Open Problems for Packet Forwarding Algorithms in a Line Network

Michael Nugent

with Antonios Antoniadis, Neal Barcelo, Daniel Cole,
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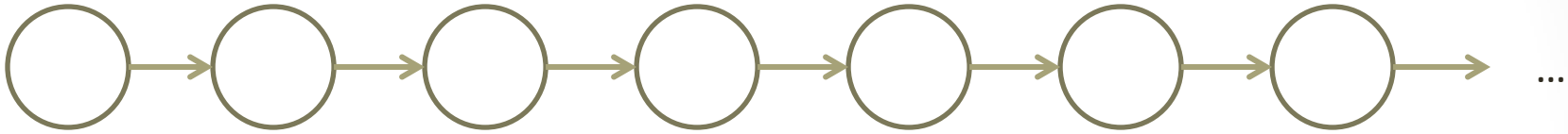
Packet Forwarding in a Line Network



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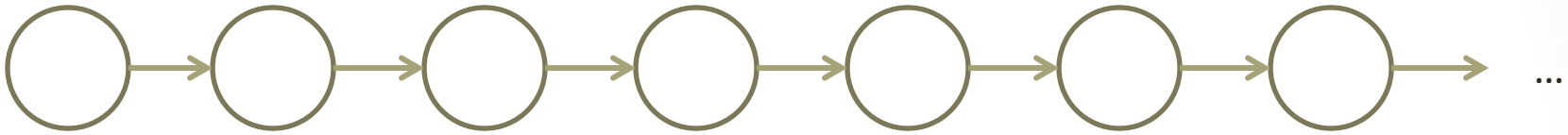

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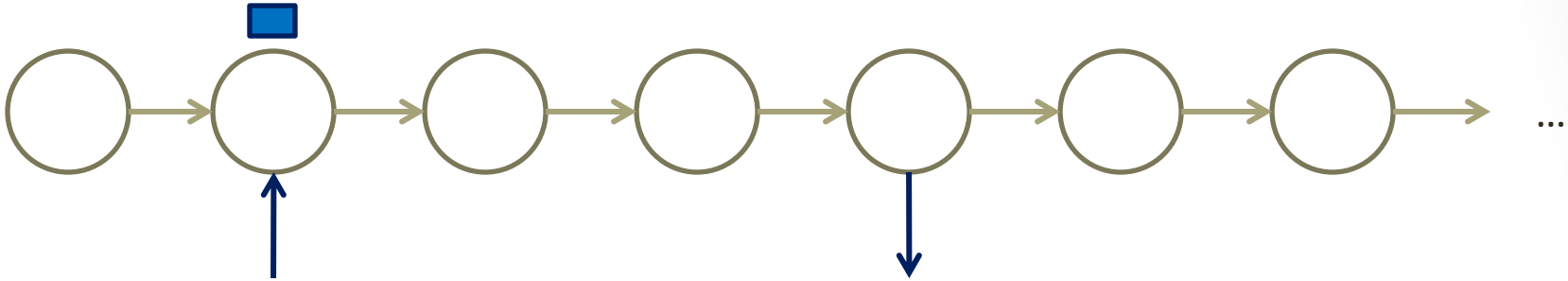

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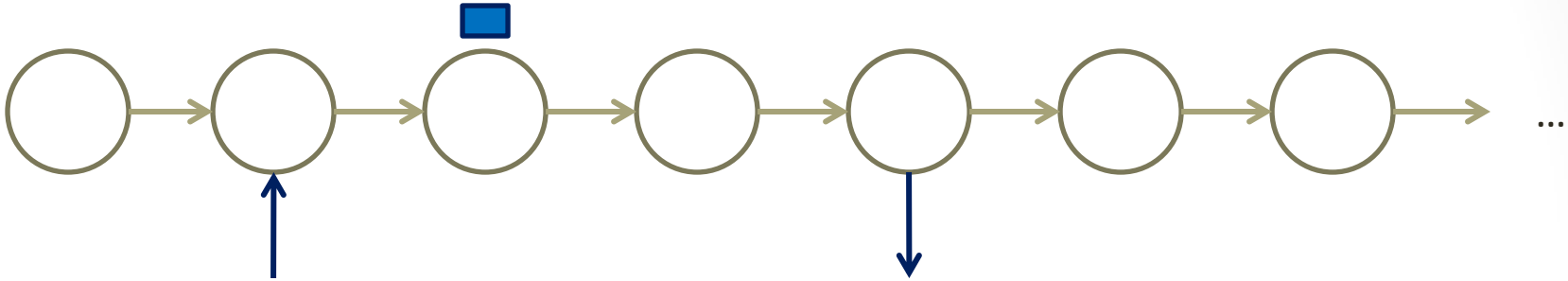

