Distributed Evaluation of Enhanced Path Queries

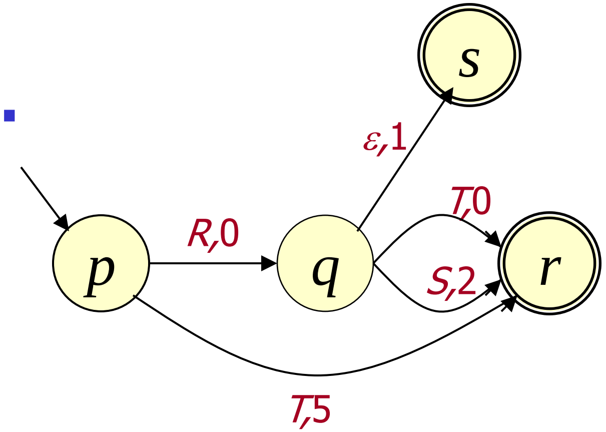
Dan C. Stefanescu, Alex Thomo

Label setting vs. Label Correcting Algorithms

- Label setting algorithms: Use priority queue
  - E.g. Dijkstra's
  - When a node is labeled we know for sure that it's the best label, i.e. it will be the weight of the shortest path from the source to that node.

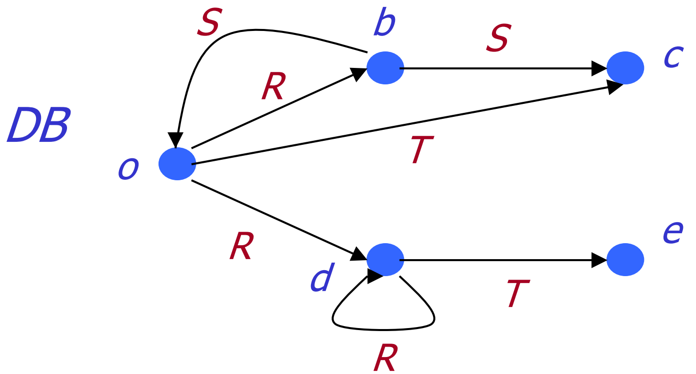
- Label correcting algorithms: Use FIFO queue
  - E.g. Pallotino's
  - When a node is labeled we don't know for sure that it's the best label, possibly we will improve it later.
  - Appropriate to extend to distributed setting…

Let's apply it…



We will build the green graph implicitly and lazily.

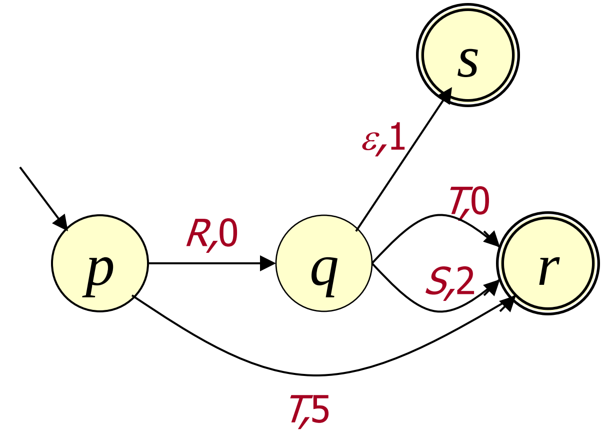
Along the way we will apply the shortest path general algorithm.



Queue : (o,p,0)

Object-State-Weight Table : Here we store the "labeling"s of the green graph nodes.

Let's apply it…



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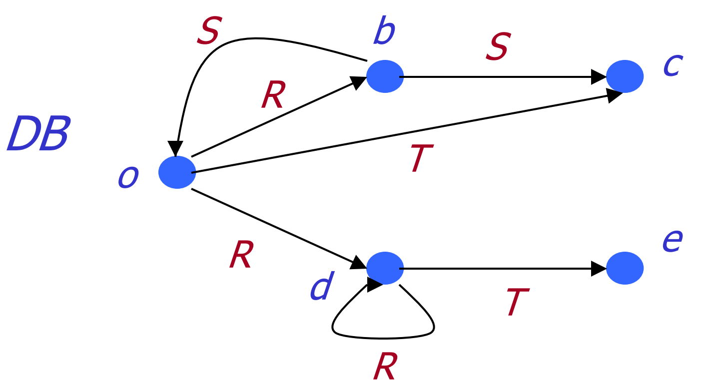

Queue : (c,r,5) (b,q,0) (d,q,0)

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(o,p,0)

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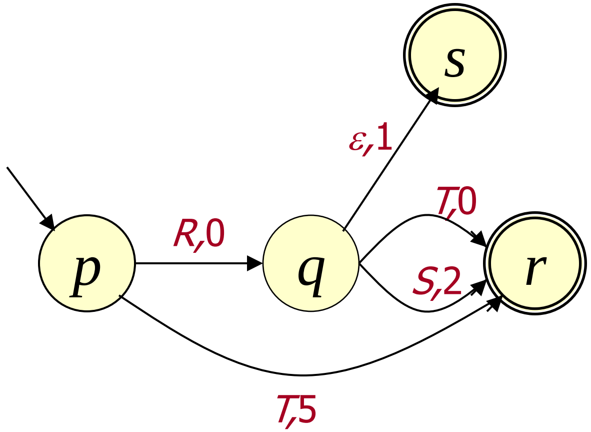

