

Petri Nets

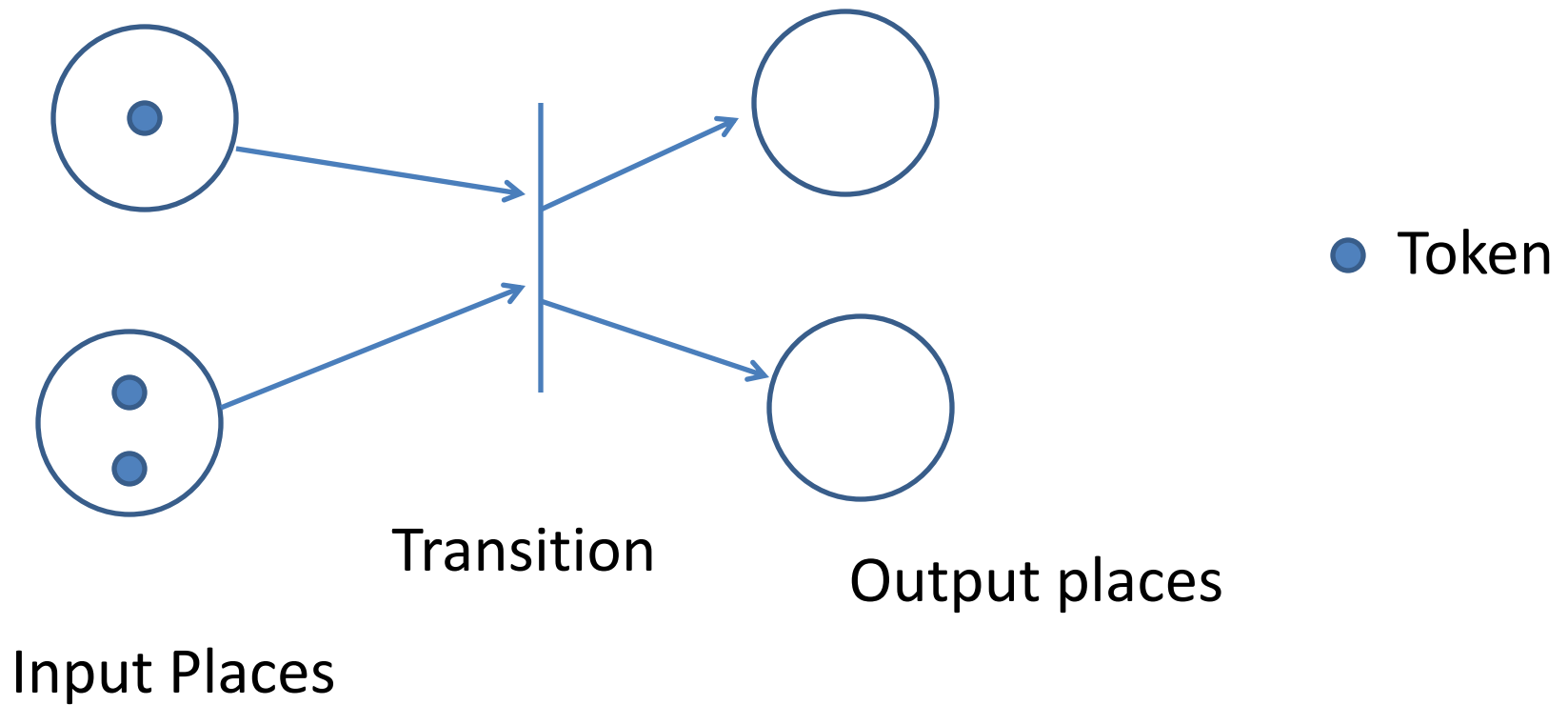
Petri Nets

- Used to model the functionality or behavior of the system.
- PN is a formal language or graphical language for modeling the systems with concurrency.
- PN is a bi-partite graph.
 - Types of nodes:
 - PLACE** (or Condition) that holds something (example, tokens)
 - Transition** that represent essentially some event or activity that occurs
- Tokens are circulated among the places

Petri Nets

- Places and Transitions are connected by a directed arcs.
- Arc only exist between Transition and Place, and vice-versa.