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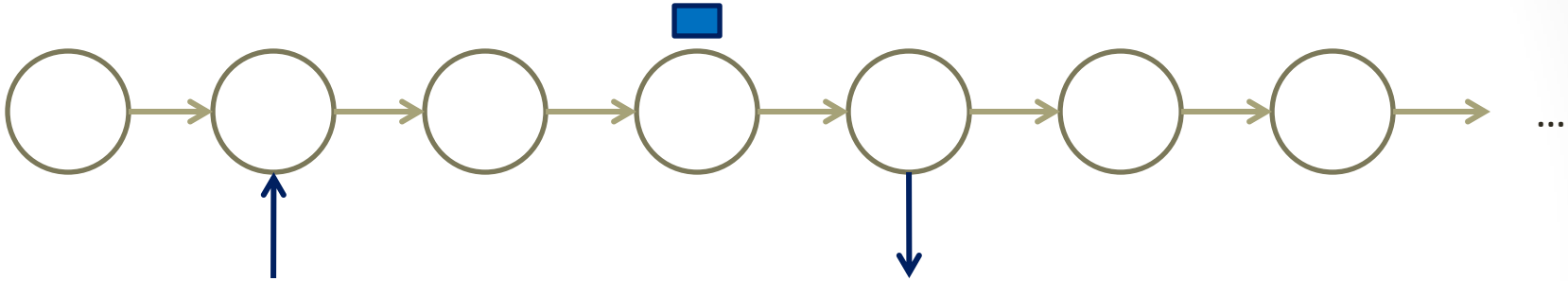

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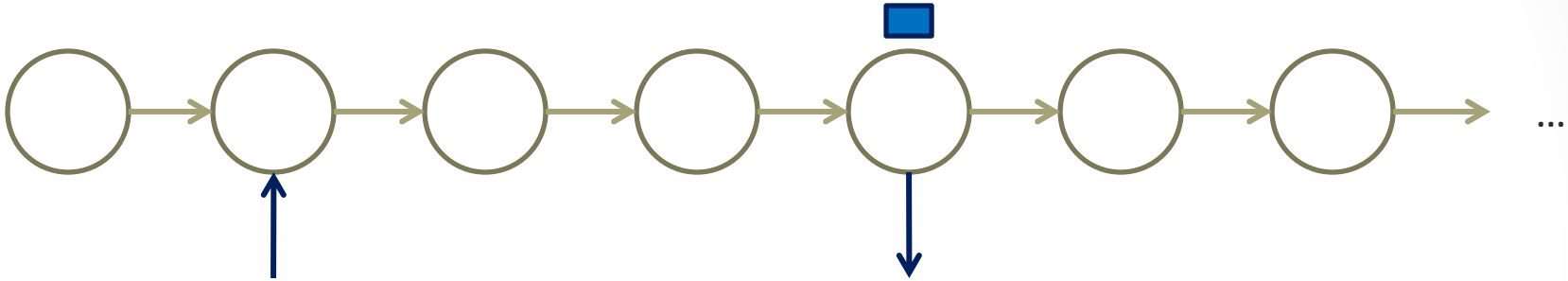