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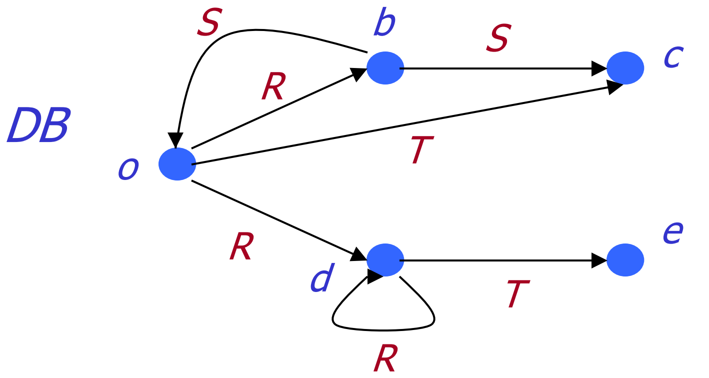

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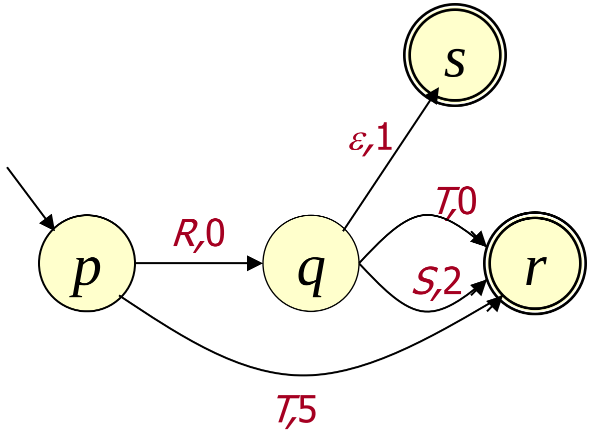

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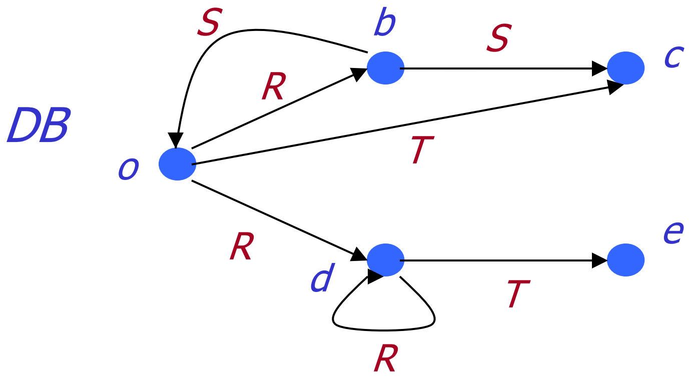

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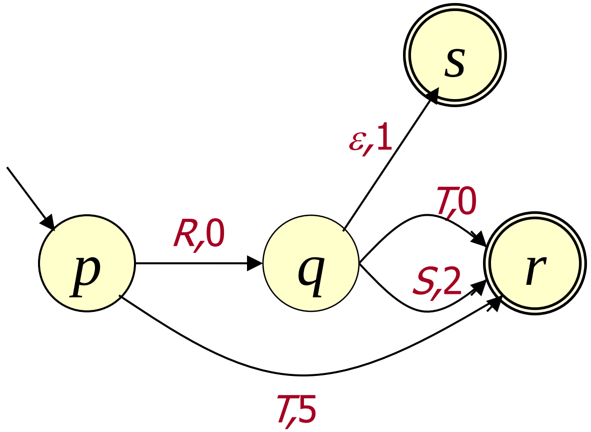

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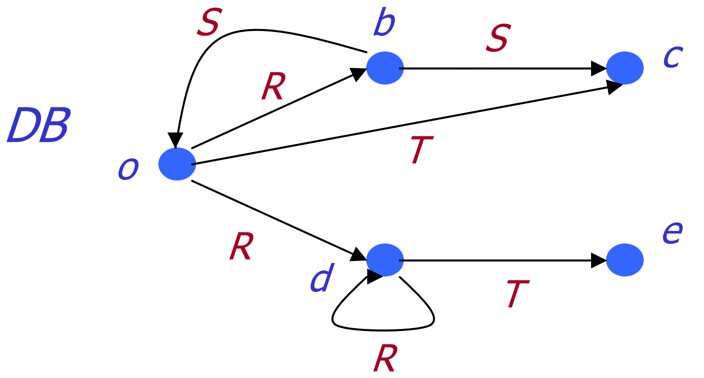

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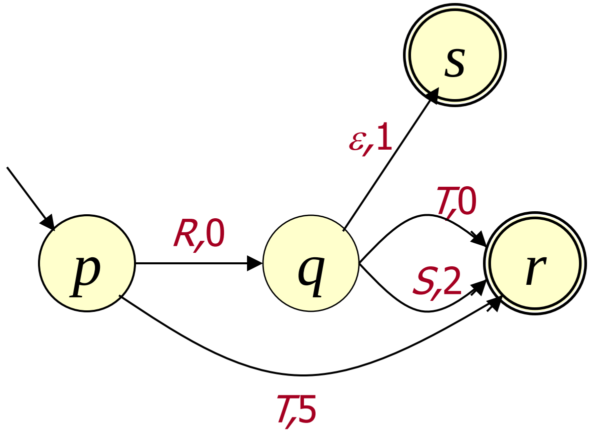