Petri Nets

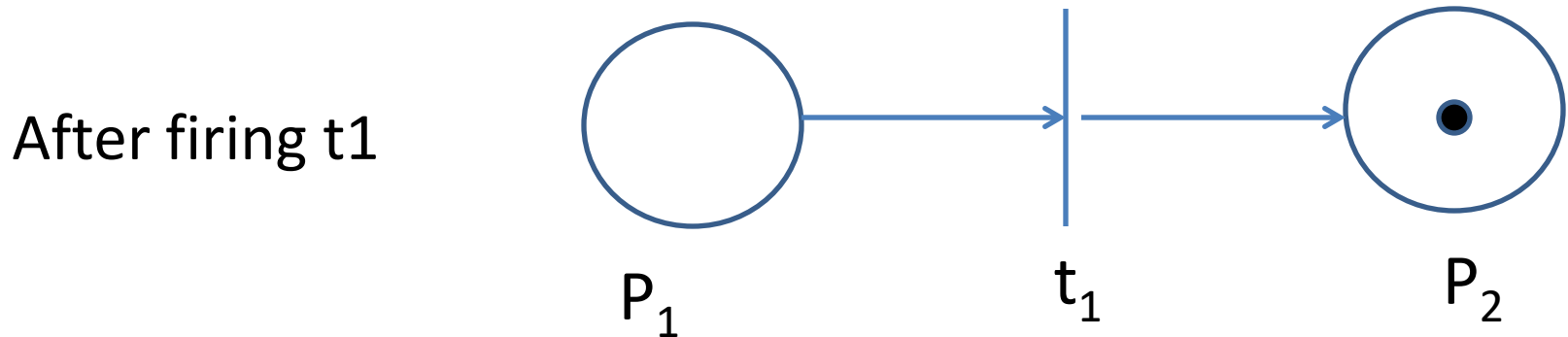
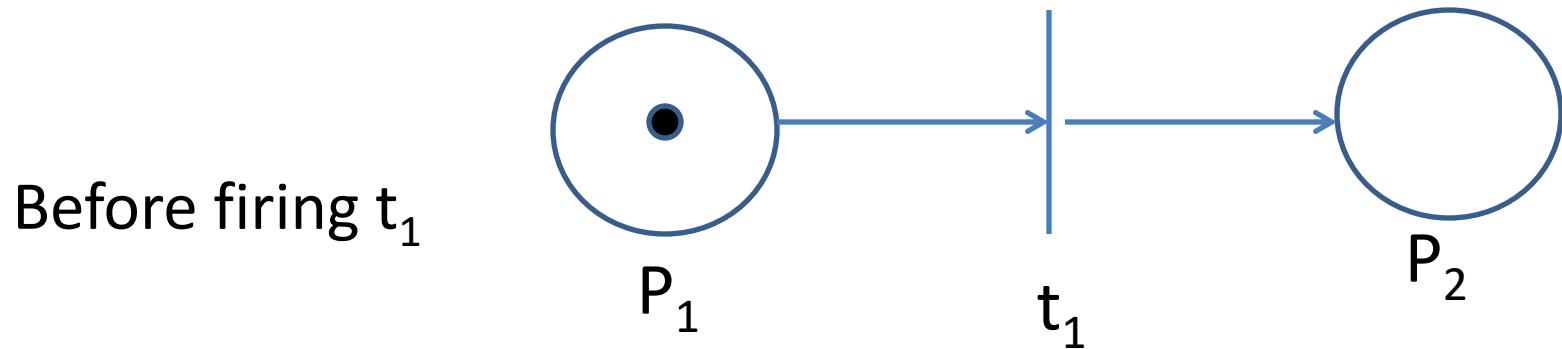


Petri Nets

- Transition is triggered only when at least one token is present in all input places.
- Once fired, one token is removed from all input places and added to all of its output places.

Petri Nets

- Input places as Pre-condition and Output places as Post-condition.



Petri Nets

- Formally, $PN = (P, T, I, O)$

$$P = \{ P_1, P_2, \dots, P_M \}$$

$$T = \{ T_1, T_2, \dots, T_N \}$$

I and **O** are the matrices showing Input places and output places for the transitions.

	T1	T2	T3	T4	T5
P1	1	0	0	0	0
P2	0	1	0	0	0
P3	0	0	1	0	0
P4	0	0		1	0
P5	0	0	0	0	1

Input (I)

- A marking of a PN at time t ,

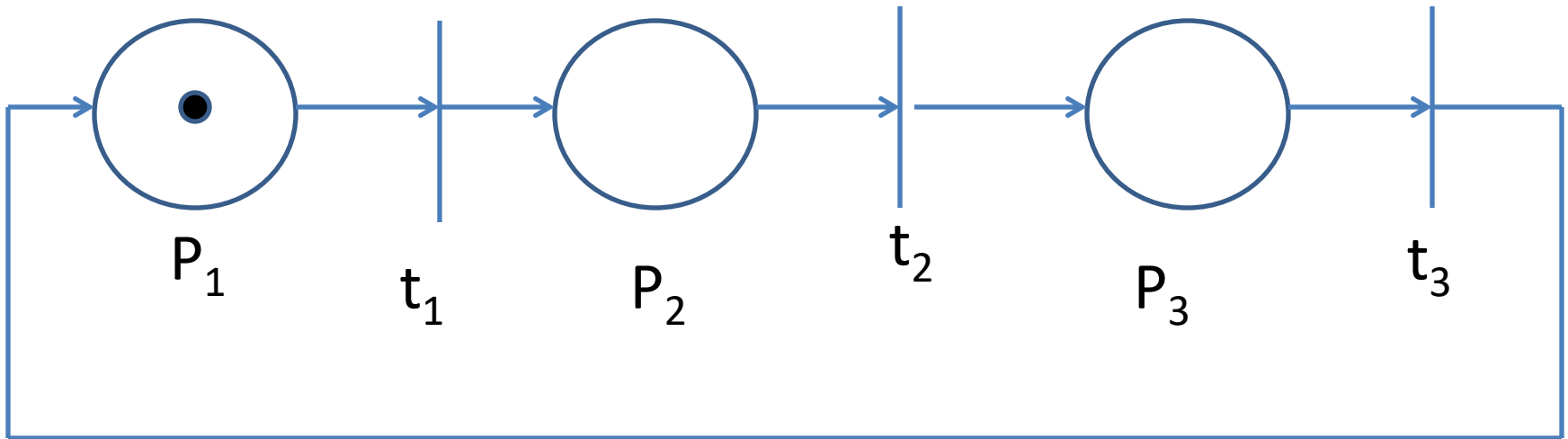
$$M(t) = \{ m_1(t), m_2(t), \dots, m_M(t) \}$$

