Lecture 1

Overview and discussion of concurrent systems.

What is a "concurrent system"?

Defⁿ: A system composed of many interacting parts.

Eg.

- An assembly line.
- A fleet of cars
- Product distribution system
- The Australia Post mail delivery process.

Why model concurrent systems?

- To understand their operation.
- To enhance efficiency.
- To reduce operating costs.
- To confirm their correctness.

What do we model?

- The unique physical or symbolic components which make up a system.
- The way states are related to each other. This gives us the structure of the system.
- The motion of data or other dynamic items in the system being modelled.

System constraints

- Cars can approach at any time
- Cars are to proceed onto the bridge as soon as possible.

Modelling with Petri-Nets

- States: Define the unique physical or symbolic components which make up a system.
- Arcs/Transitions: Connect the states together to give us the structure of the system.
- Tokens: Represent the dynamic nature of the system.

System constraints

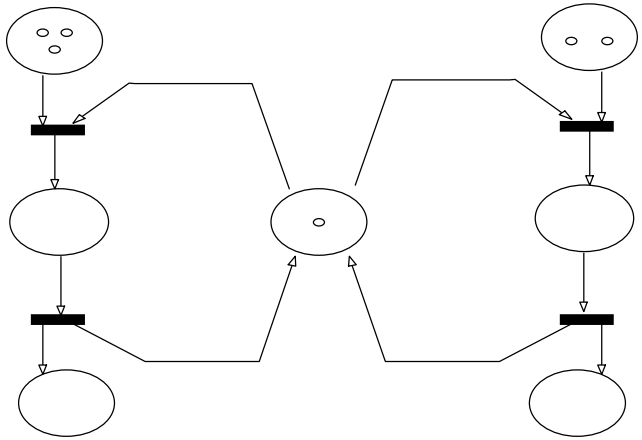
- Cars can approach at any time
- Cars are to proceed onto the bridge as soon as possible.
- ***Guarantee that there are no collisions.***

An example

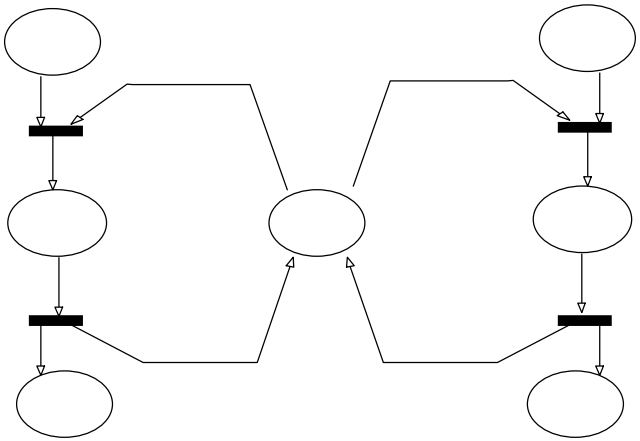
- Suppose we wish to model the flow of traffic across a single lane bridge.

We model the areas of the bridge as states, providing a state for each area of the bridge in which we are interested. We will provide states which represent the places where the cars are waiting to enter the bridge. We will divide the bridge itself into two logical states, to represent the flow of traffic in two directions.

A complete model



State-transition diagram



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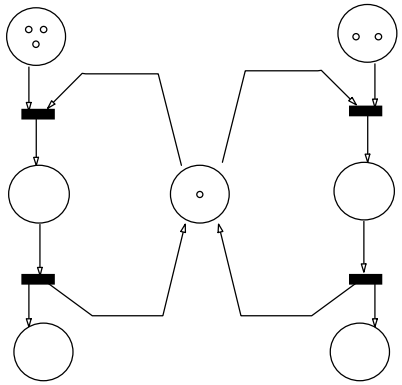
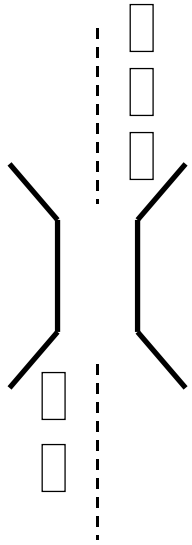


