Incorrect Systems: It's not the Problem, It's the Solution

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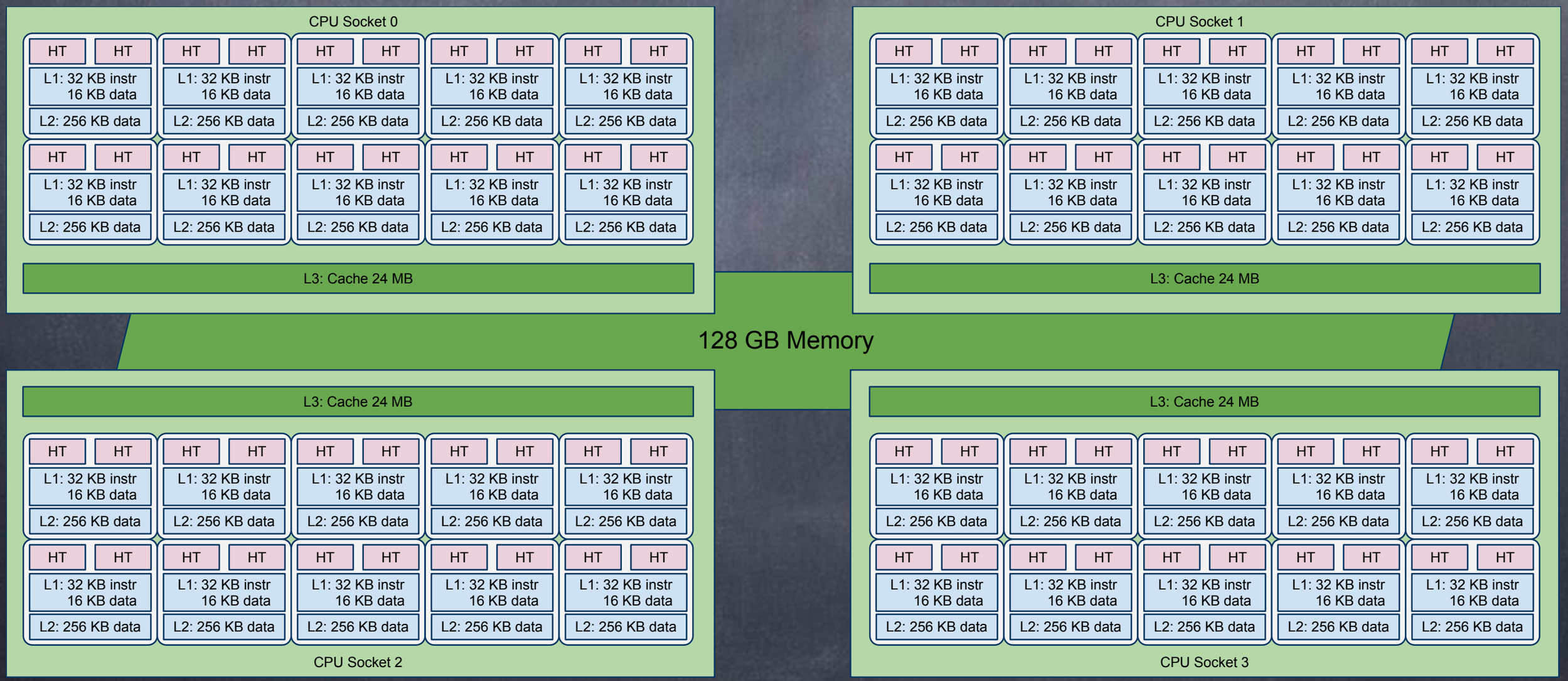
Universität Salzburg

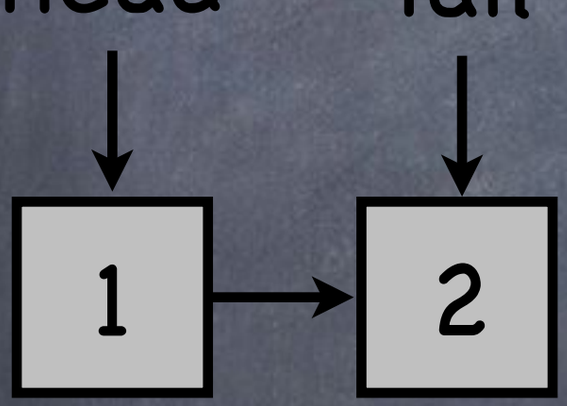
DAC, San Francisco, California, June 2012