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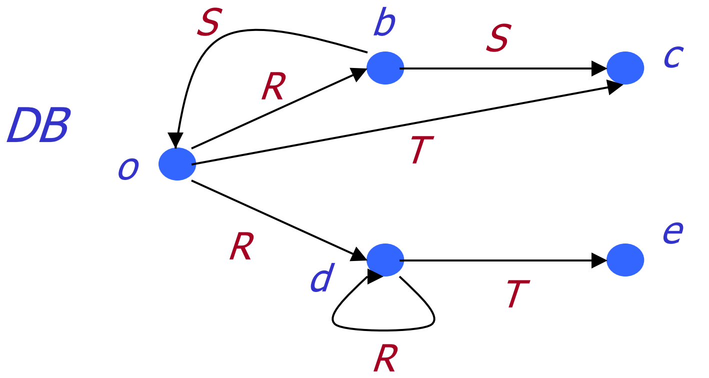

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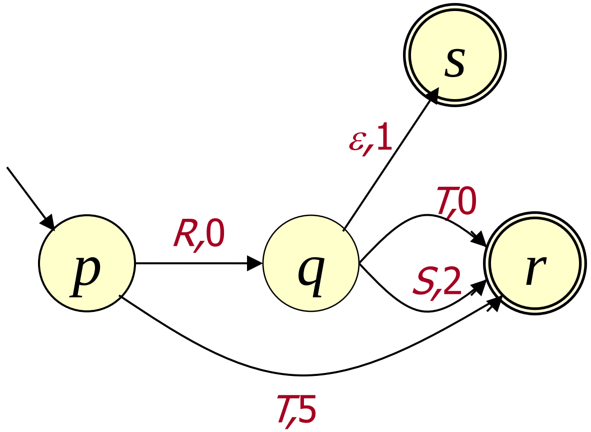

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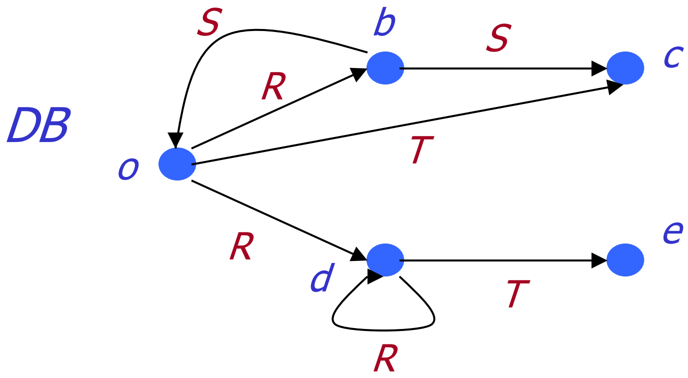

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(o,p,0) (c,r,2) (b,q,0) (d,q,0) (b,s,1)

…

Distributed Algorithm

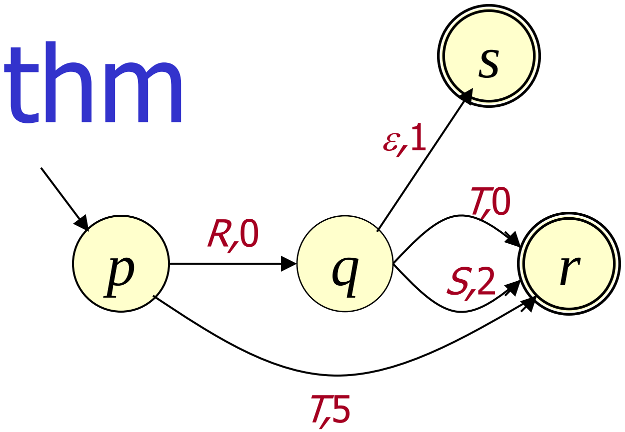
- The nodes are partitioned in different processors, which don't share memory.
- Communication is achieved through asynchronous message passing.

Idea

- Partition the *Object-State-Weight* table among the processors
- When dequeueing see whether the corresponding object is in the local *Object-State-Weight* table.
  - If yes, proceed as previously
  - Otherwise pack the dequeued triple in a message and send it to the processor holding the real DB node.

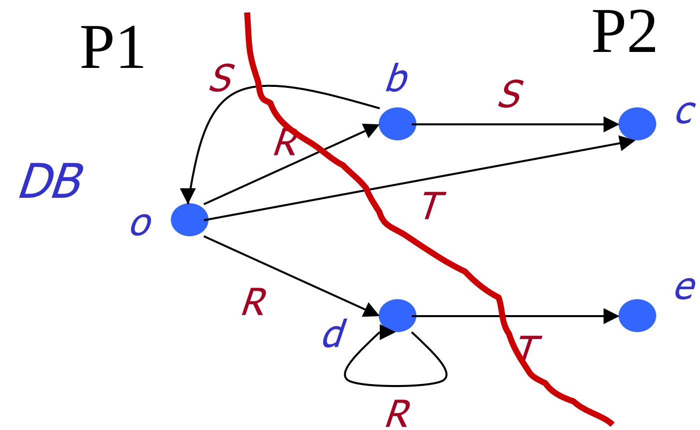
- Terminate when the processing queues of all processors are empty and there is no message sent but not yet received.

