Non-determinism

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Non-deterministic selection

```
*[ [| #A -> A?x
    [] #B -> B?x
    |];
    Z!x
 ]
```
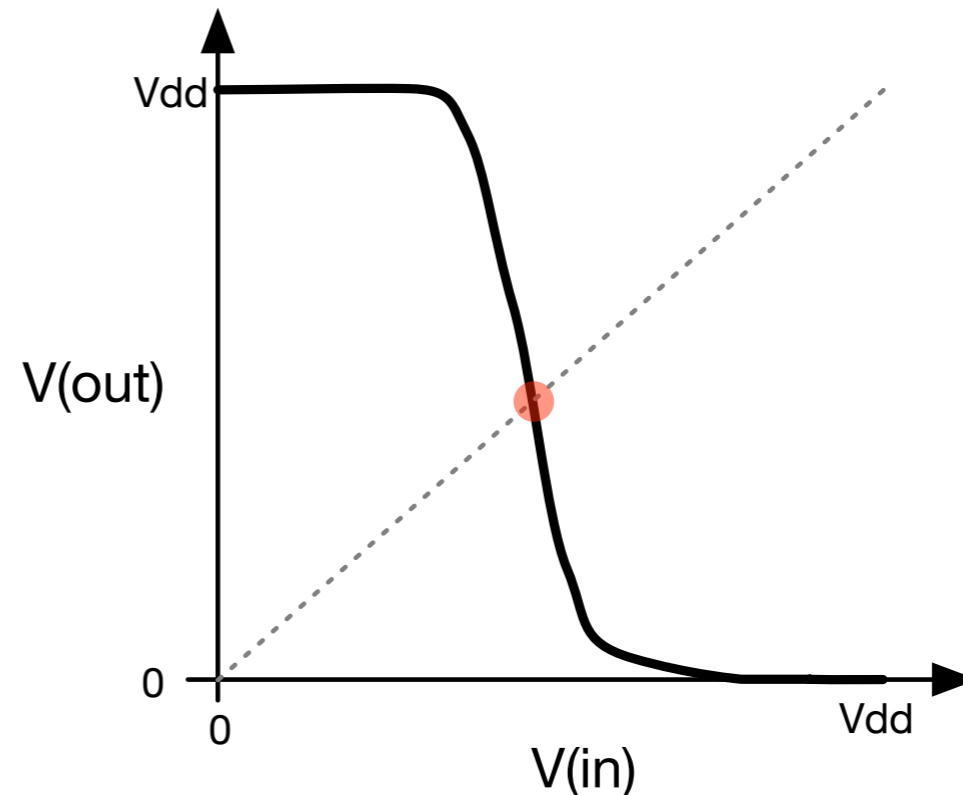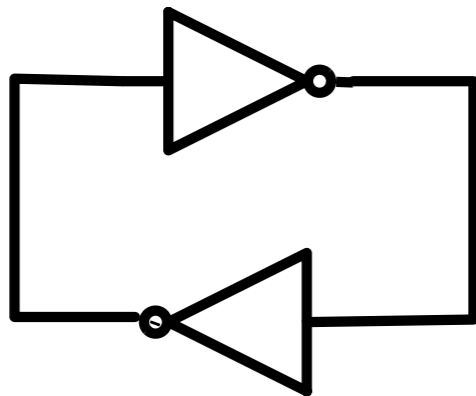
- When a communication is pending on both A and B