Physical system

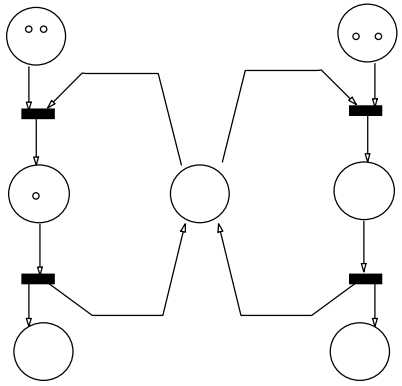


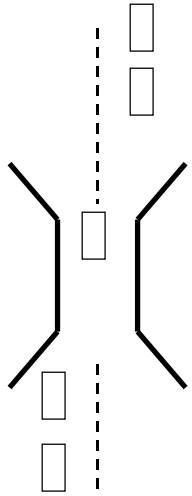
What is missing?

- The cars!!!!!!
- How do we represent them?
- We need to add a dynamic component to our system.
- Obviously Cars == Tokens!!

Model

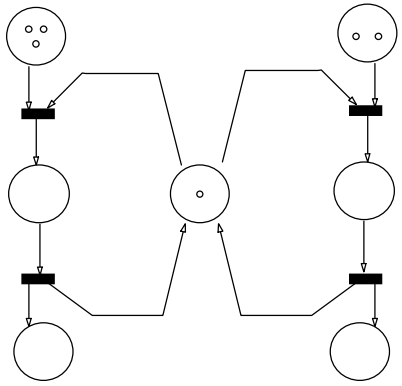
Physical system

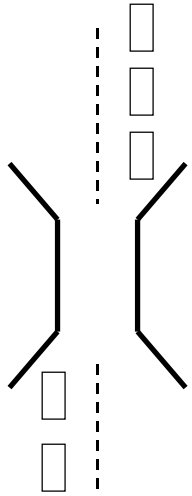




Model

Physical system





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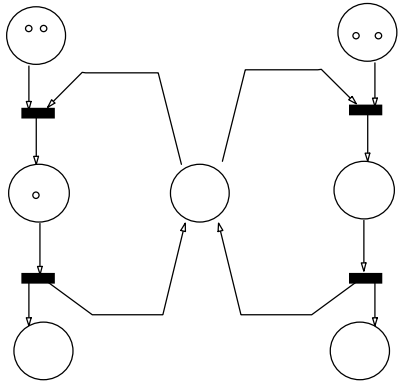

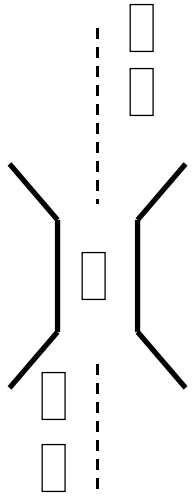

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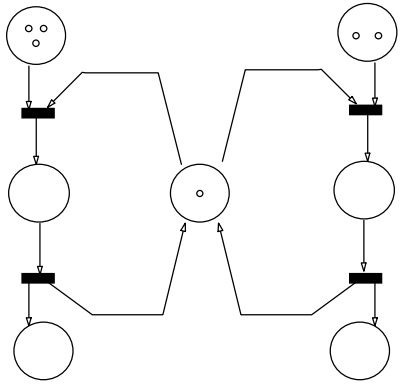

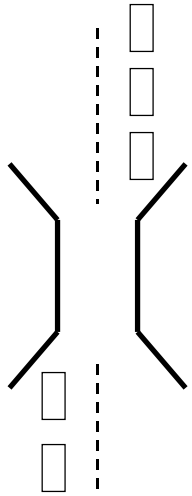

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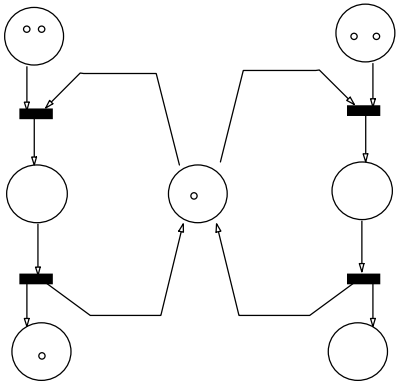