Distributed Algorithm



Suppose:

- o, d are in processor P1
- b, c, e are in processor P2



P1:

Queue : (o,p,0)

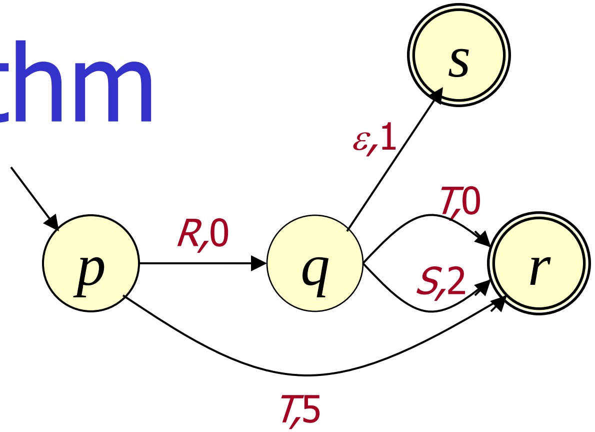
Object-State-Weight Table :

P2:

Queue :

Object-State-Weight Table :

Distributed Algorithm



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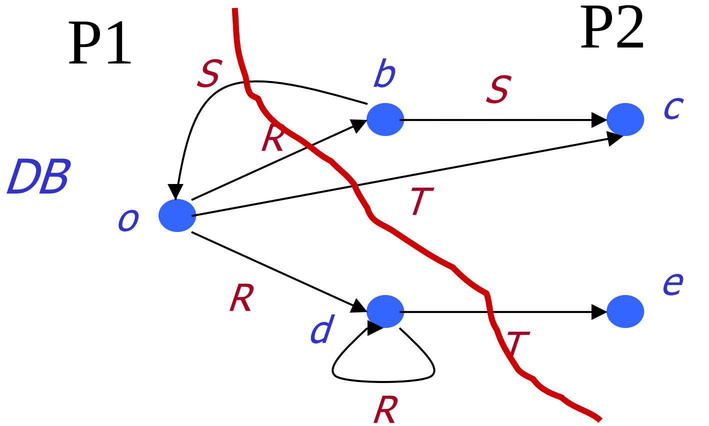


P1:

Queue : (c,r,5) (b,q,0) (d,q,0)

Object-State-Weight Table :

(o,p,0)

message (c,r,5)

P2:

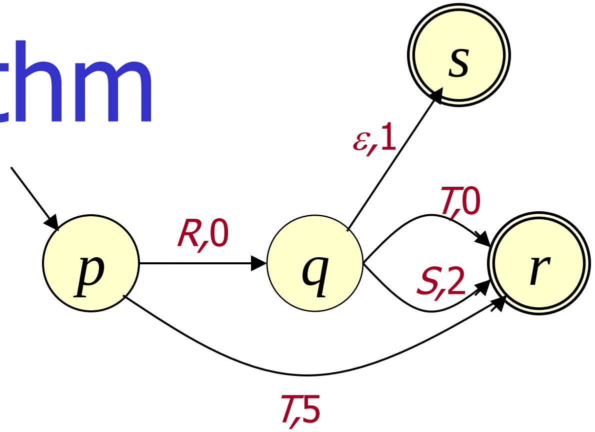
Queue :

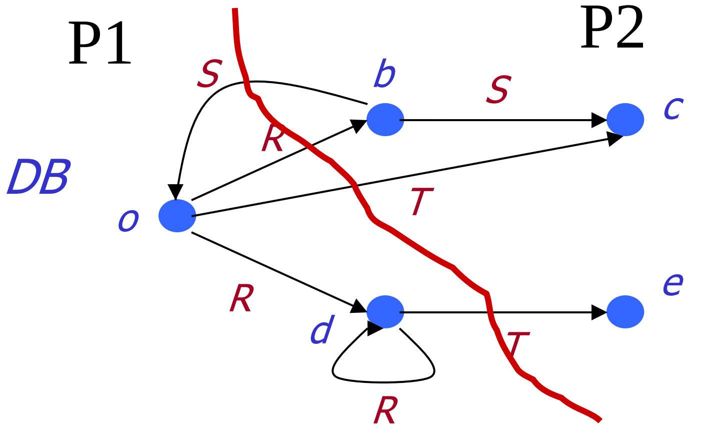
Object-State-Weight Table :

Distributed Algorithm

Suppose:

- o, d are in processor P1
- b, c, e are in processor P2





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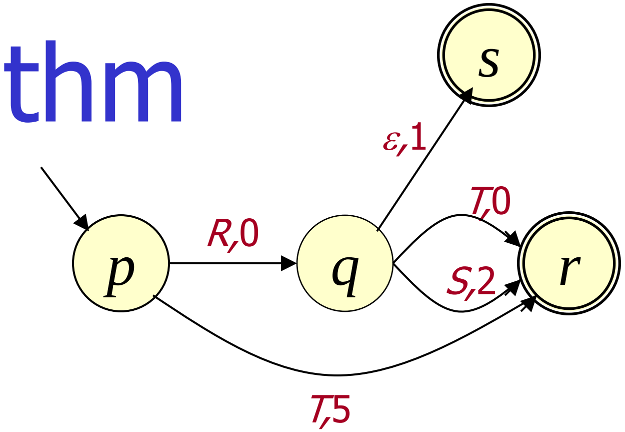
Distributed Algorithm



