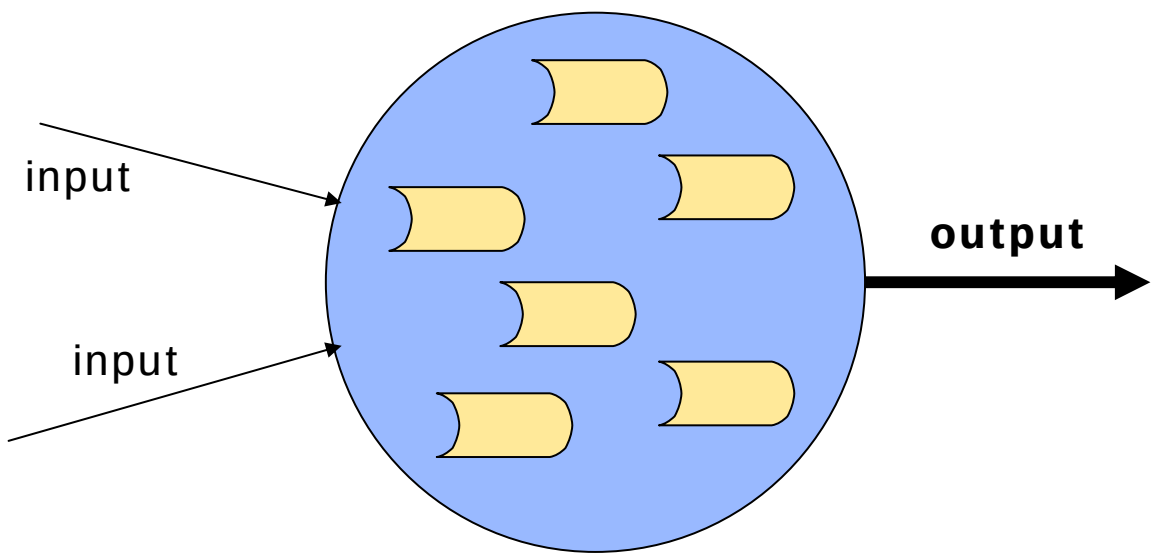
Workflow Management

Business Processes with Information Technology

Definition of Business Process

A set of activities that takes one or more types of inputs and turns them into an output of greater value to the customer.

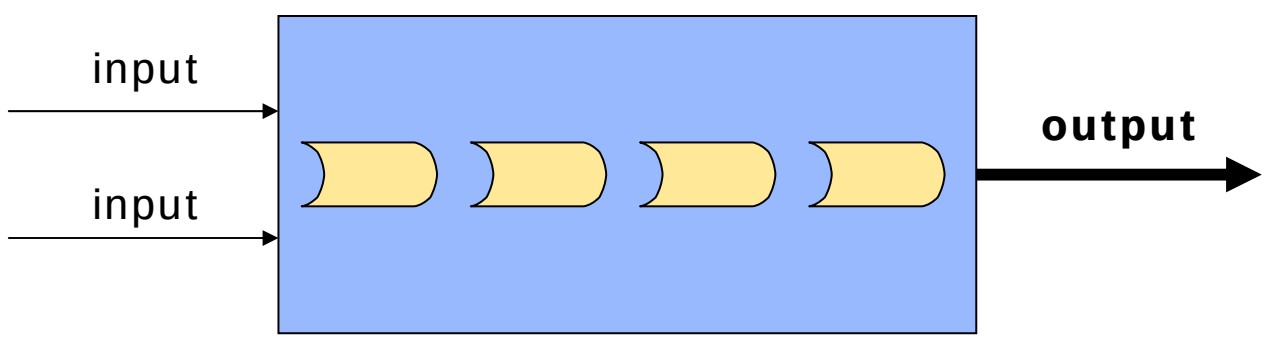
[Hammer]



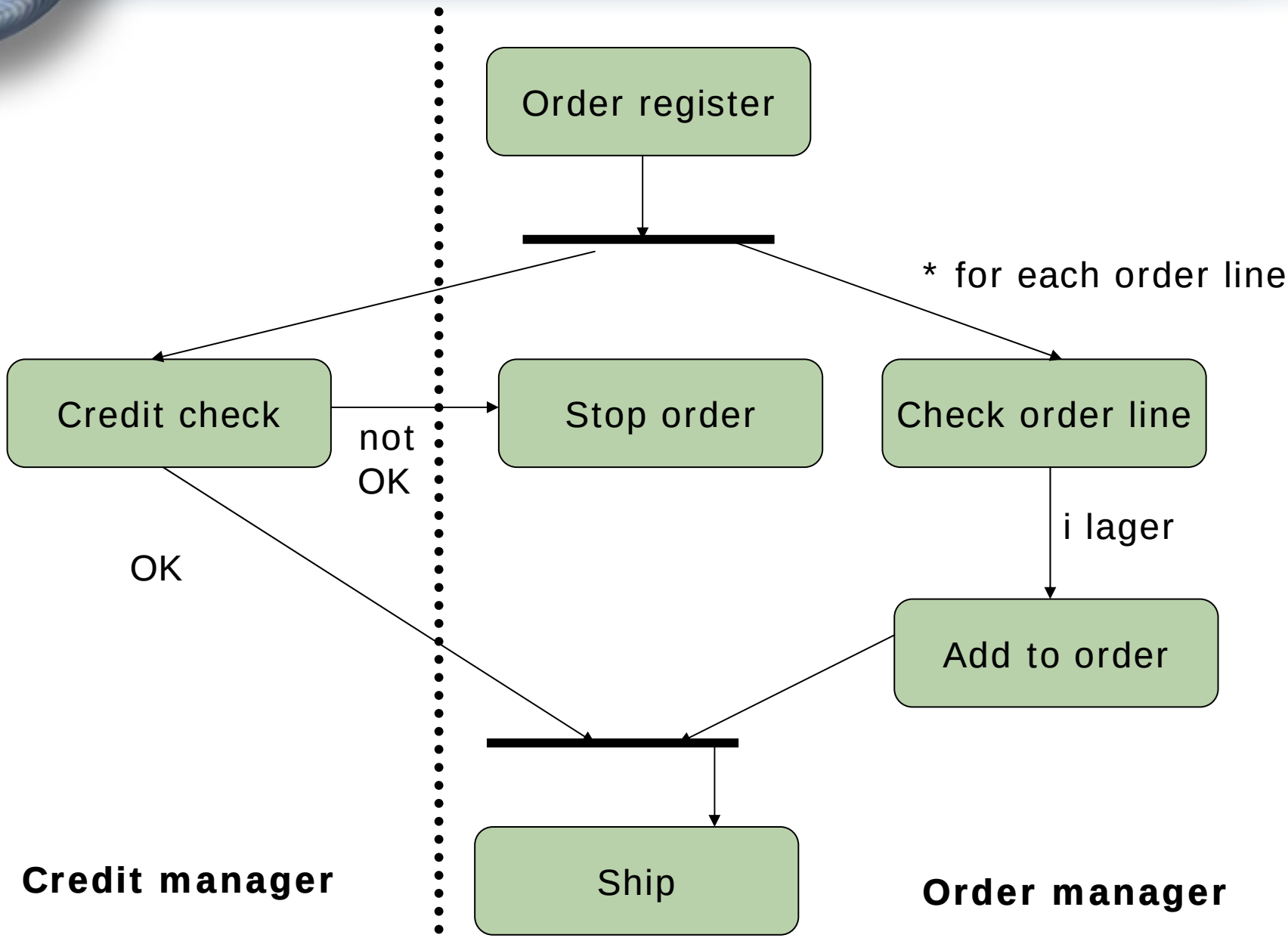
Definition of Business Process

A specific ordering of work activities across time and place, with a beginning, an end, and clearly-defined inputs and outputs; a structure for action.

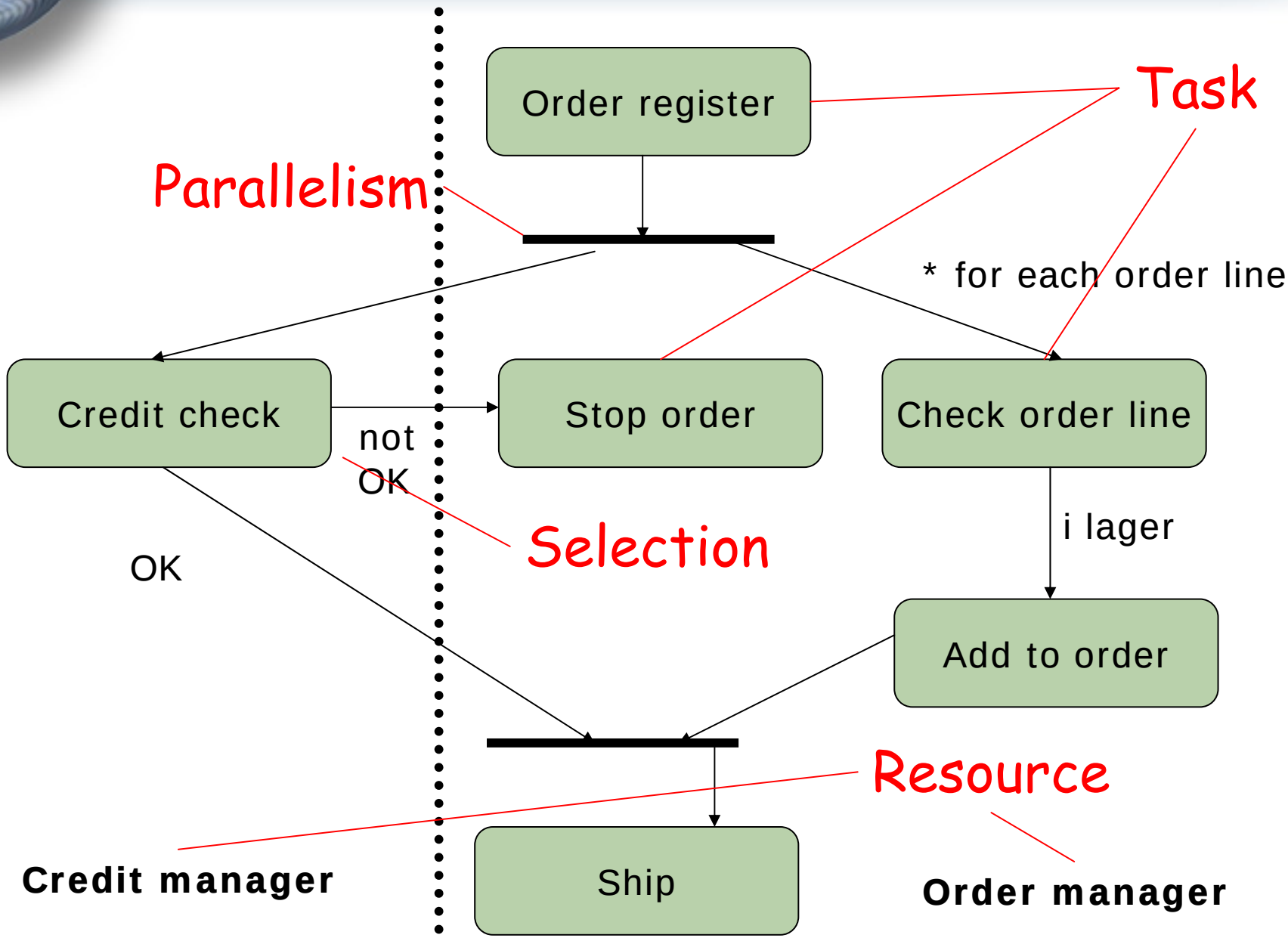
[Davenport]



An Informal Workflow



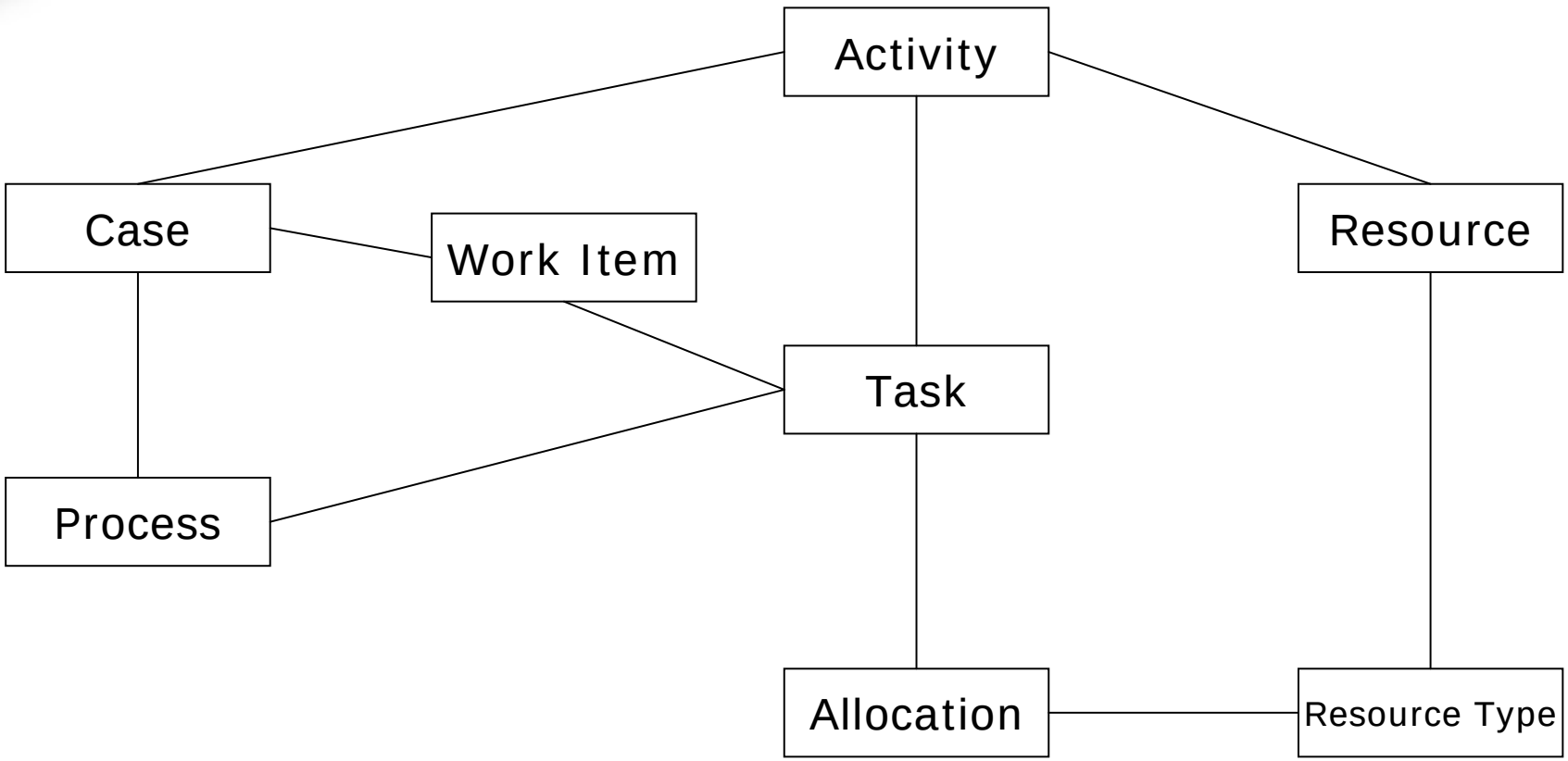
An Informal Workflow



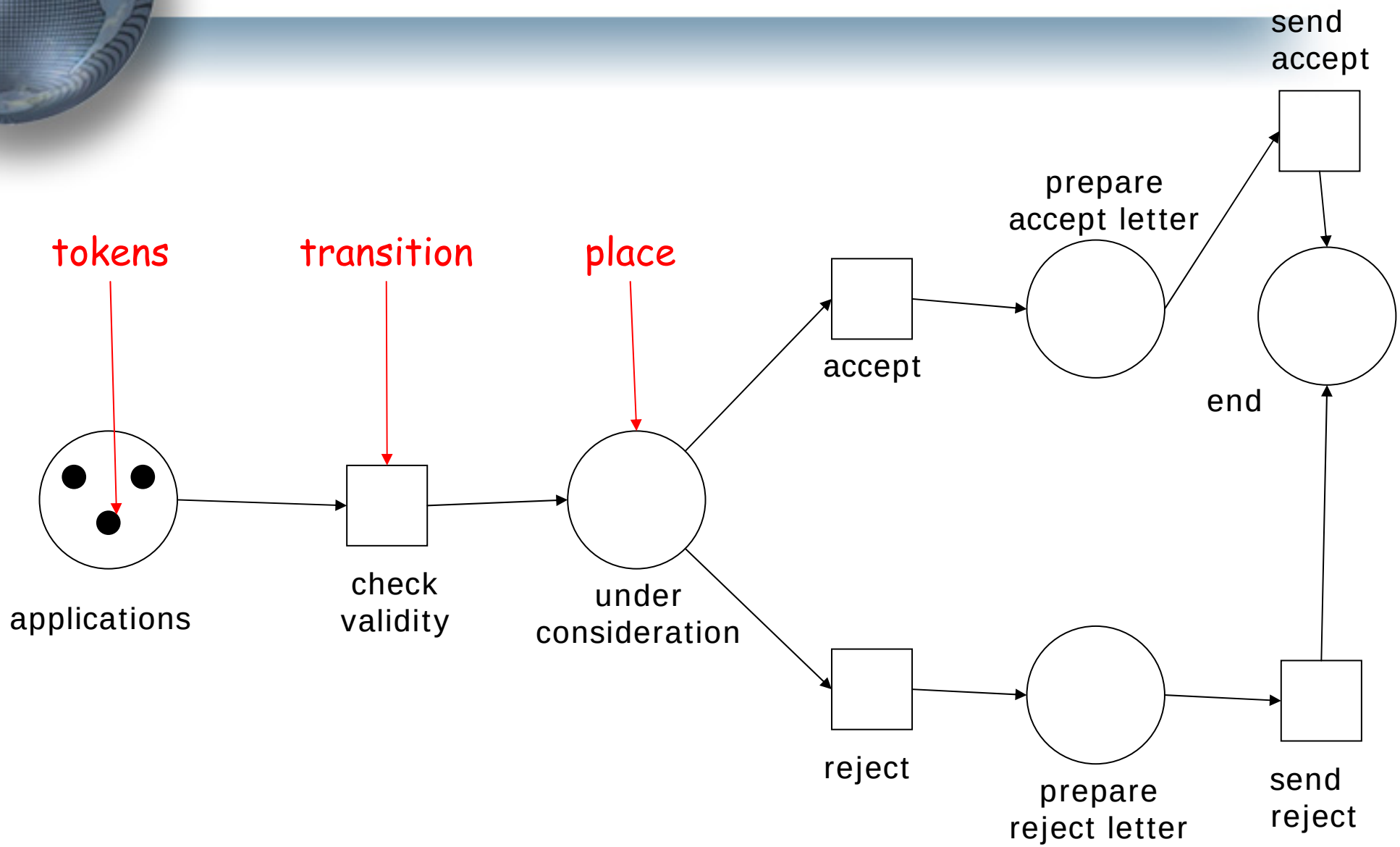
Basic Workflow Concepts

- Task - a logical unit of work that is carried out as a single whole
- Resource - a person or a machine that can perform specific tasks
- Activity - the performance of a task by a a resource
- Case - a sequence of activities performed to achieve some goal, an order, an insurance claim, a car assembly
- Work item - the combination of a case and a task that is just to be carried out
- Process - describes how a particular category of cases shall be managed
- Control flow construct - sequence, selection, iteration, parallelisation