$m_i(t)$ is # of tokens in place i at time t

$M(t_0)$ is the initial marking of the system

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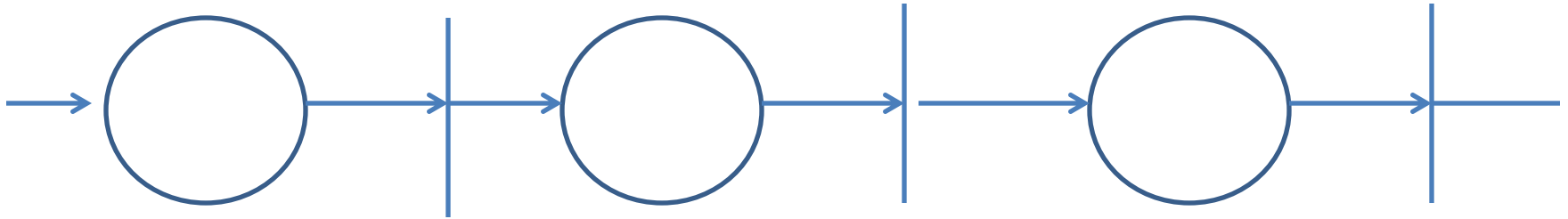
- Example



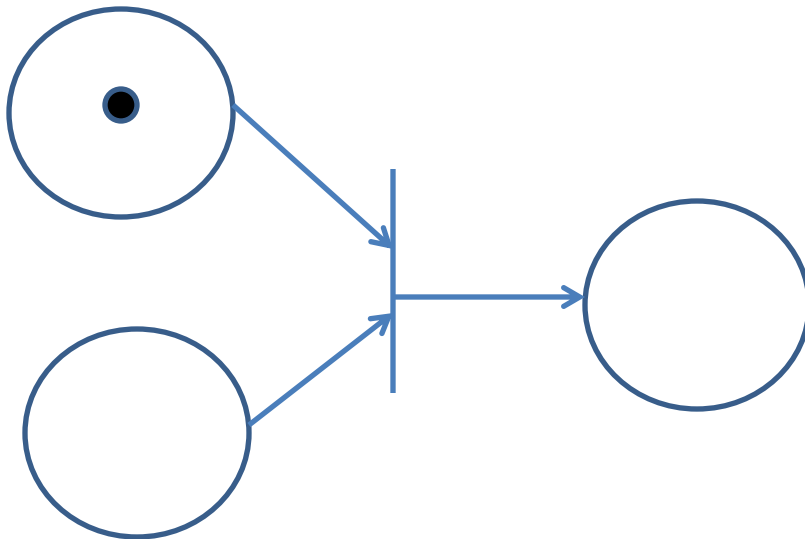
$$M(t_0) = (1, 0, 0)$$

Petri Nets

- Sequential Action