  ❖ We can pick either
      … but we have to make a choice

  ❖ The **arbitration** problem

Should two courses be judged equal, then the will cannot break the deadlock, all it can do is to suspend judgement until the circumstances change, and the right course of action is clear.
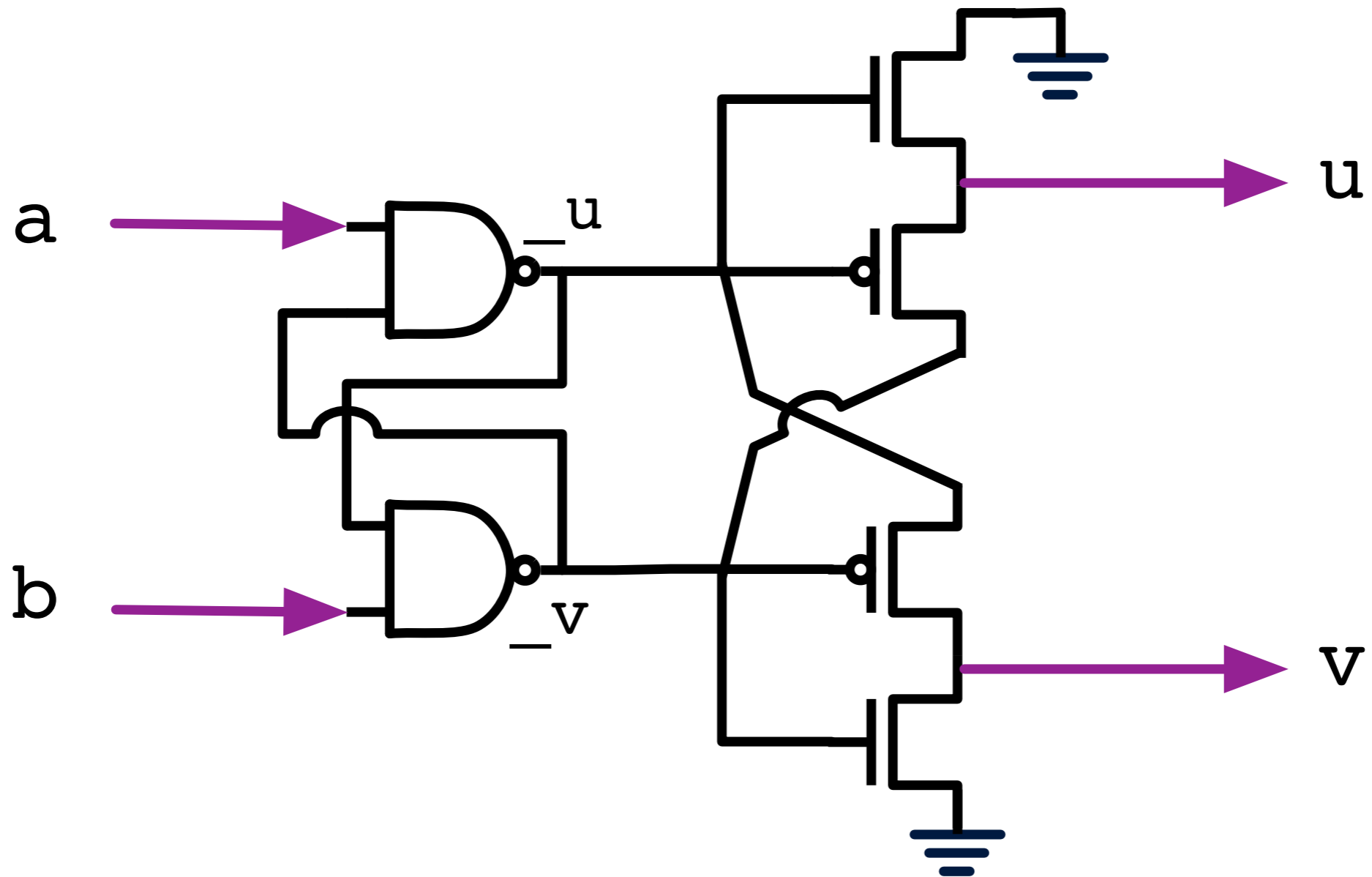
— Jean Buridan, c. 1340