Basic Workflow Concepts

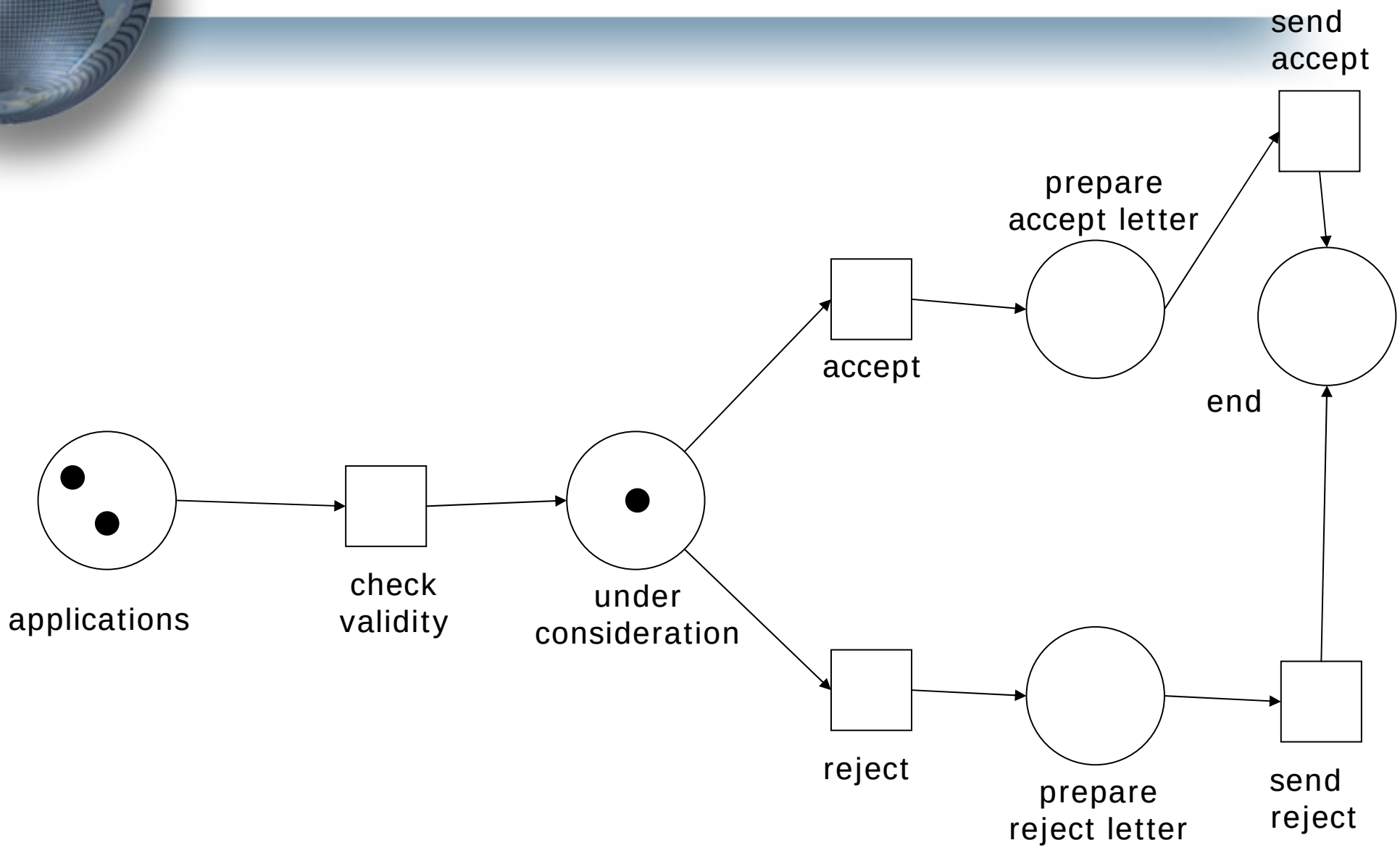


Application Process



When a transition fires it removes one token from each input place and adds one token to each output place

Application Process



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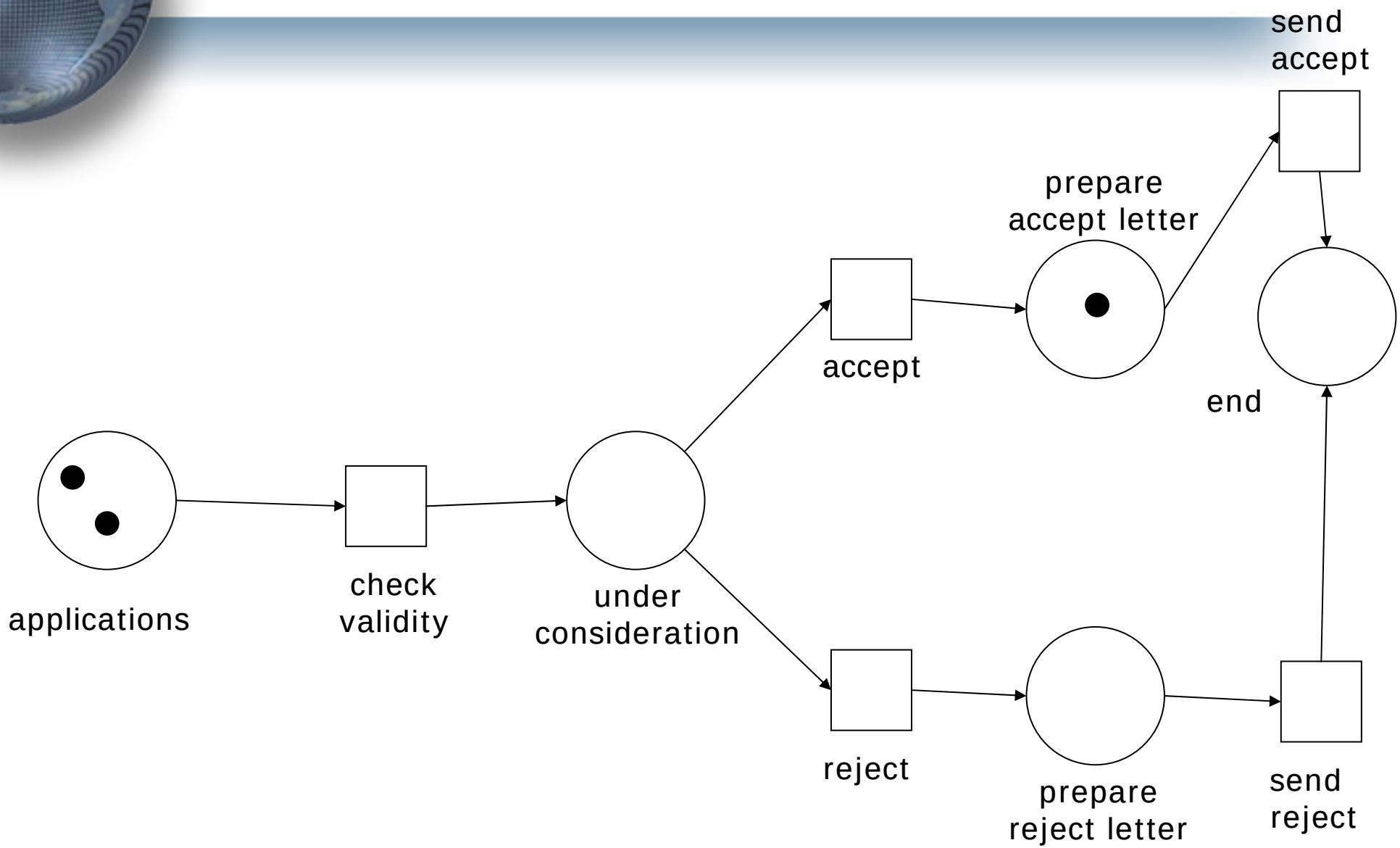

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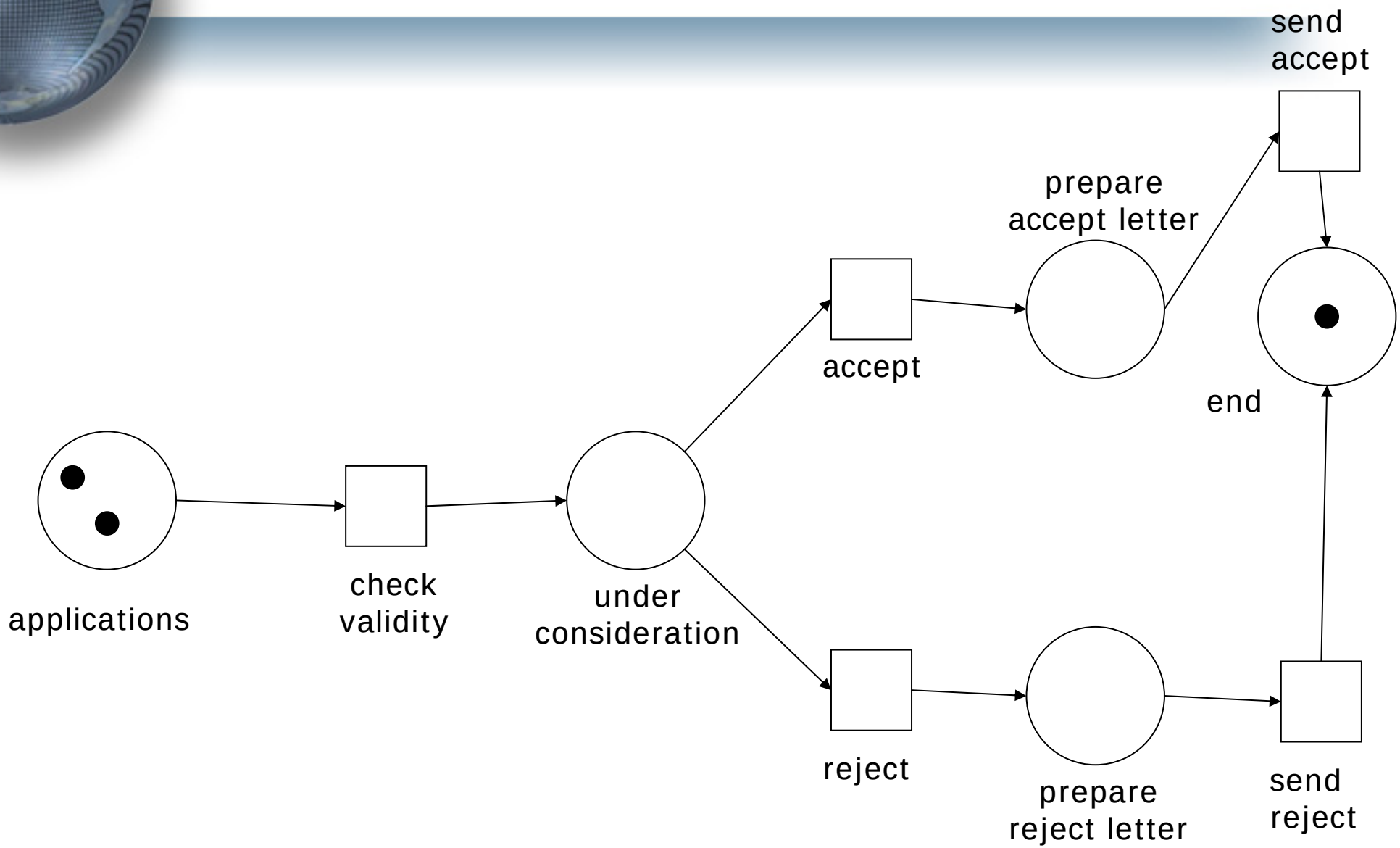

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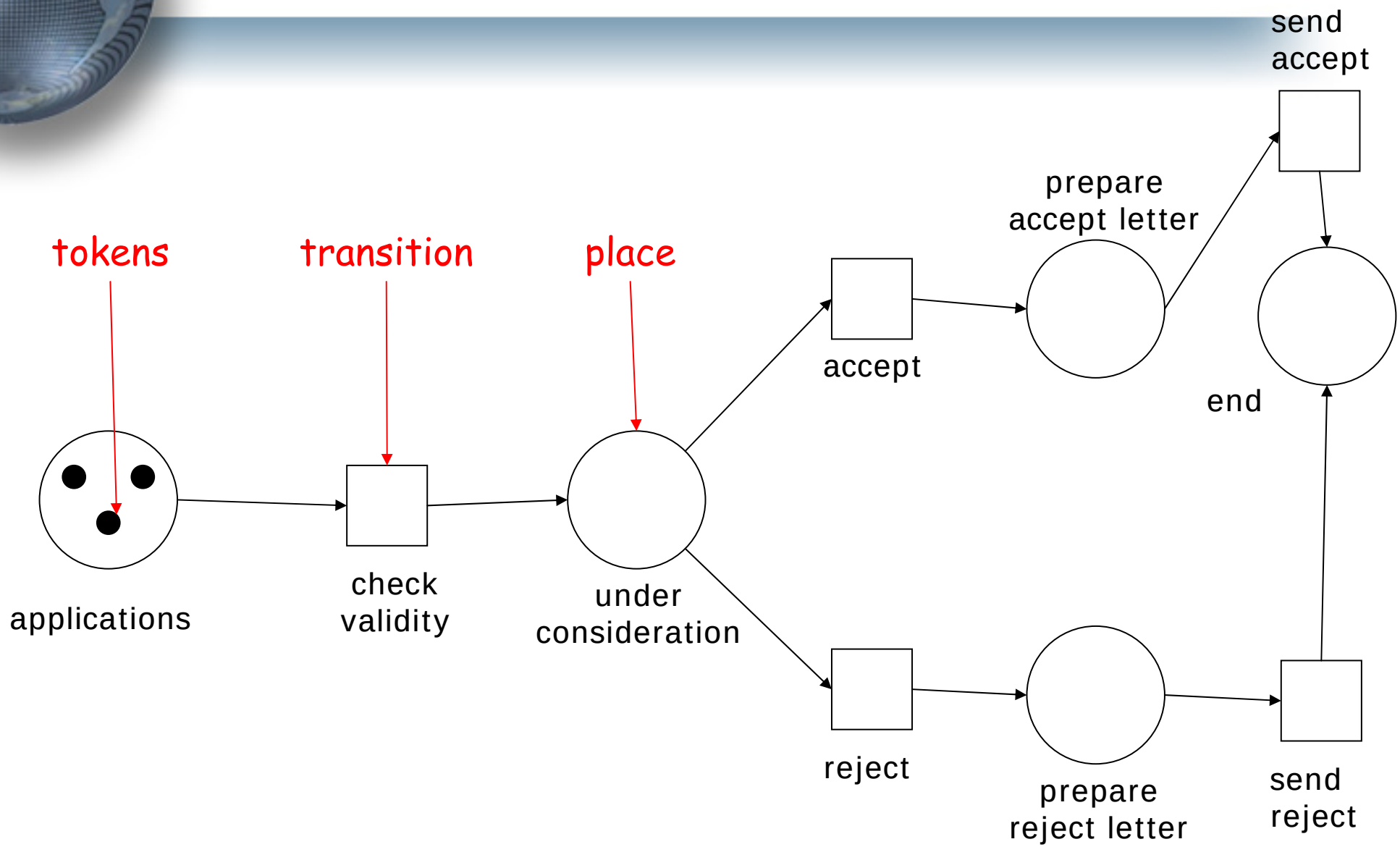