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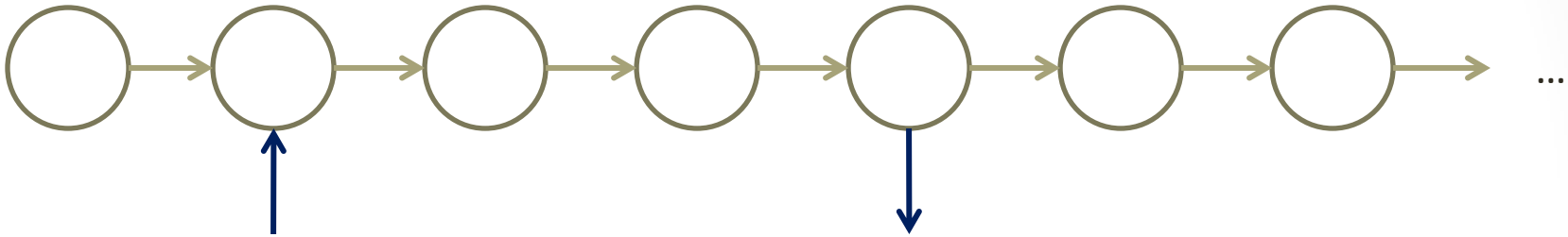

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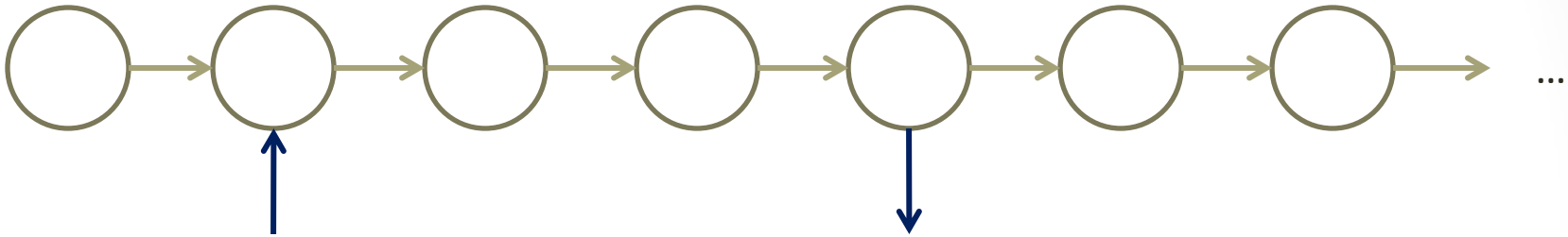

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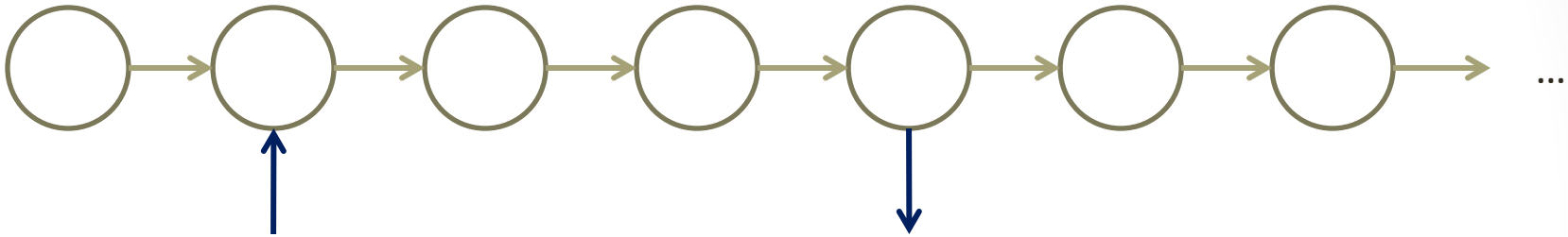

