



# Petri Nets

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Chapter 4  
Sections 4.3.3 & 4.3.4



## Definition of a Petri net

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- It is a bipartite directed graph with components  $\langle P, T, In, Out \rangle$

- **Two types of nodes**

- **P are places**
- **T are transitions**

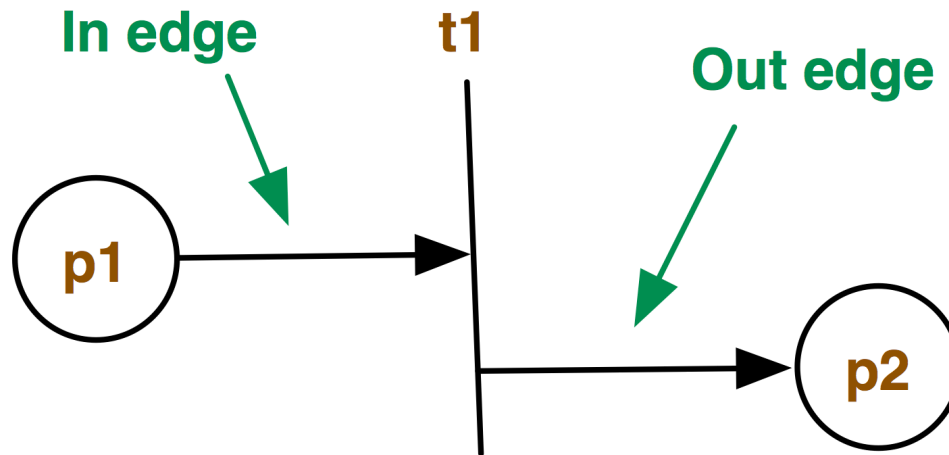
- **Two types of edges**

- **In are input to transitions**
- **Out are output from transitions**

$$In \subseteq P \times T$$

$$Out \subseteq T \times P$$

## Components of a Petri Net



$p_1, p_2 \in P$      $t_1 \in T$

$(p_1, t_1) \in \text{In}$

$(t_1, p_2) \in \text{Out}$



## Marked Petri net

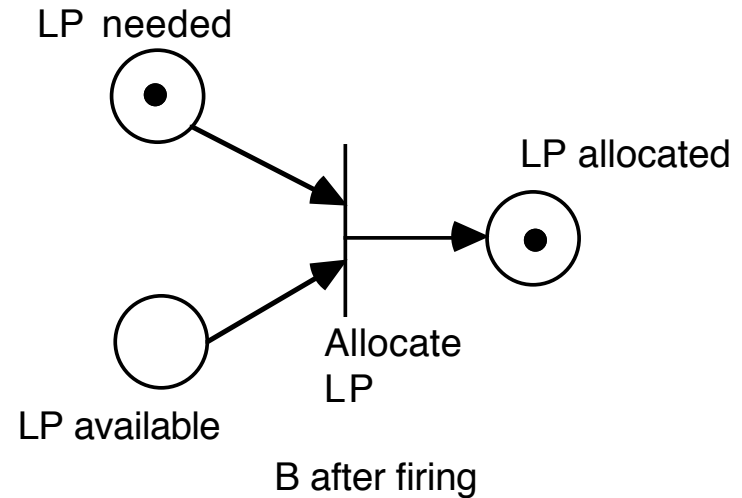
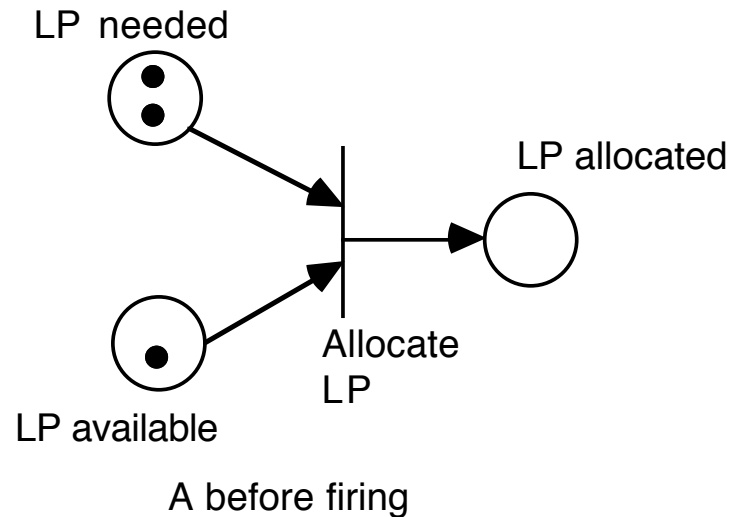
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- It is a Petri net augment with a marking  $M$ 
  - A marking is a mapping  $M$  from places to integers