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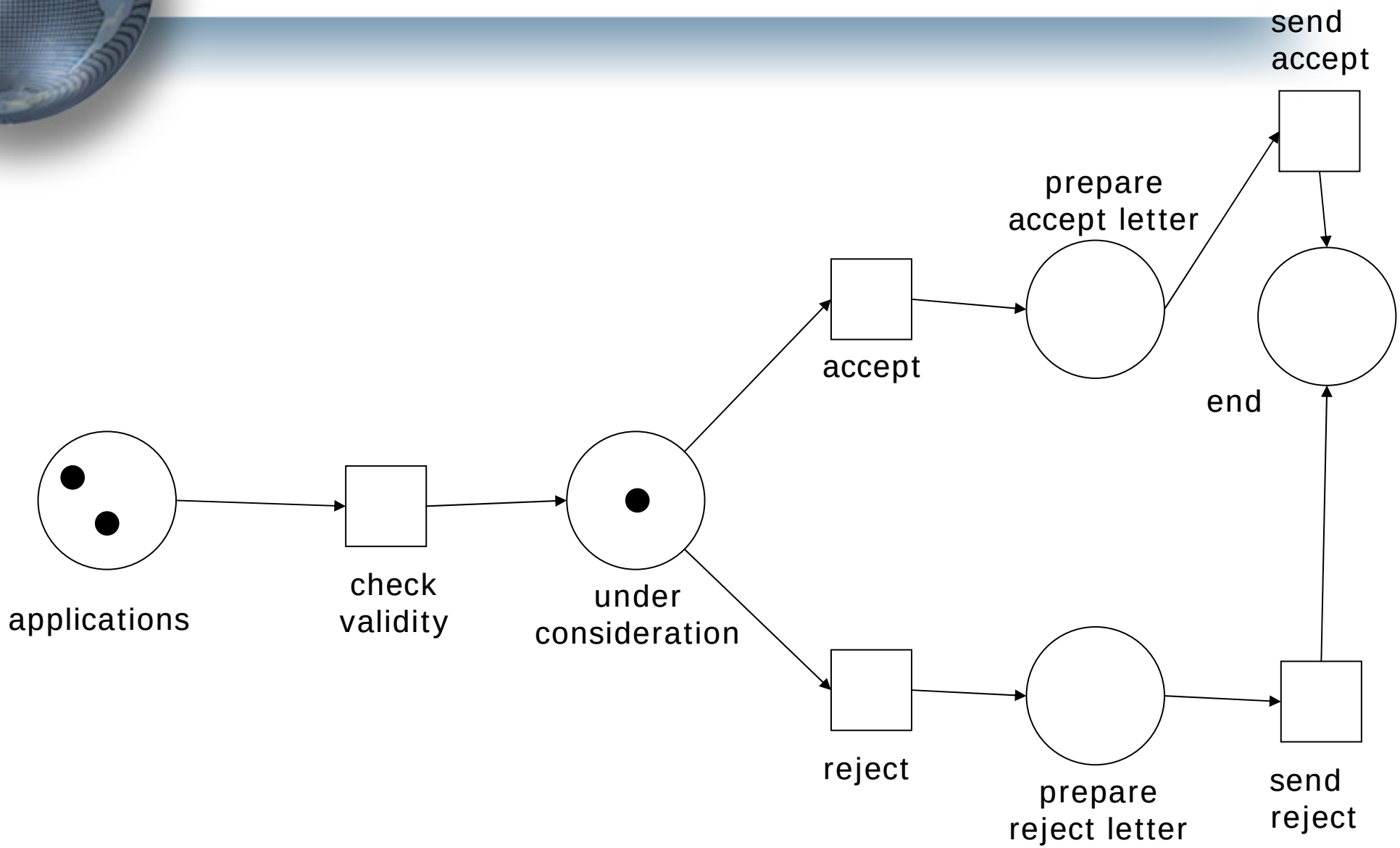

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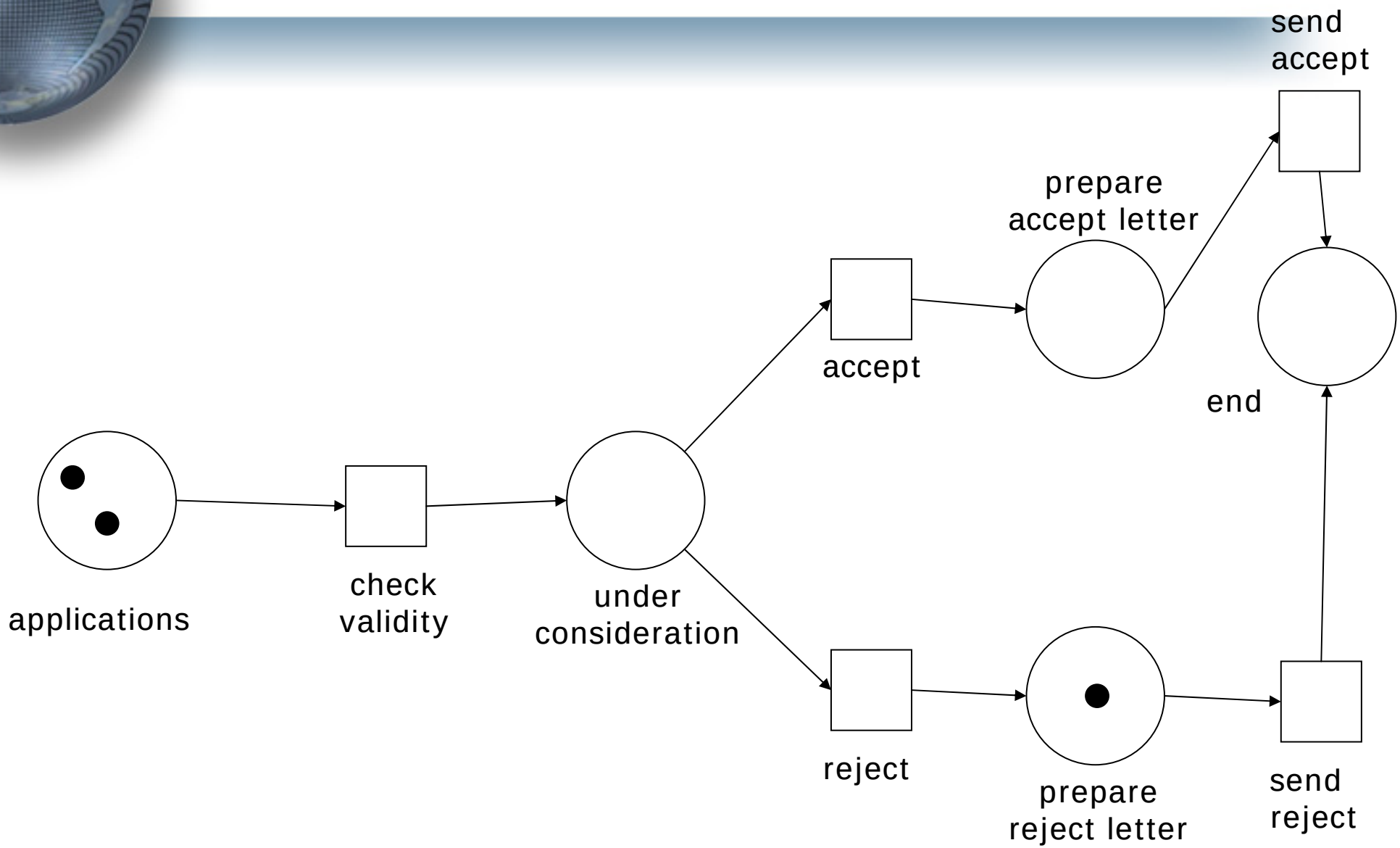
Application Process



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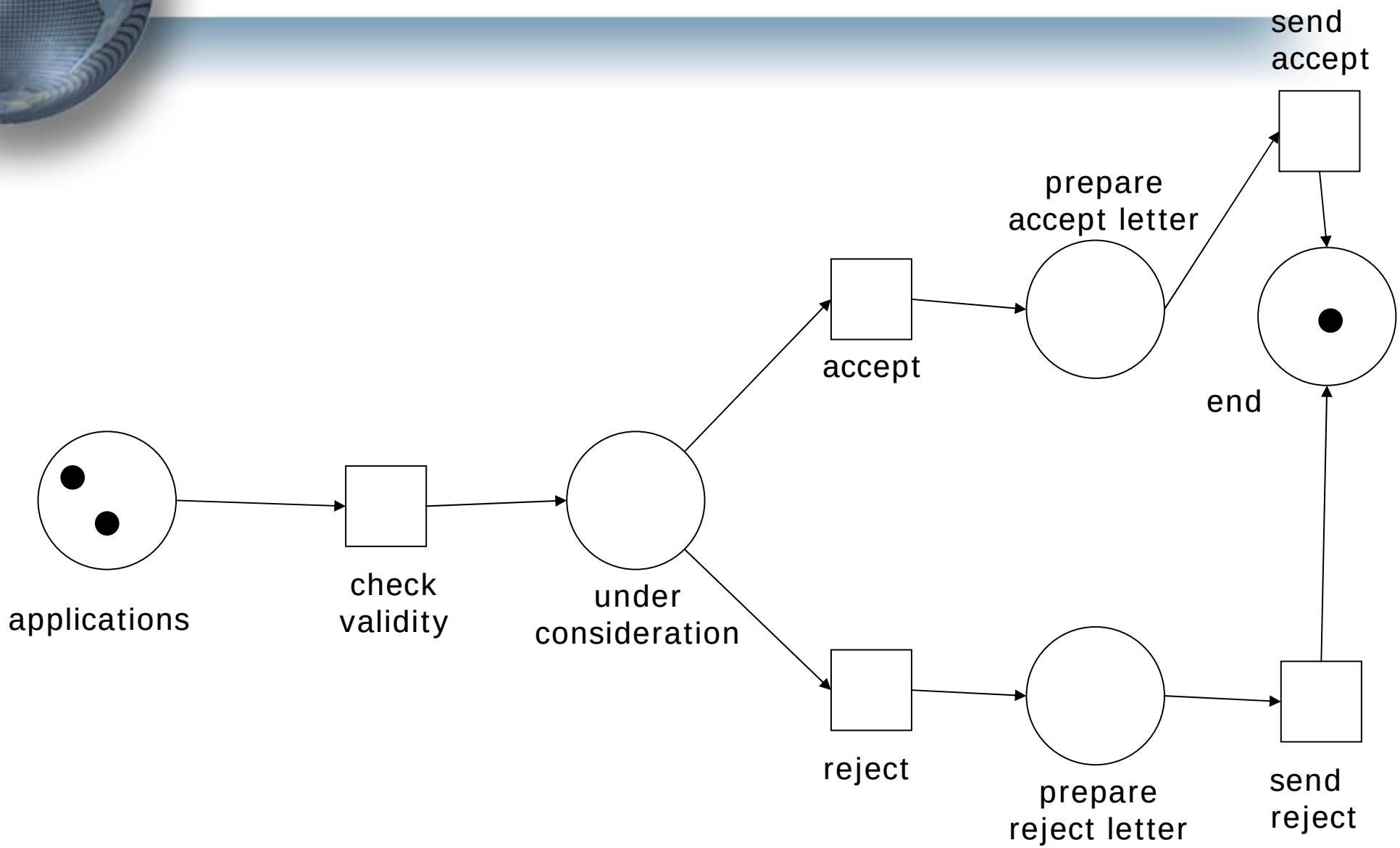
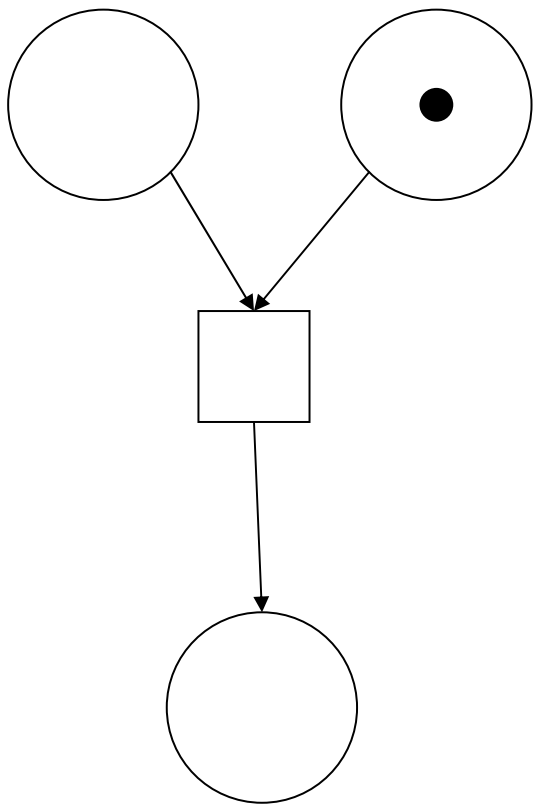
Application Process



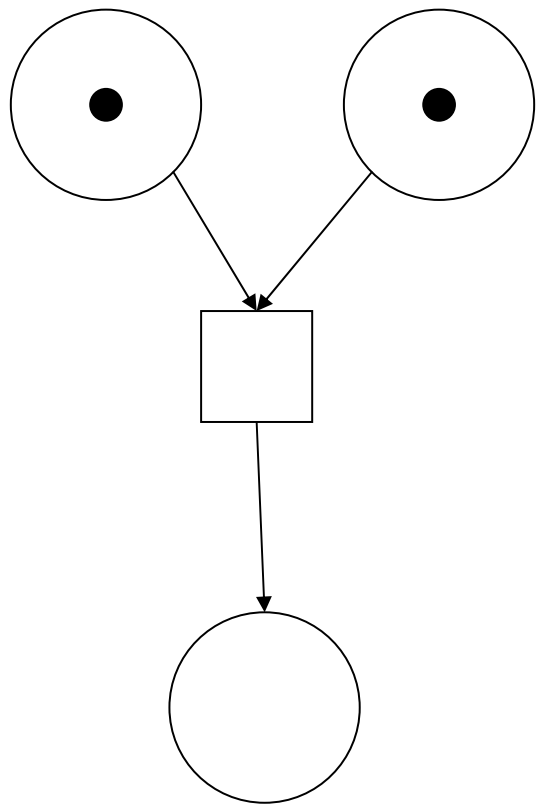
When a transition fires it removes one token from each input place and adds one token to each output place

