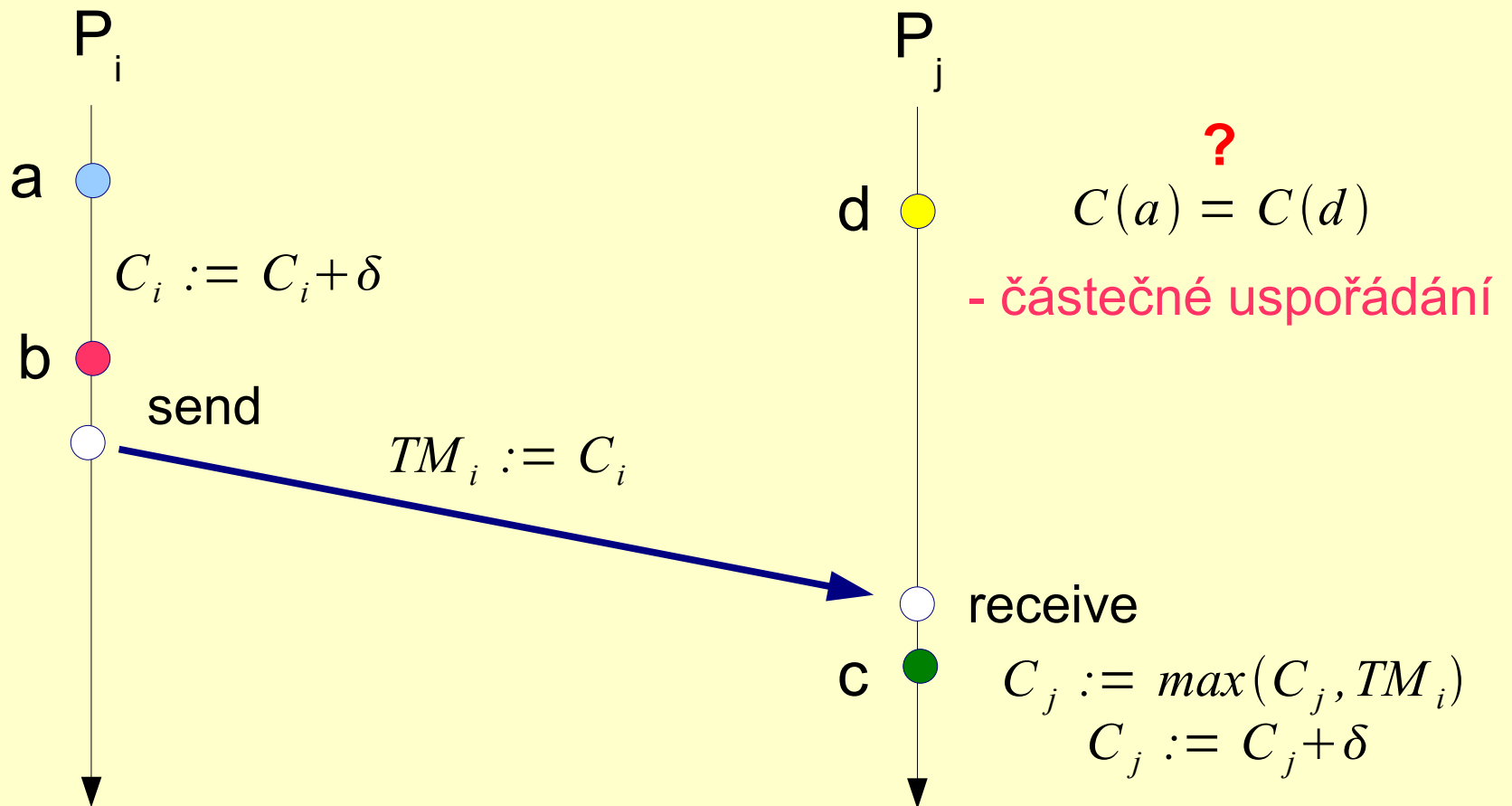
Logické hodiny

Scalar timestamps – Lamport's clock



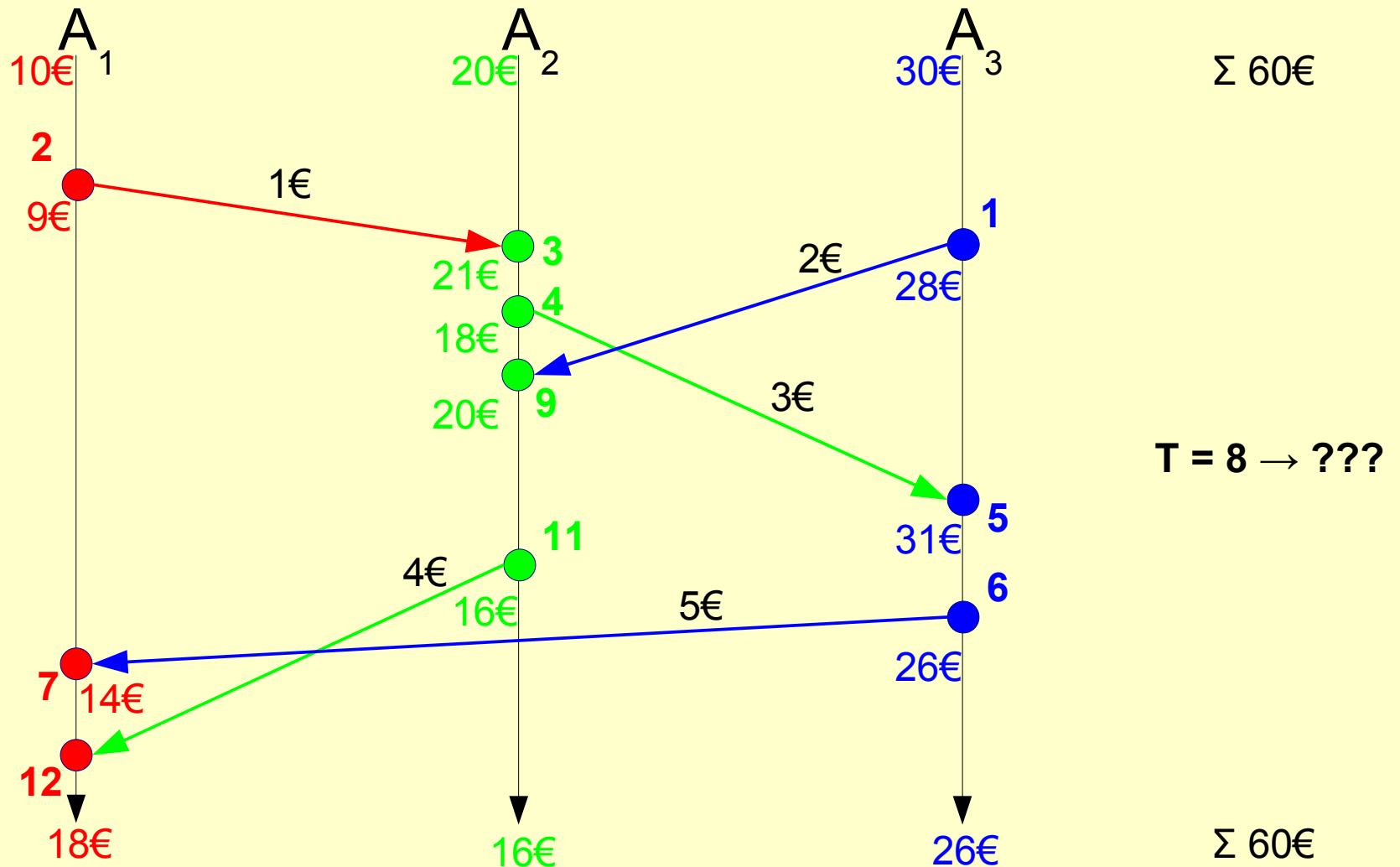
Logické hodiny