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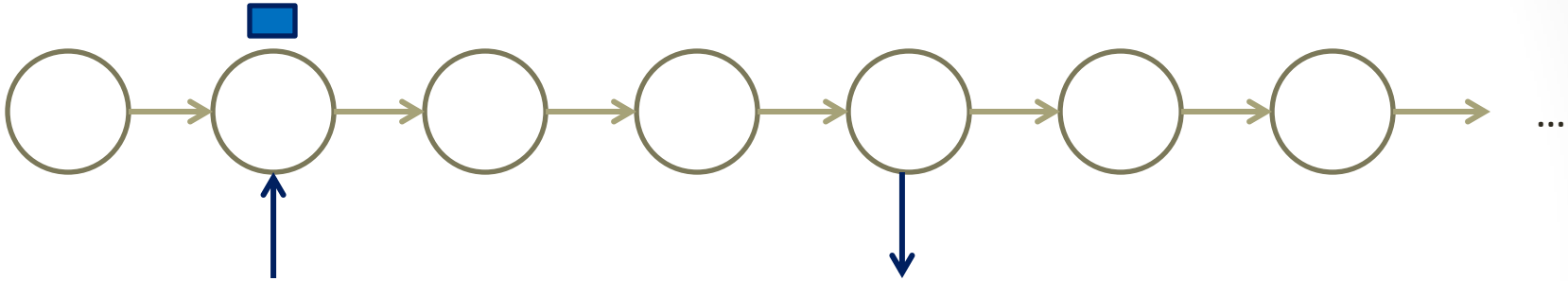

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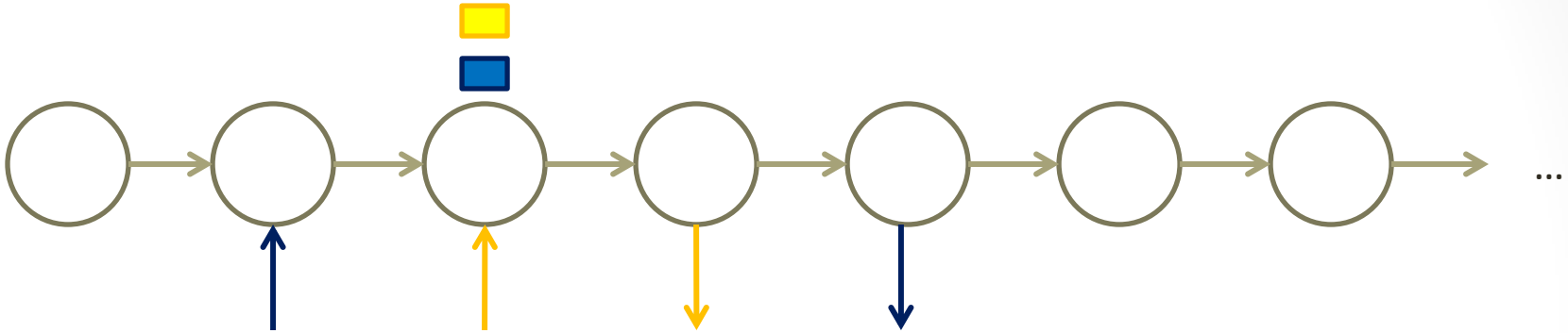

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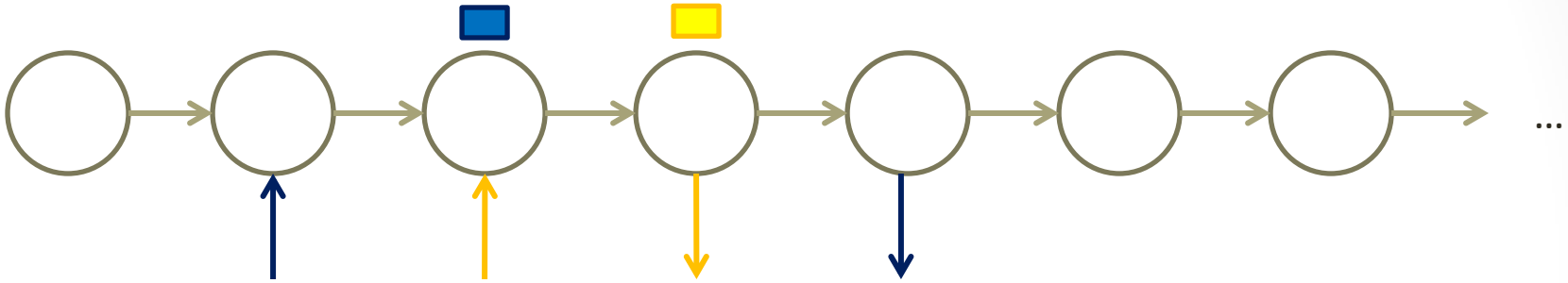