Metastable state

- Unstable equilibrium
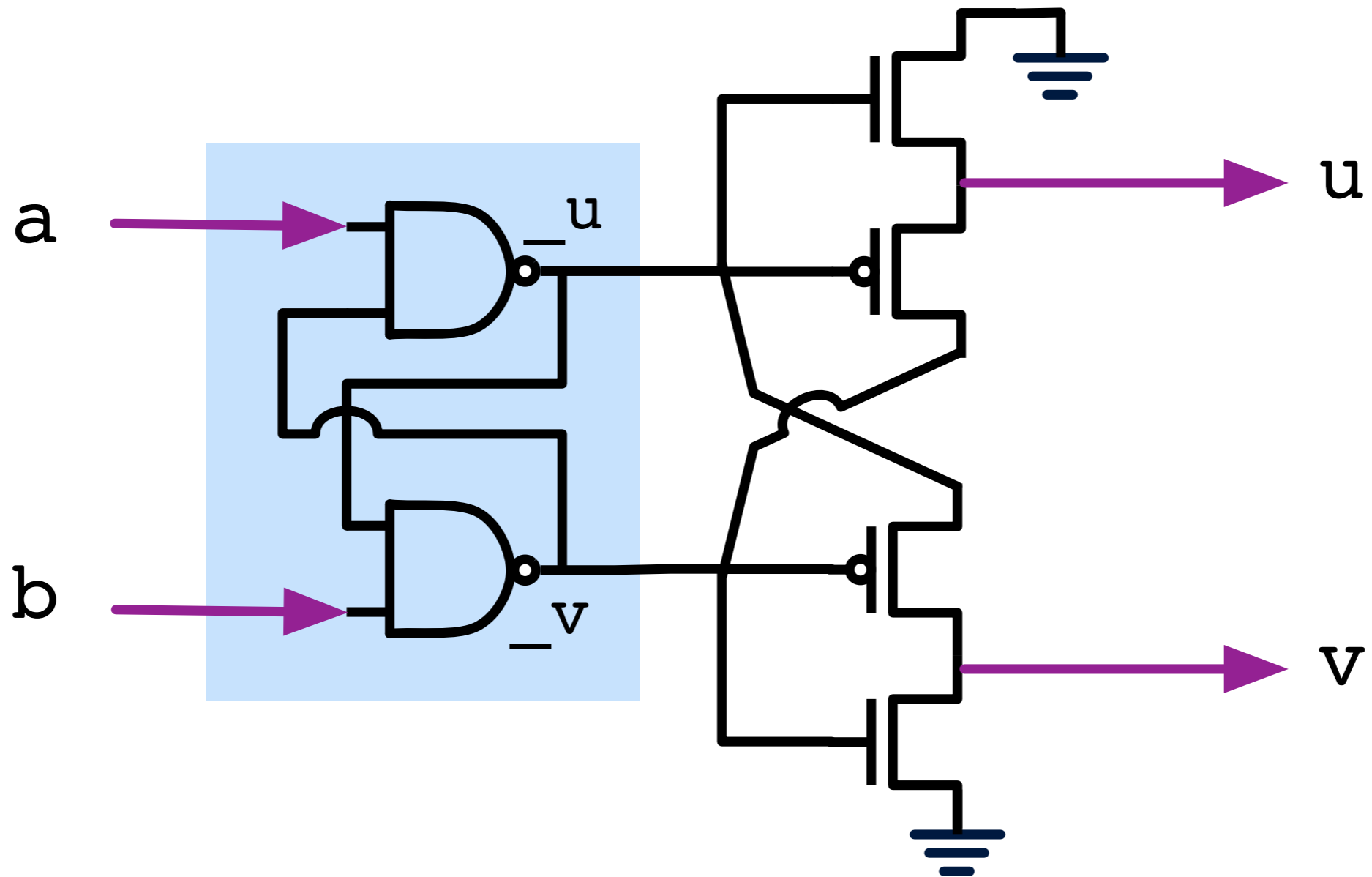
  ❖ Inverted pendulum

  ❖ Balancing a pencil on its tip

- Another example: cross-coupled inverter

  ❖ Stable states: 0/1 and 1/0

  ❖ Metastable state: V(out) = V(in)

