The k-Server Problem with Delays on the Uniform Metric Space

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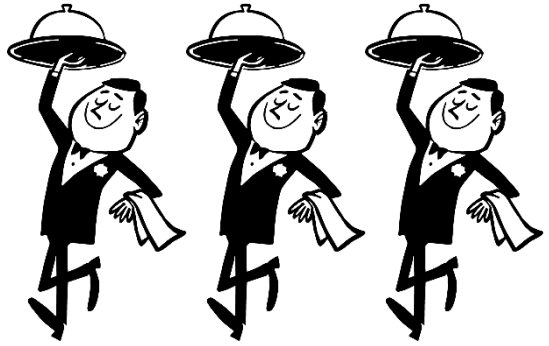
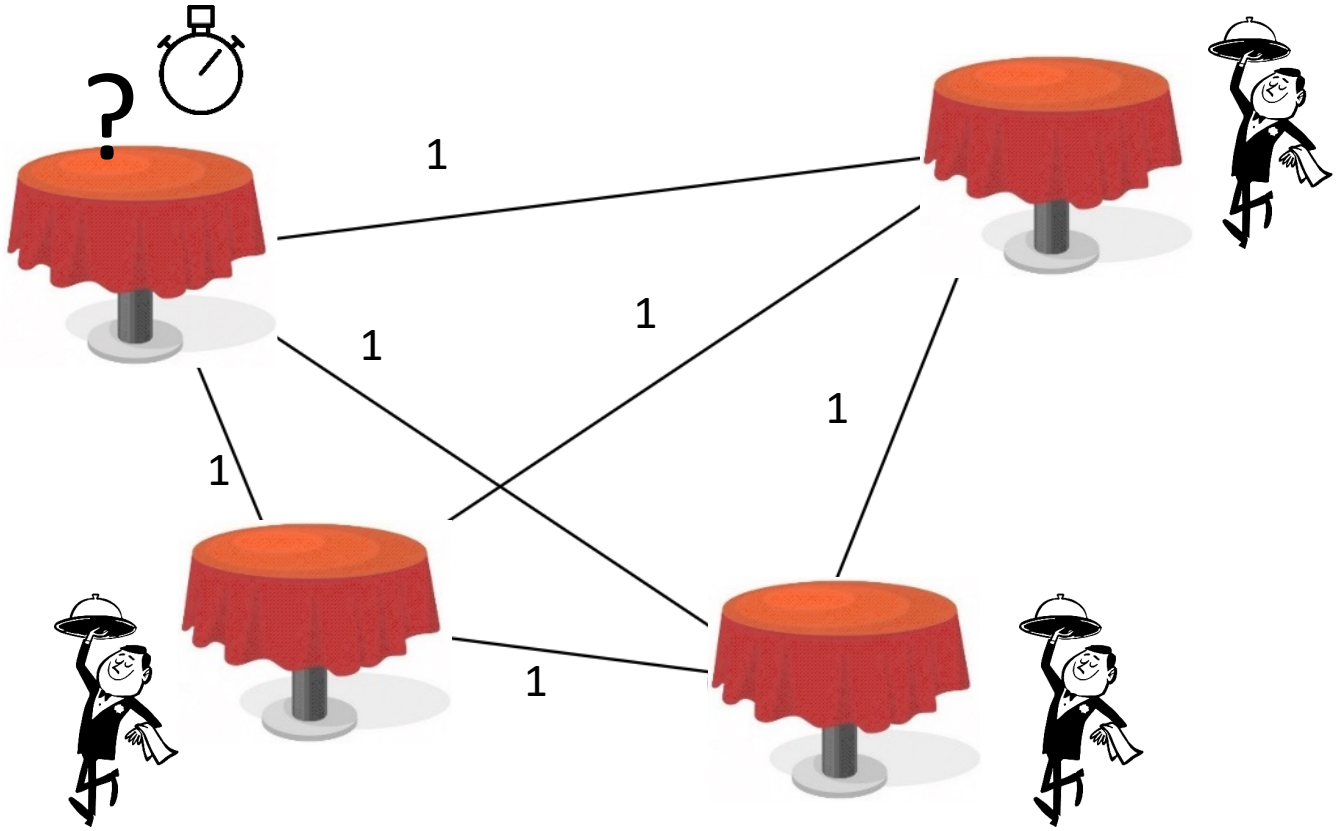
Distributed Computing