Metrics of Correctness in Systems Engineering

4 processors x 10 cores x 2 hardware threads = 80 hardware threads



1 Concurrent First-in-First-out (FIFO) Queue



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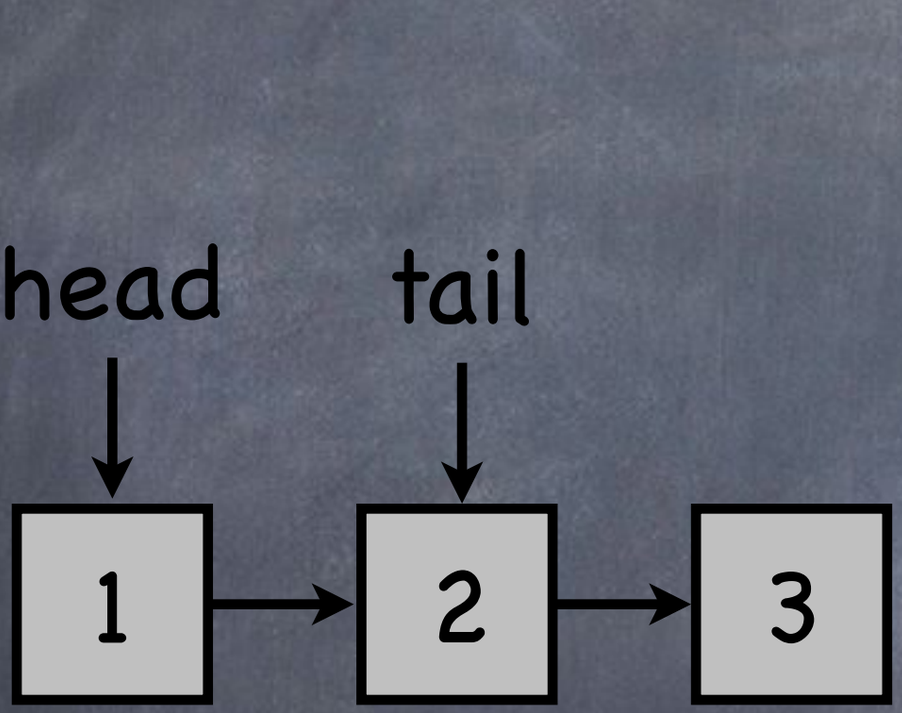

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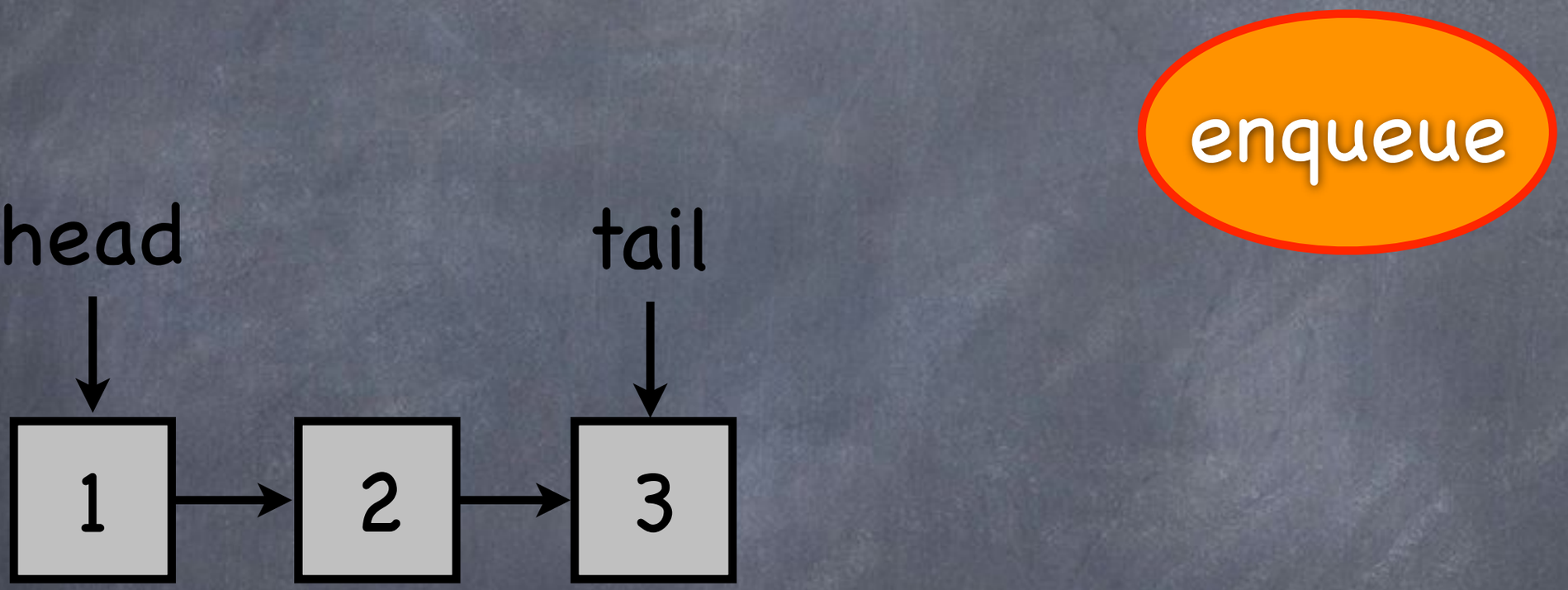