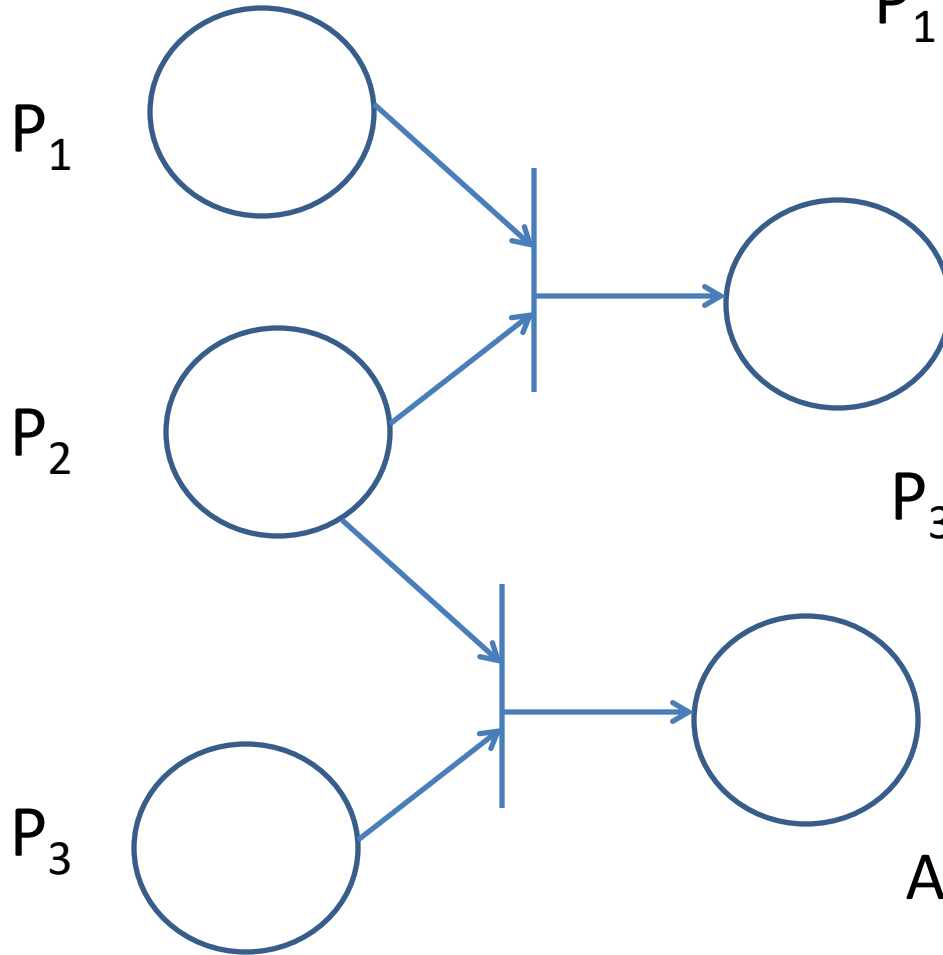


- Dependency



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- Conflict



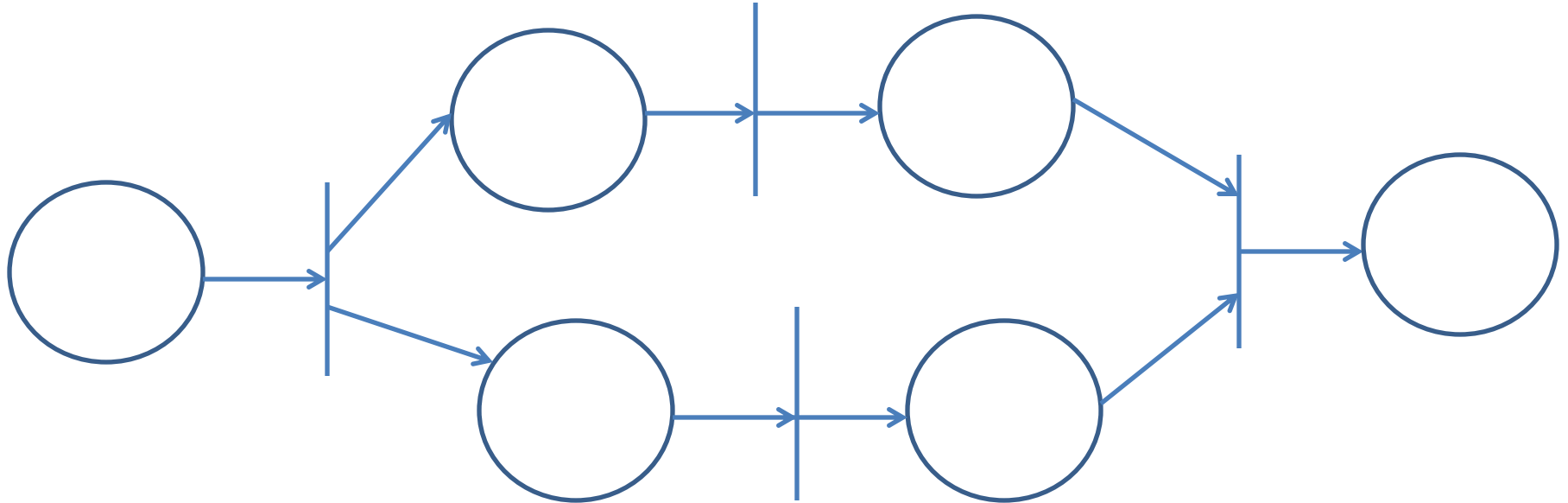
P_1 and P_2 have tokens, but not P_3
then t_1 is fired.

P_3 and P_2 have tokens, but not P_1
then t_2 is fired.

All have tokens, then conflict.