Enabled Transition

A transition is enabled when there is a token in each of its input places

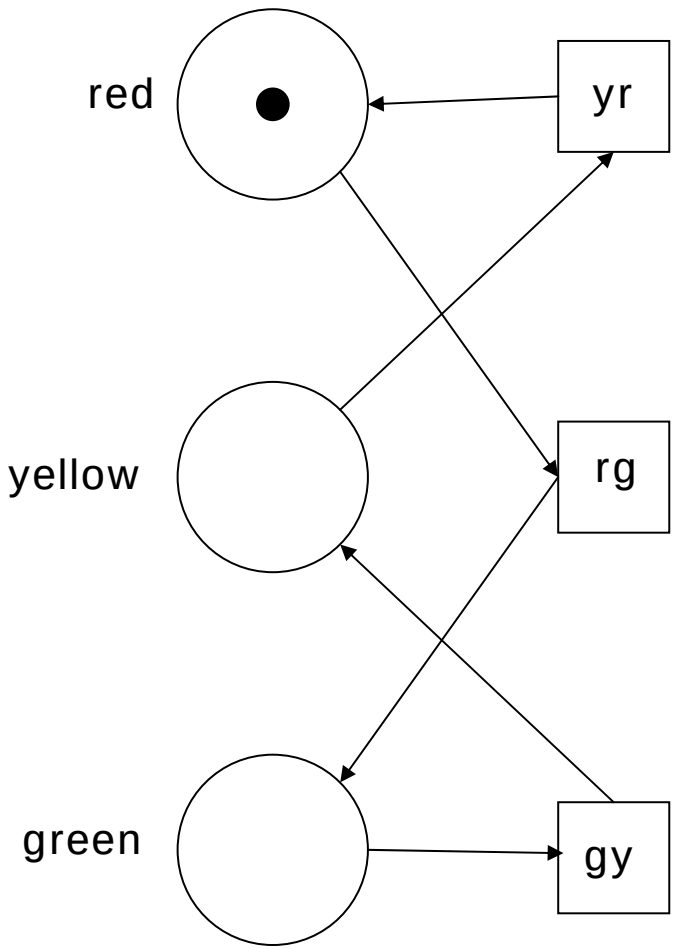


Not enabled

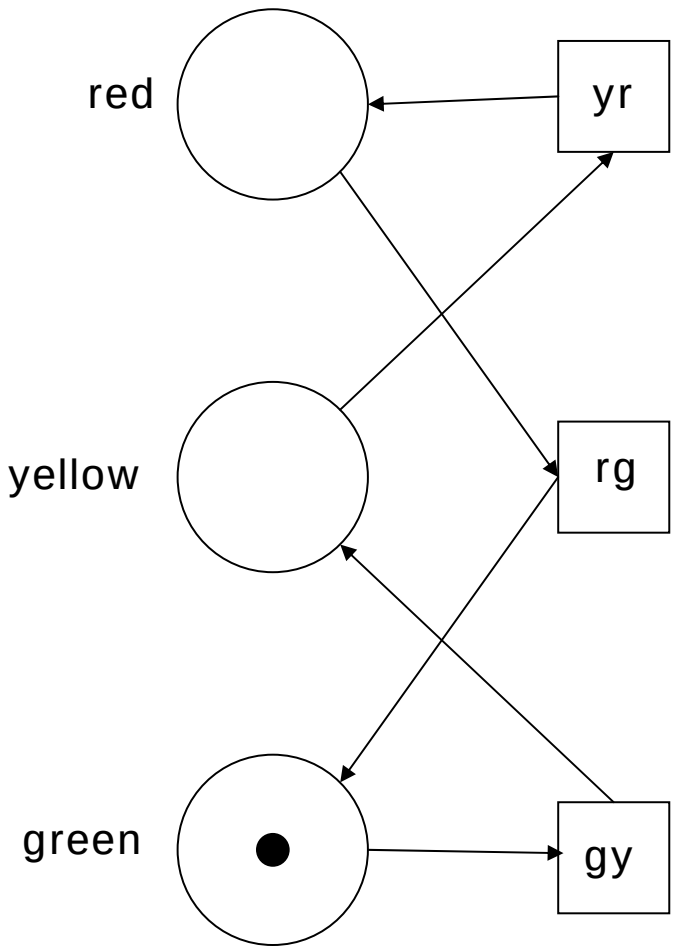


Enabled

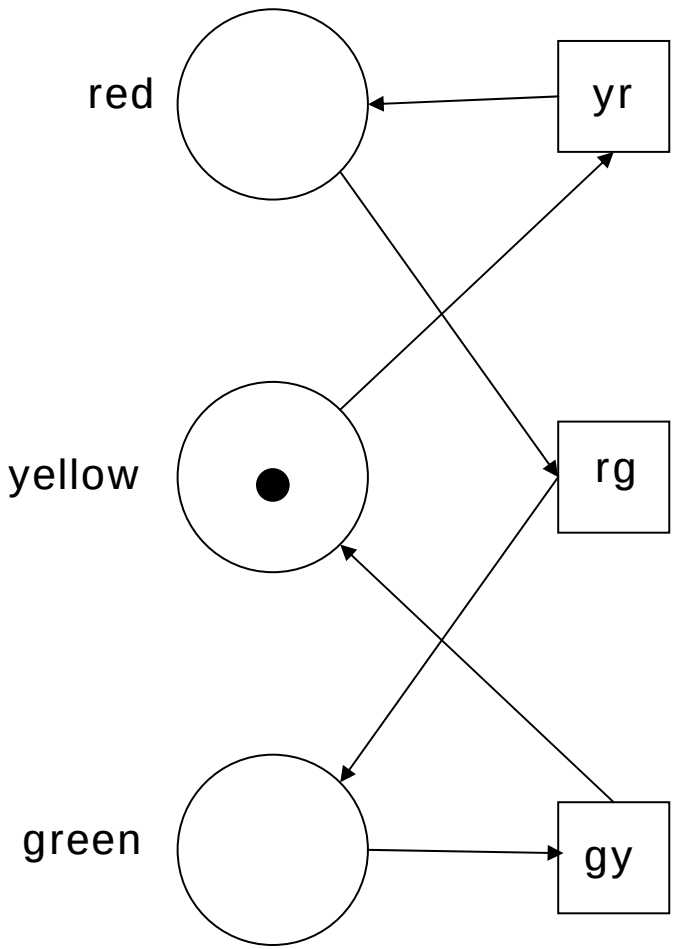
Dutch Traffic Light



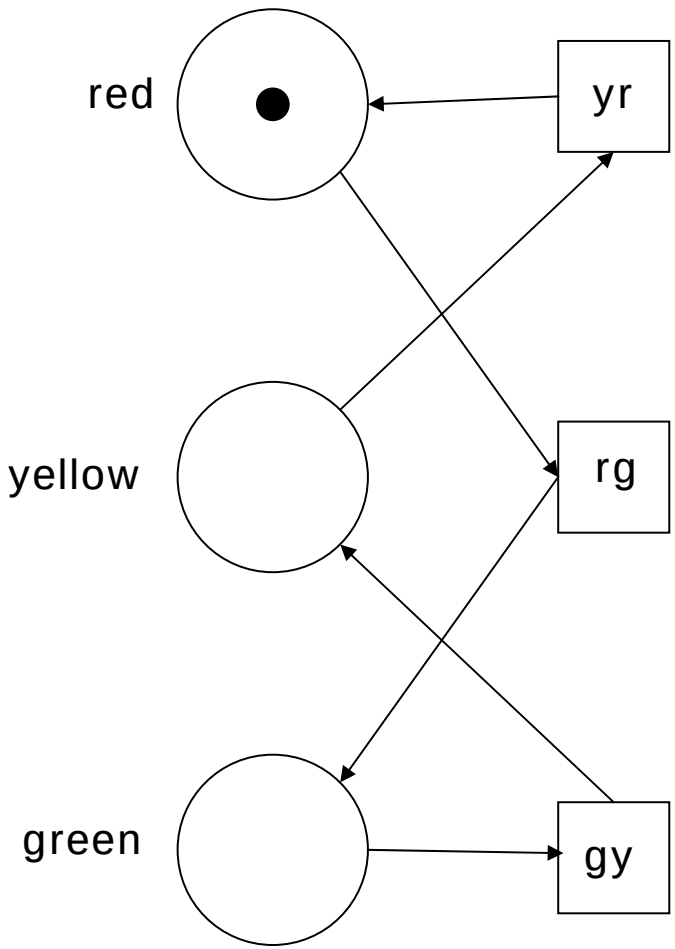
Dutch Traffic Light



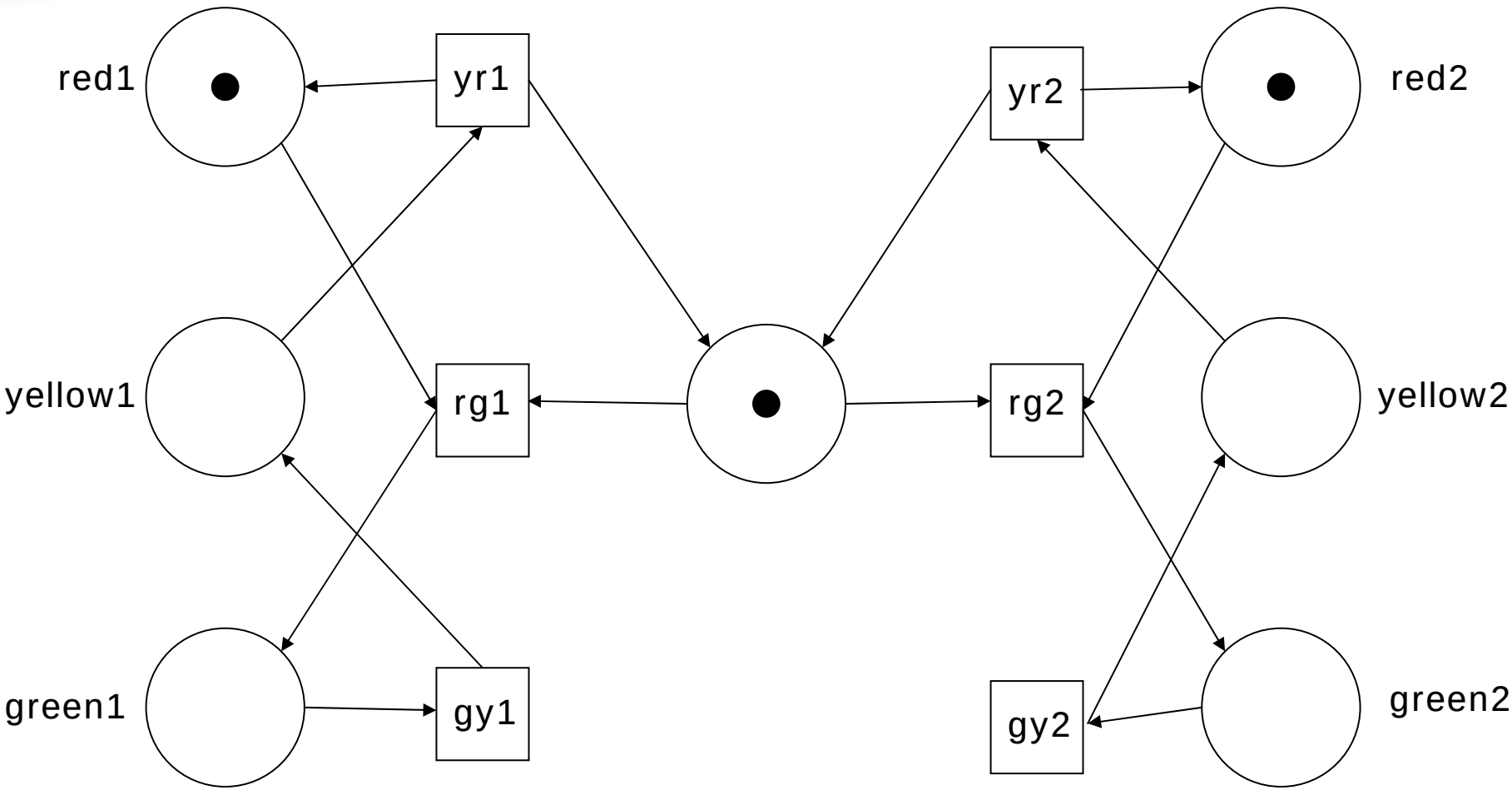
Dutch Traffic Light



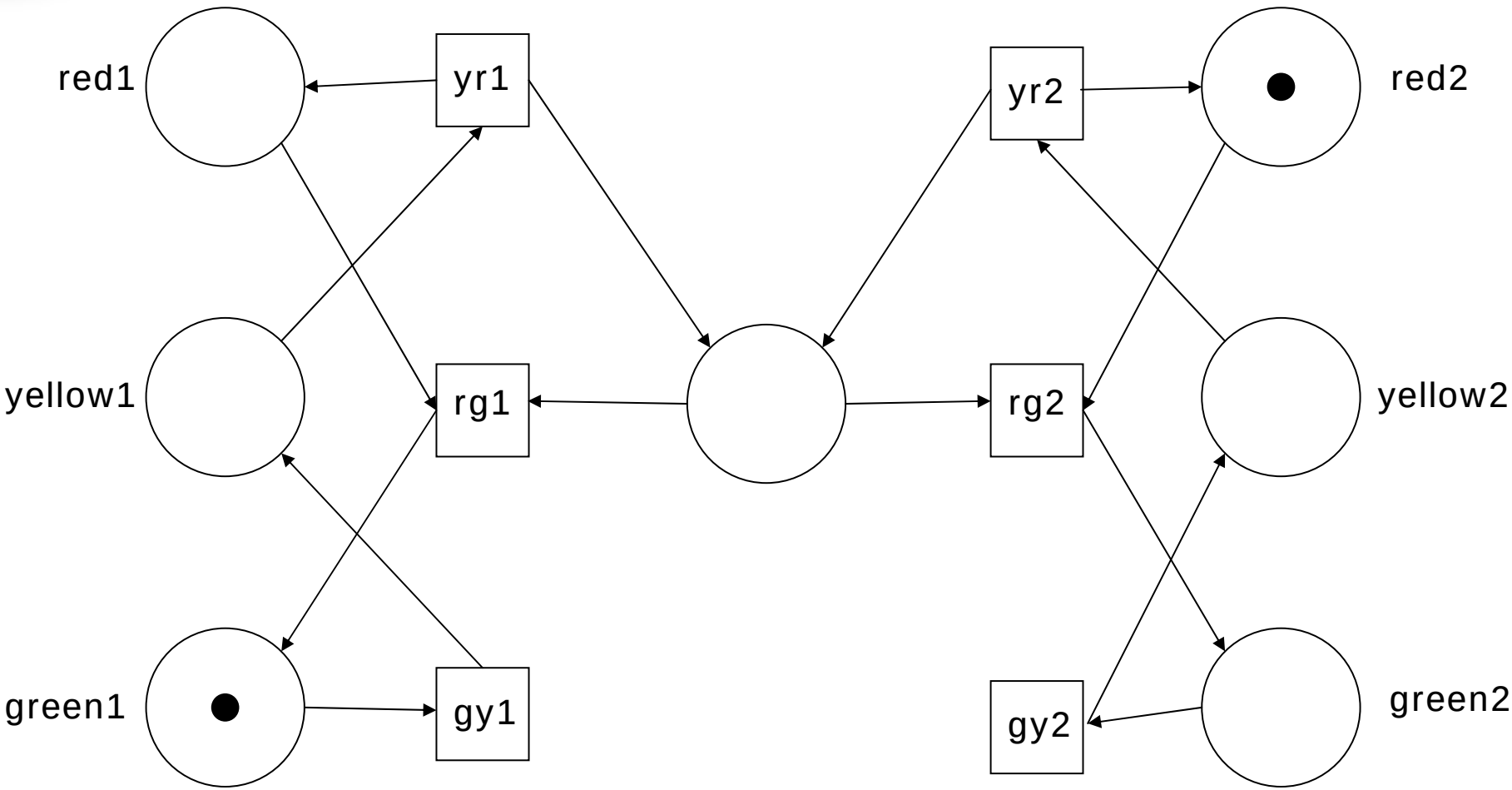
Dutch Traffic Light



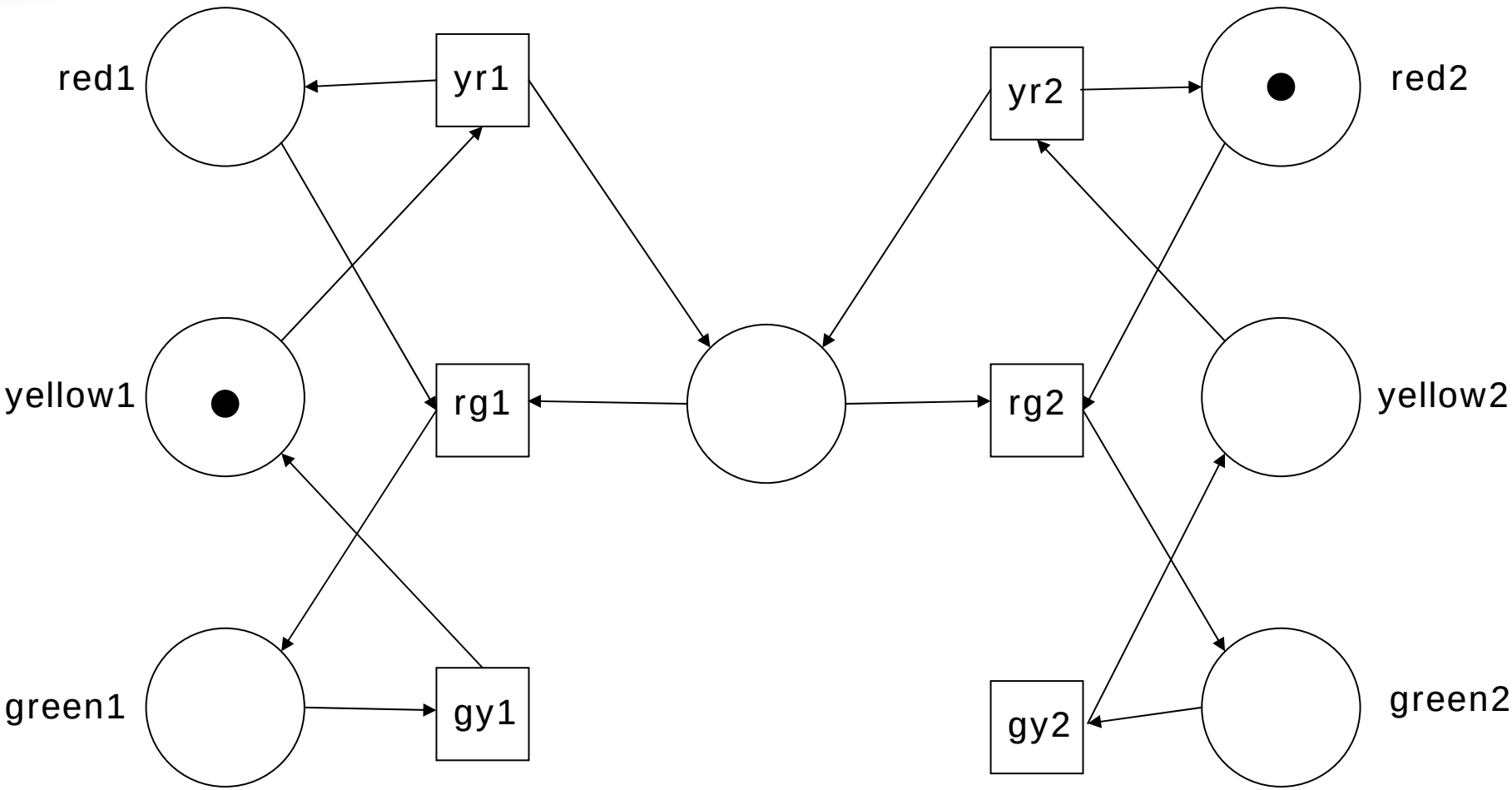
Two Traffic Lights



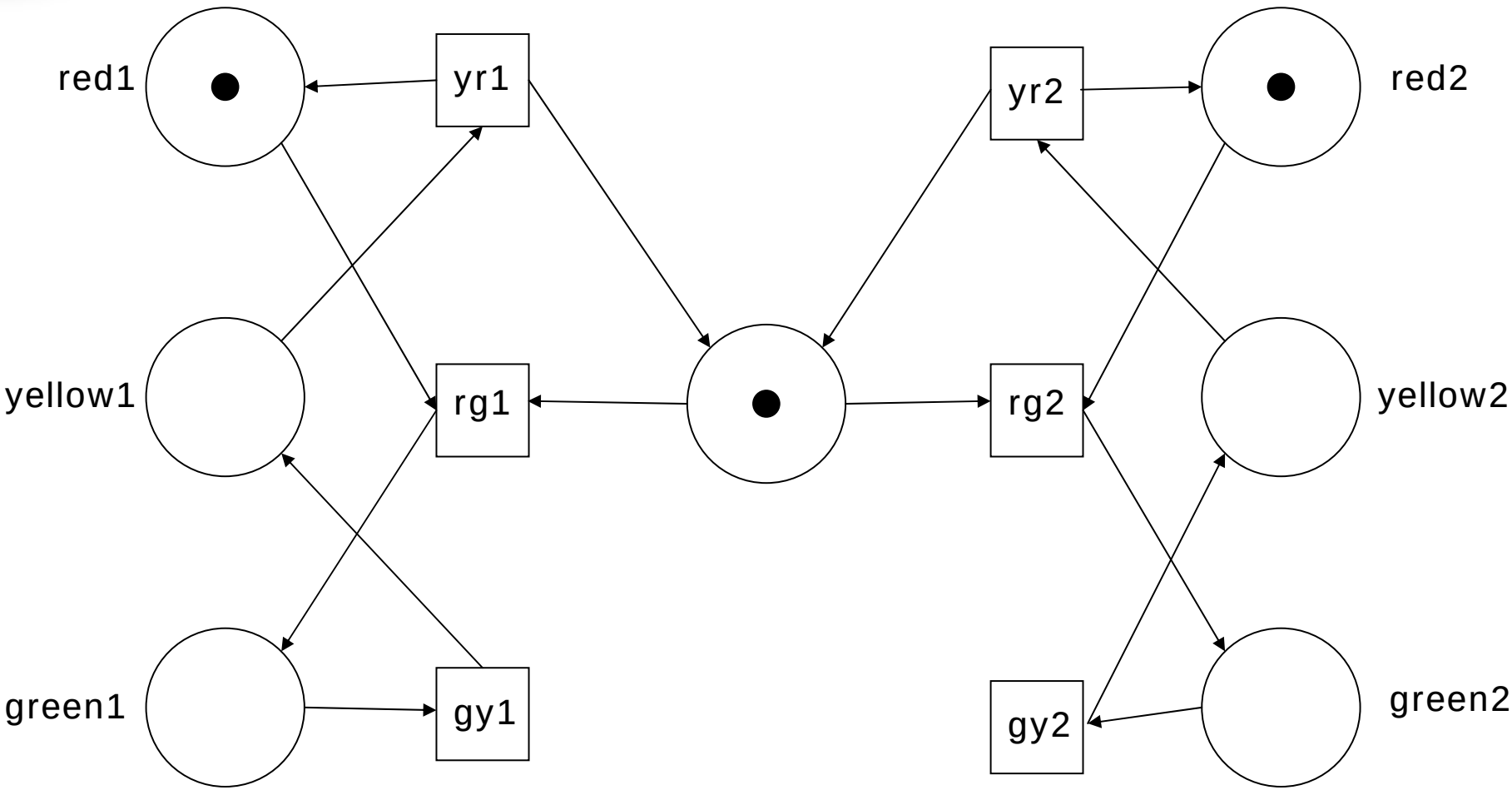
Two Traffic Lights



Two Traffic Lights