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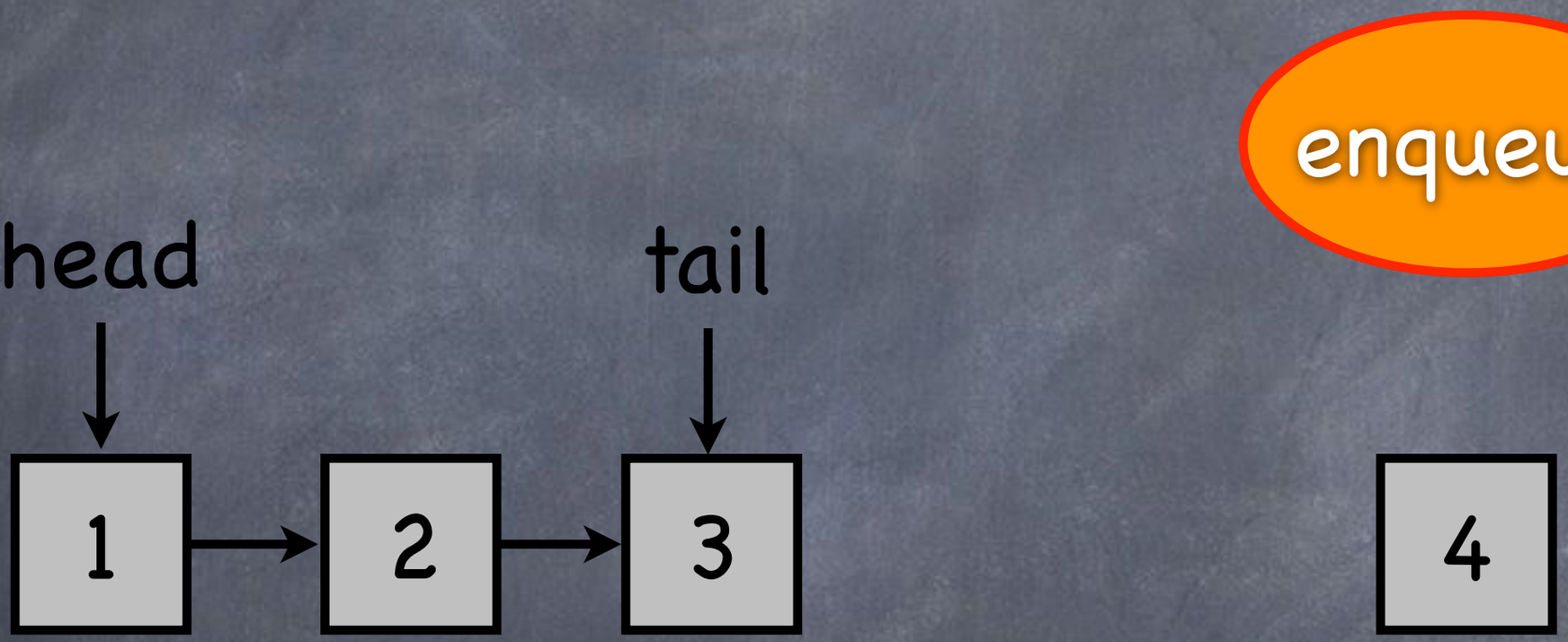

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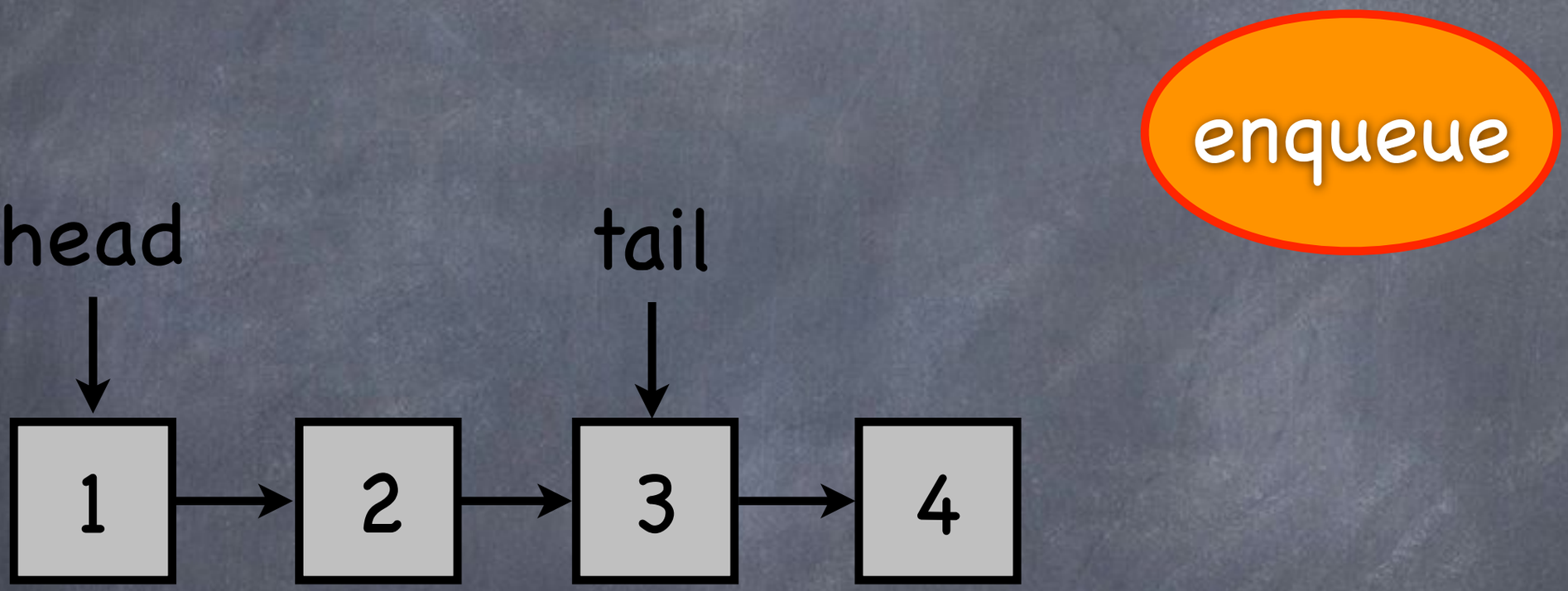