Scalar timestamps – Lamport's clock



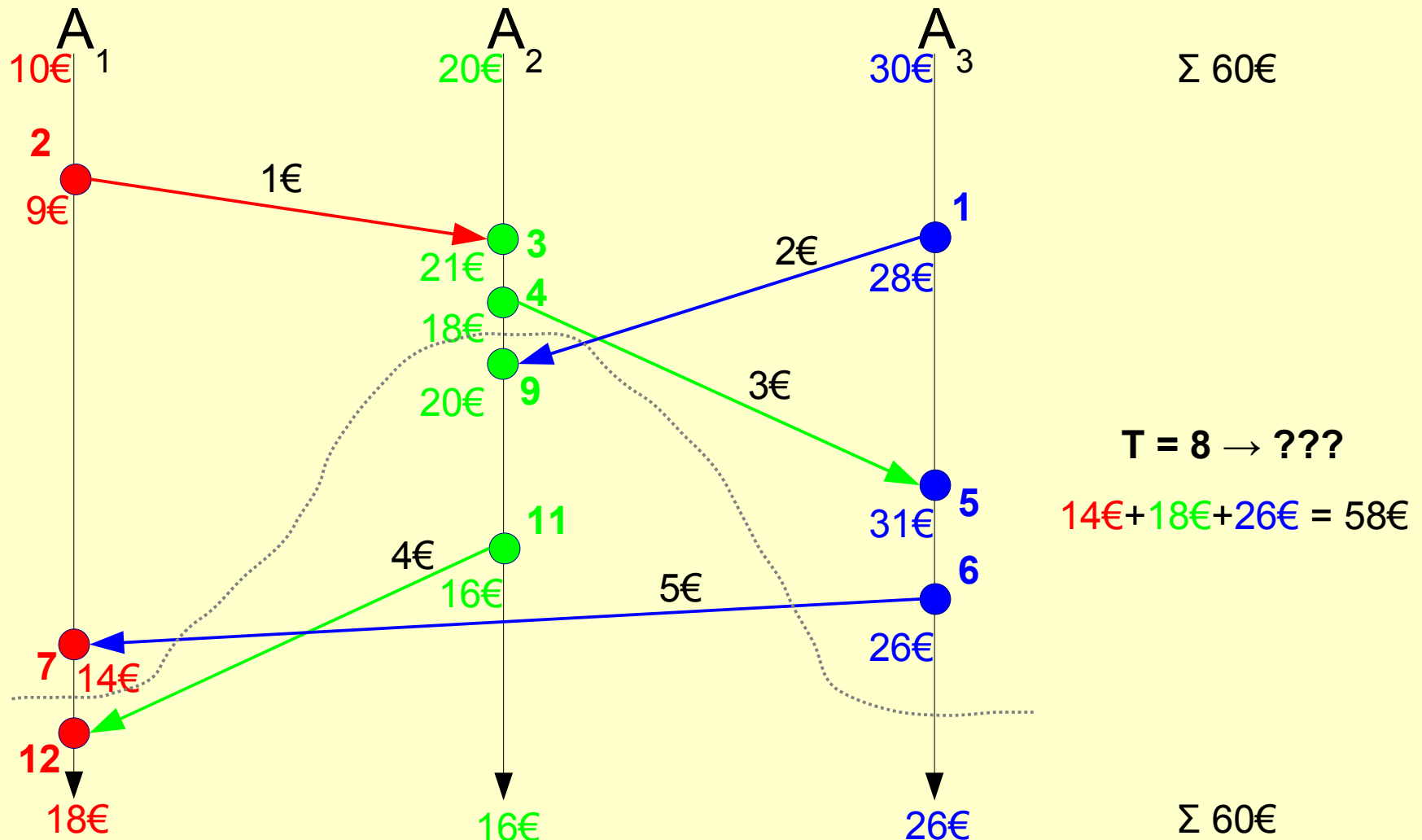
Logické hodiny

Banking problem



Logické hodiny

Banking problem



Logické hodiny