Arbiter
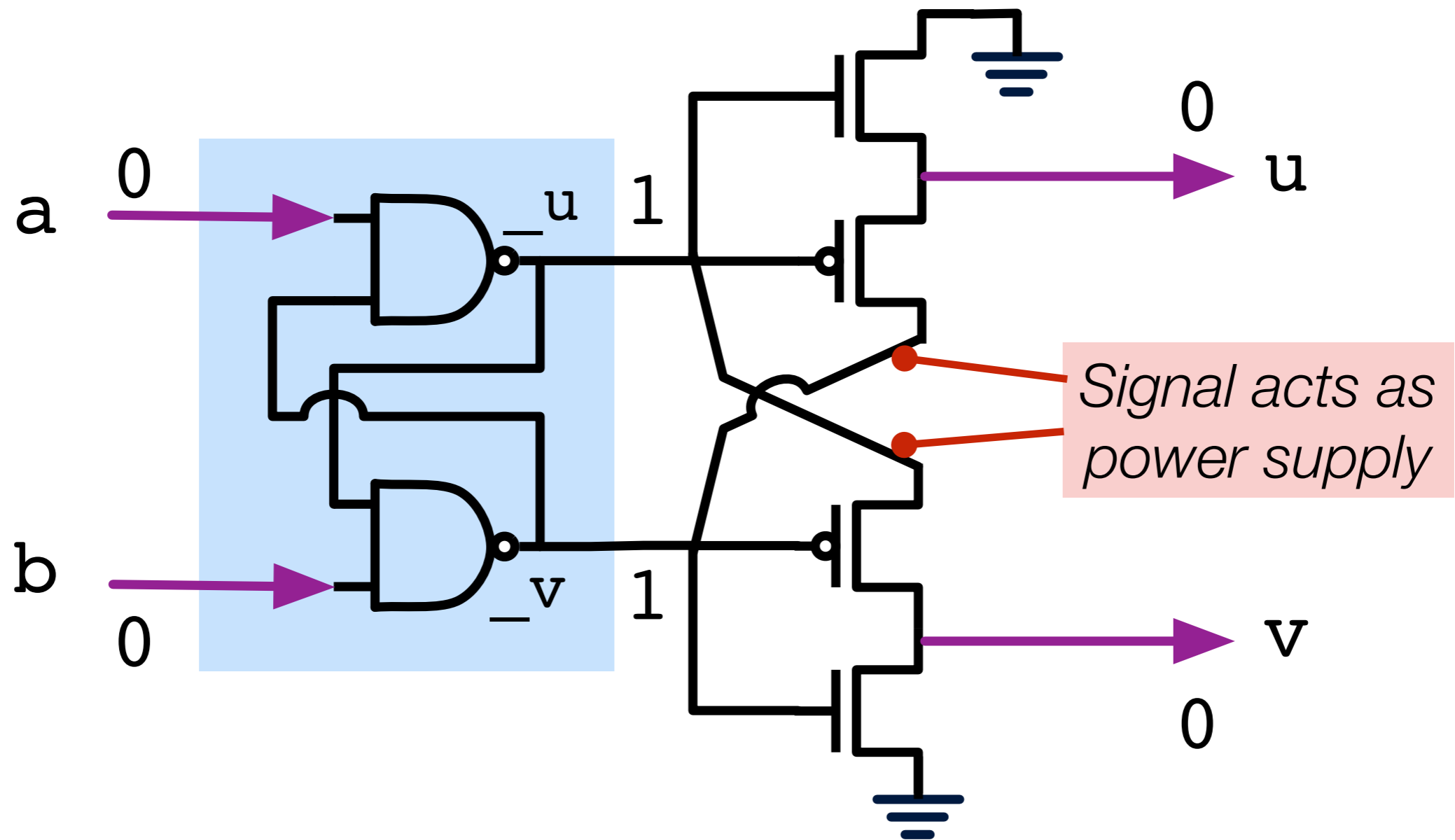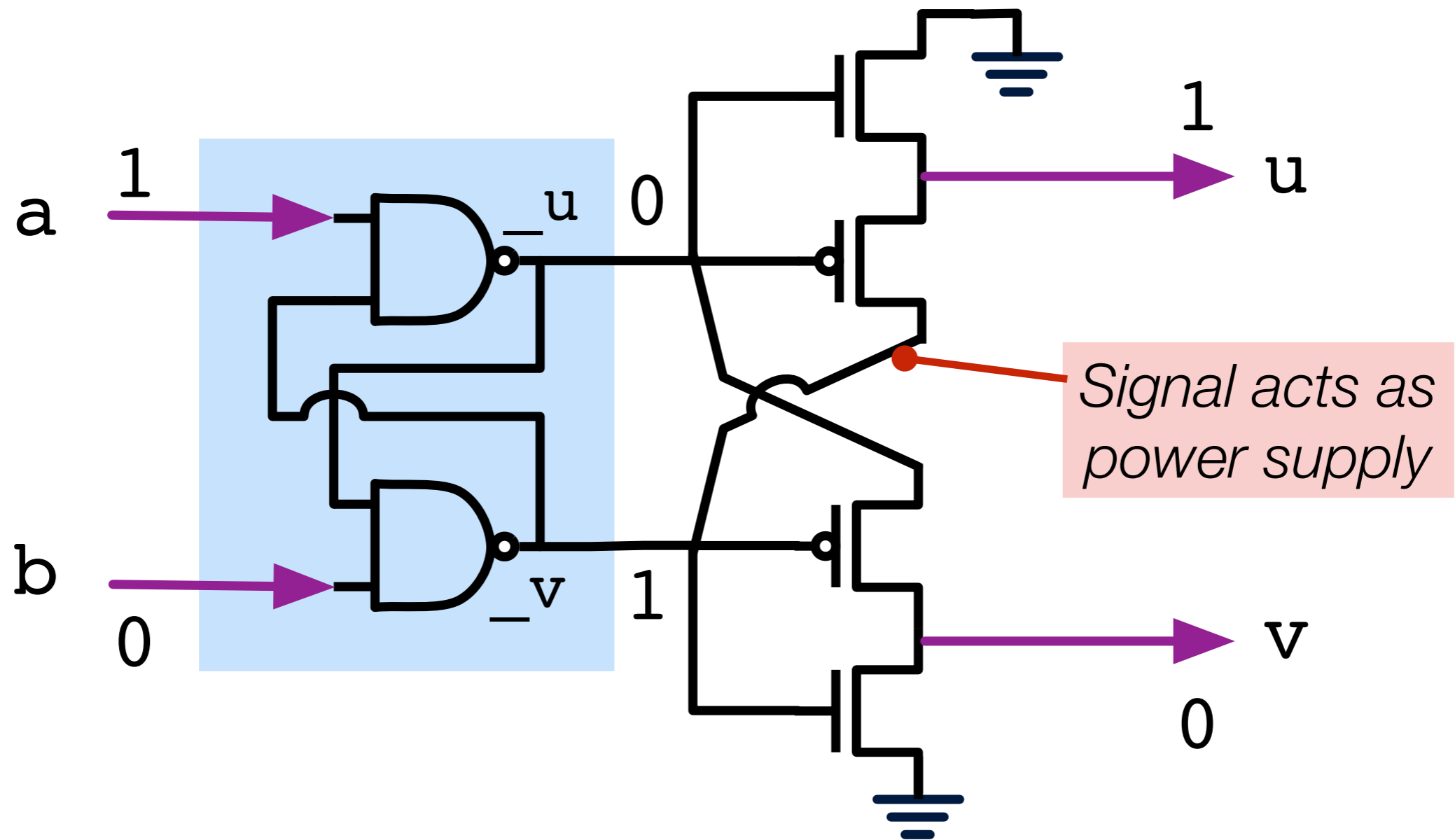
Arbiter