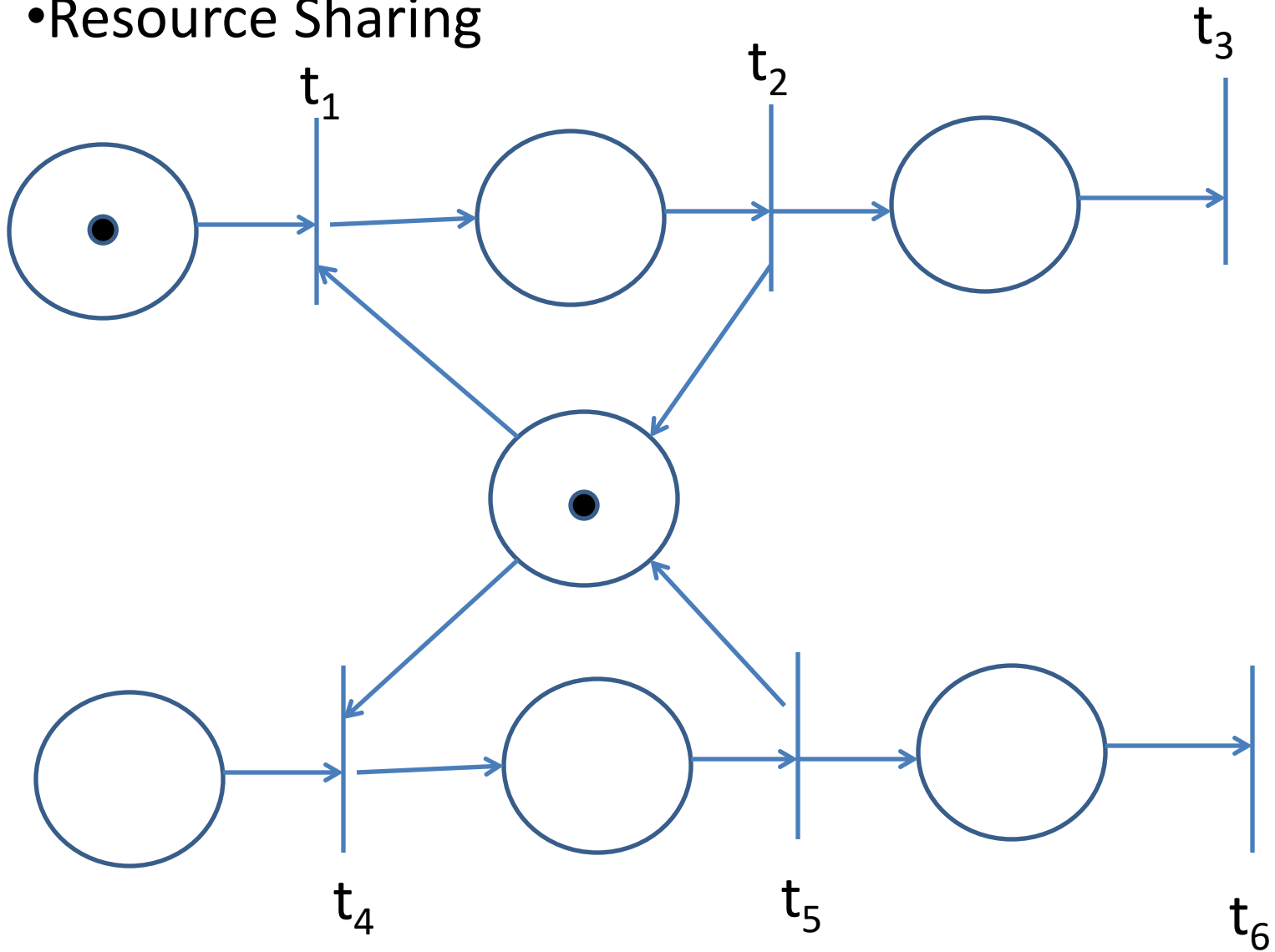
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- Concurrence