Scalar timestamps – Lamport's clock

doplnění na úplné uspořádání

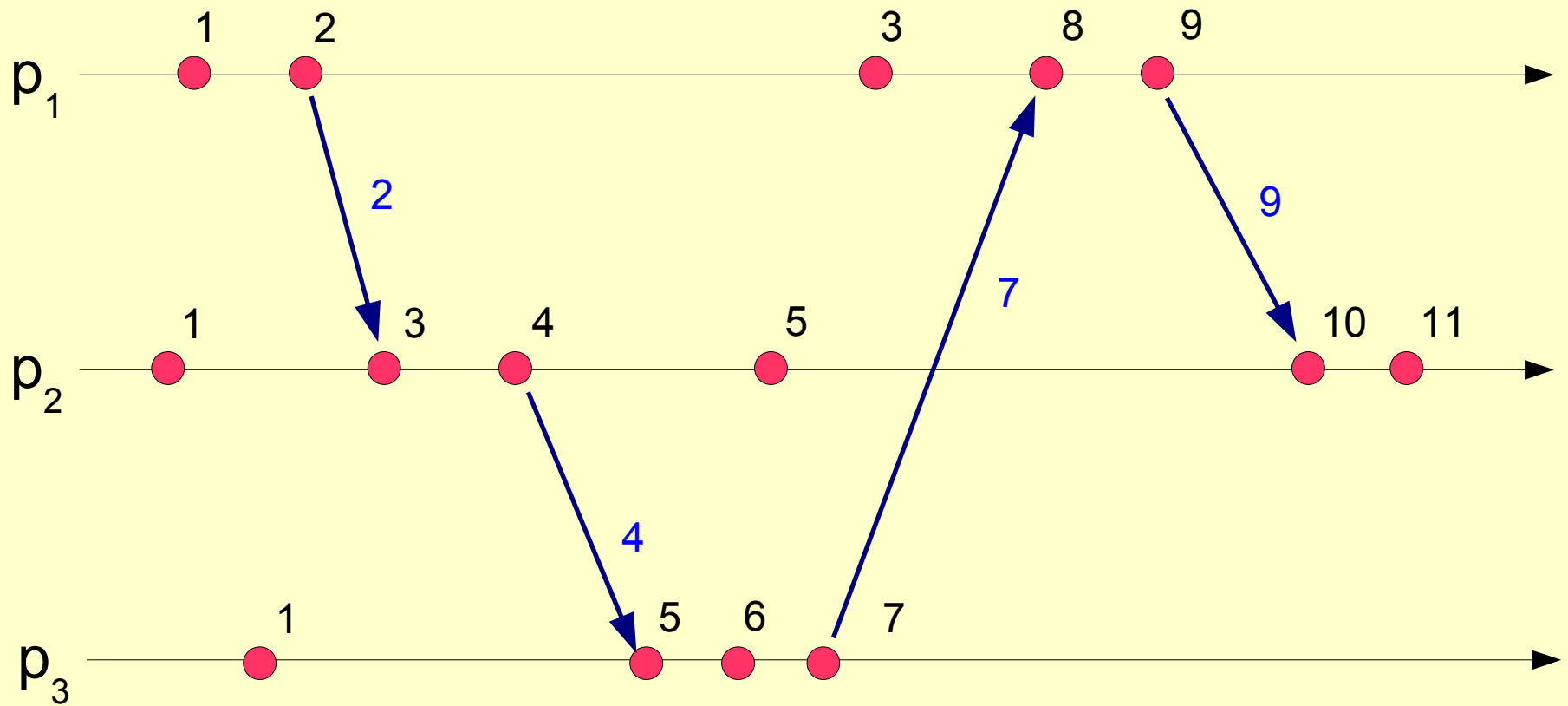
$$a \Rightarrow b$$

1. $C(a) < C(b)$
2. $(C_i(a) = C_j(b)) \wedge (i < j)$



