Lingering issues in distributed scheduling

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Joint work with **S. Borst** (Bell Labs & TU/e)
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Context

Constrained queueing networks:

- Queues want to transmit packets subject to constraints on which queues can transmit simultaneously
- Constraint graph

Motivation

- Wireless networks: interference
- Switched networks

Very active research topic

Context

Shah, Shin and Tetali (2013):

After each transmission, release the resource with probability $\psi(q)$, with q the number of packets.

Theorem

If $\psi(q) = 1/\log q$, this algorithm is throughput optimal for any constraint graph.

But: Theorem (Bouman et al. (2011))

The average stationary delay increases in heavy traffic ($\rho \uparrow 1$) at least as fast as $\psi^{-1}(1-\rho)$.

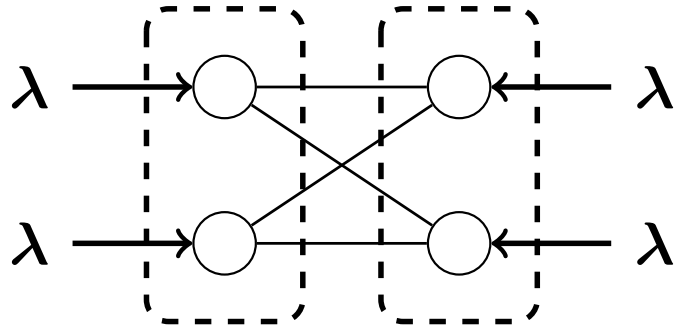
Lower bound $\exp(1/(1-\rho))$ for $\psi(q) = 1/\log q$

- **Optimal delay: $1/(1-\rho)$**
- **Can we achieve a better delay performance?**

Lingering effect

Set-up

- $\psi(q) = q^{-\alpha}$ for $\alpha > 1$
- Complete, symmetric bi-partite constraint graph.



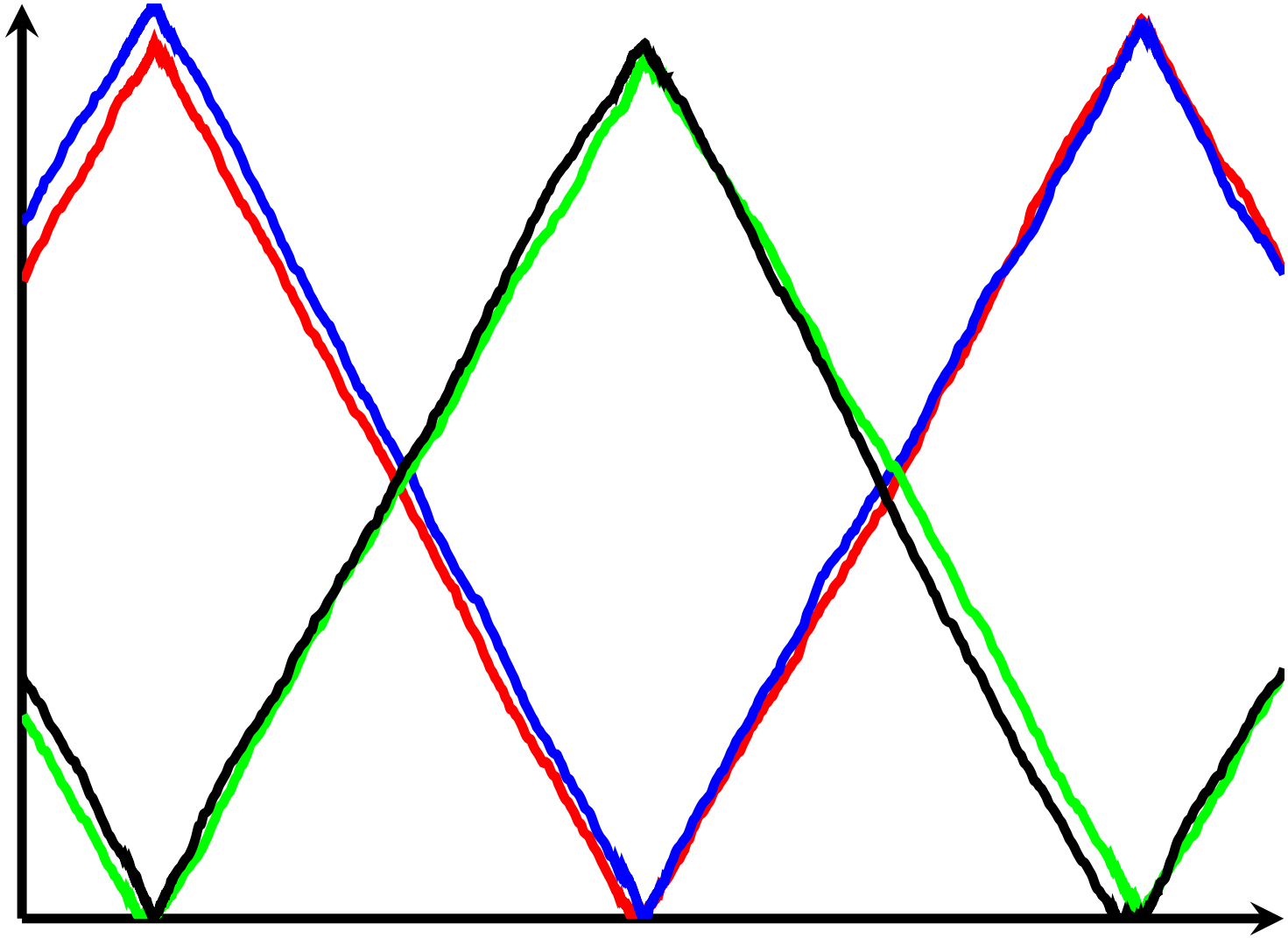
Result

Throughput optimal (for this topology) and mean stationary delay increases like $\sim 1/(1-\rho)^2$

Square comes from a lingering effect

- $\alpha > 1$: queues switch when (close to) empty
- Lack of synchronization: one queue lingers around 0

Lingering effect



Lingering effect