Arbiter
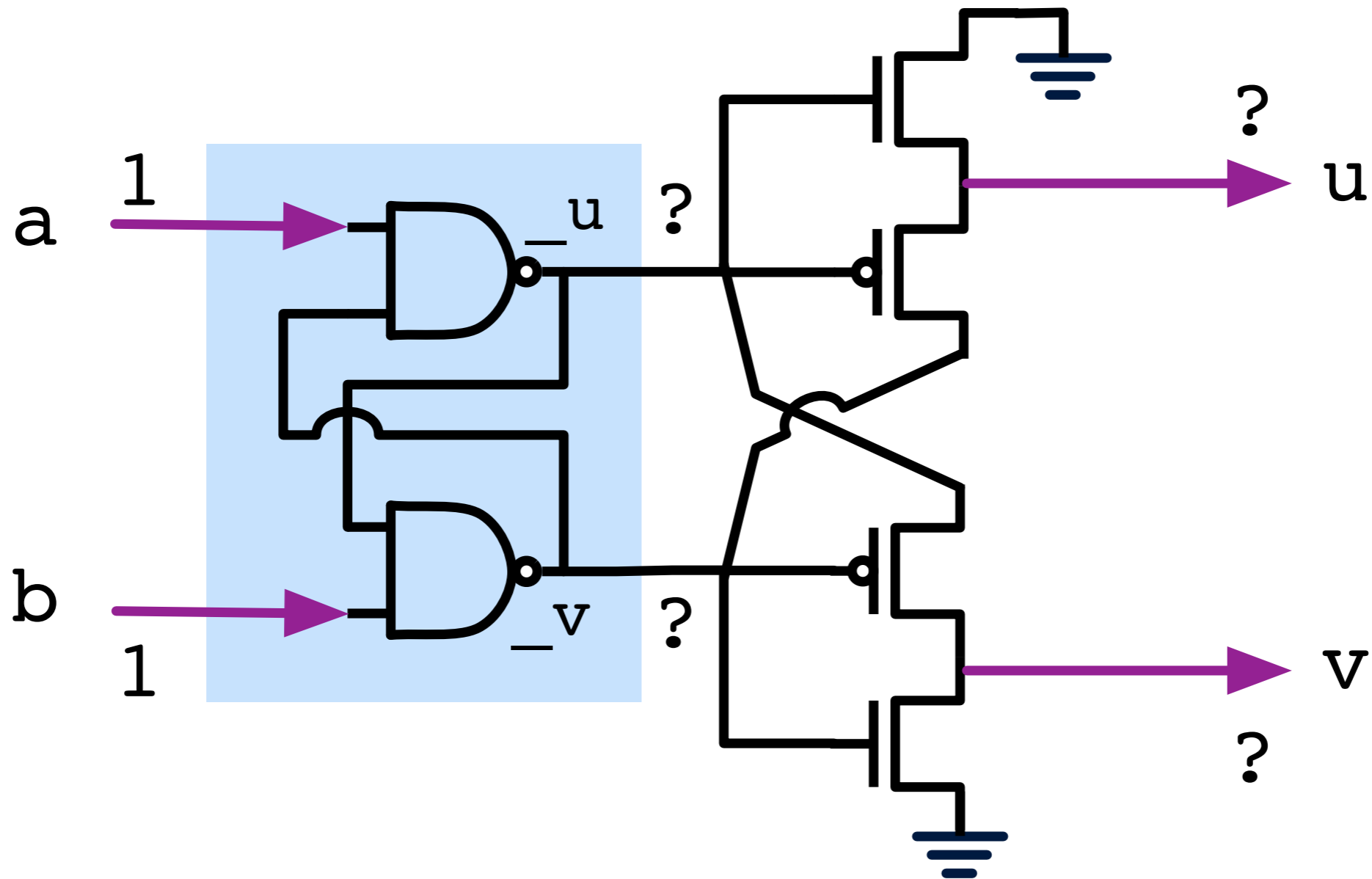

Signal acts as power supply

Arbiter