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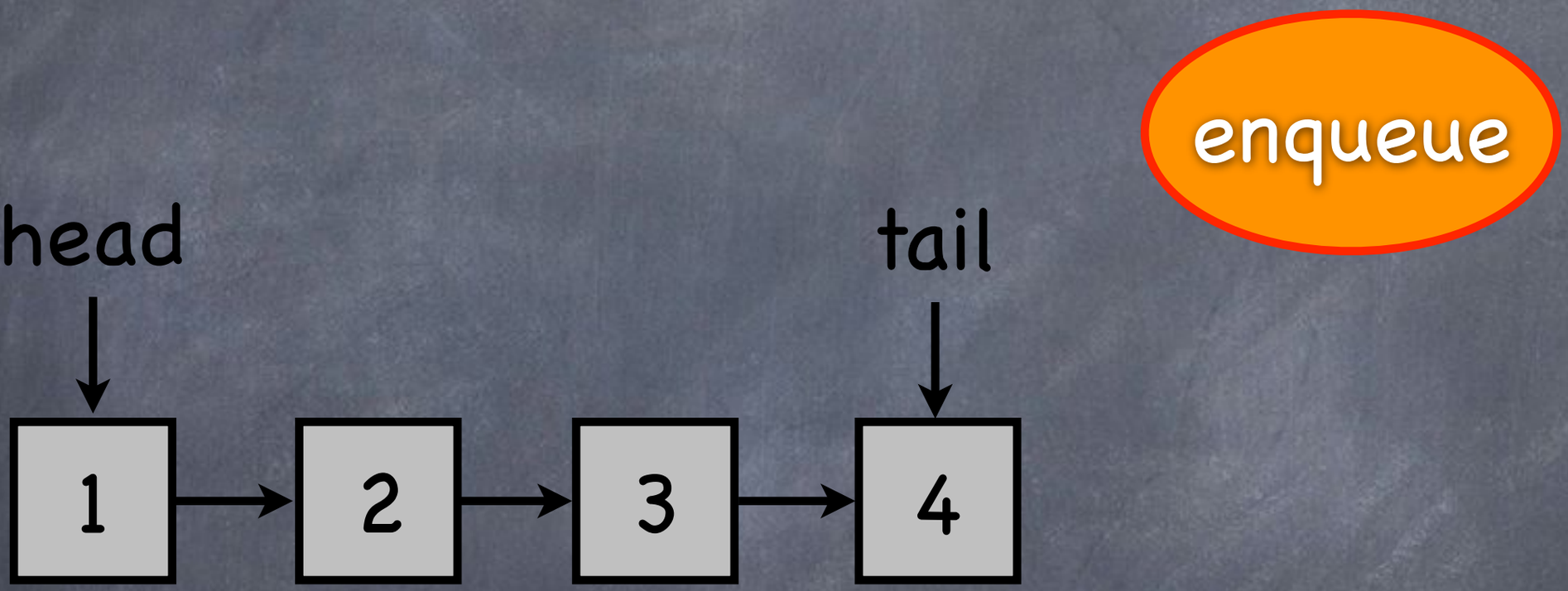

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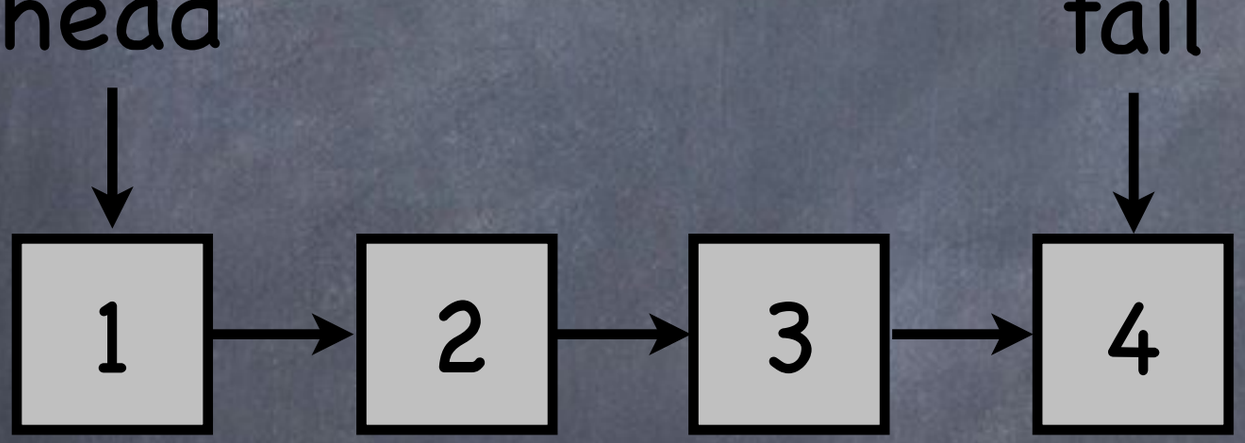