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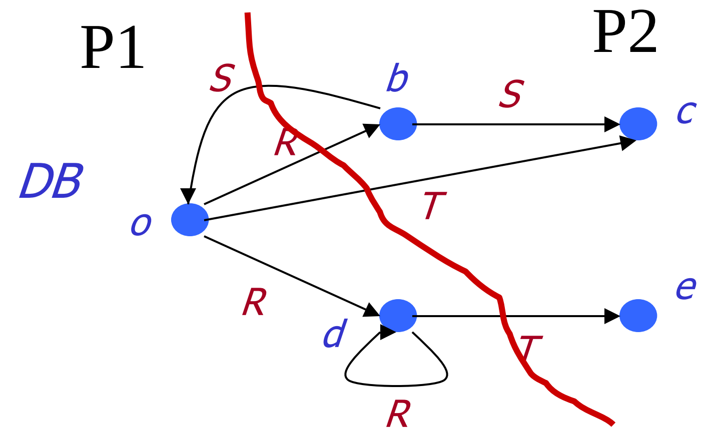

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Distributed Algorithm

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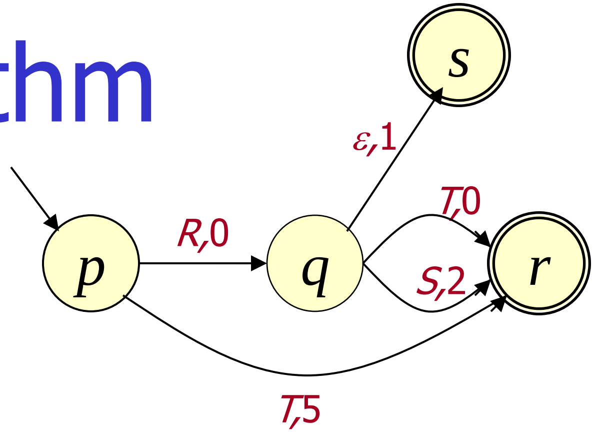

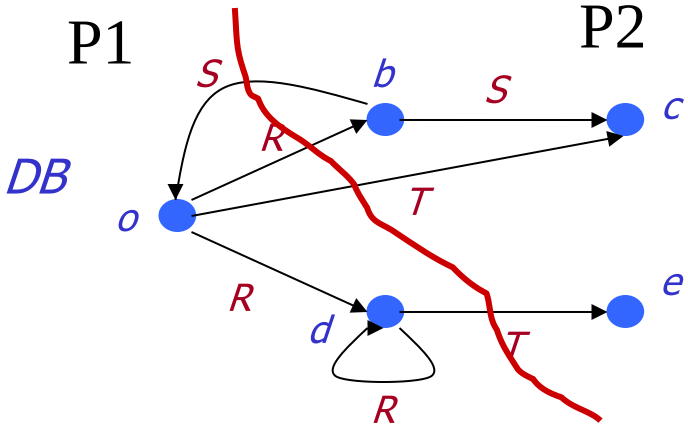

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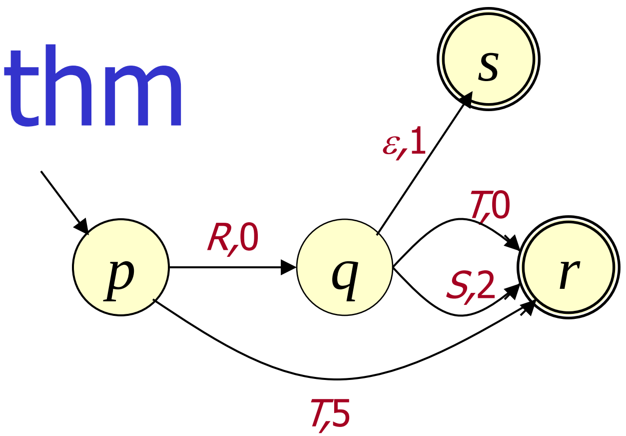

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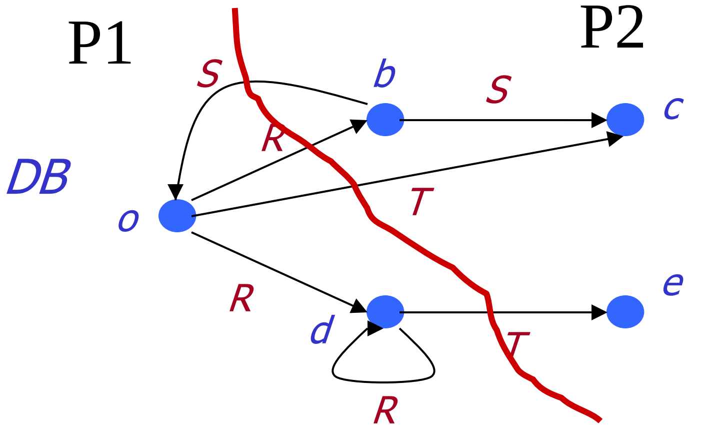