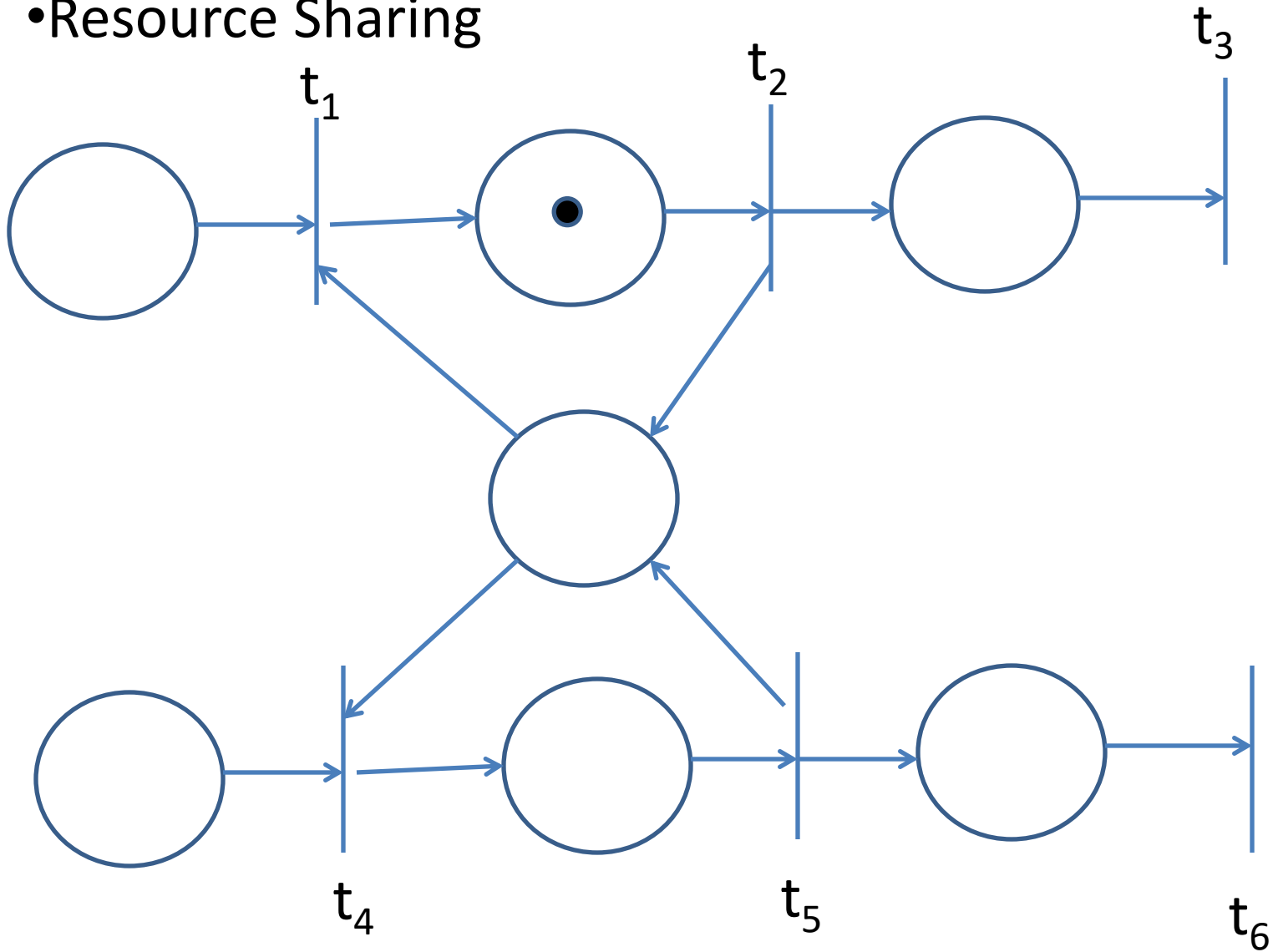
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- Resource Sharing