k-Server Problem with Delays



Waiter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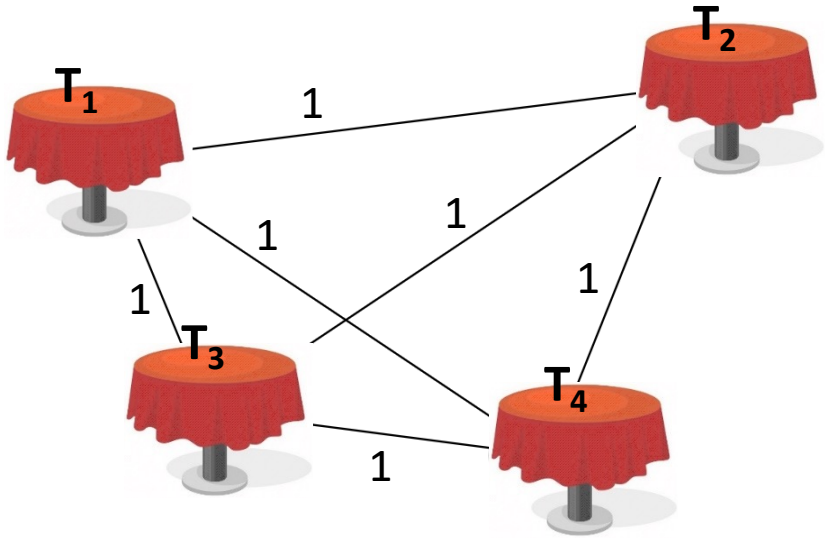
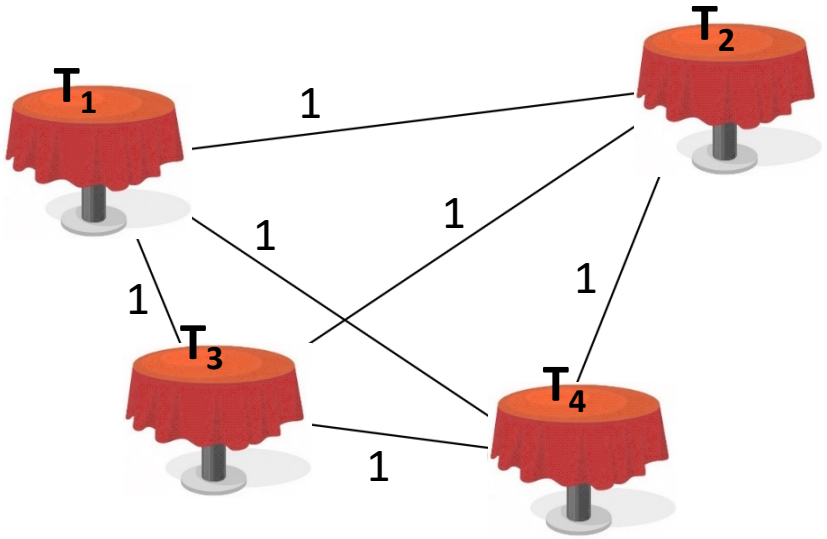
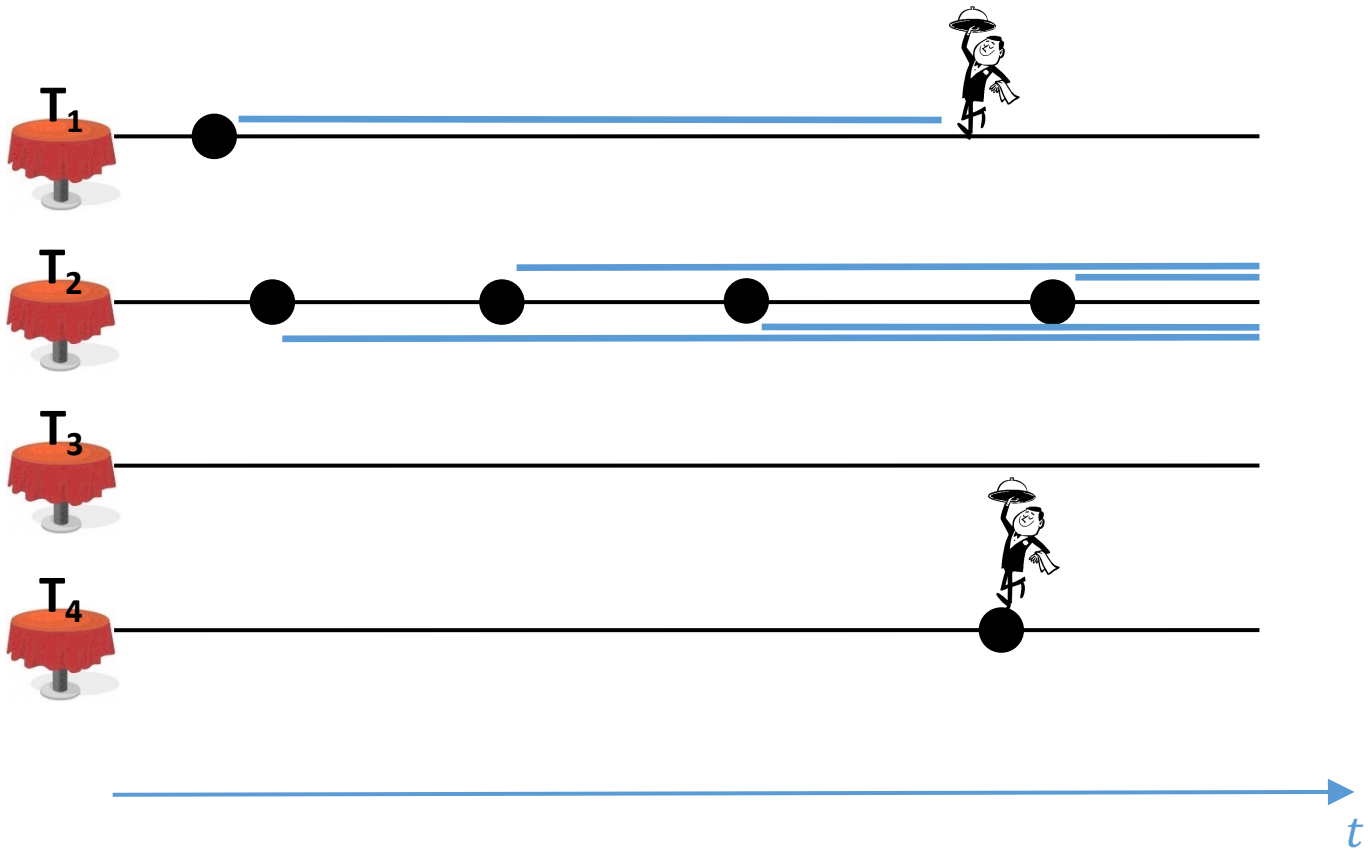
Online