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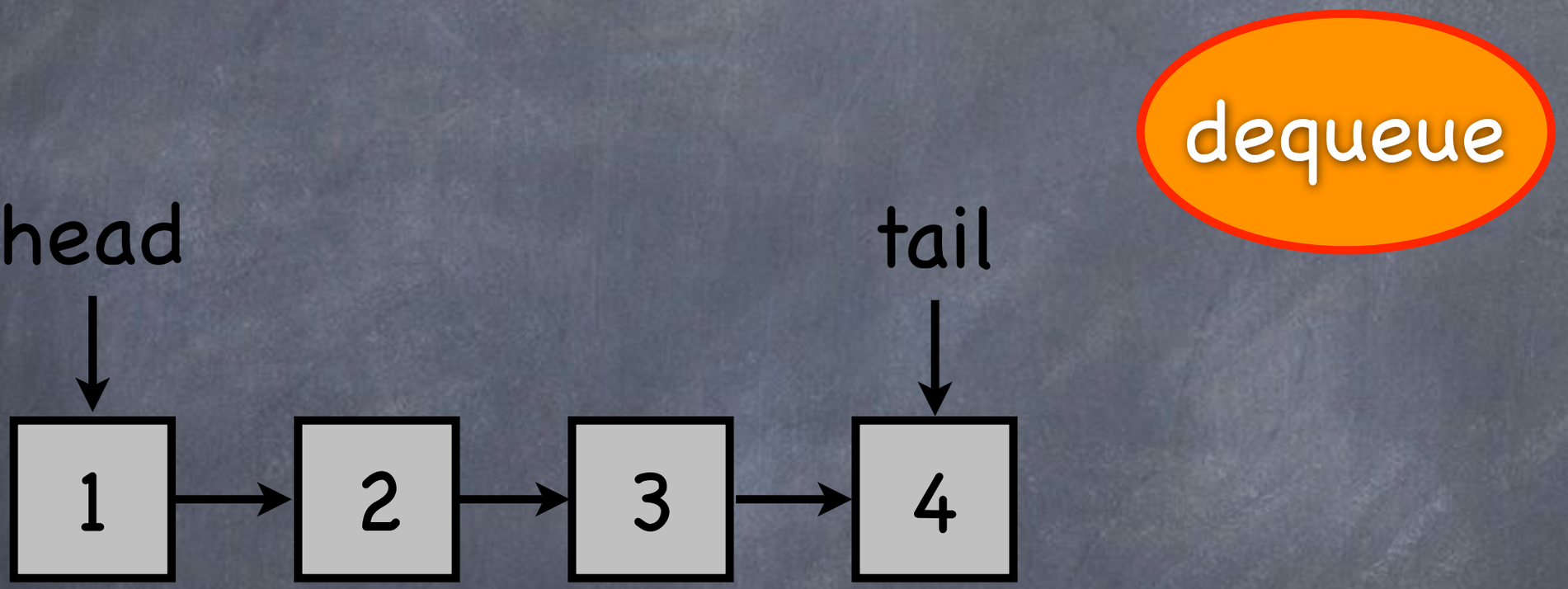