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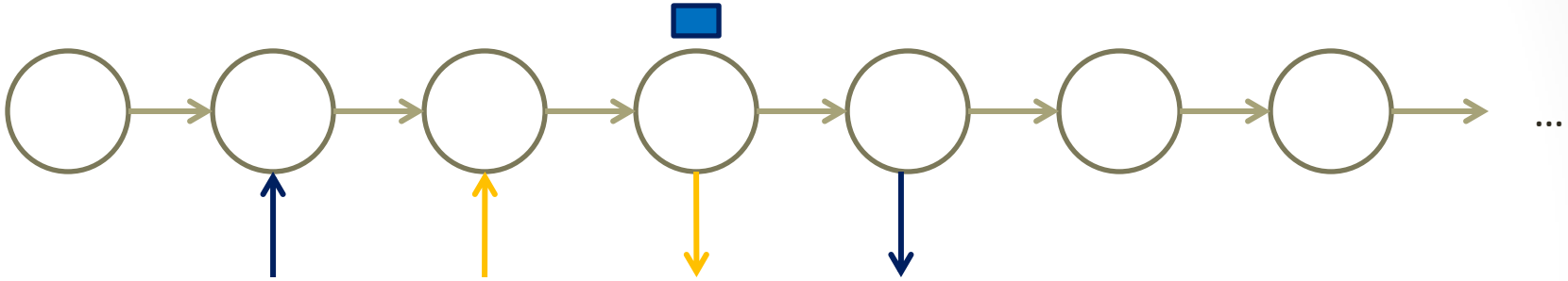

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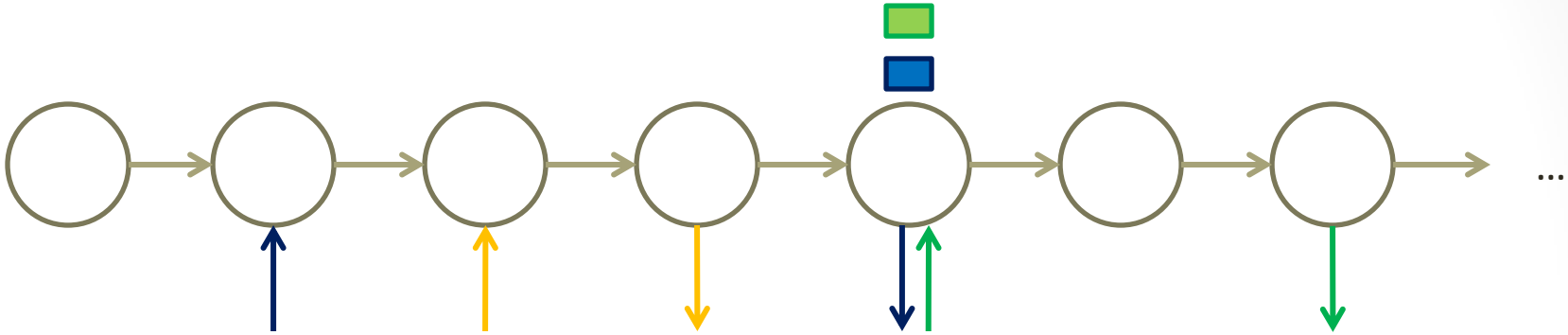