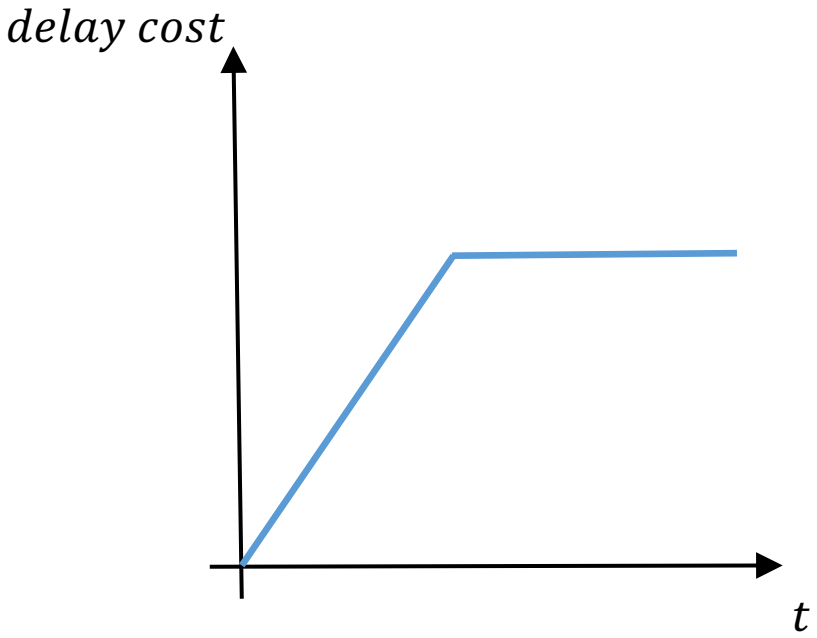


Offline

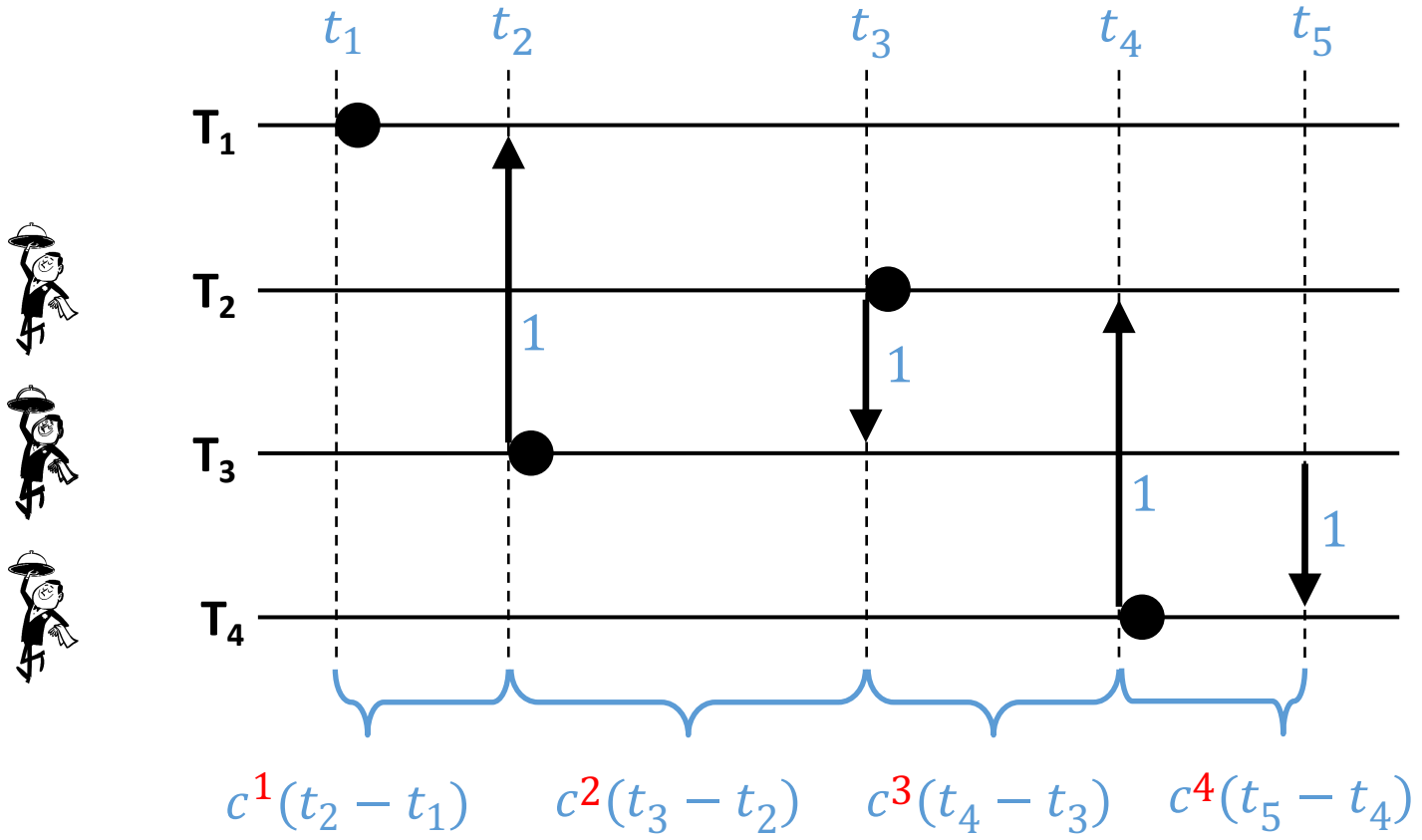


Delay Cost