$$M : P \rightarrow \mathbb{N}$$

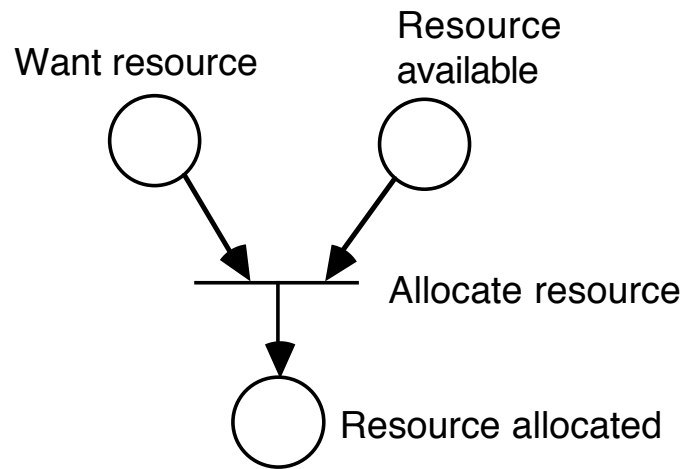
- Designated by tokens in a diagram

## Example of a Petri net transition firing

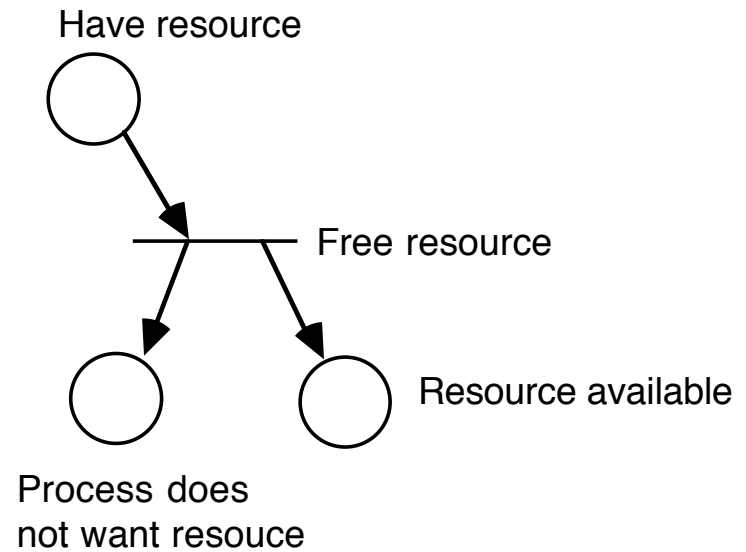


- **A transition can fire when**
  - **Every input place has at least one token**
- **When a transition fires**
  - **One token is removed from every input place**
  - **One token is added to every output place**