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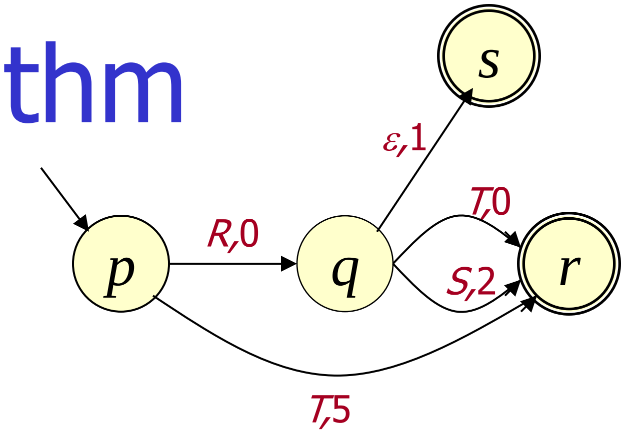

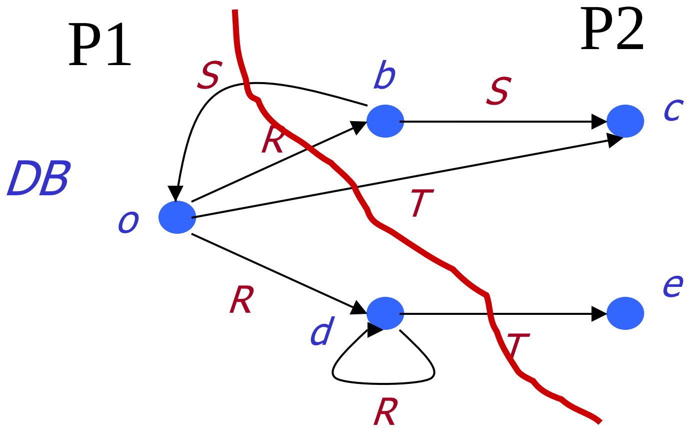

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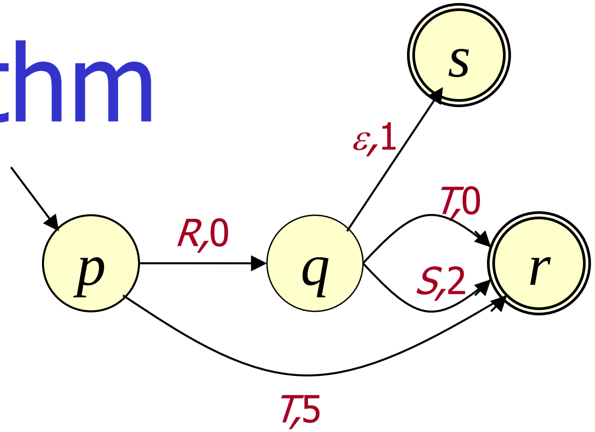

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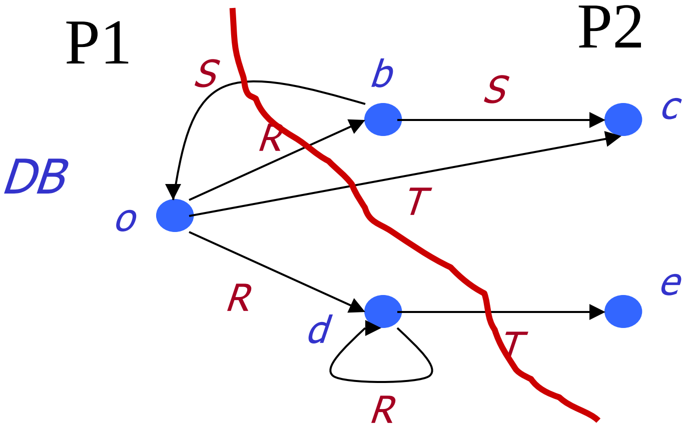

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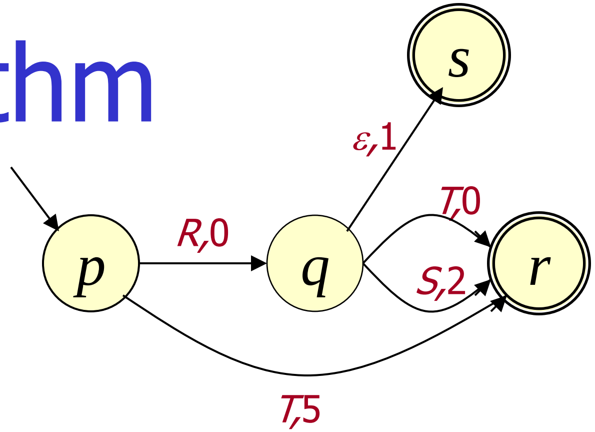