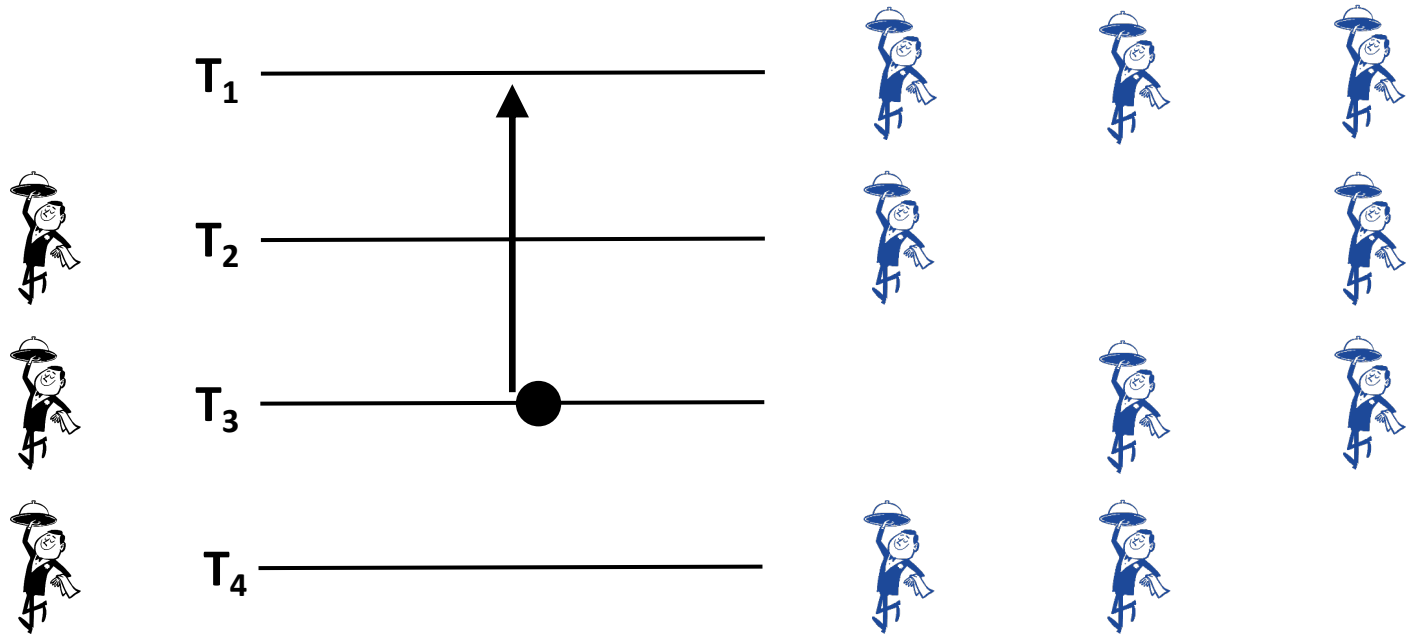




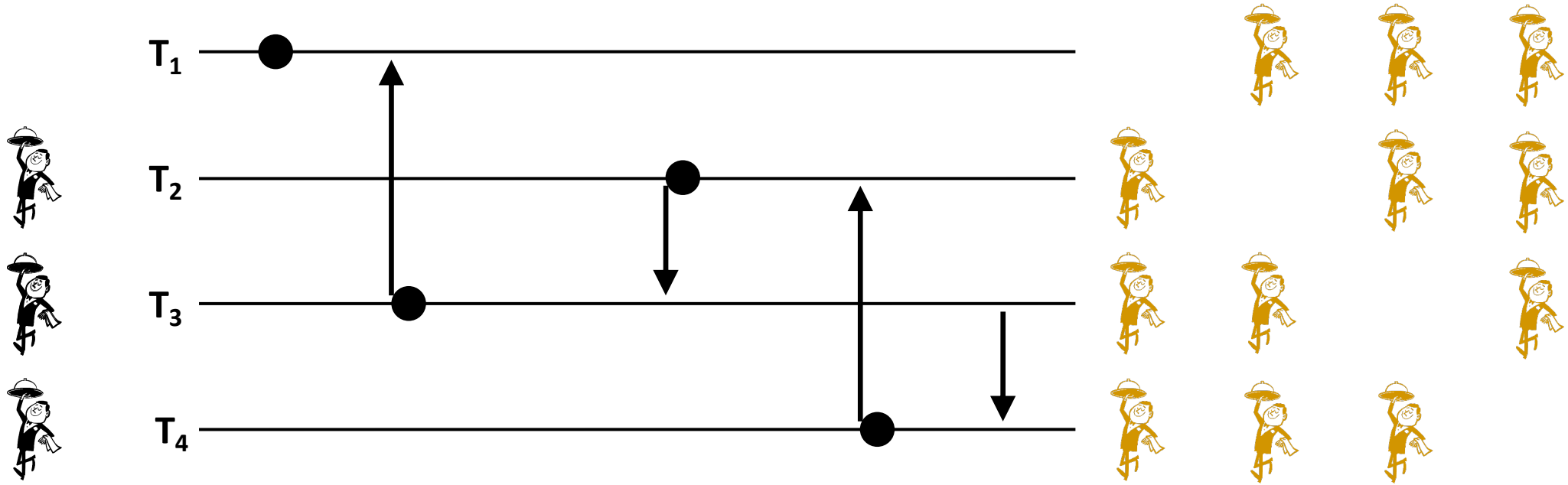
Worst-Case Request Sequence ($k = 3$)