Two Traffic Lights



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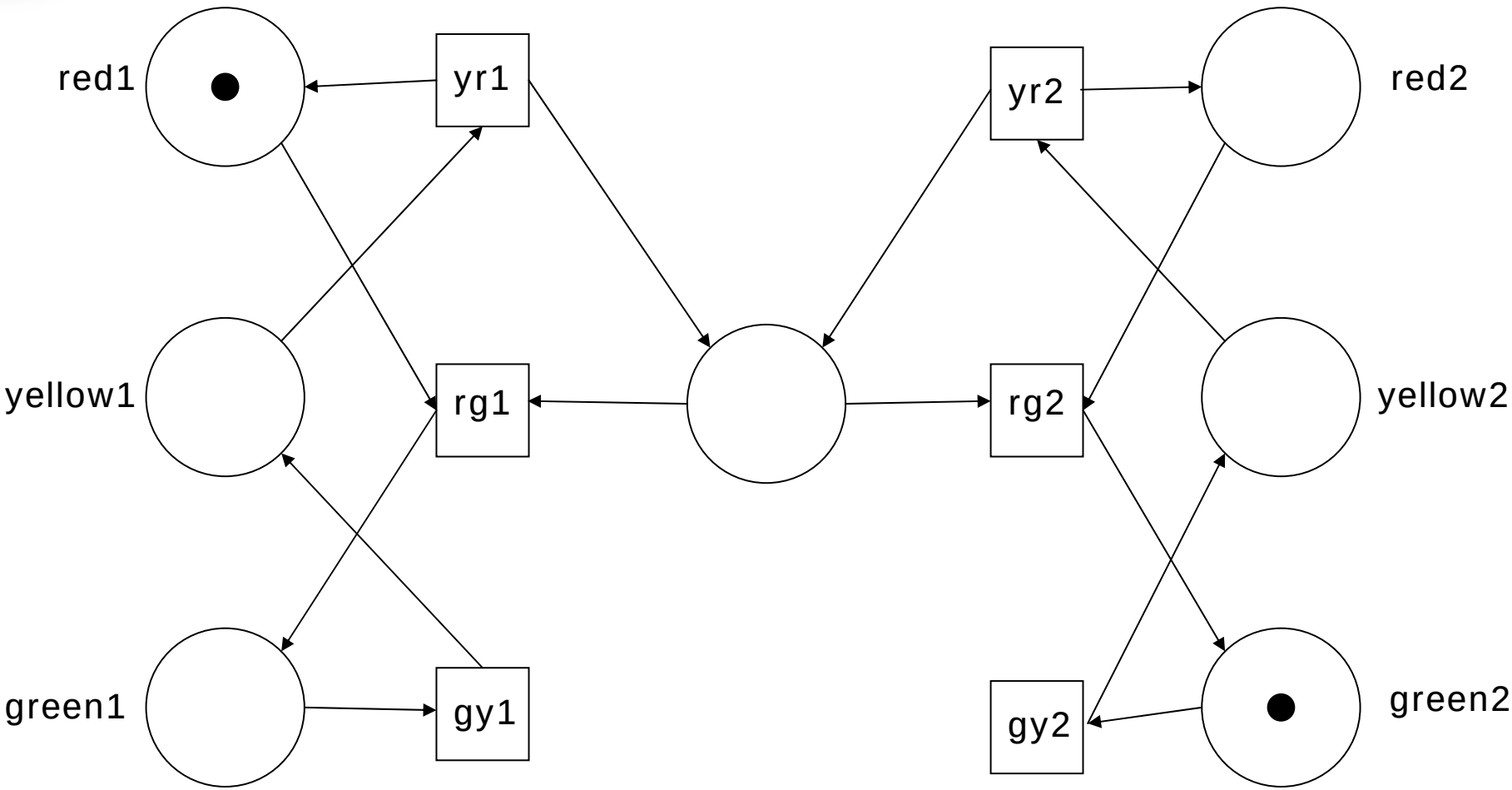
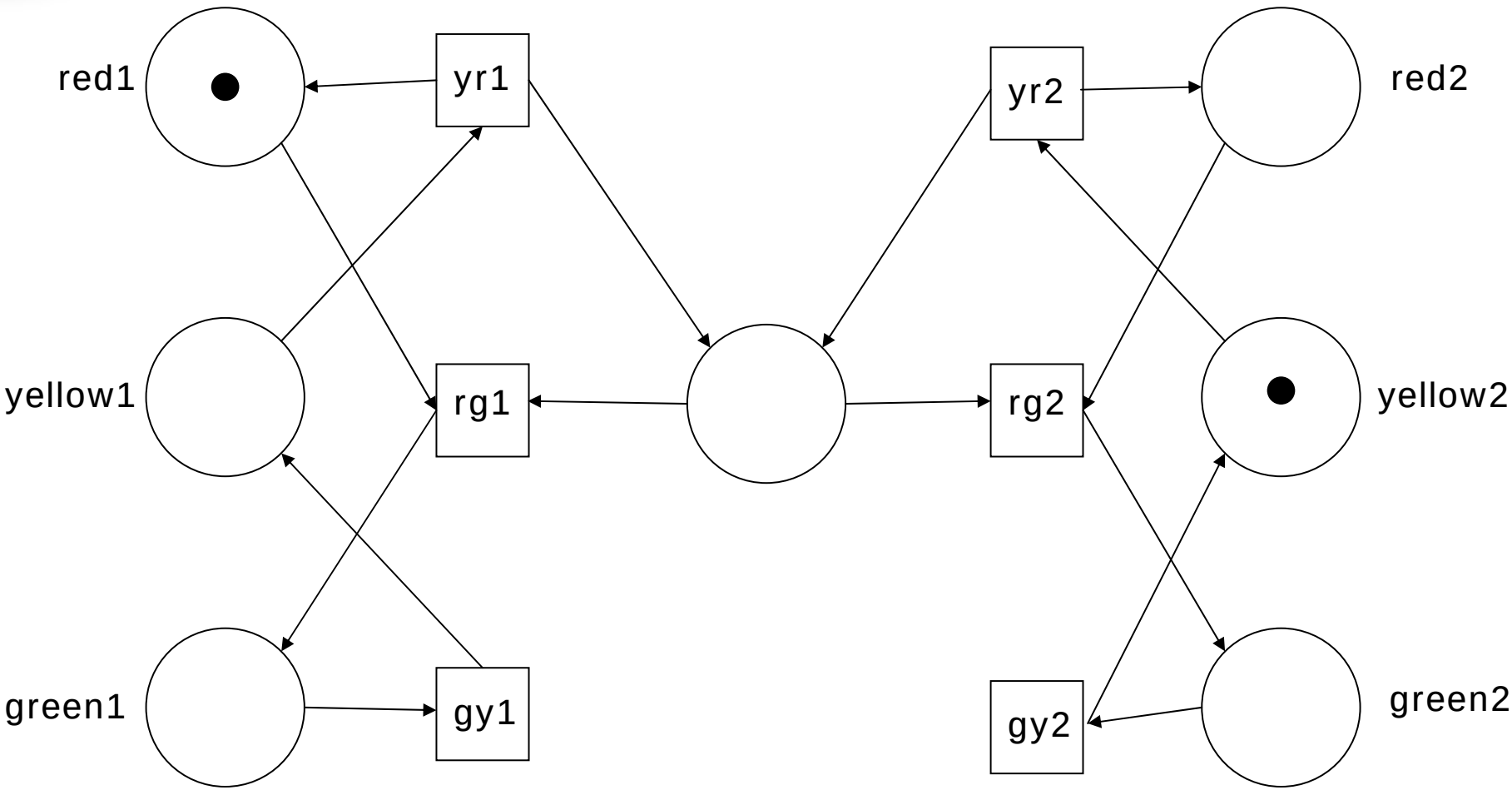


Two Traffic Lights



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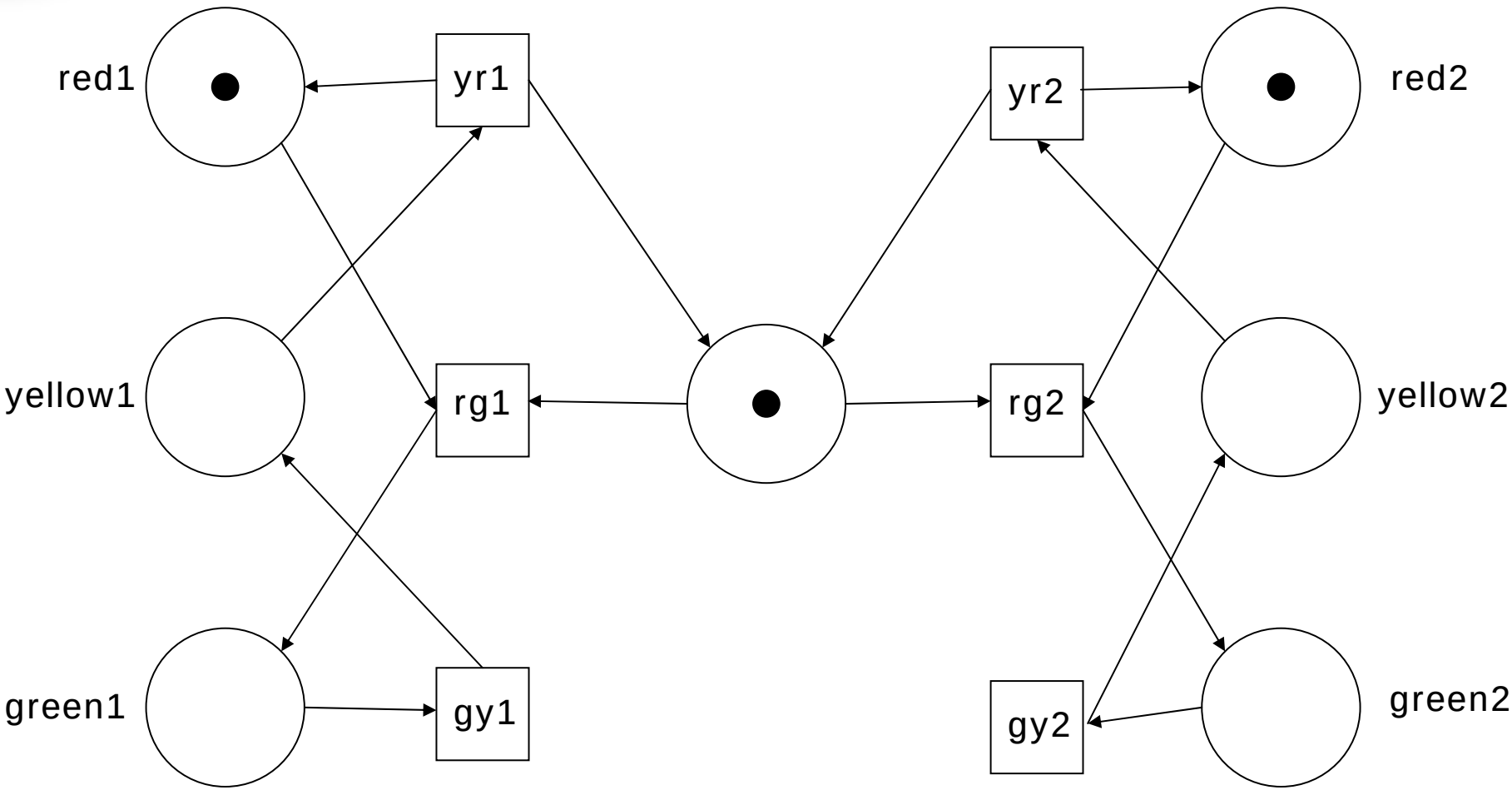


Exercise - Traffic Light

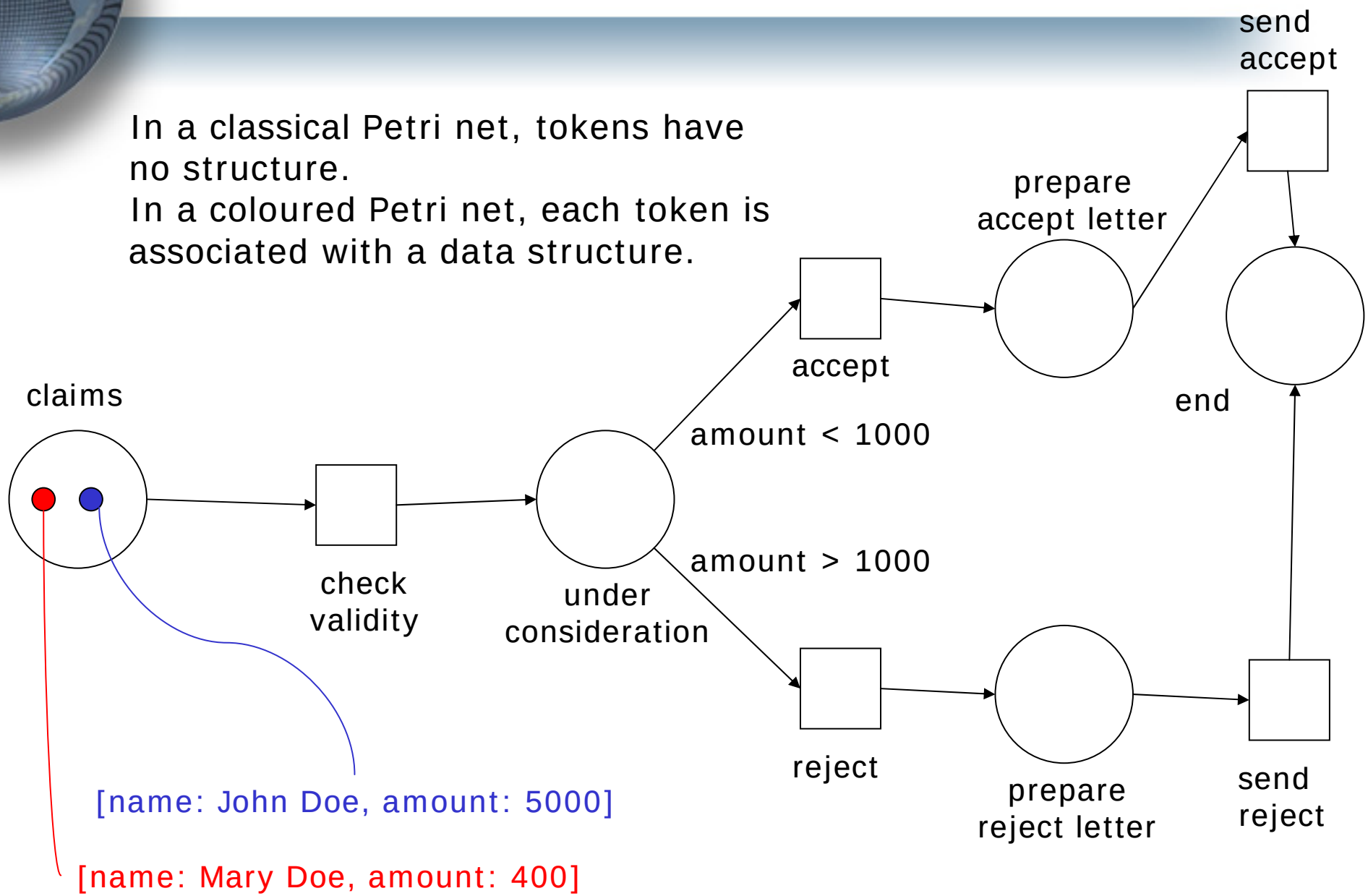
Construct a Petri net for a traffic light that has four possible states:

- red
- yellow
- green
- red + yellow

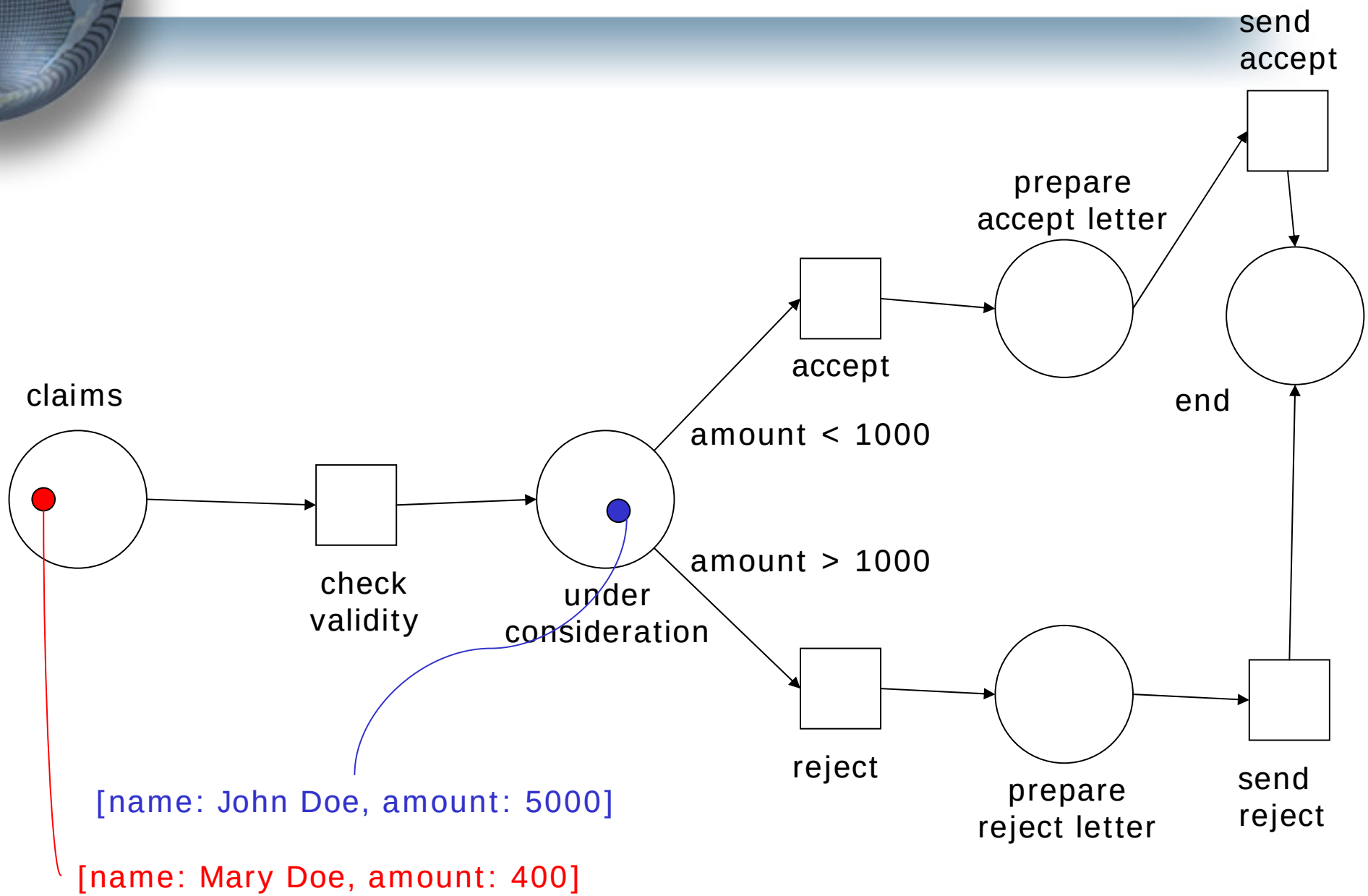
The light moves from red to (red + yellow) and then to green. From green it moves to yellow and then to red.