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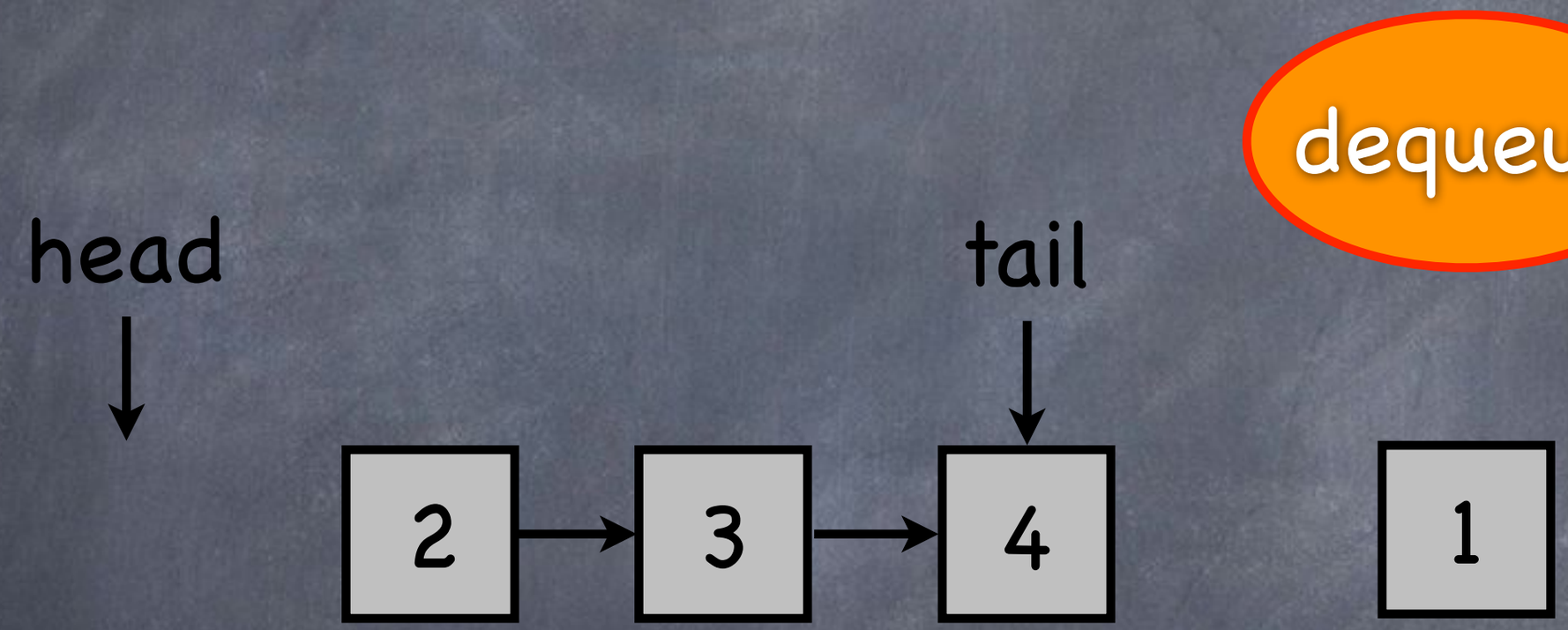

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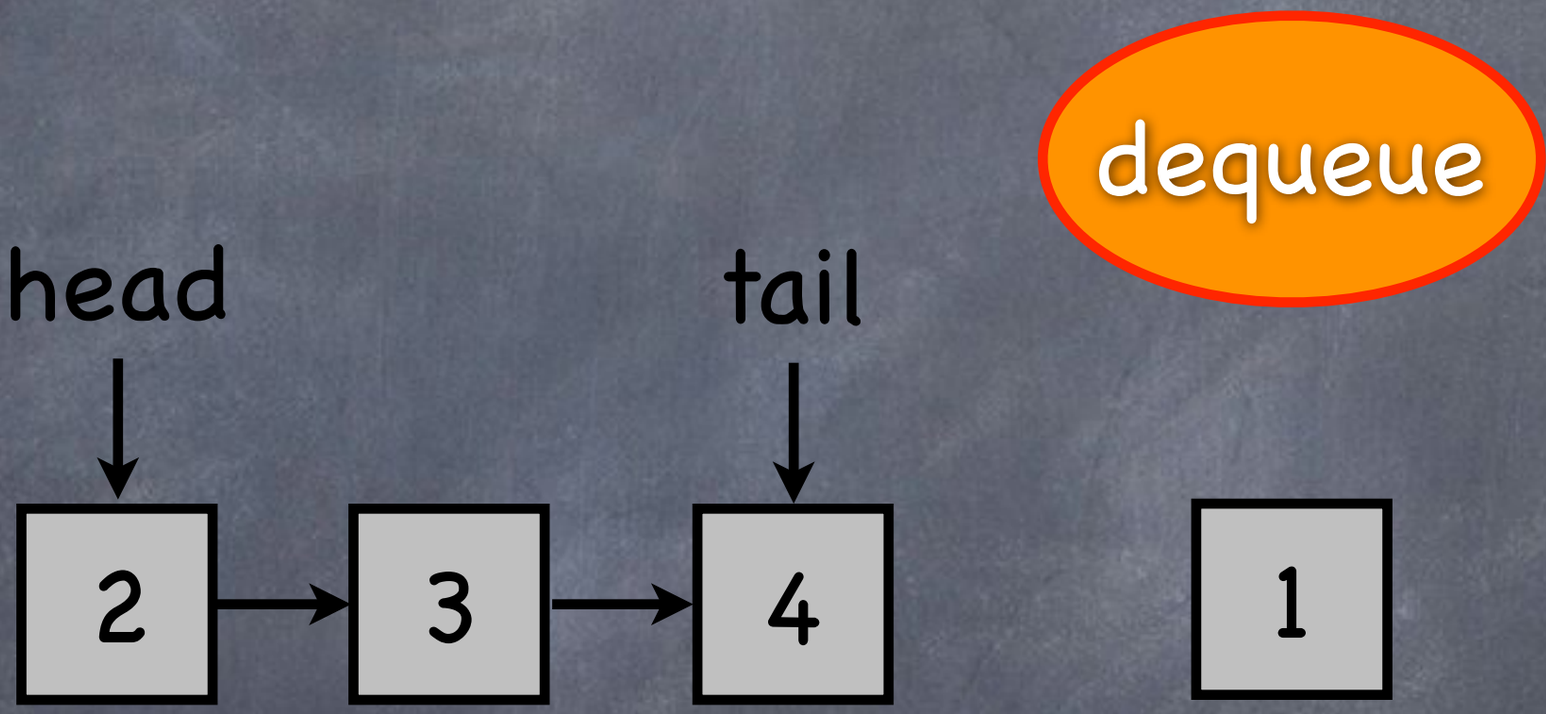