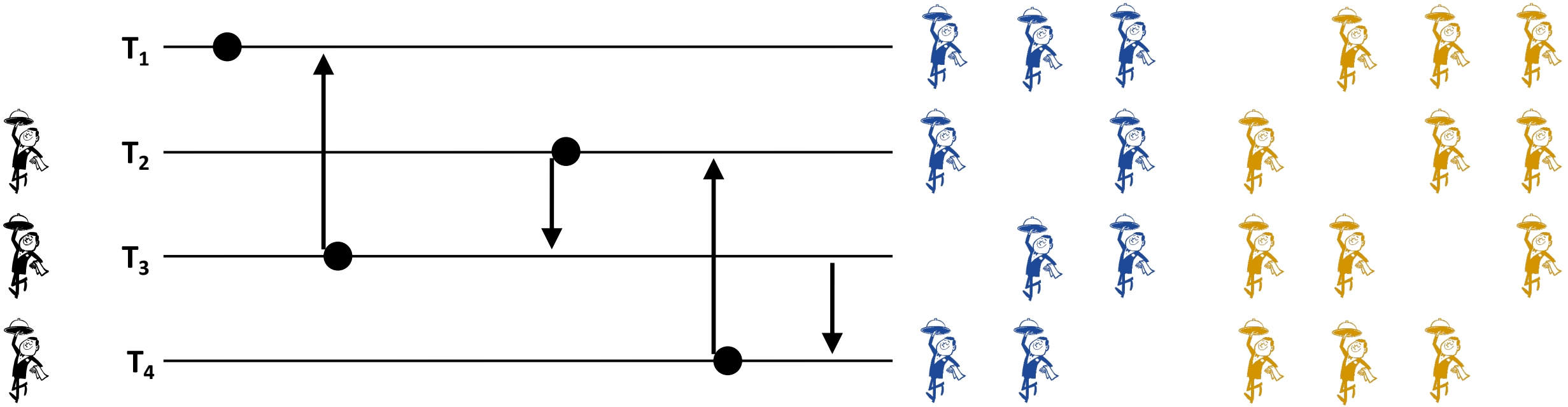
Dynamic Offline Algorithms



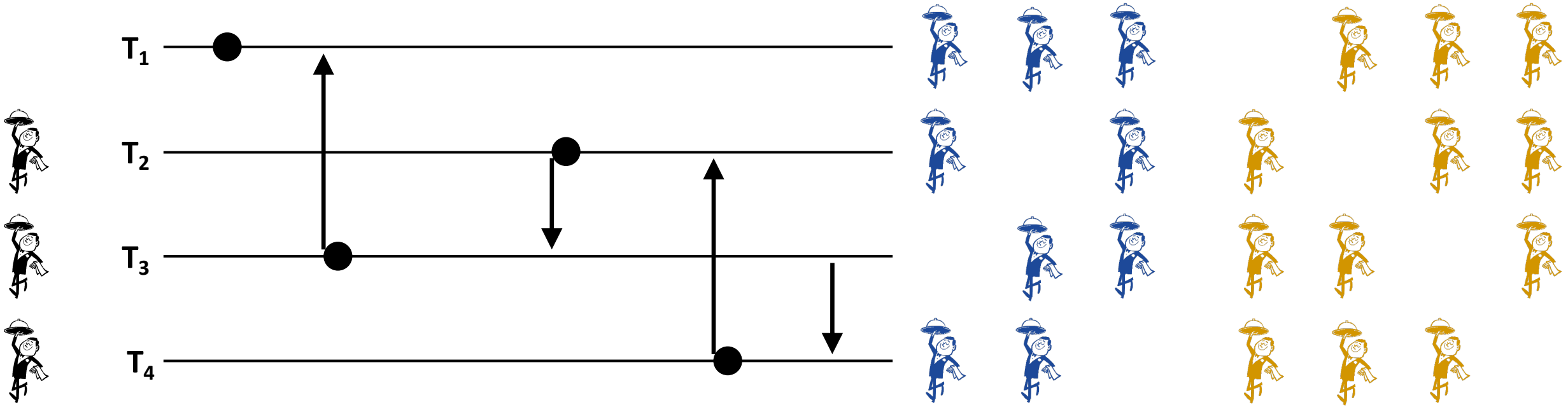
Static Offline Algorithms



Cost Calculation



Competitive Ratio $\geq 2k + 1$



Online

Moving costs: X