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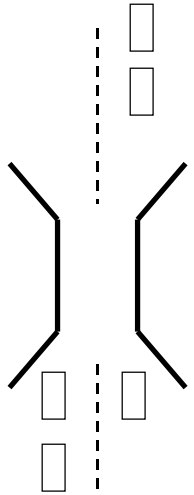

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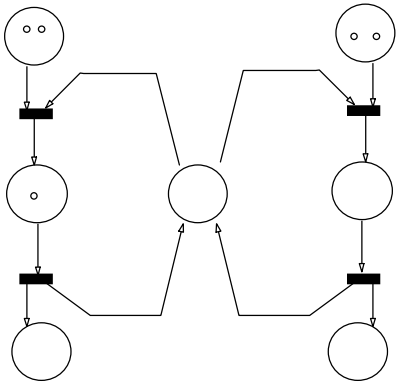

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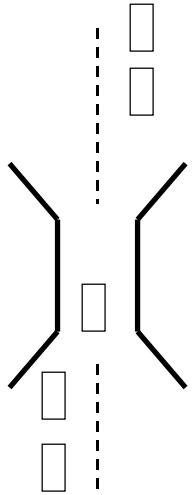

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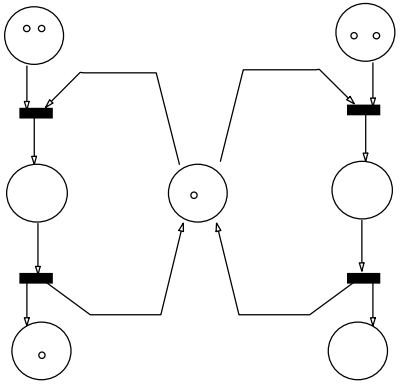

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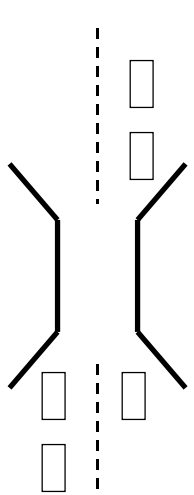

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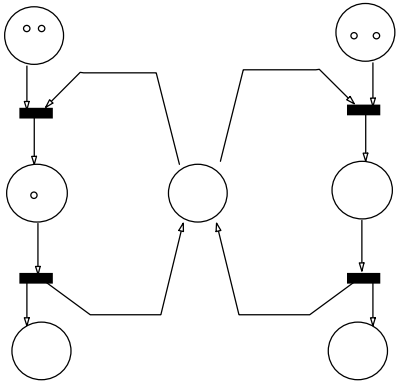

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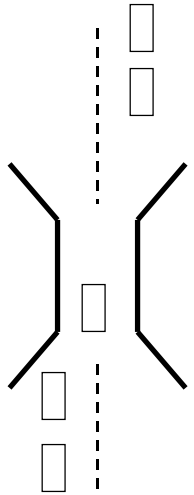

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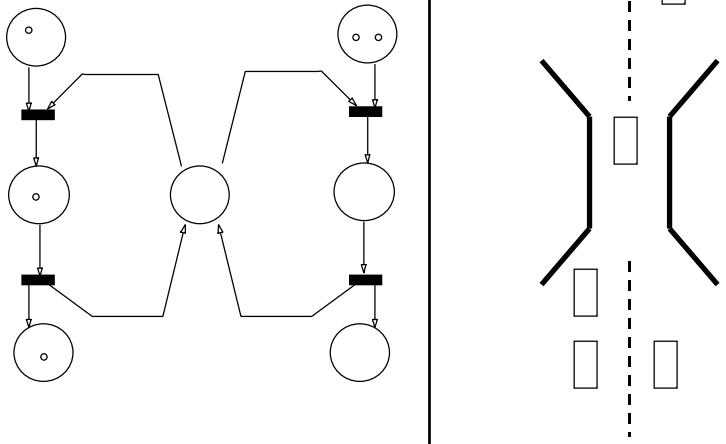