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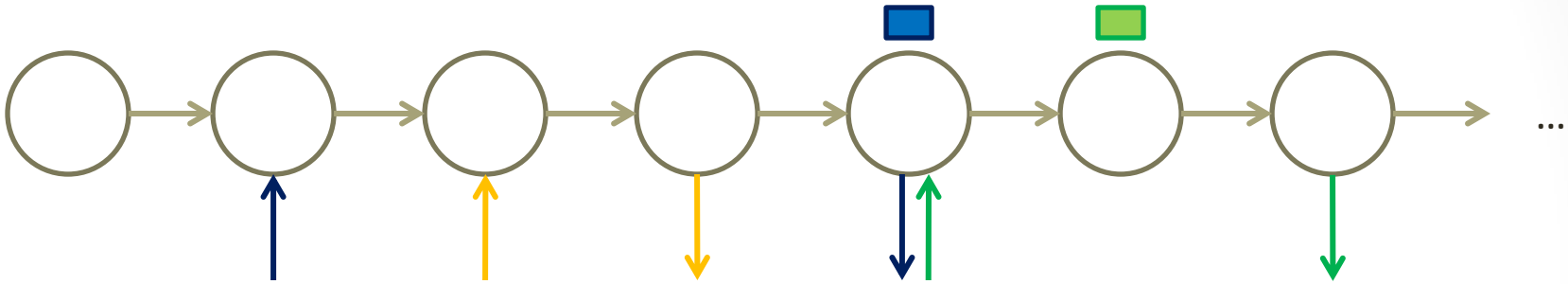

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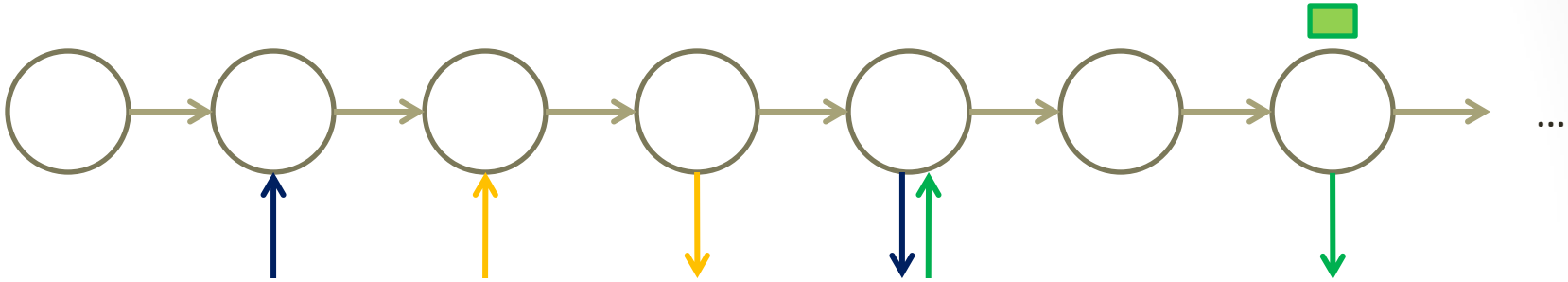

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Maximum Flow

- Open Problem: Is there a O(1)-competitive algorithm to minimize the maximum flow?

- Natural Algorithm: Earliest Arrival (or First In First Out)
- Earliest Arrival is not O(1)-competitive
- Earliest Arrival and Furthest-To-Go are scalable (with $1 + \varepsilon$ speed they are $O(1/\varepsilon)$-competitive)

Total (Average) Flow

- Open Problem: Is there a O(1) speed O(1)-competitive algorithm for minimizing the total flow?

- There exists no O(1)-competitive algorithm
- Natural Algorithms: Furthest-To-Go and Shortest-To-Go
- Given O(1) speed, no natural combination of Furthest-To-Go and Shortest-To-Go are O(1)-competitive

Flow plus Energy

- Open Problem: Is the natural speed scaling algorithm O(1)-competitive for minimizing total flow plus energy when routers are speed scalable?
  - Speed scalable means that routers can be at any nonnegative speed and power is a concave function of speed (e.g., $P(s)=s^{\alpha}$)
  - Natural Speed Scaling Algorithm: Each router runs at power equal to the number of packets at that router
  - **Variant 1**: Any scheduling policy may be used
  - **Variant 2**: There is a fixed scheduling policy

Thanks!