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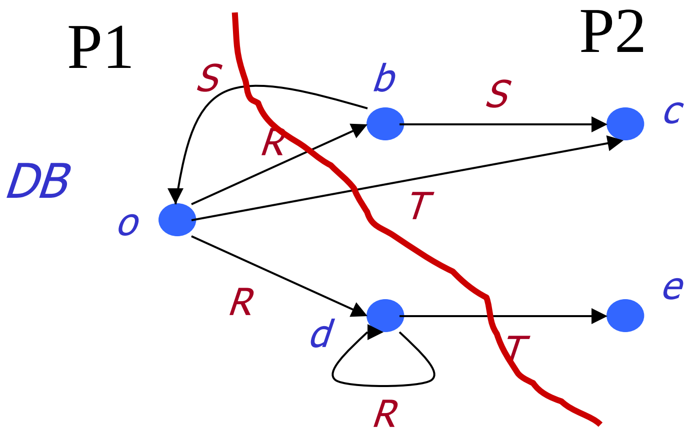

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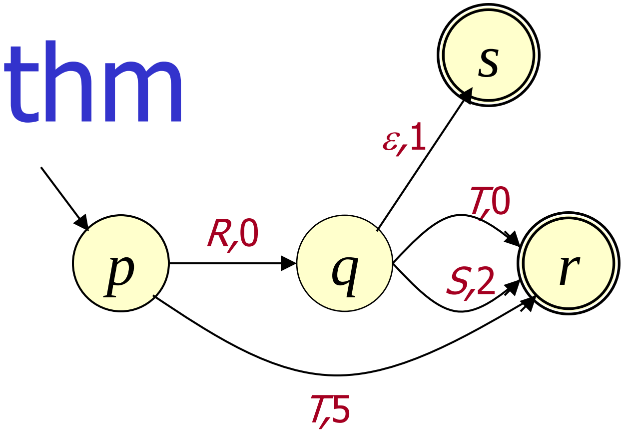

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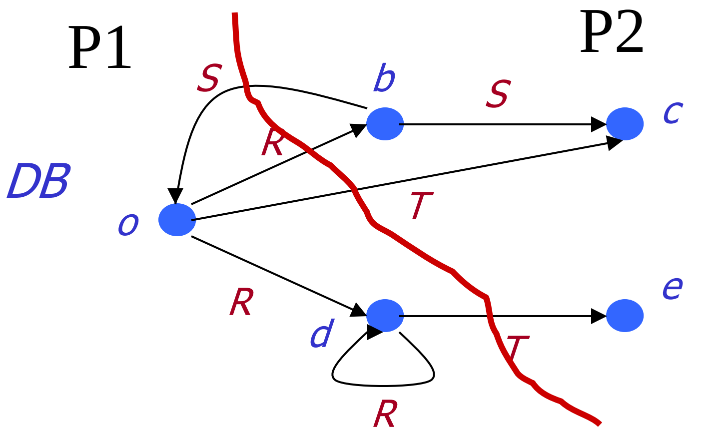

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message (o,r,2)

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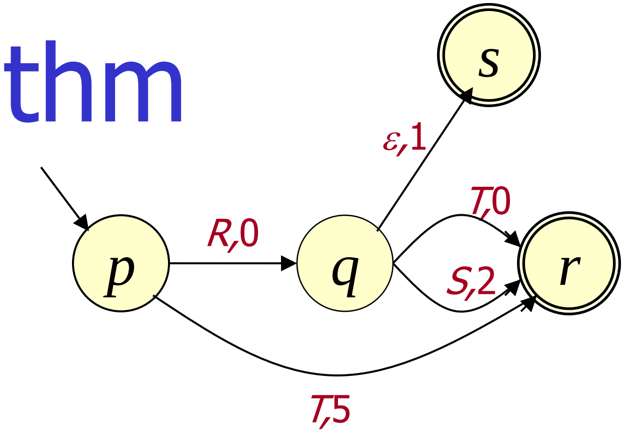
Distributed Algorithm



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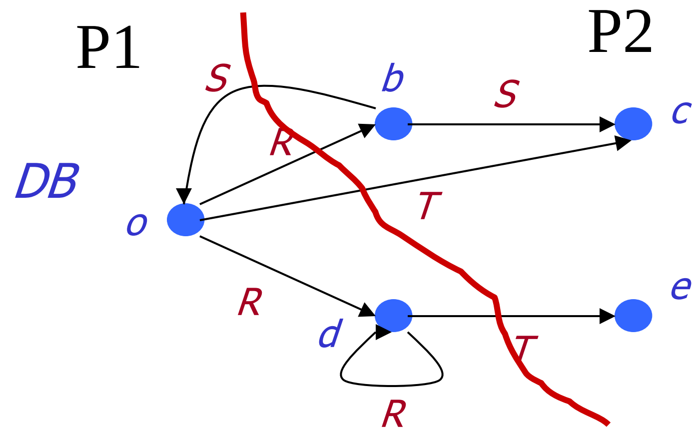

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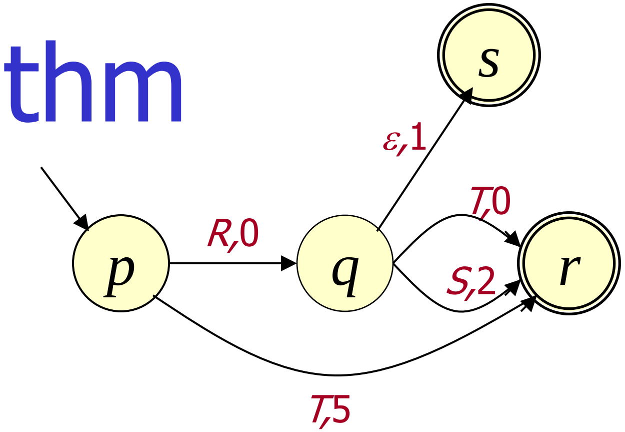