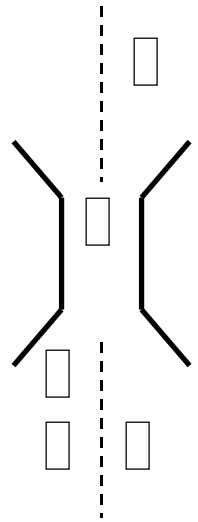

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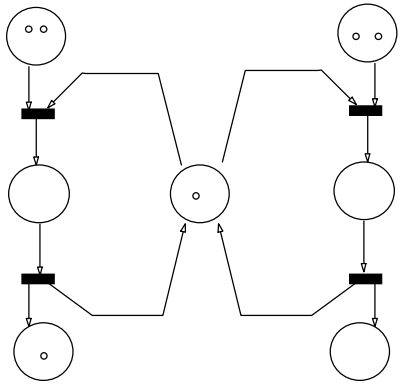

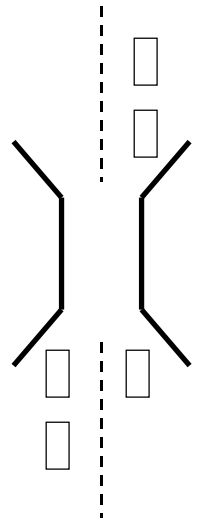

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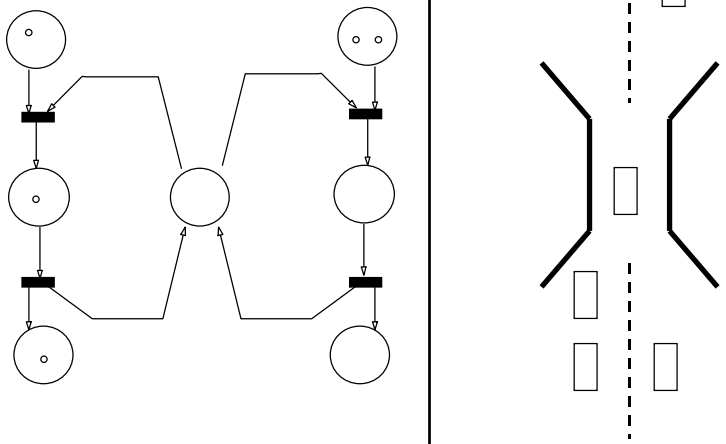

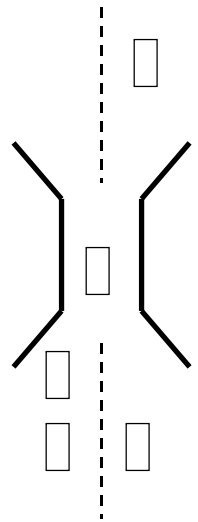

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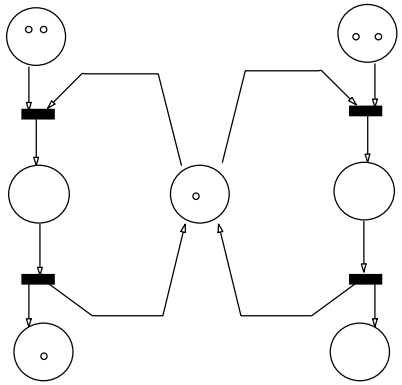

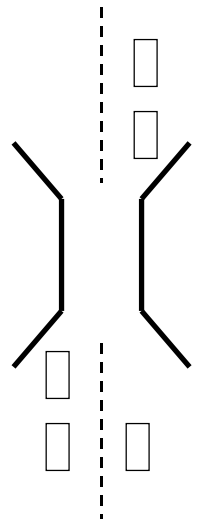

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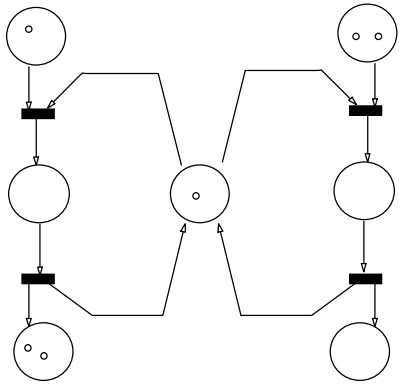