# Schematic for modeling semaphores

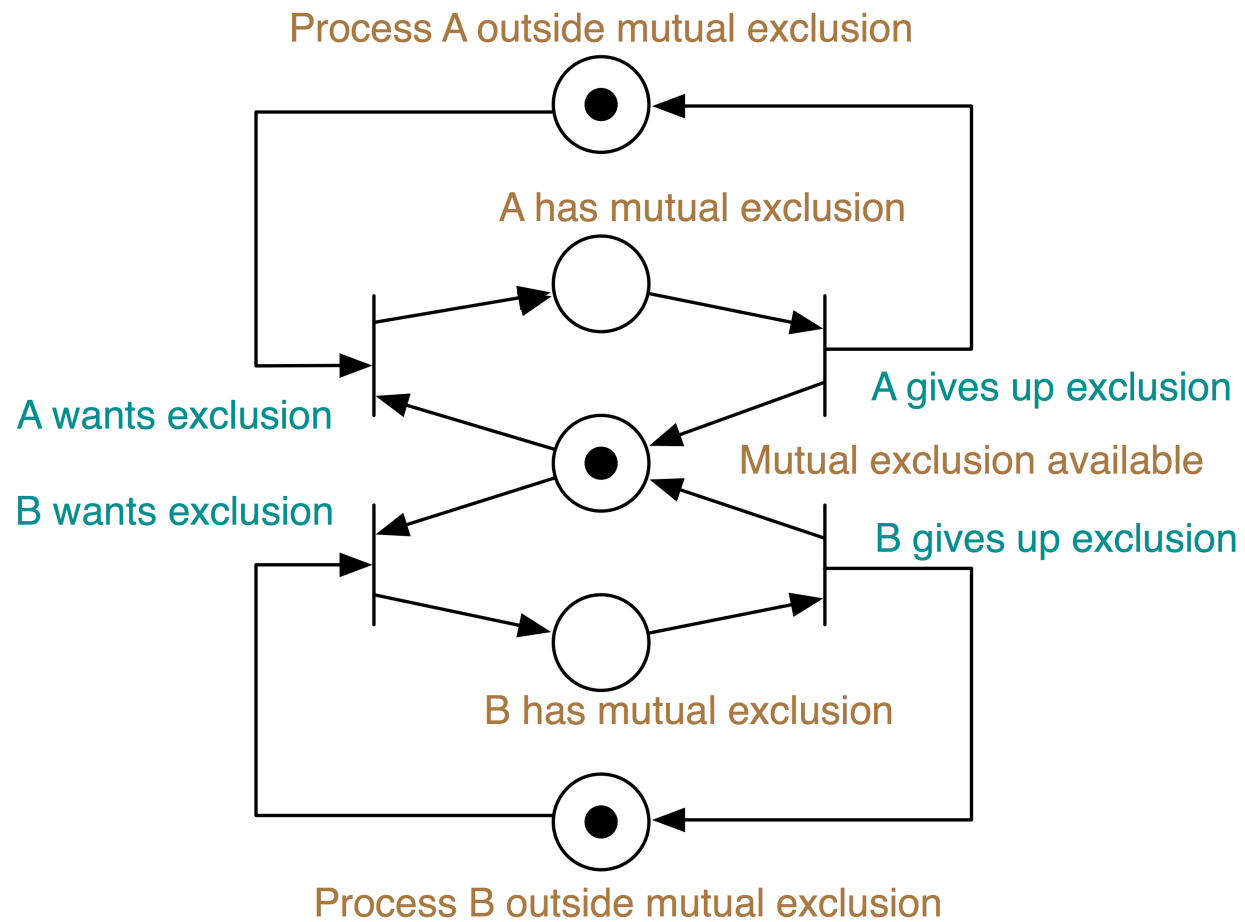


Semaphore for get resource



Semaphore for free resource

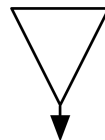
# Modeling Mutual Exclusion



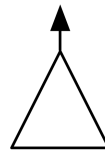
## Definition of an event-driven Petri net

- It is a Petri net augment with two additional types of nodes

- **I – Input ports**



- **O – Output ports**



- In and Out include ports

$$In \subseteq (P \cup I) \times T$$

$$Out \subseteq T \times (P \cup O)$$



# Model for a Single Server

A marked event-driven Petri net