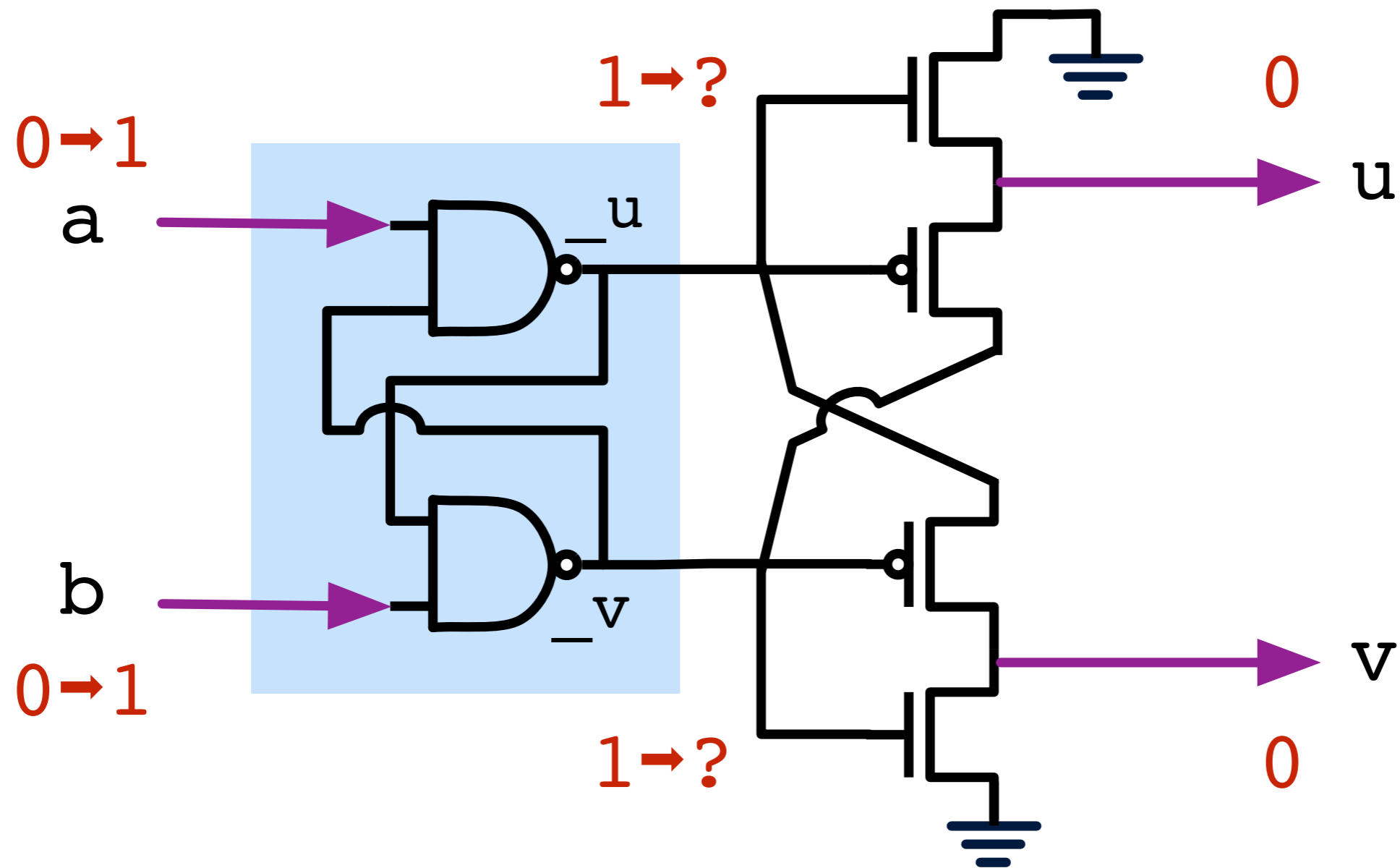Signal acts as power supply

Arbiter
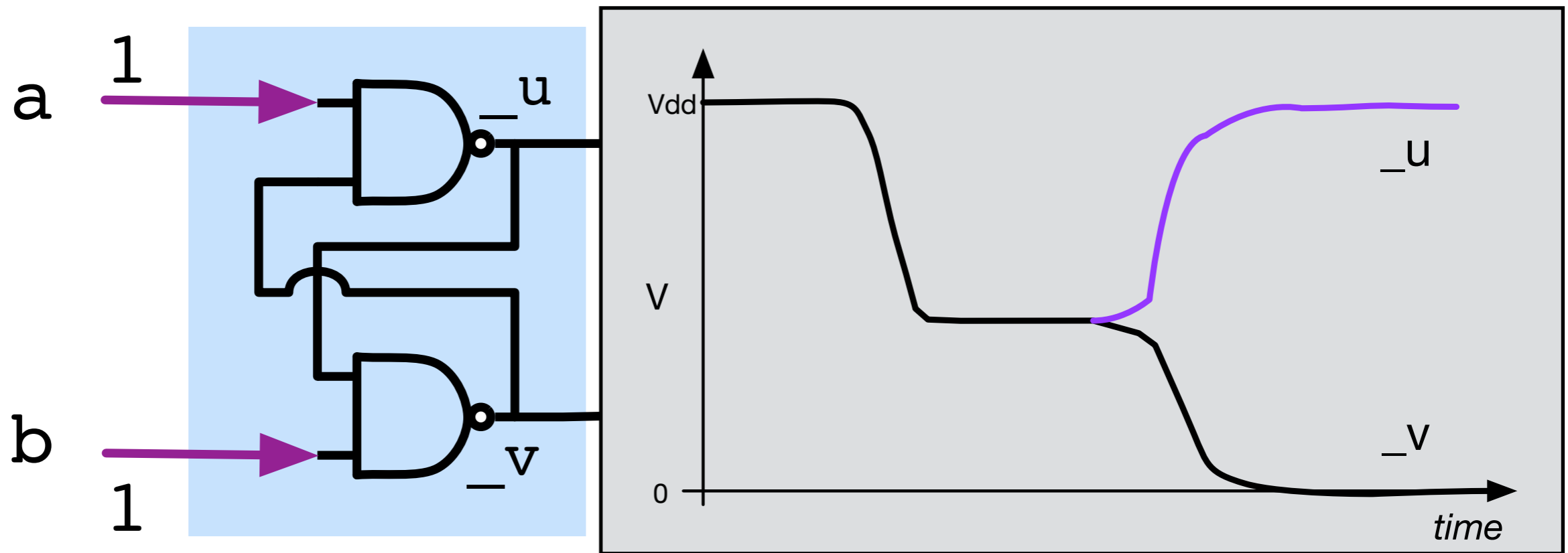