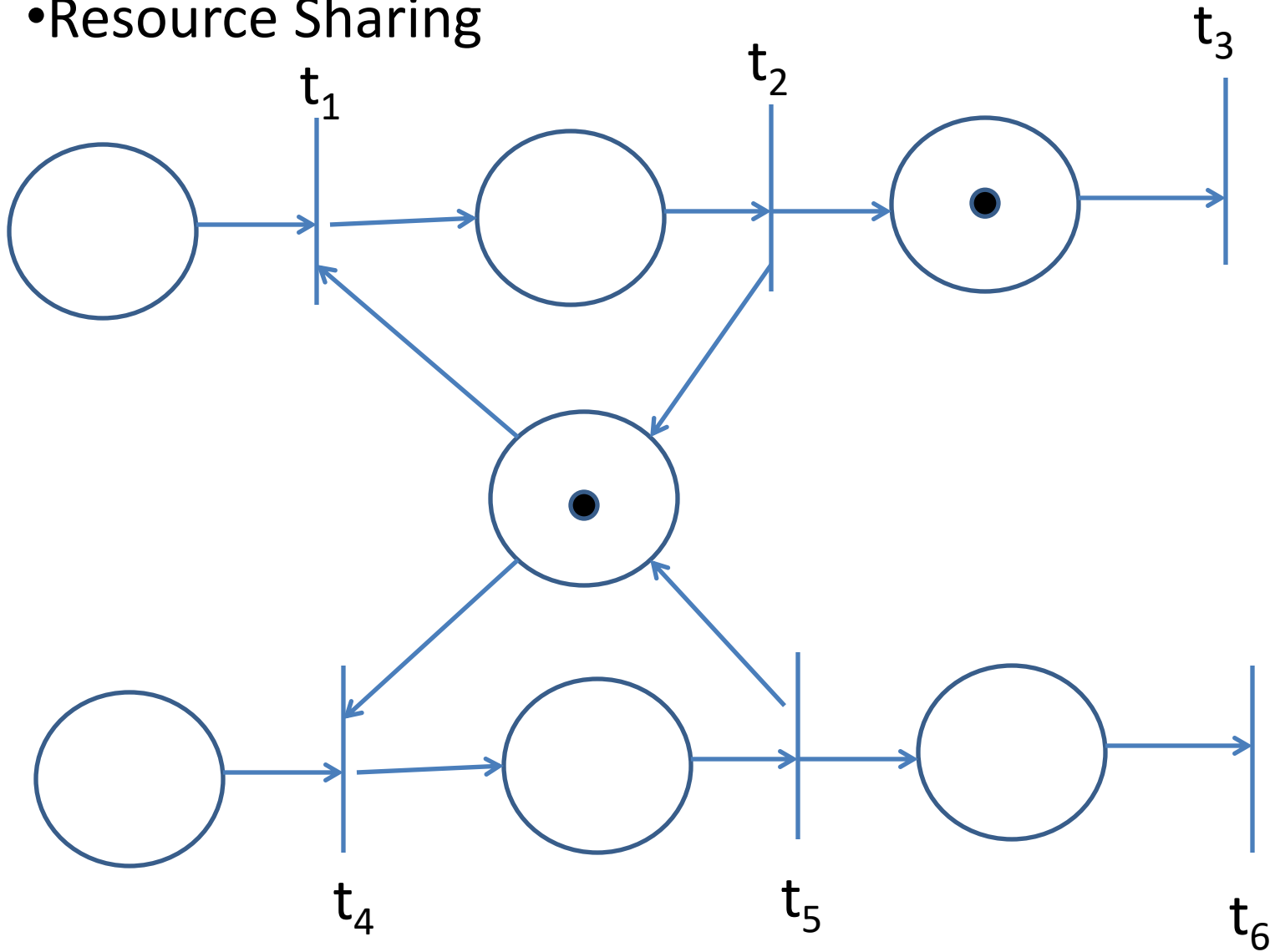
Petri Nets

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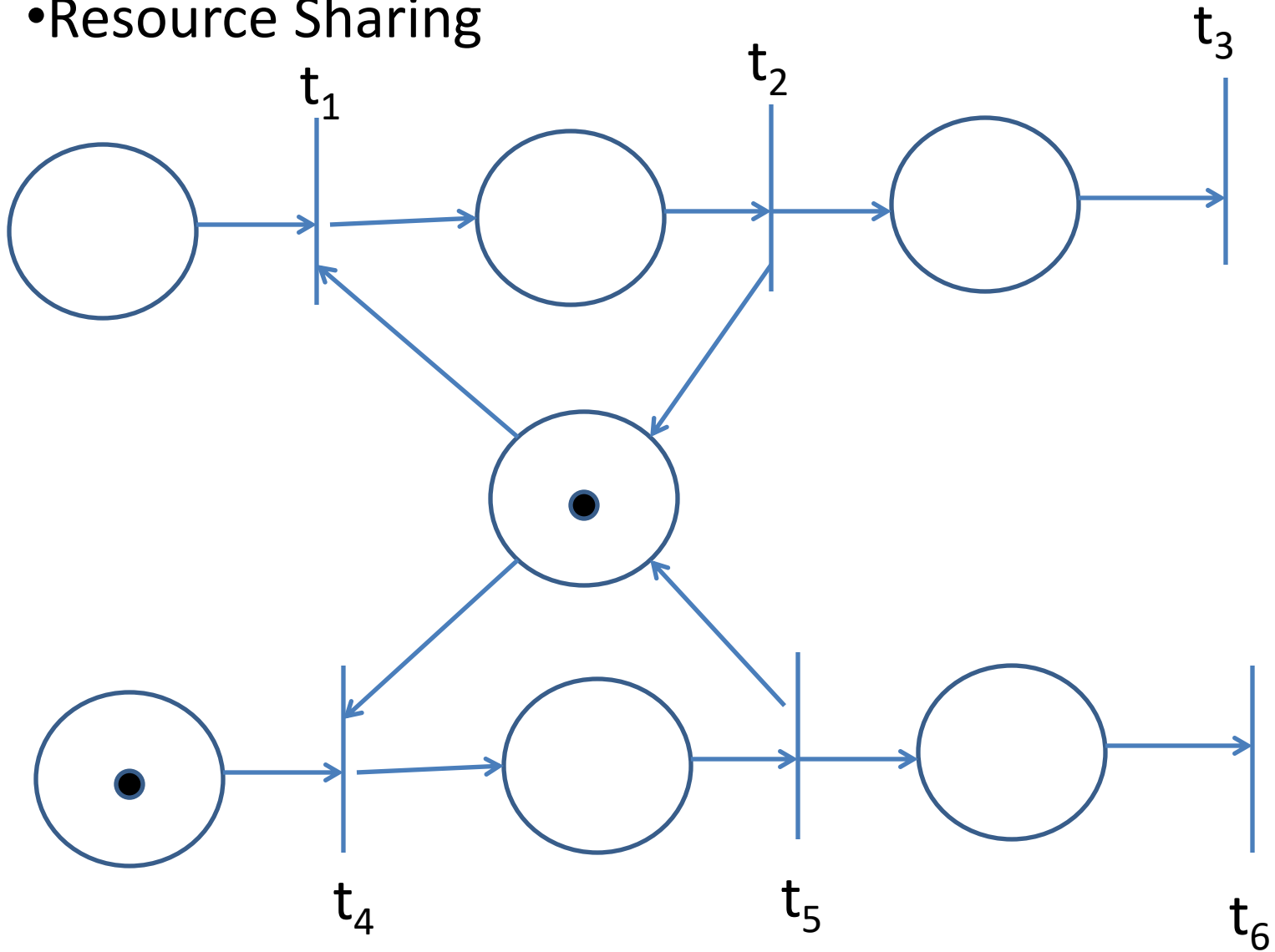
Petri Nets