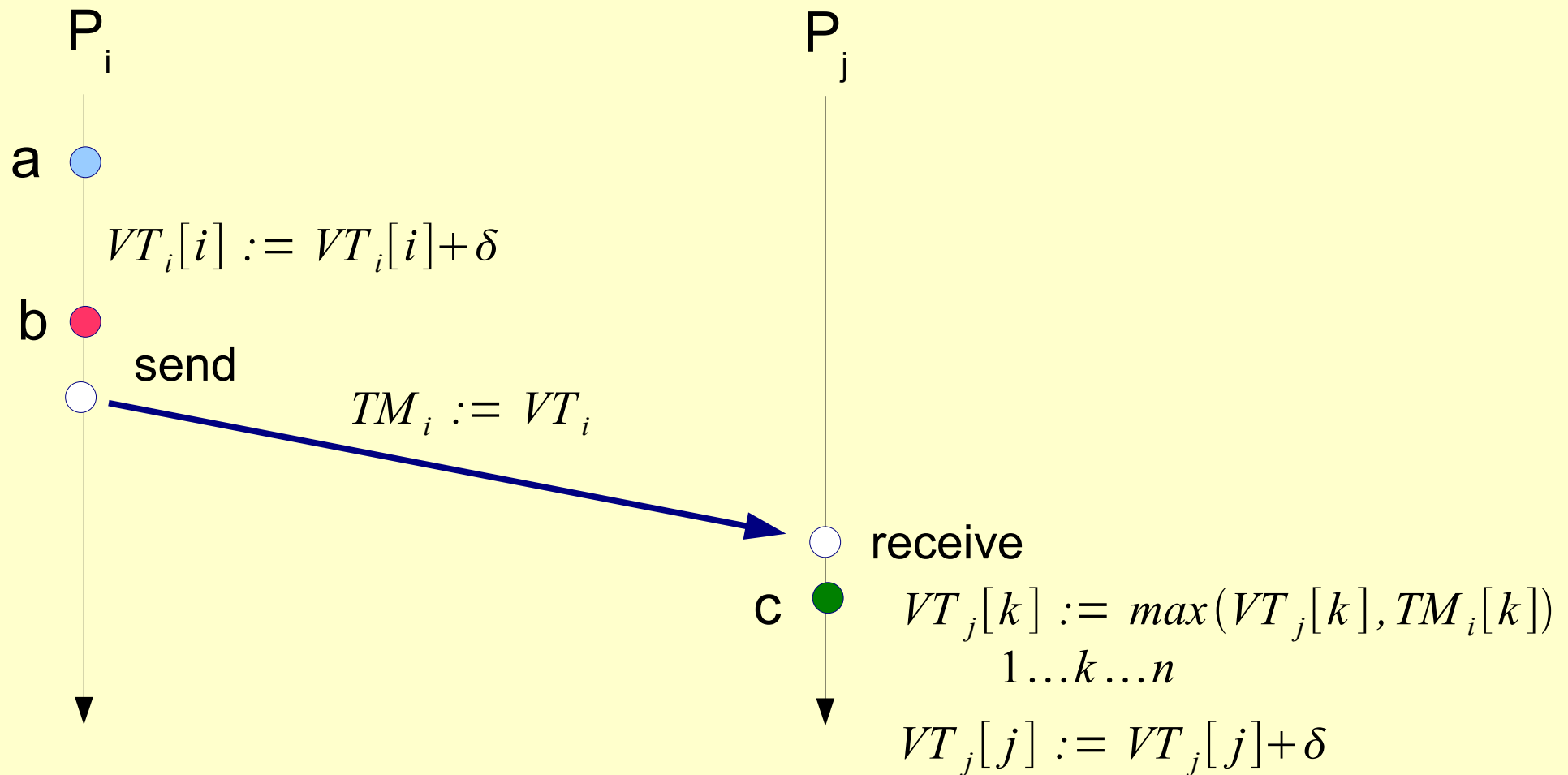
Logické hodiny

Scalar timestamps – Lamport's clock



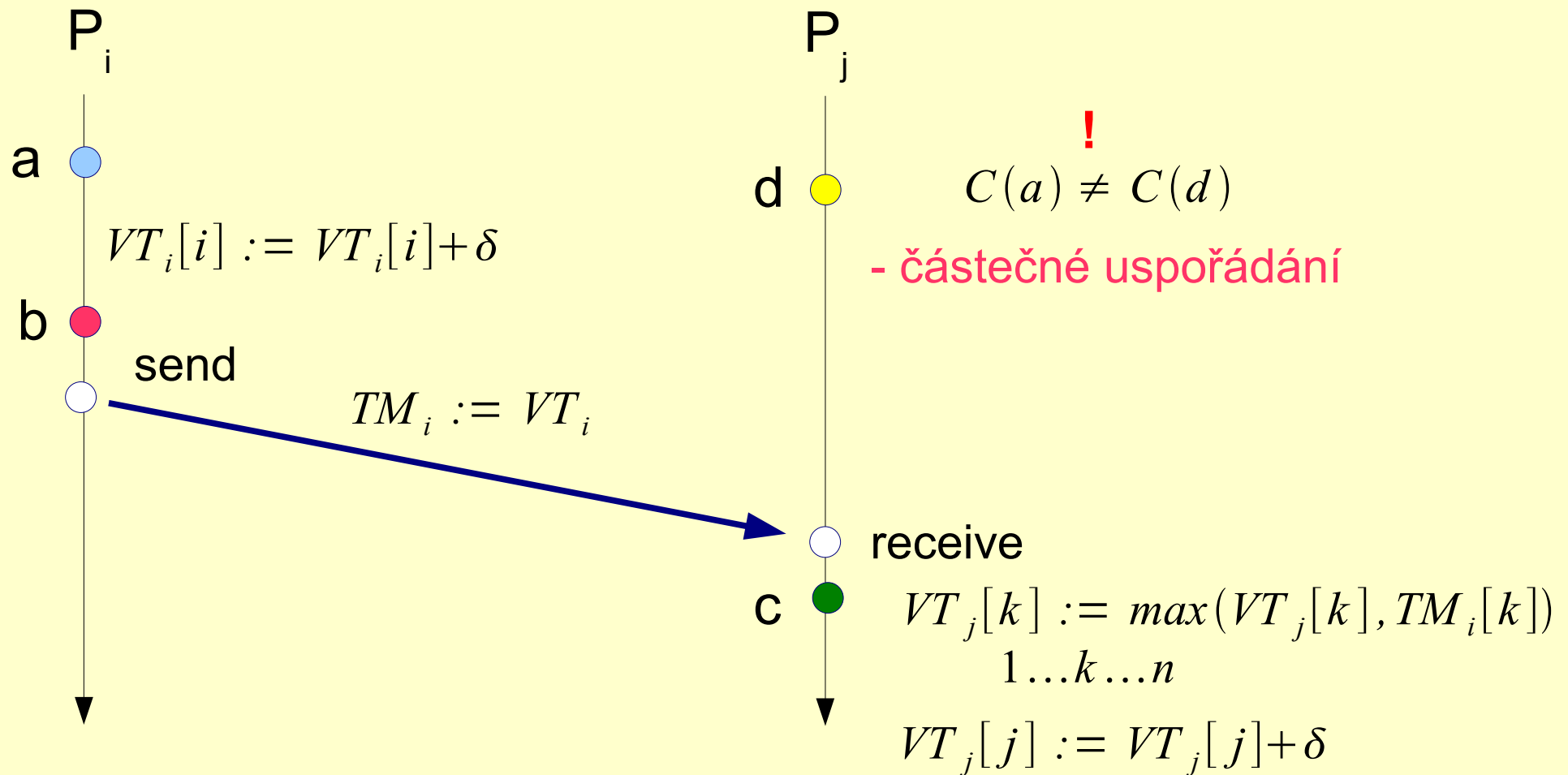
Logické hodiny