Coloured Petri Nets

In a classical Petri net, tokens have no structure.
In a coloured Petri net, each token is associated with a data structure.

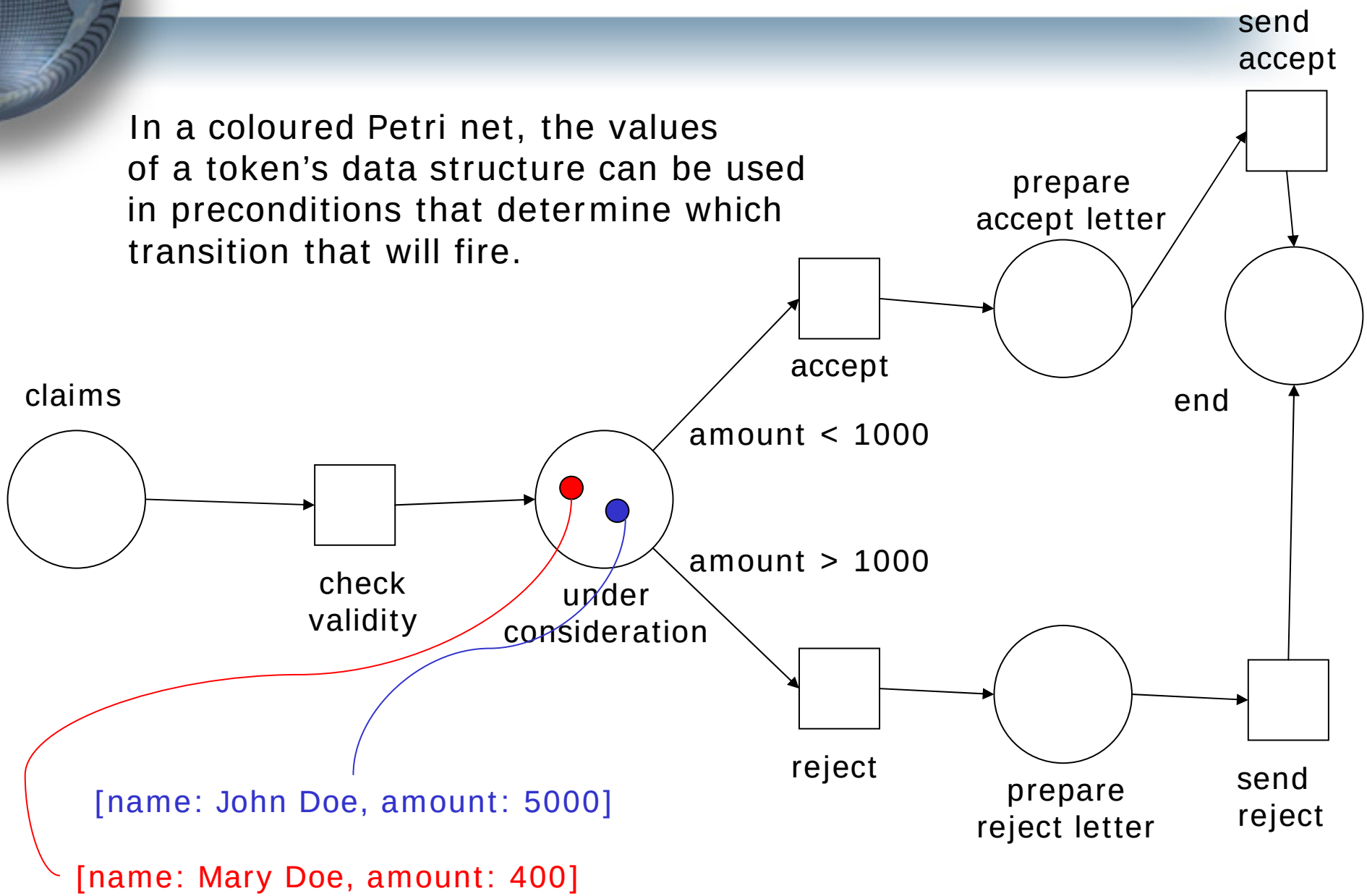


Coloured Petri Nets



Coloured Petri Nets

In a coloured Petri net, the values of a token's data structure can be used in preconditions that determine which transition that will fire.



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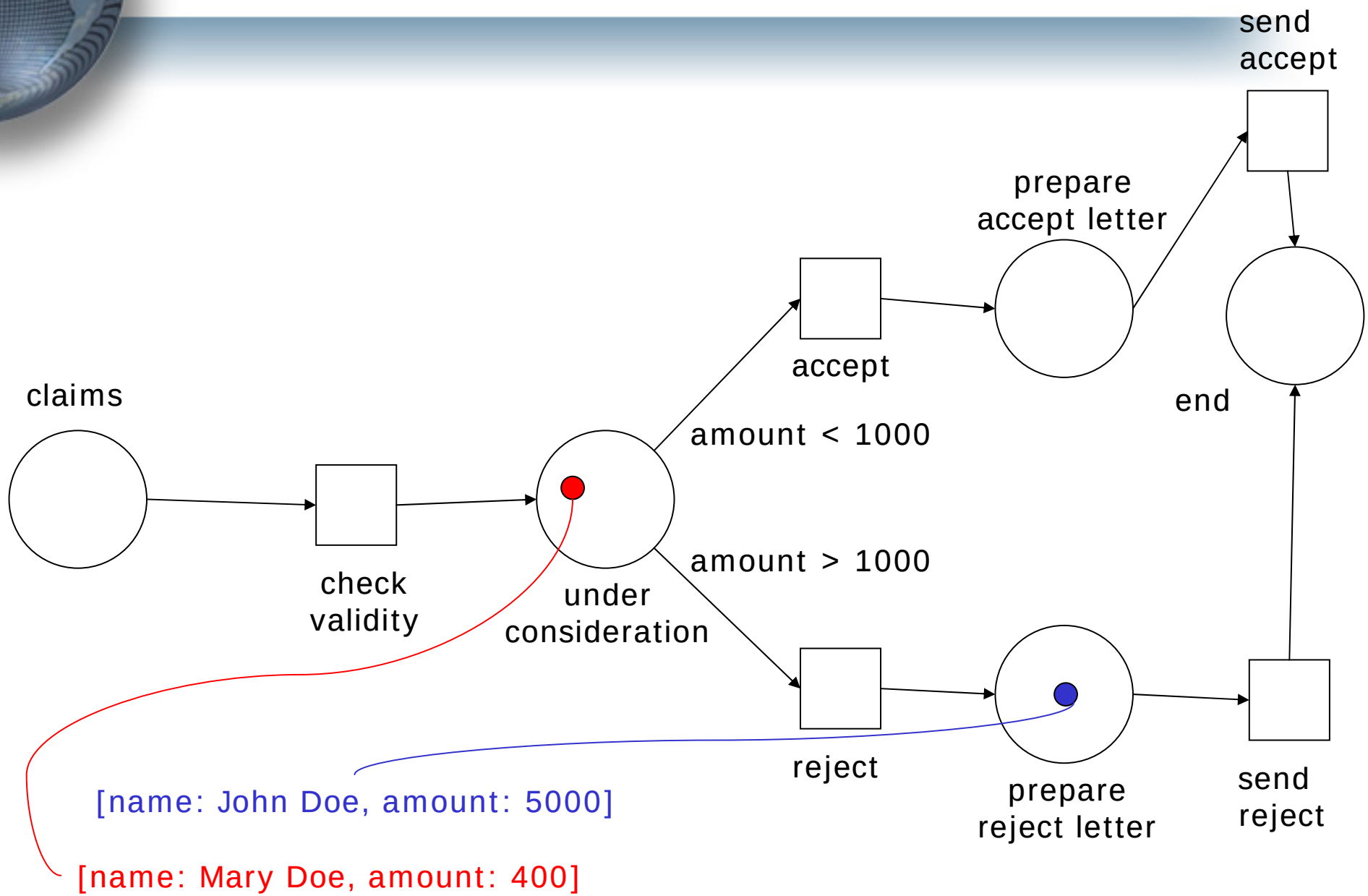

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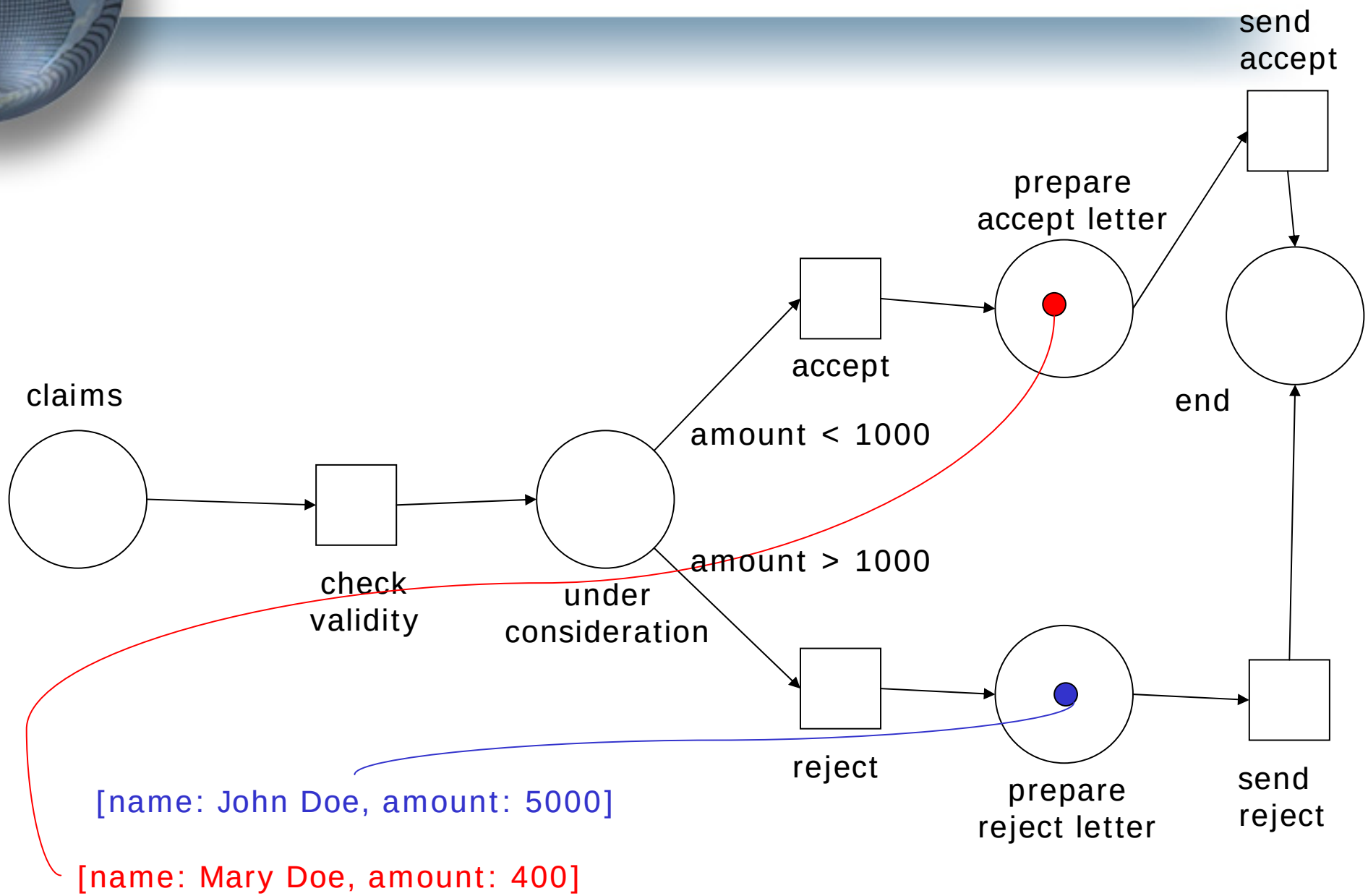

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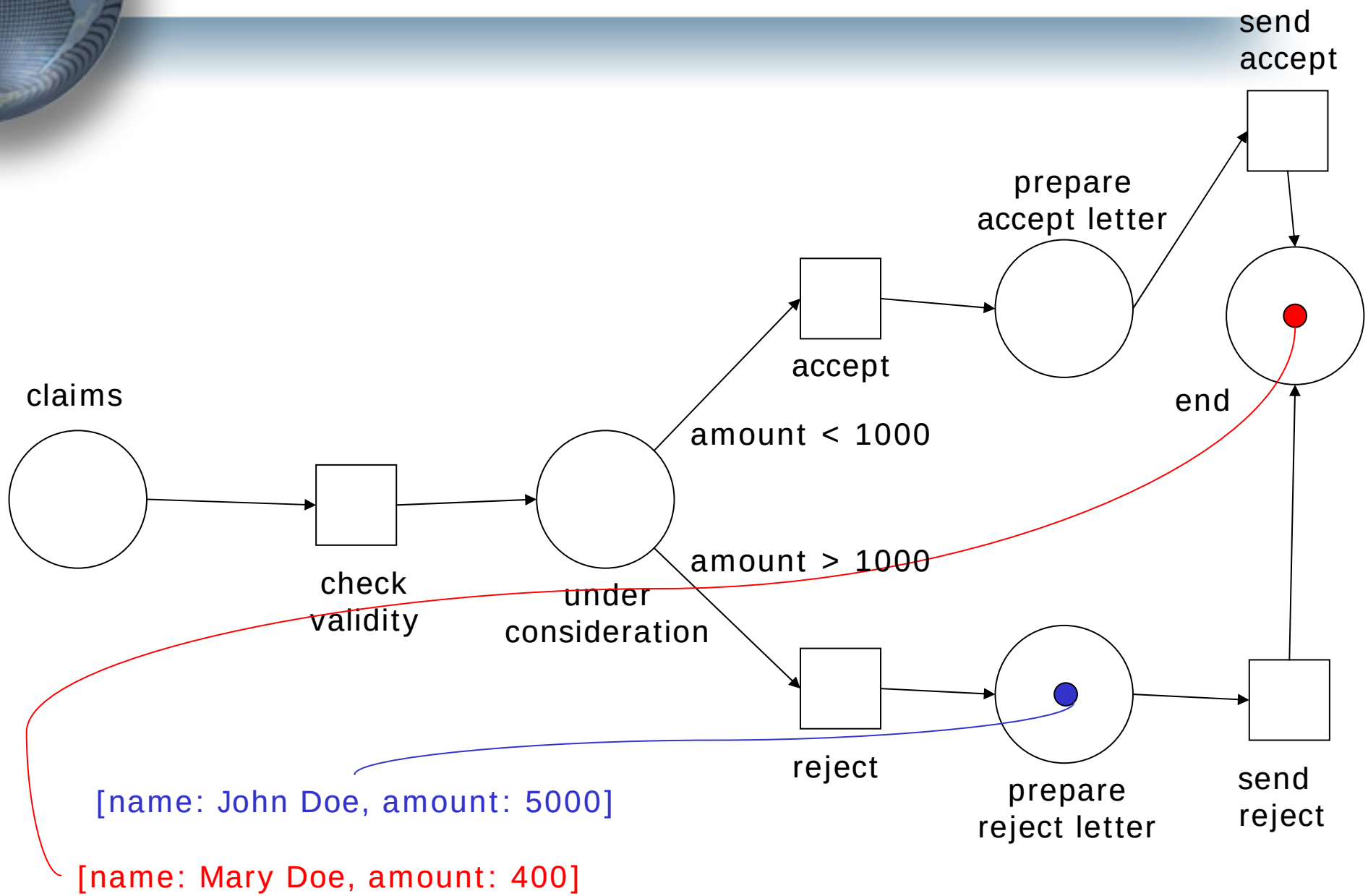