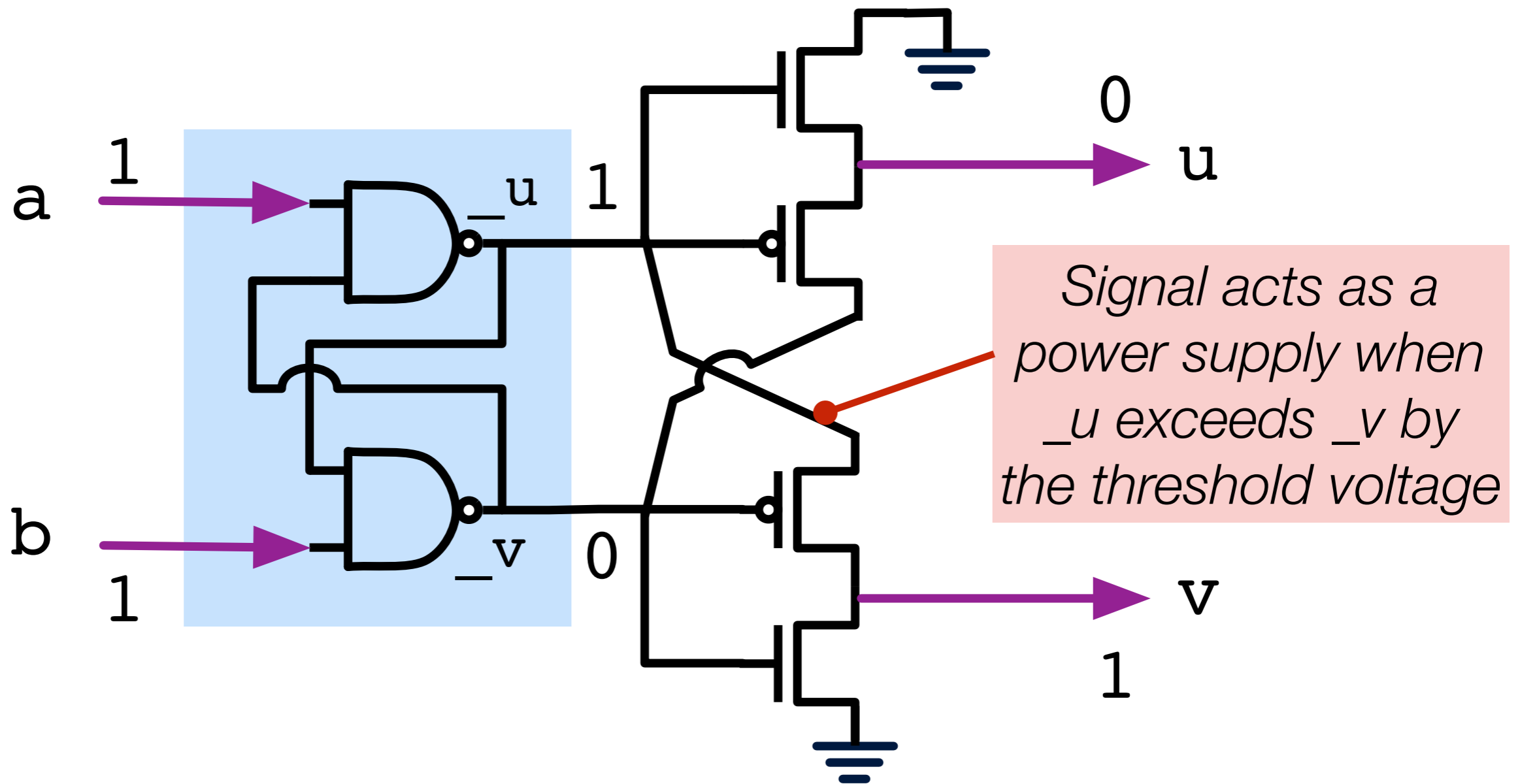
$$\Pr[\text{time} \geq t] = Ae^{-t/\tau}$$