Delay costs: $Y = \sum_{i=1}^{X} c^i(t_{i+1} - t_i)$

Dynamic

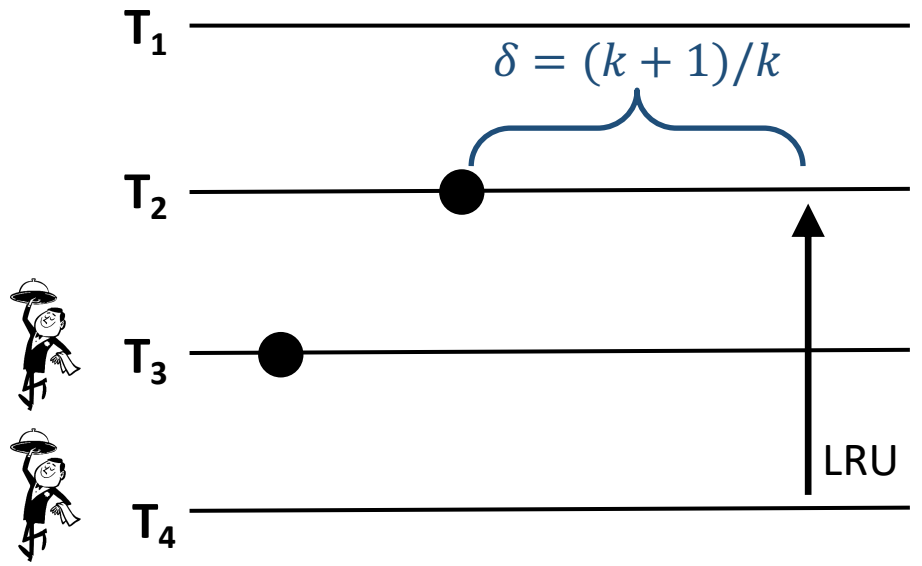
Moving costs: X
Delay costs: 0

Static

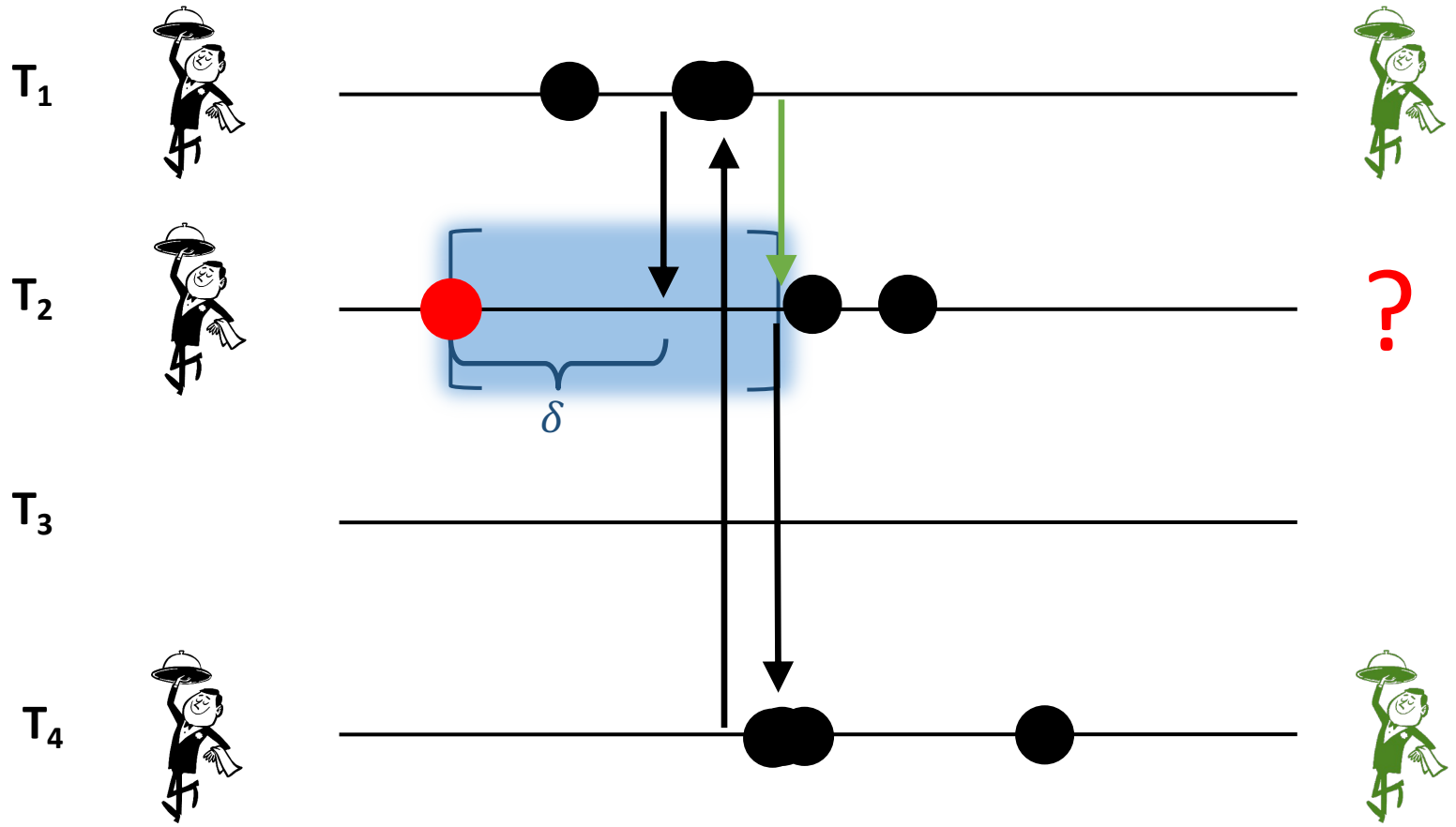
Moving costs: 4
Delay costs: $(1 + \epsilon)Y$