Vector timestamps – vector clock



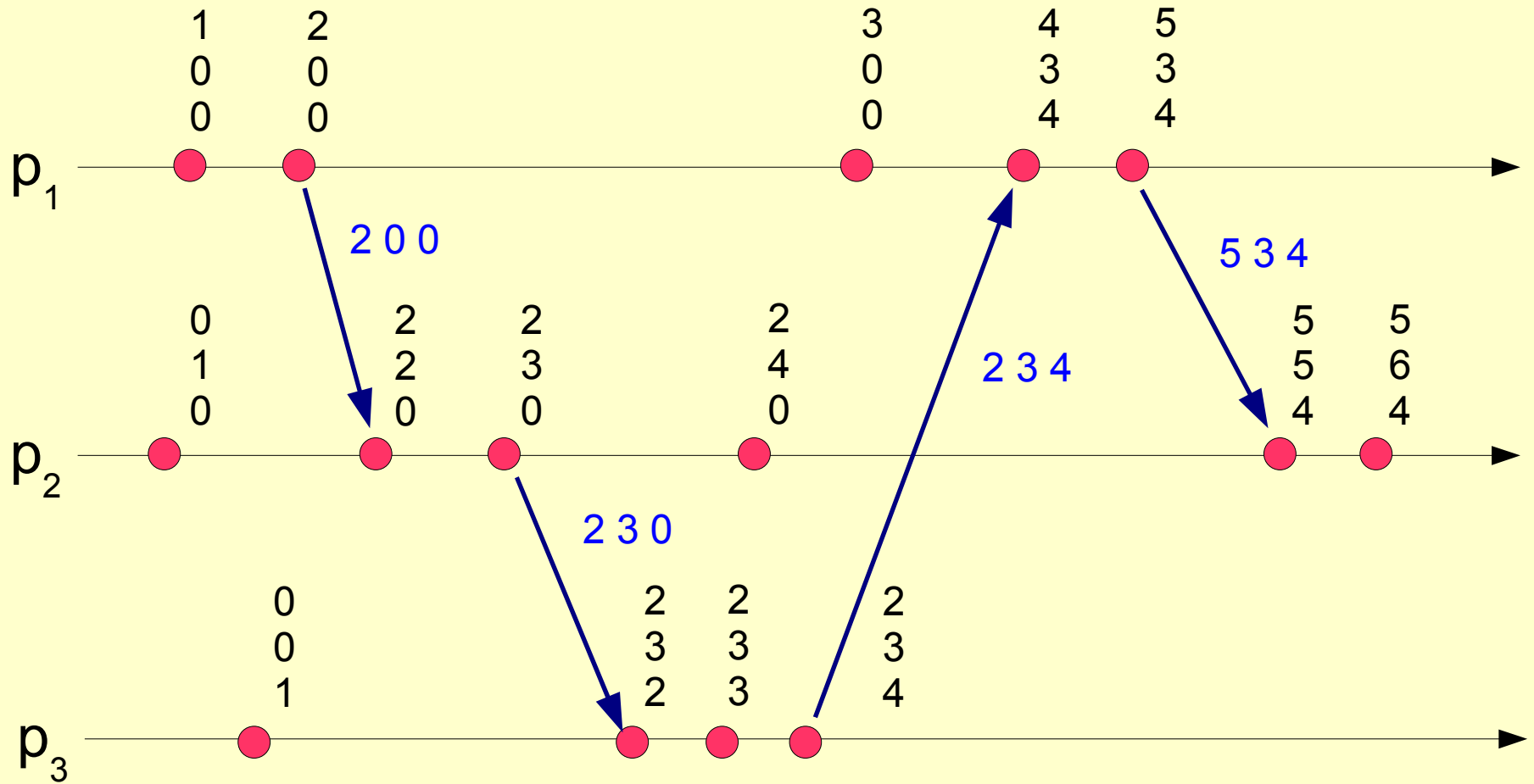
Logické hodiny

Vector timestamps – vector clock



Vektorové hodiny

Vector timestamps – vector clock



Vektorové hodiny

Vector timestamps – vector clock

isomorfismus

uspořádání událostí \Leftrightarrow uspořádání časových známek

$$h \rightarrow k \Leftrightarrow VT_h < VT_k$$

použití

zajištění konzistence replikovaných dat

array clock – tenzorové hodiny

použití při zajištění odolnosti replikovaných dat