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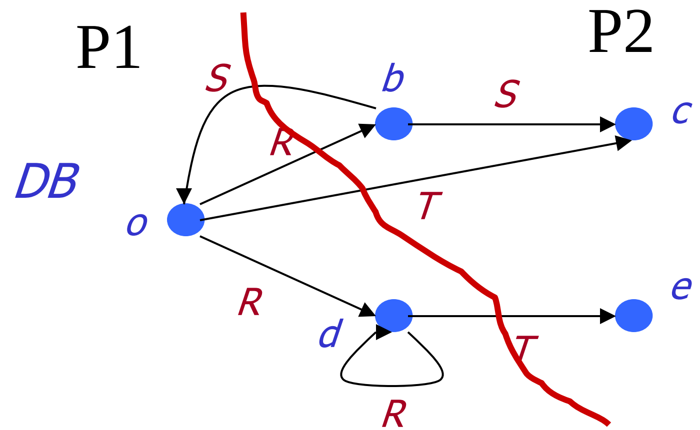

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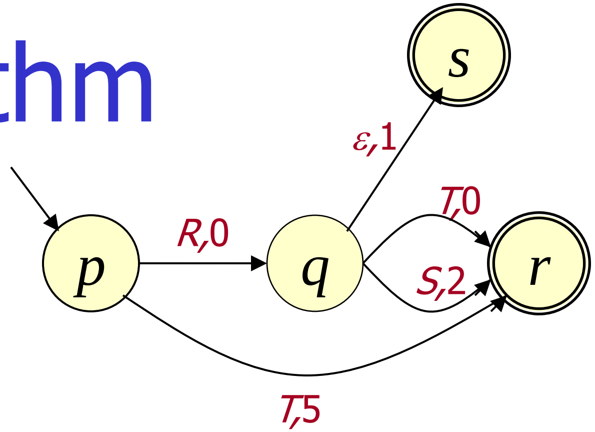

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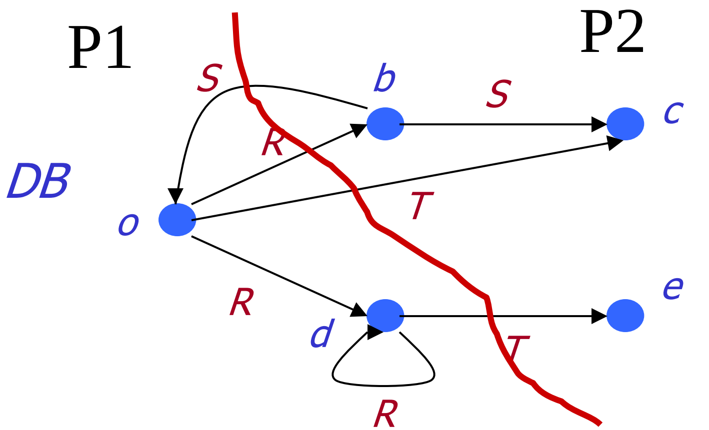

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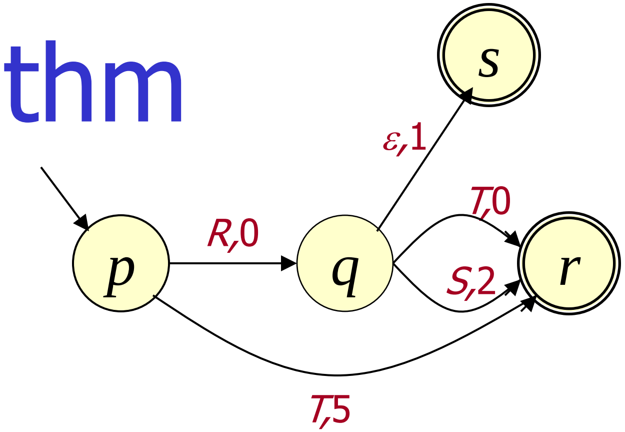

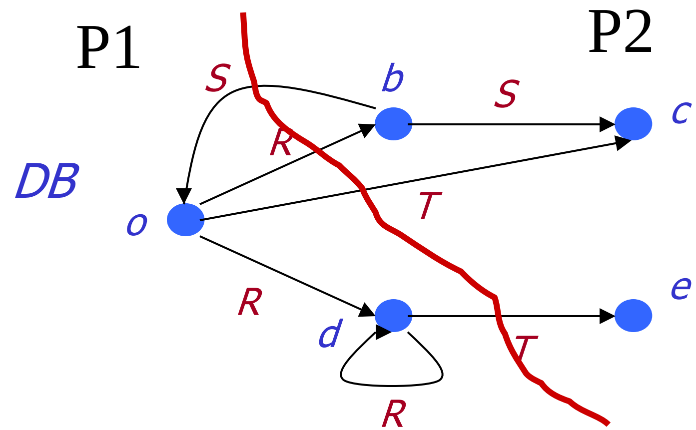

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P2:

Queue :

Object-State-Weight Table :

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References

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