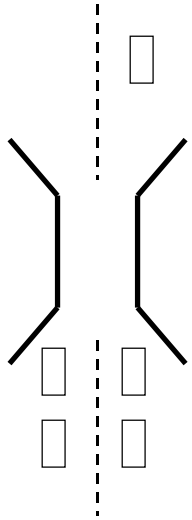

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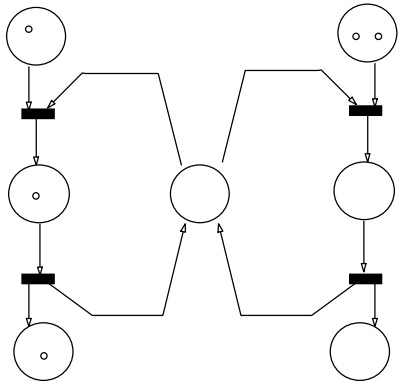

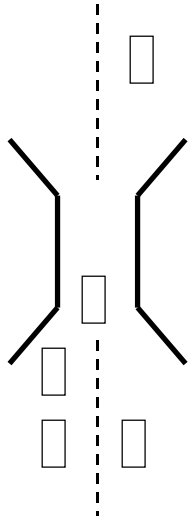

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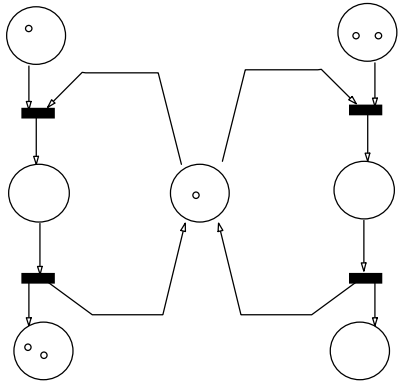

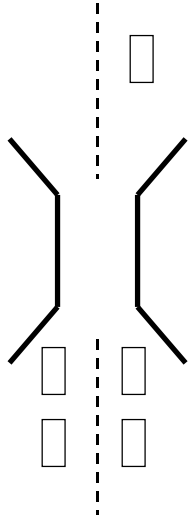

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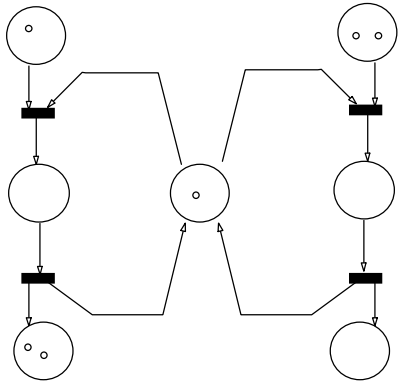

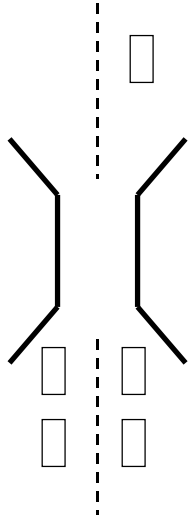

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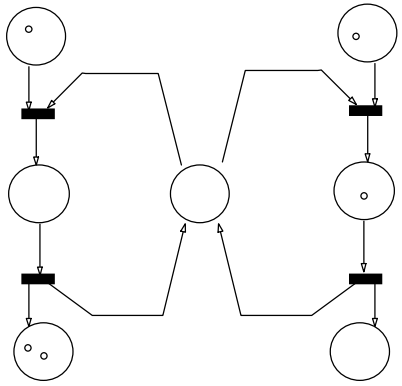

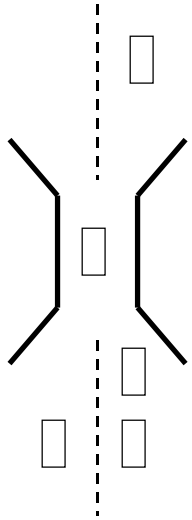

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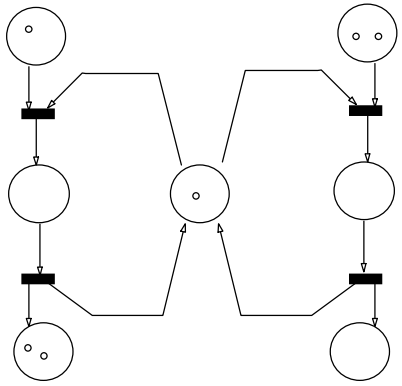