The Paging Problem

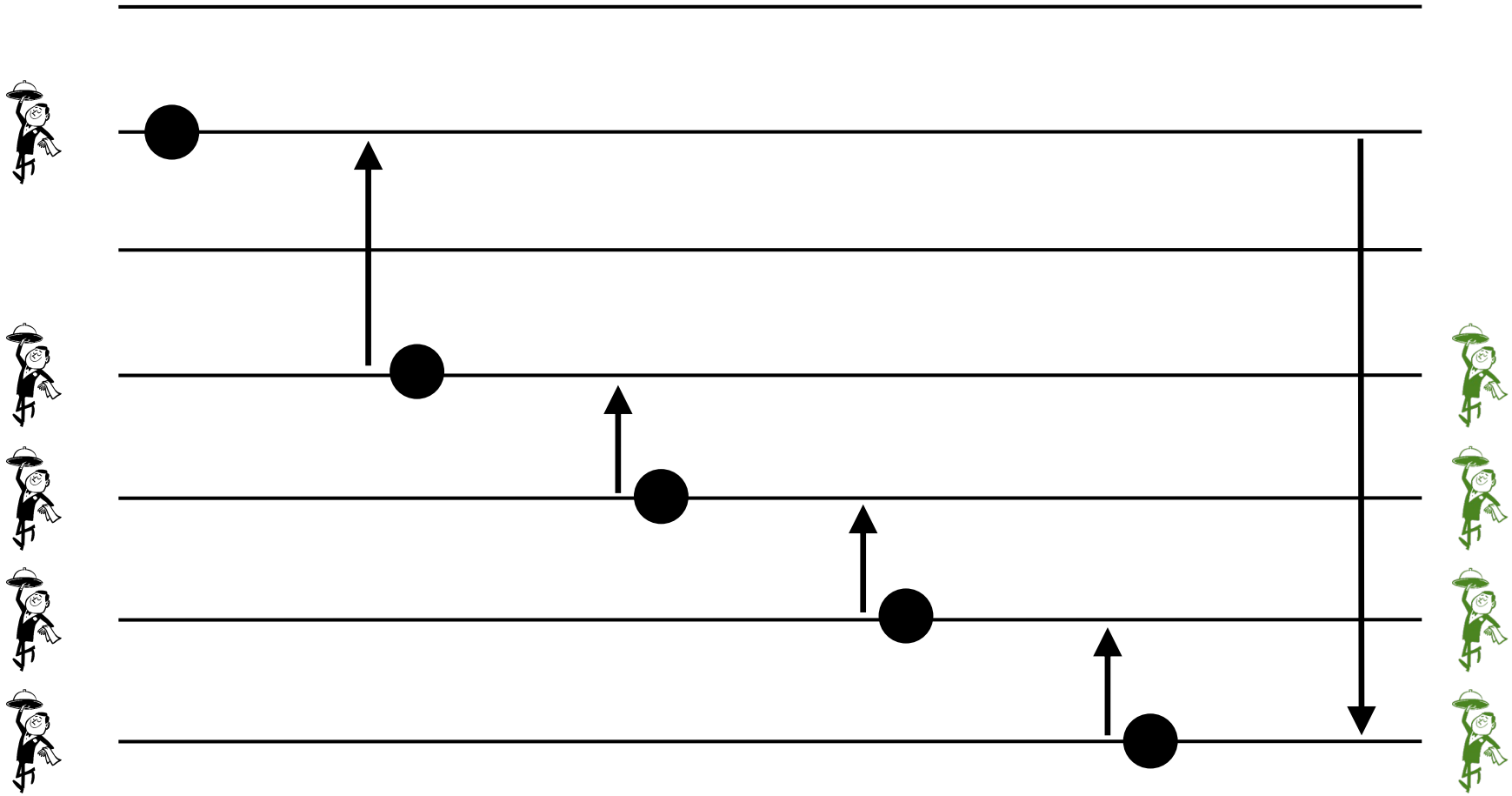
- LRU
- CLOCK
- FIFO
- FWF



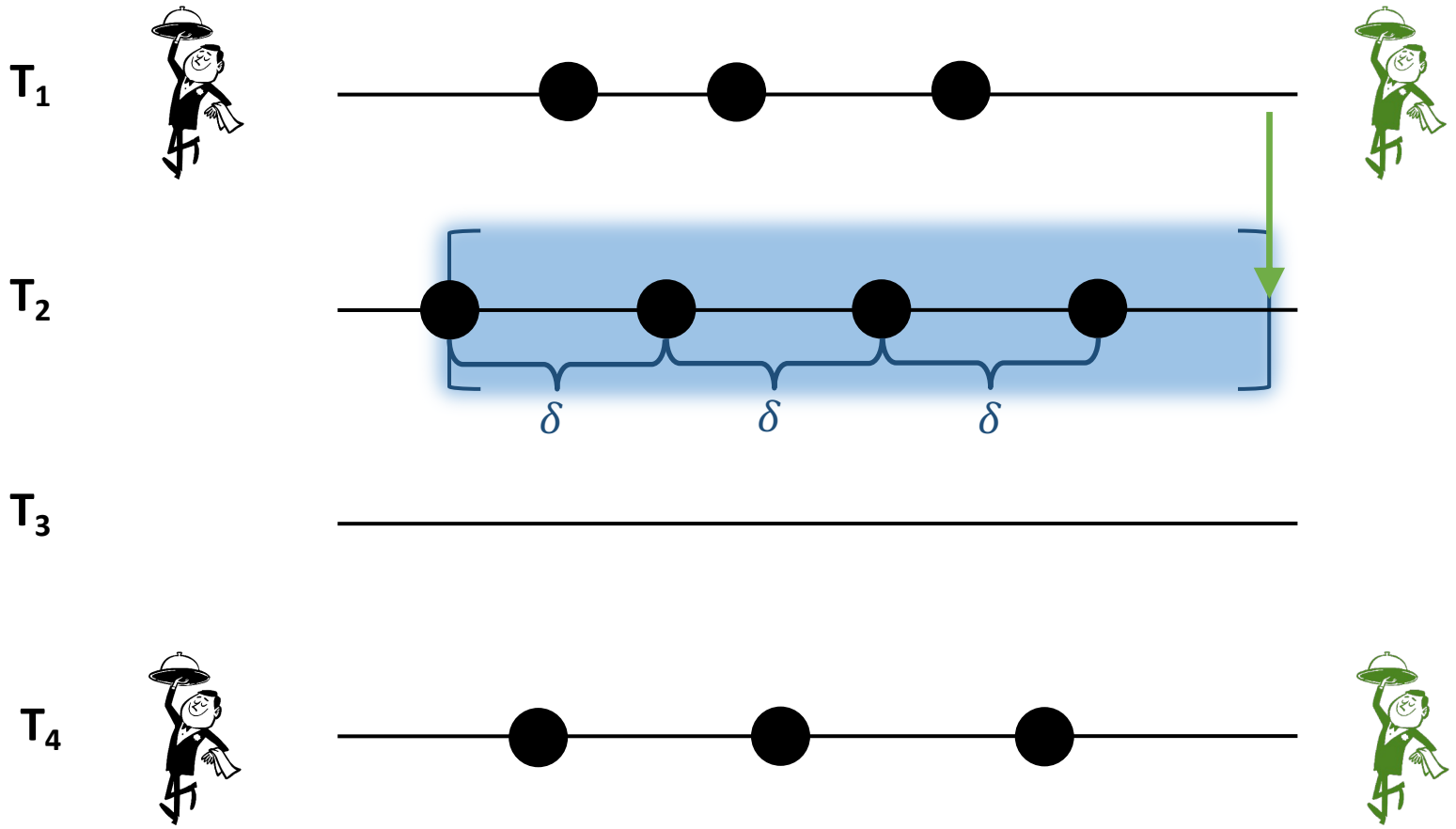
Phase Partition ($k = 2$)