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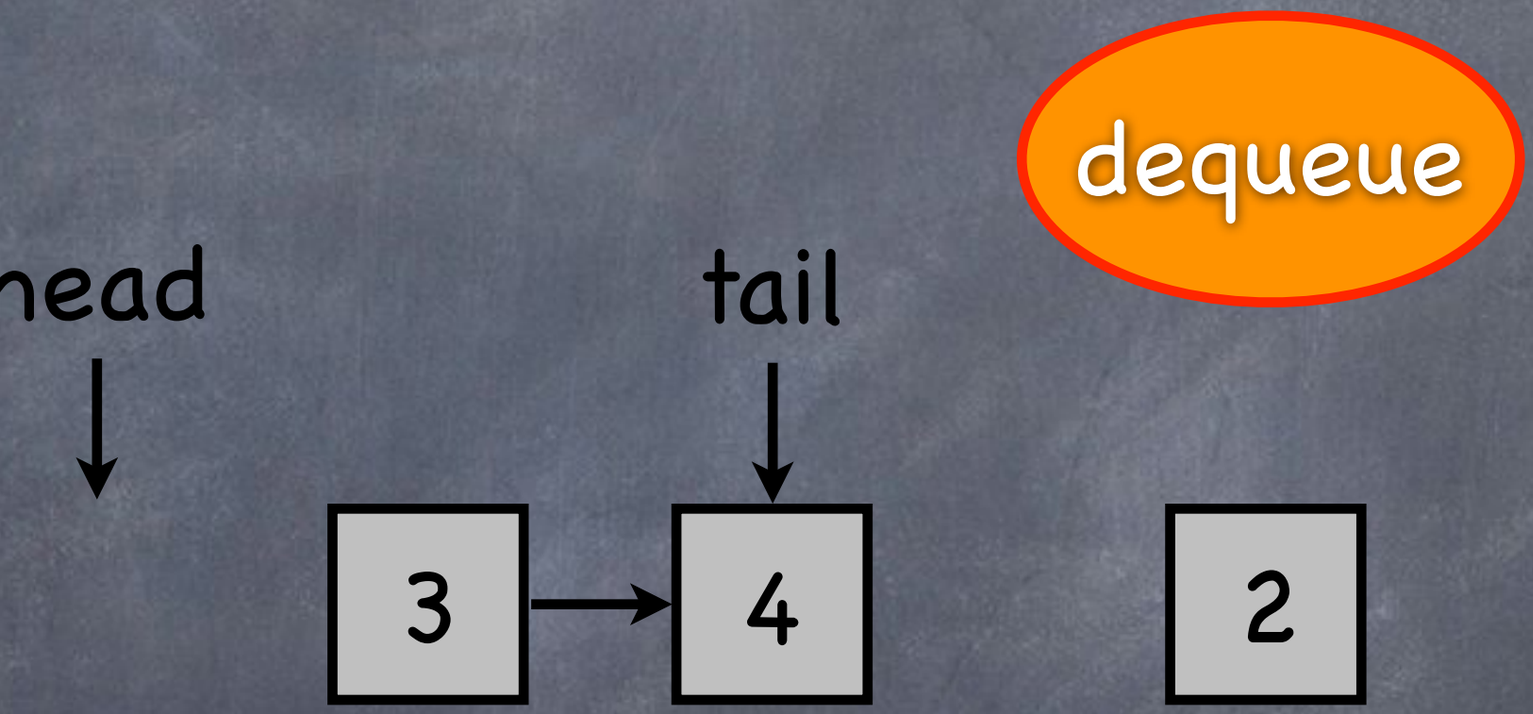