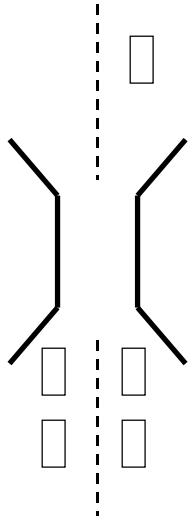

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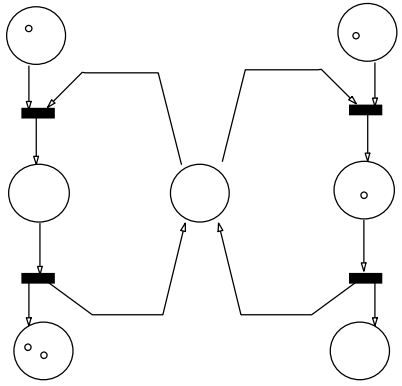

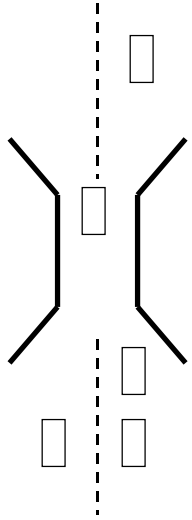

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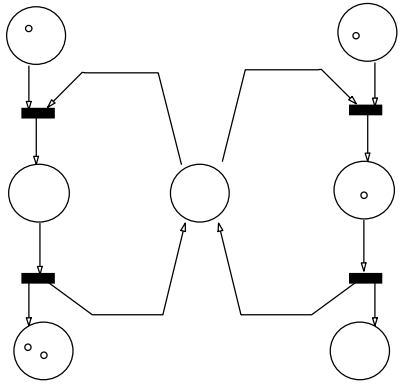

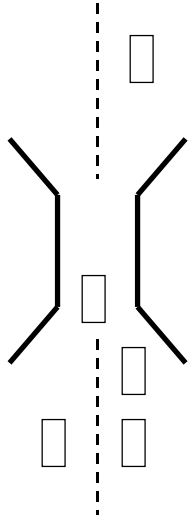

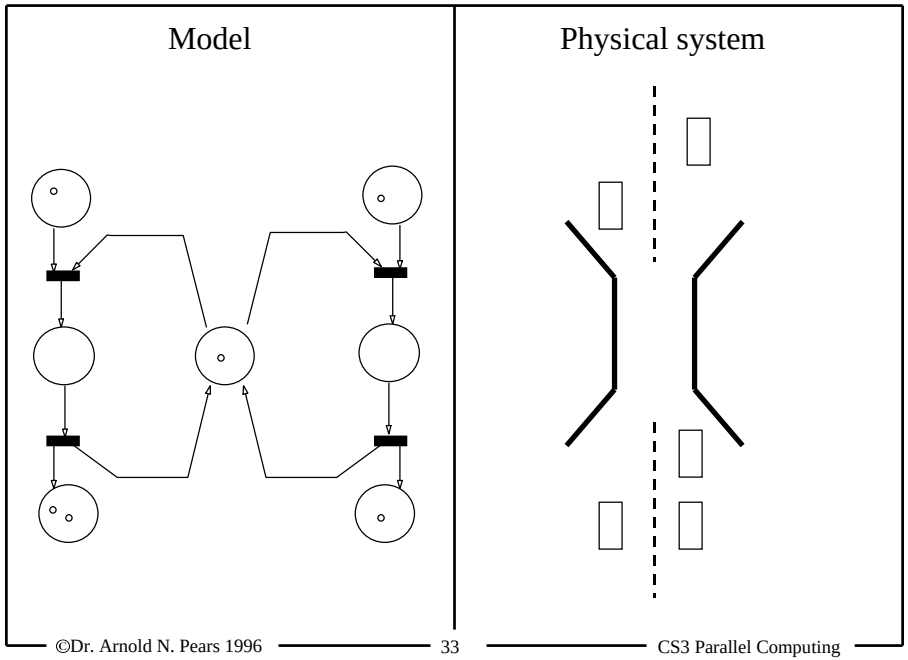

Things to note

- Choice of a transition is non-deterministic.
- The system does not ensure fairness.
  - If fairness is required it must be implemented directly.
- Not all tokens represent cars.

- What defines safety for this system?