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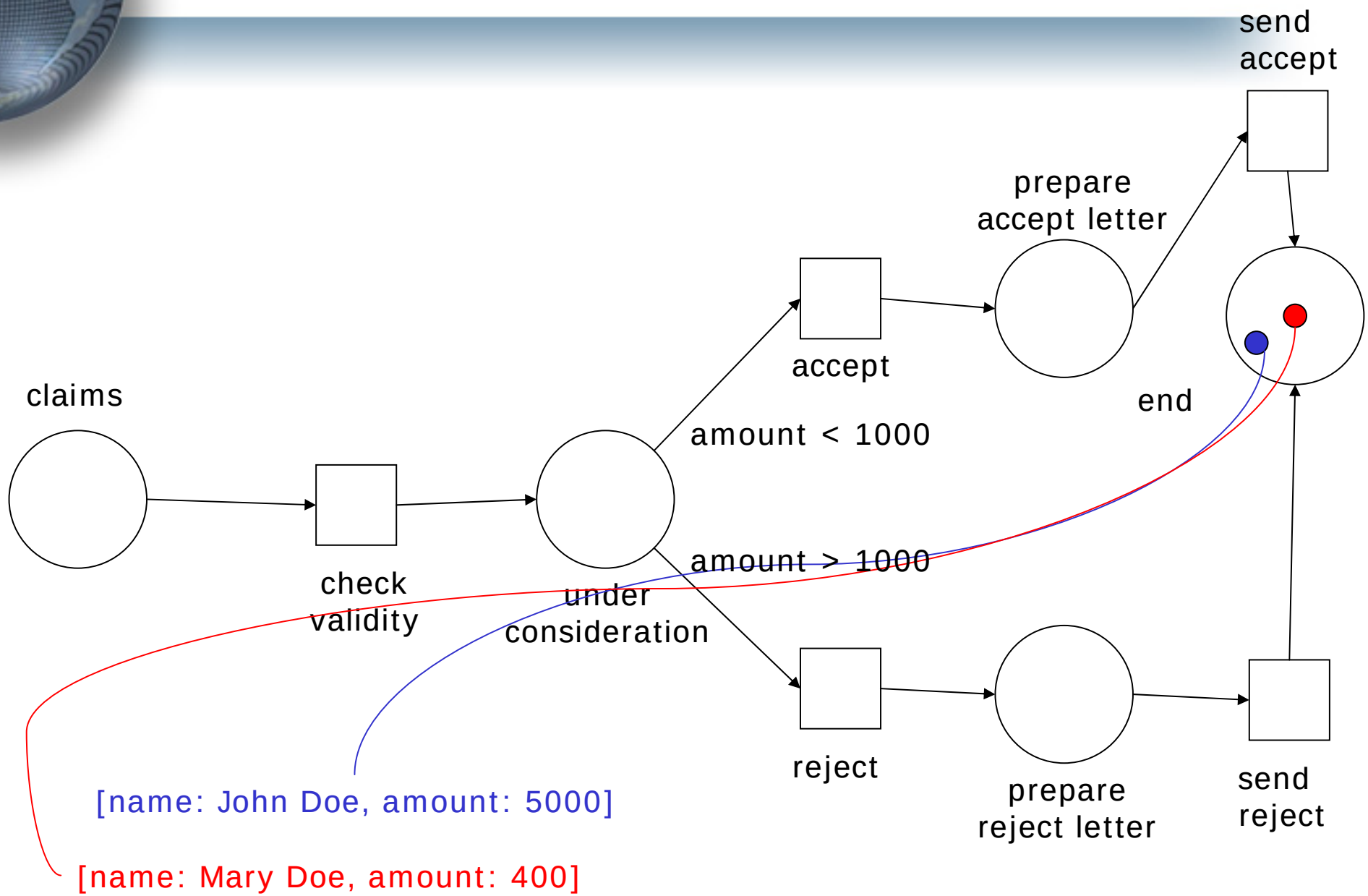
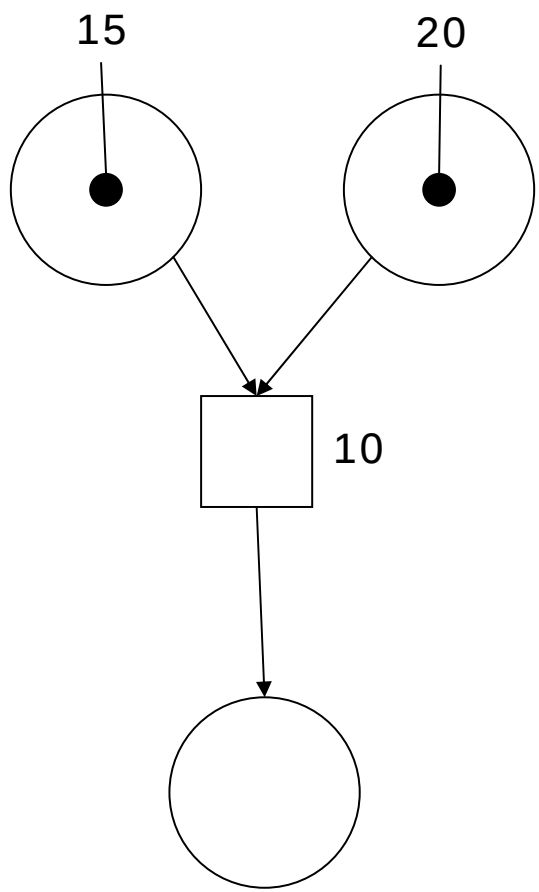


Petri Net with Time

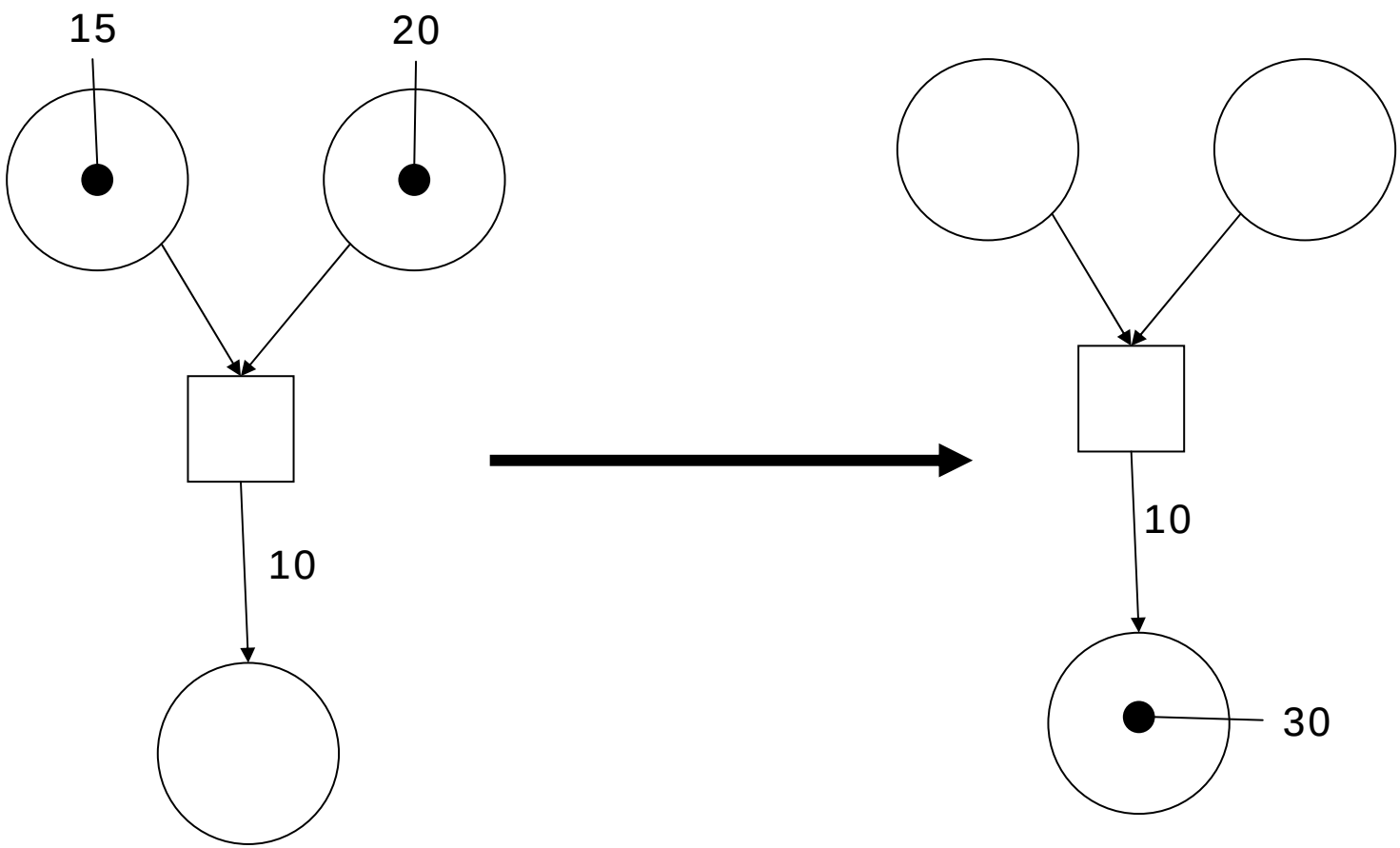
Every token gets a *timestamp*, indicating the time from which the token is available.

A transition is enabled when each token to be consumed has a timestamp equal or prior to the current time.

Each transition gives a *delay* to a token produced by the transition.

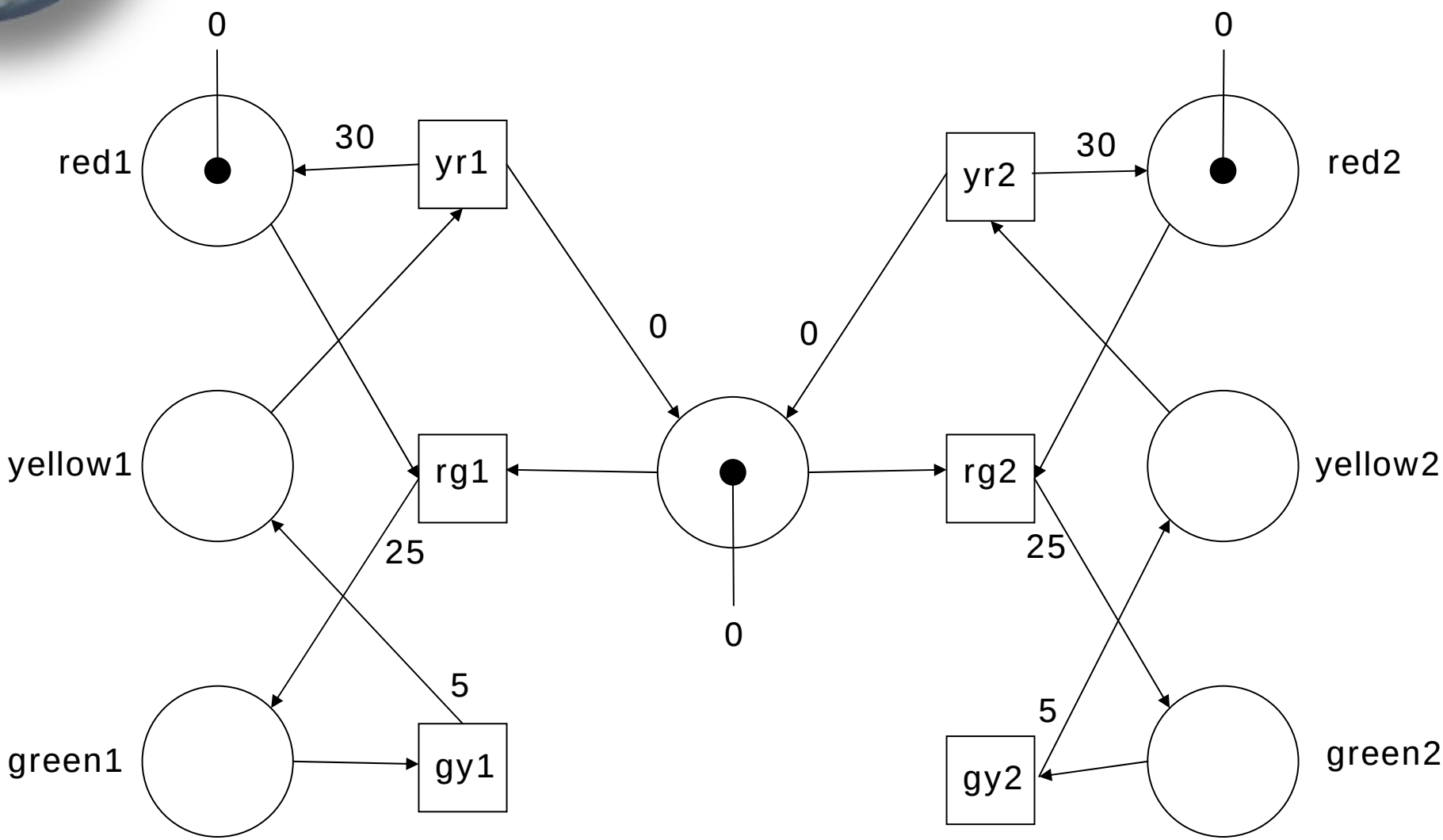


Petri Net with Time



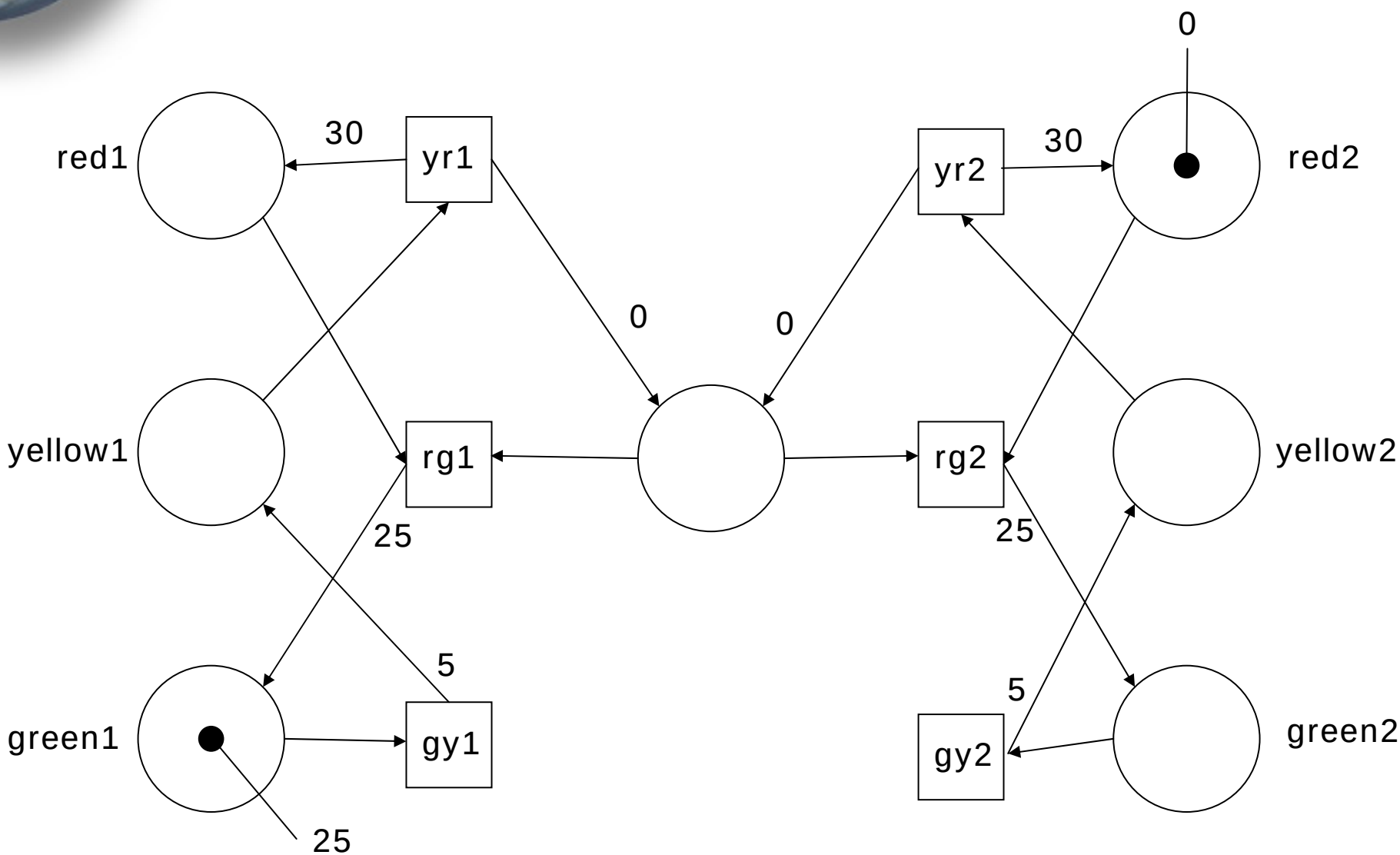
Before current time = 20, the transition is not enabled and cannot fire. At current time = 20, it will fire. The timestamp of the produced token equals the current time + the transition delay.