Phase Partition ($k = 4$)



Phase Partition ($k = 2$)

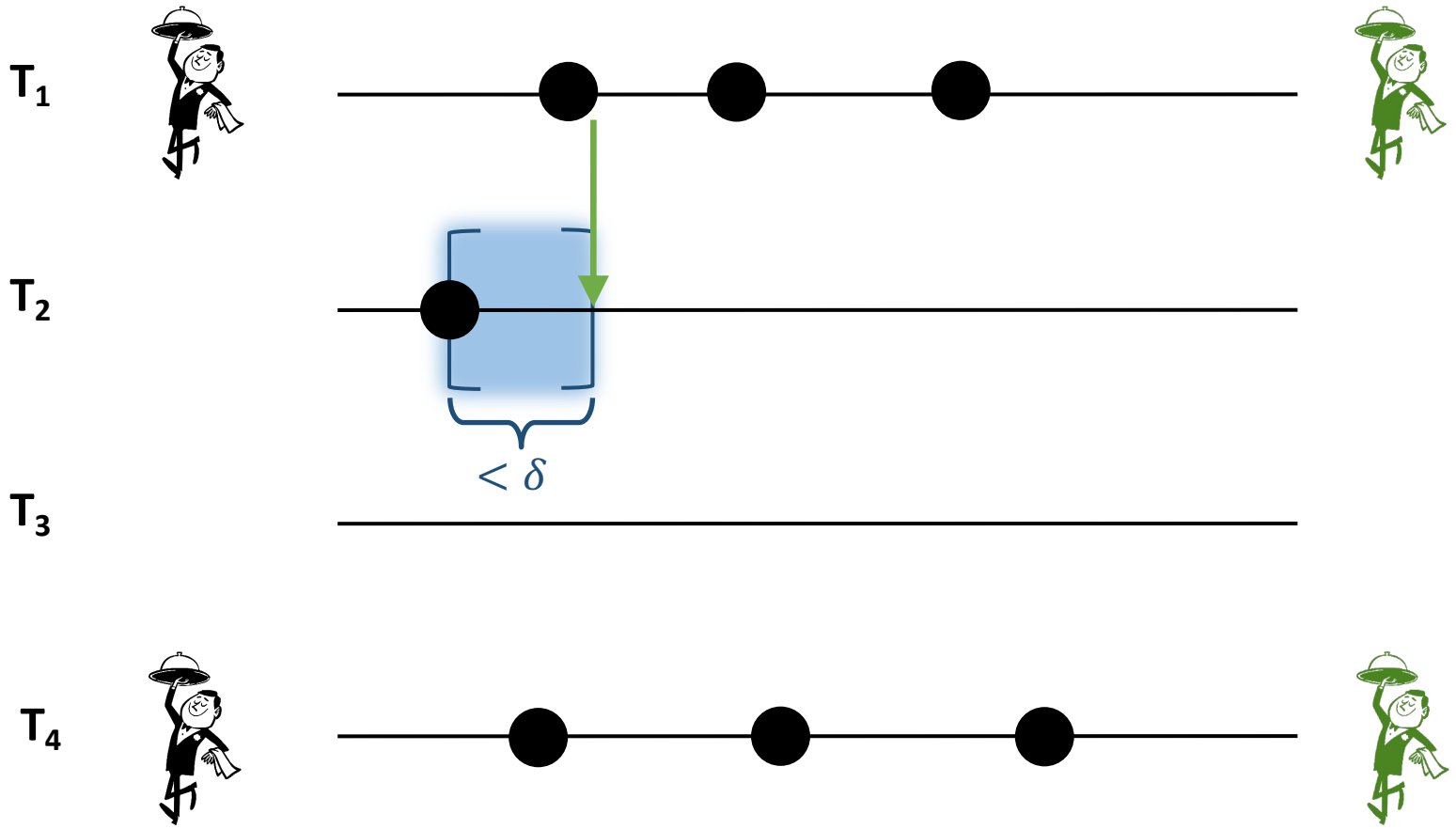


Phase length $> \delta$:

Offline: $phase\ length + 1$

Online: $\lfloor \frac{phase\ length}{\delta} \rfloor (k+1)(1+\delta)$

Phase Partition ($k = 2$)



Phase length $< \delta$:

Offline: $phase\ length + 1$

Online: $k(1 + \delta)$

k-Server Problem with Delays

Competitive Ratio	Uniform Metric	General Metric
Lower Bound	$2k+1$	$2k+1$
Upper Bound	$2k+1$	$O(k \log^5 n)$ [Azar et al., 2017]

Questions?