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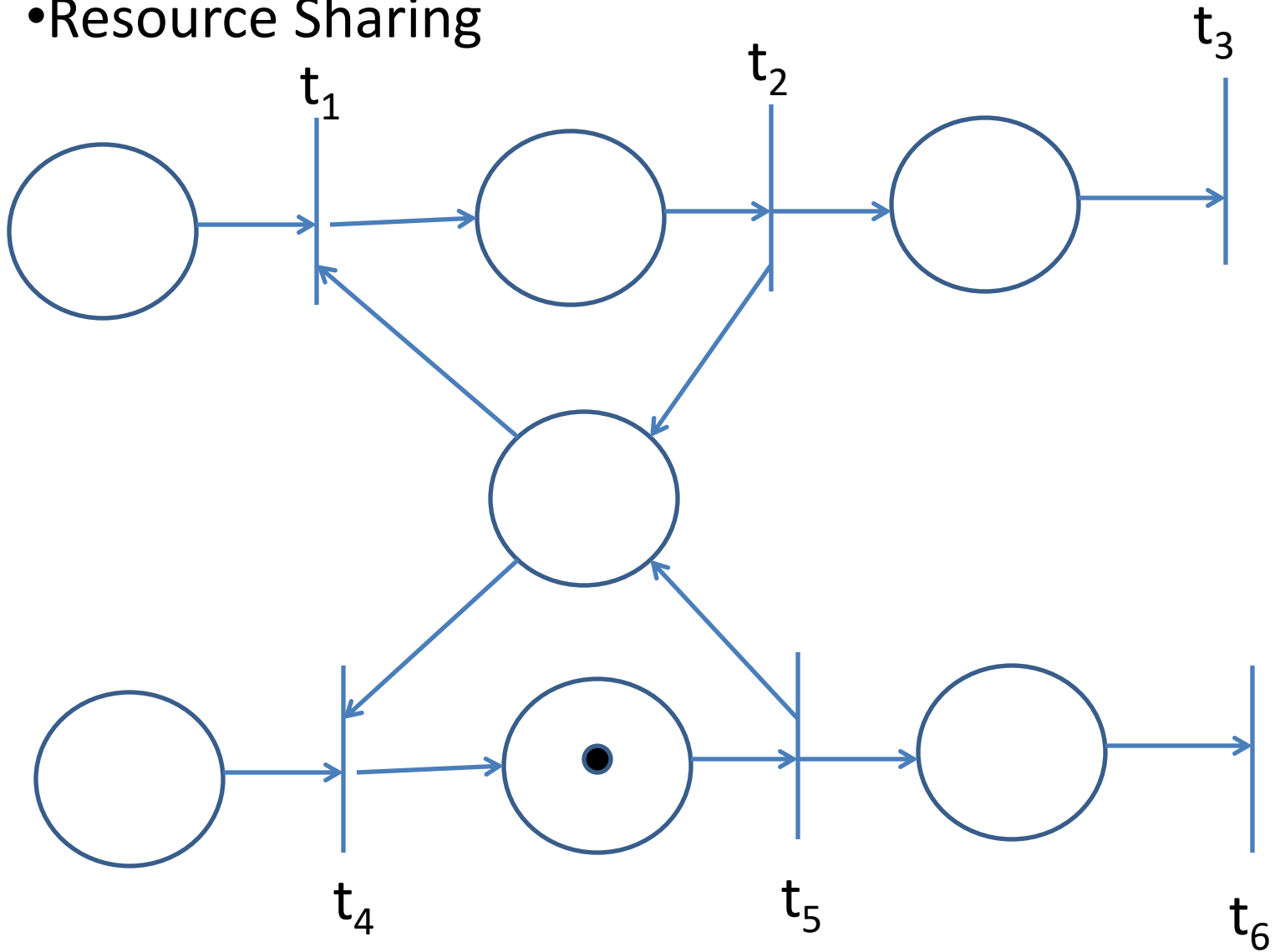
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