Two Traffic Lights with Time



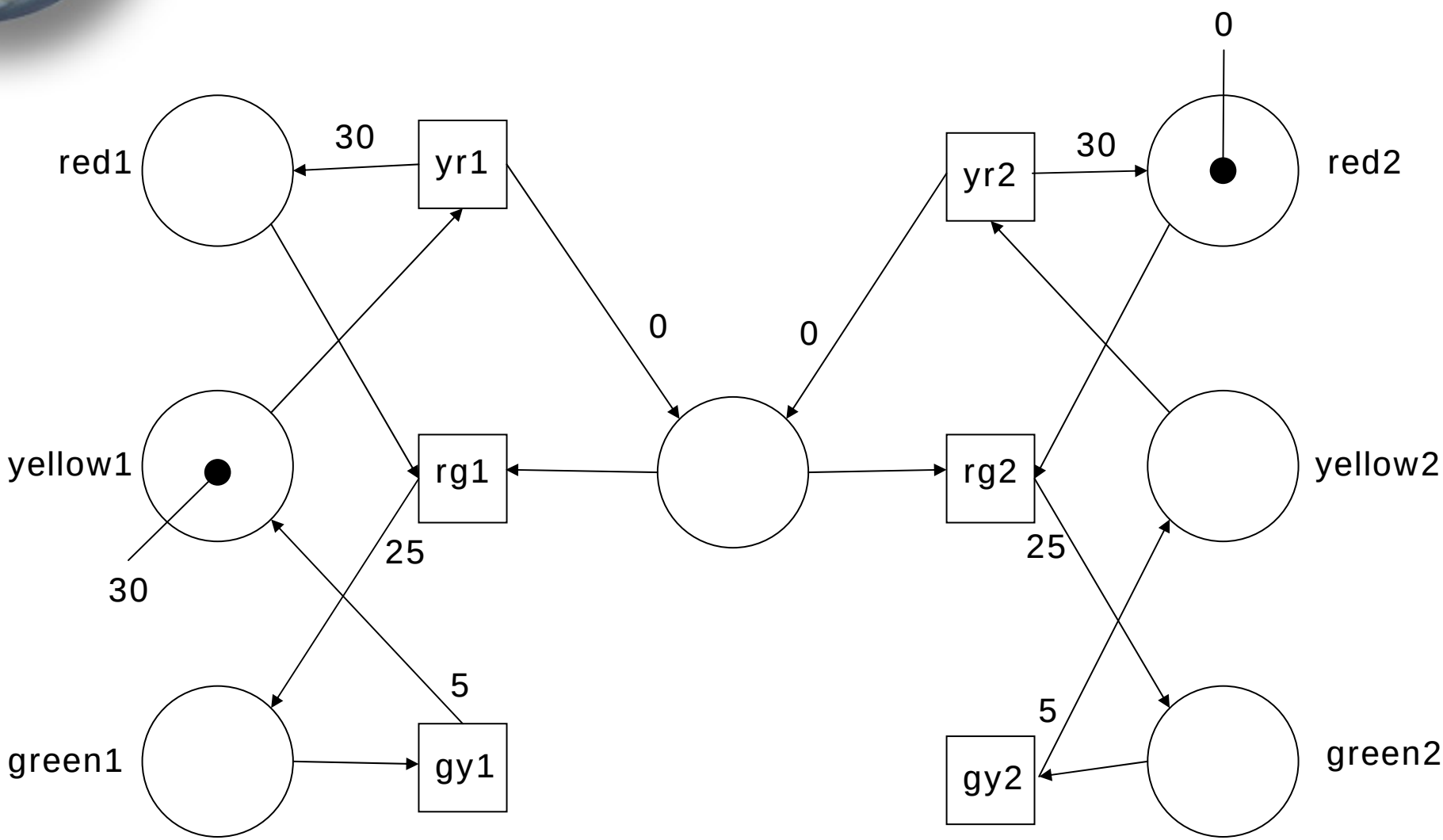
Current time = 0

Two Traffic Lights with Time



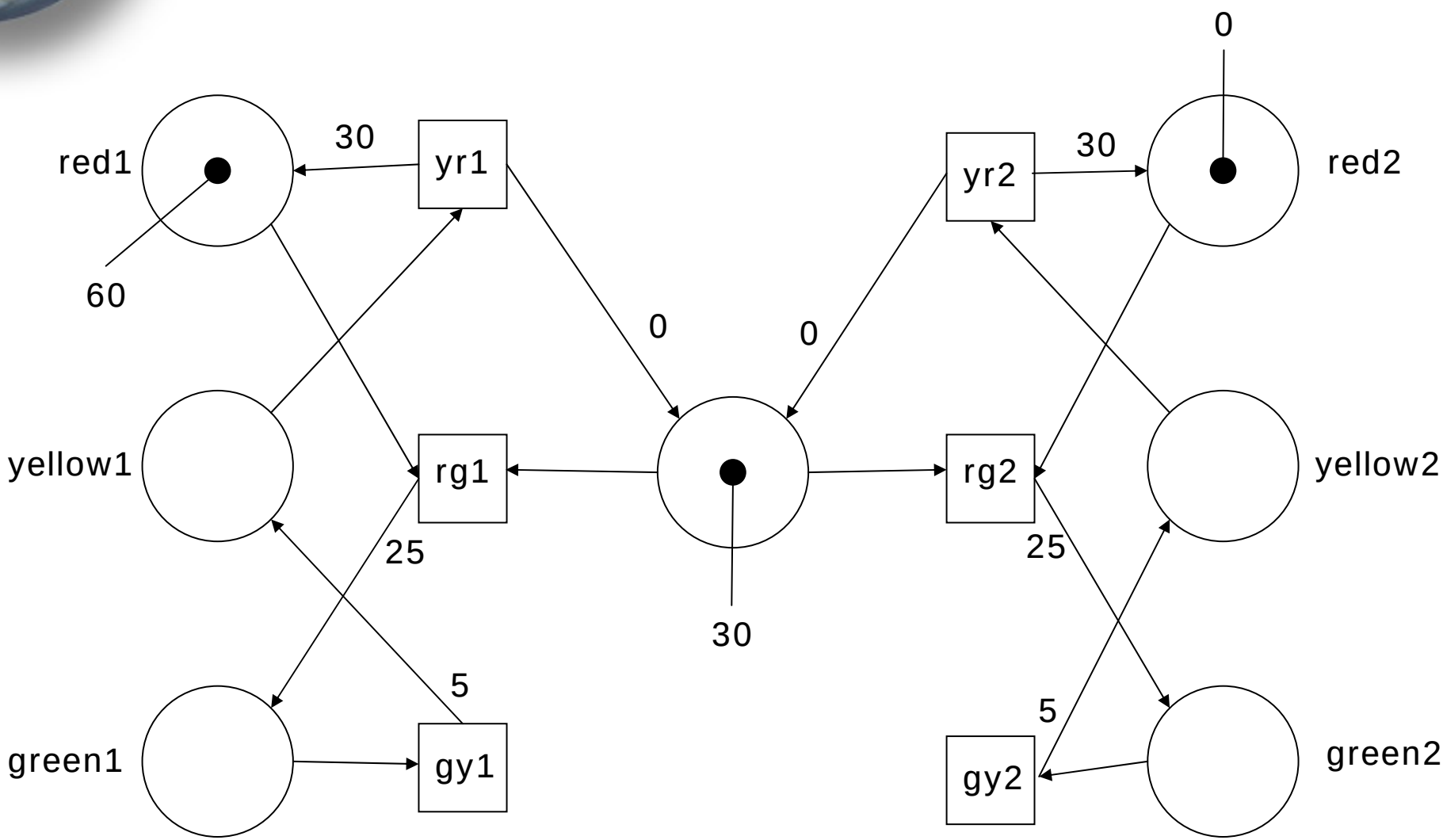
Current time = 1

Two Traffic Lights with Time



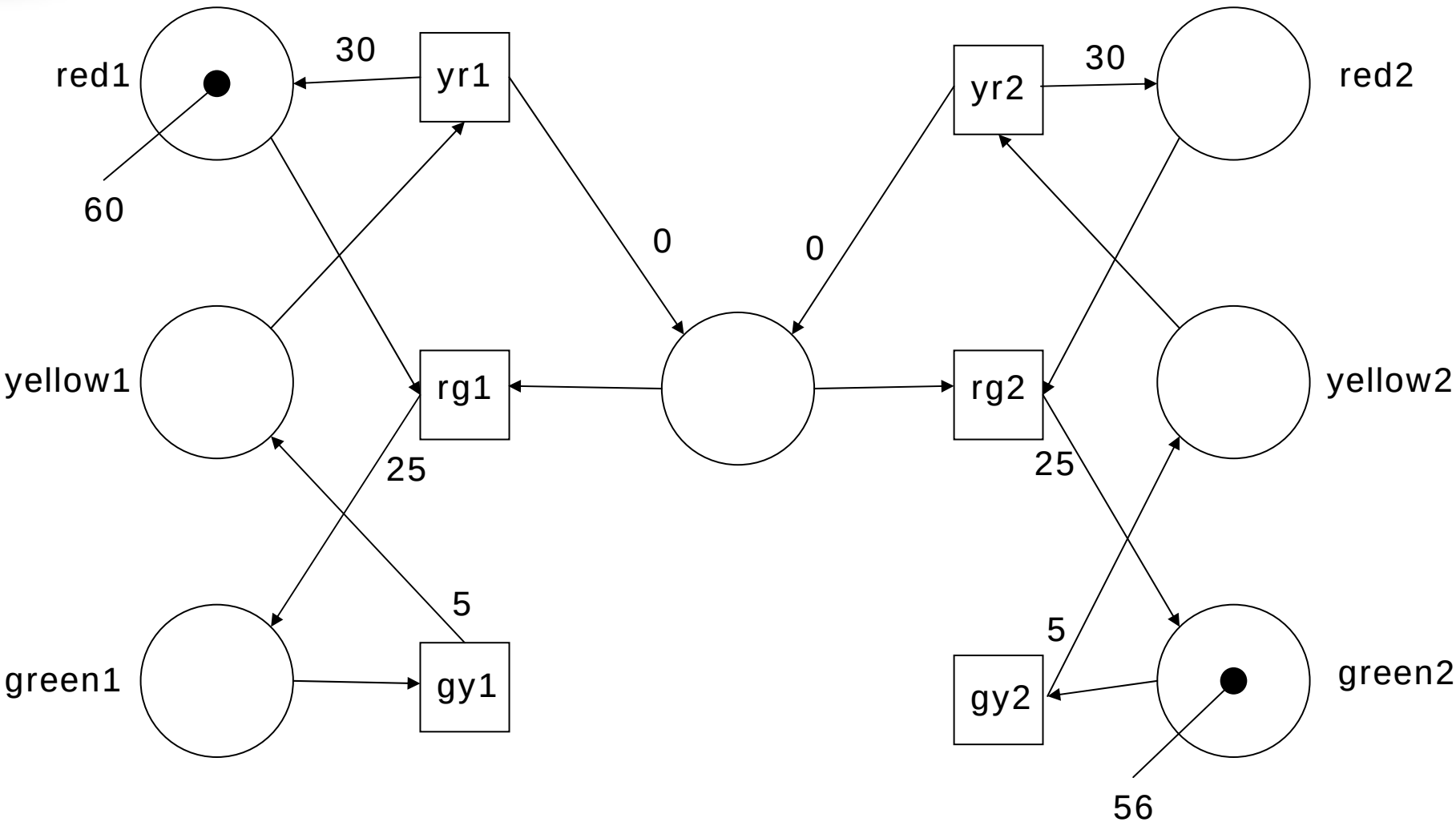
Current time = 26

Two Traffic Lights with Time



Current time = 31

Two Traffic Lights with Time



Current time = 32

Swimming School Exercise

A student registers at the swimming school. The student will take one or more swimming lessons followed by an examination.
Every lesson has a beginning and an end. A student must have his or her individual teacher during a lesson. There are five teachers. Each swimming lesson is followed by another swimming lesson or an individual examination.
An examiner is present at the examination, from beginning to end. There are two examiners. When a student has completed an examination, three things might happen:

1. The student passes and leaves the school
2. The student fails, takes additional lessons, and tries again
3. The student fails and gives up

a) Model this using a classical Petri net
b) Use a coloured Petri net to express that it is required to take 10 lessons before taking the exam and that students drop out after three failed exams
c) Add time to model that a lesson takes one hour and an exam 30 min.

Basic Workflow Concepts

- Task - a logical unit of work that is carried out as a single whole
- Resource - a person or a machine that can perform specific tasks
- Activity - the performance of a task by a a resource
- Case - a sequence of activities performed to achieve some goal, an order, an insurance claim, a car assembly
- Work item - the combination of a case and a task that is just to be carried out
- Process - describes how a particular category of cases shall be managed
- Control flow construct - sequence, selection, iteration, parallelisation

Workflow Concepts in Petri Nets

- Task - transition
- Resource - token
- Activity - transition that fires
- Case - token
- Work item - enabled transition
- Process - Petri net
- Control flow construct - modelled by places and transitions

Triggers

When do transitions fire? Sometimes, someone or something has to fire them.

A work item can only be transformed into an activity once it has been triggered.

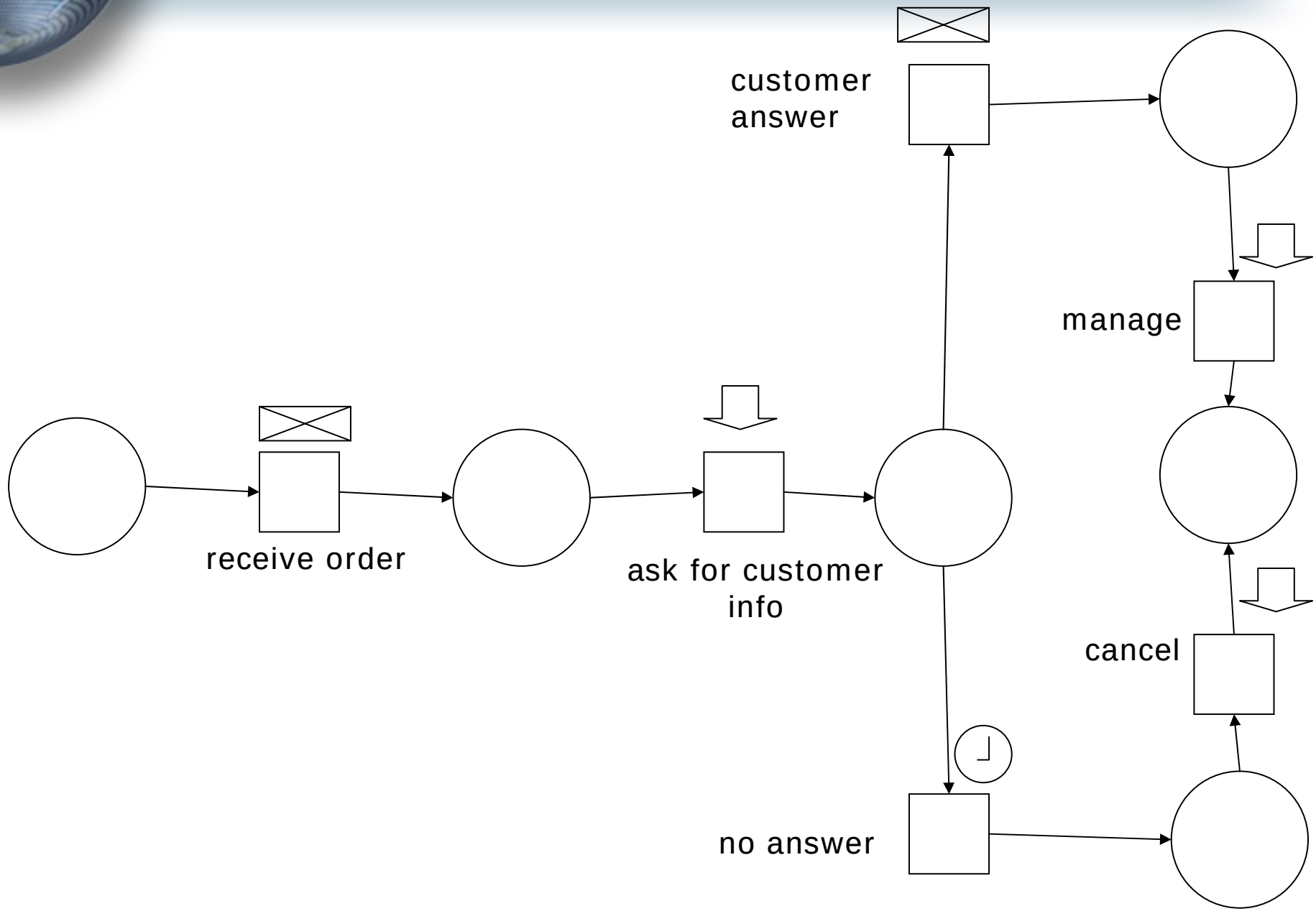
Kinds of triggers

A resource initiative

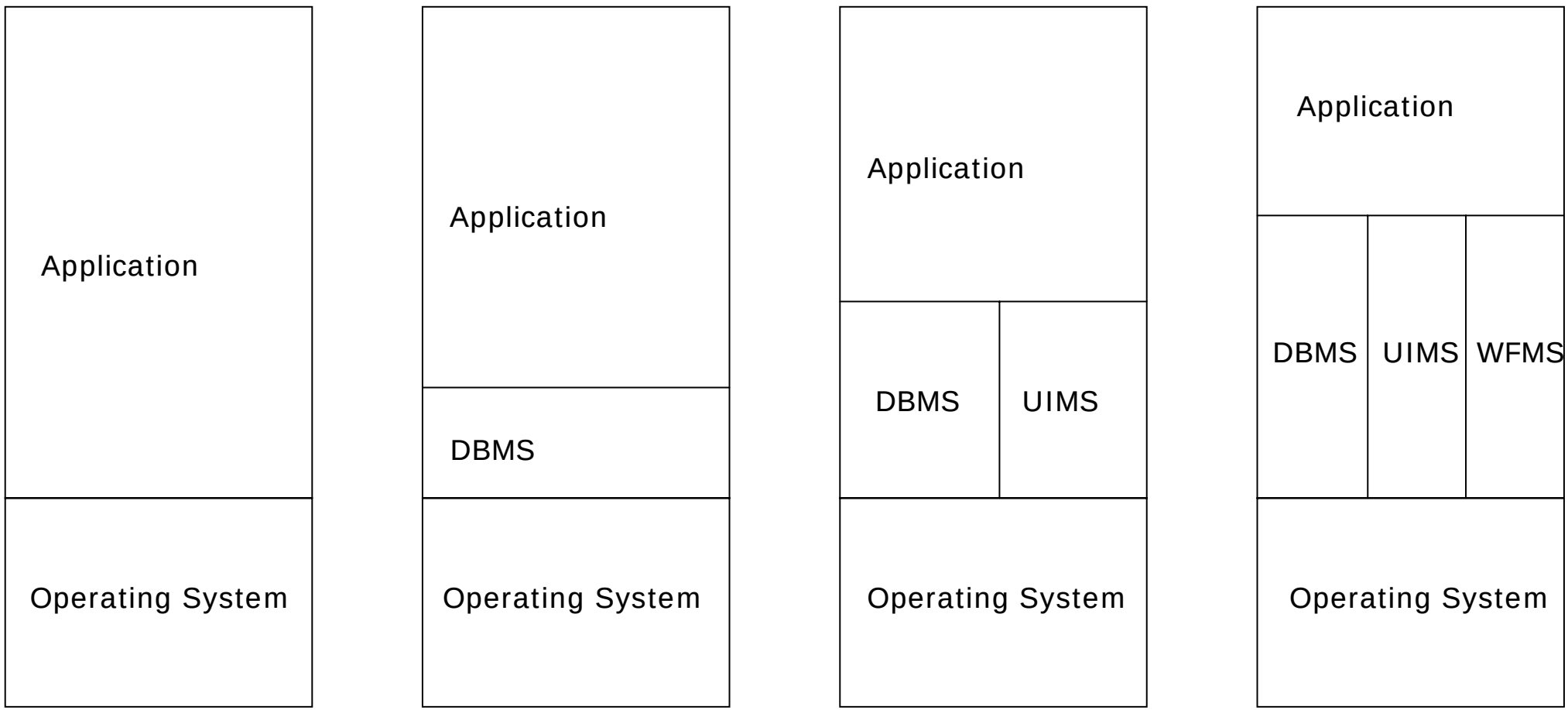
An external event

A time signal

Triggers


customer
answer
manage
receive order
ask for customer
info
cancel
no answer

A Historical Perspective



1965 - 1975 | 1975 - 1985 | 1985 - 1995 | 1995 - 2005