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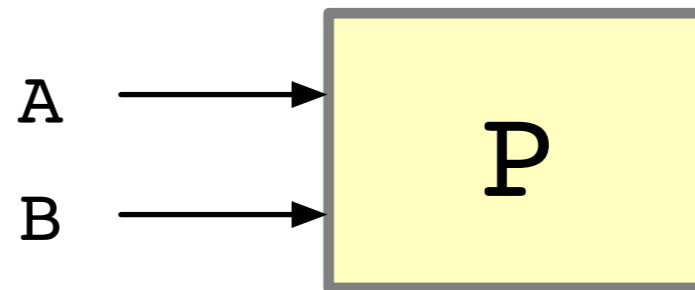Signal acts as a power supply when _u exceeds _v by the threshold voltage

$$\Pr[\text{time} \geq t] = Ae^{-t/\tau}$$

Translating non-deterministic selections

- Basic idea
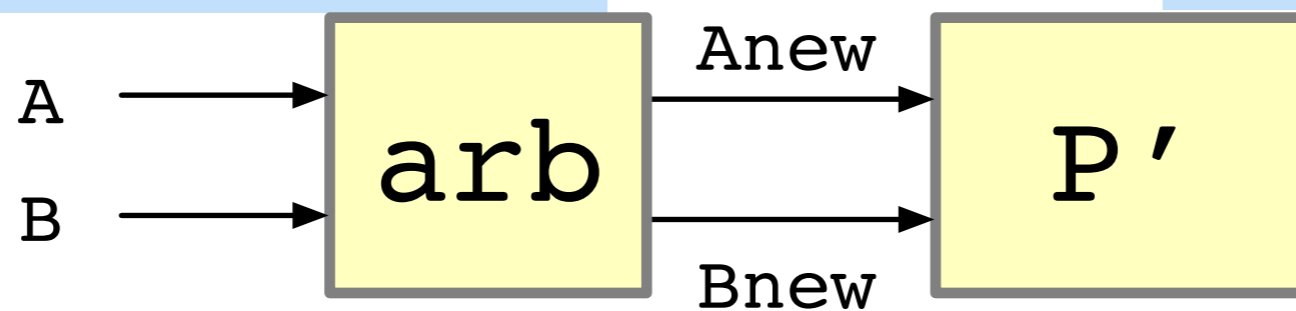
```
[| #A -> A?x
[] #B -> B?x
|]
```


❖ Factor out non-deterministic execution

```
*[
  [| #A -> Anew!A;A?
  [] #B -> Bnew!B;B?
  |]
]
```

```
[ #Anew -> Anew?x
[] #Bnew -> Bnew?x
]
```


standard component

Example circuit

```
*[
  [|  #A -> Anew!A;A?
  [] #B -> Bnew!B;B?
  |]
]
```