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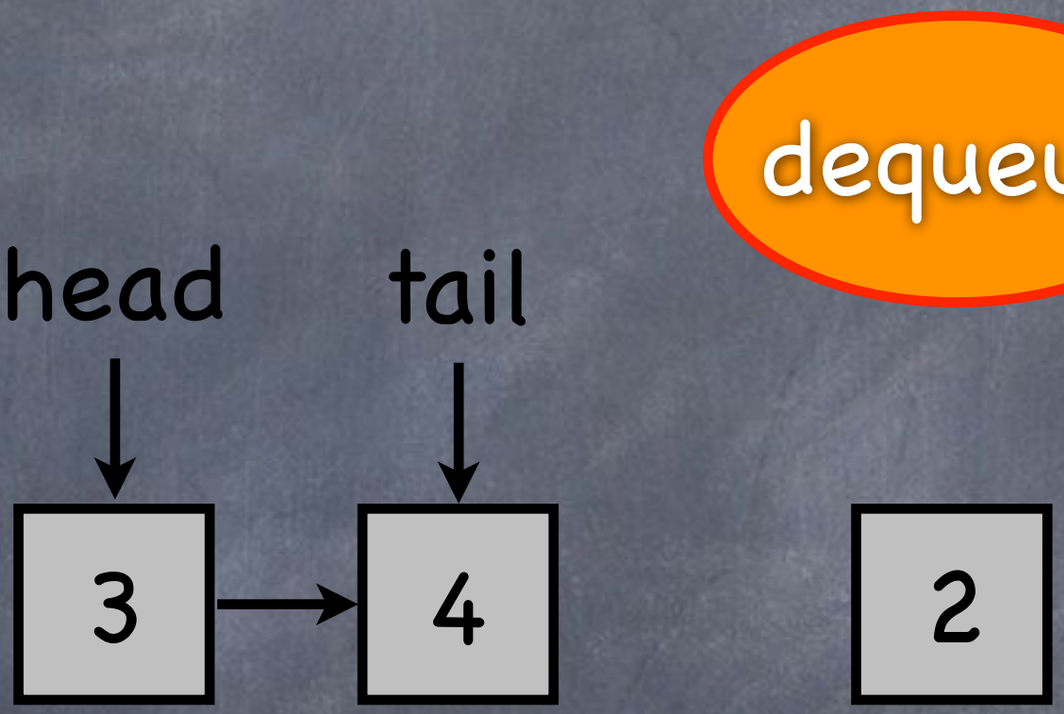
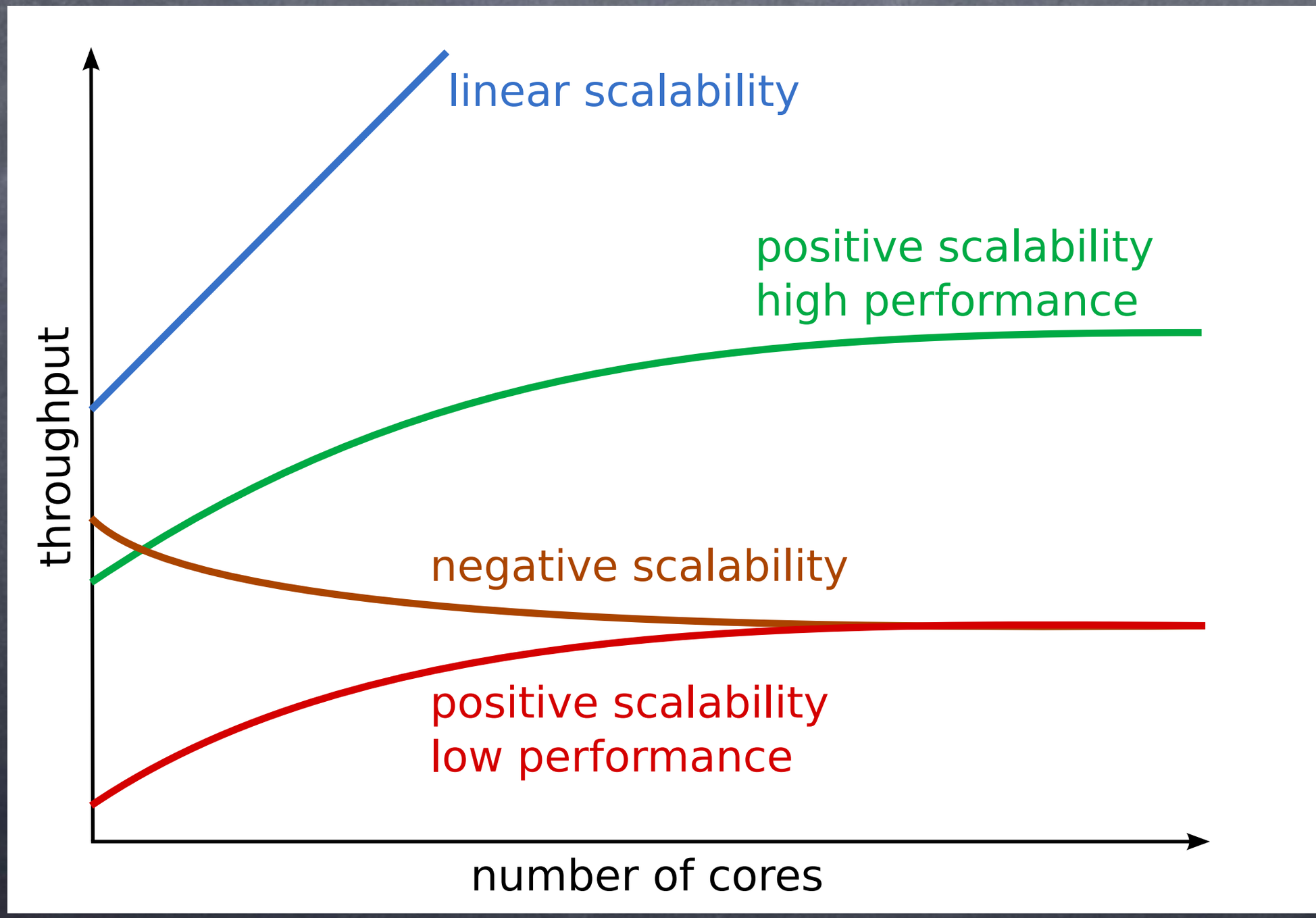
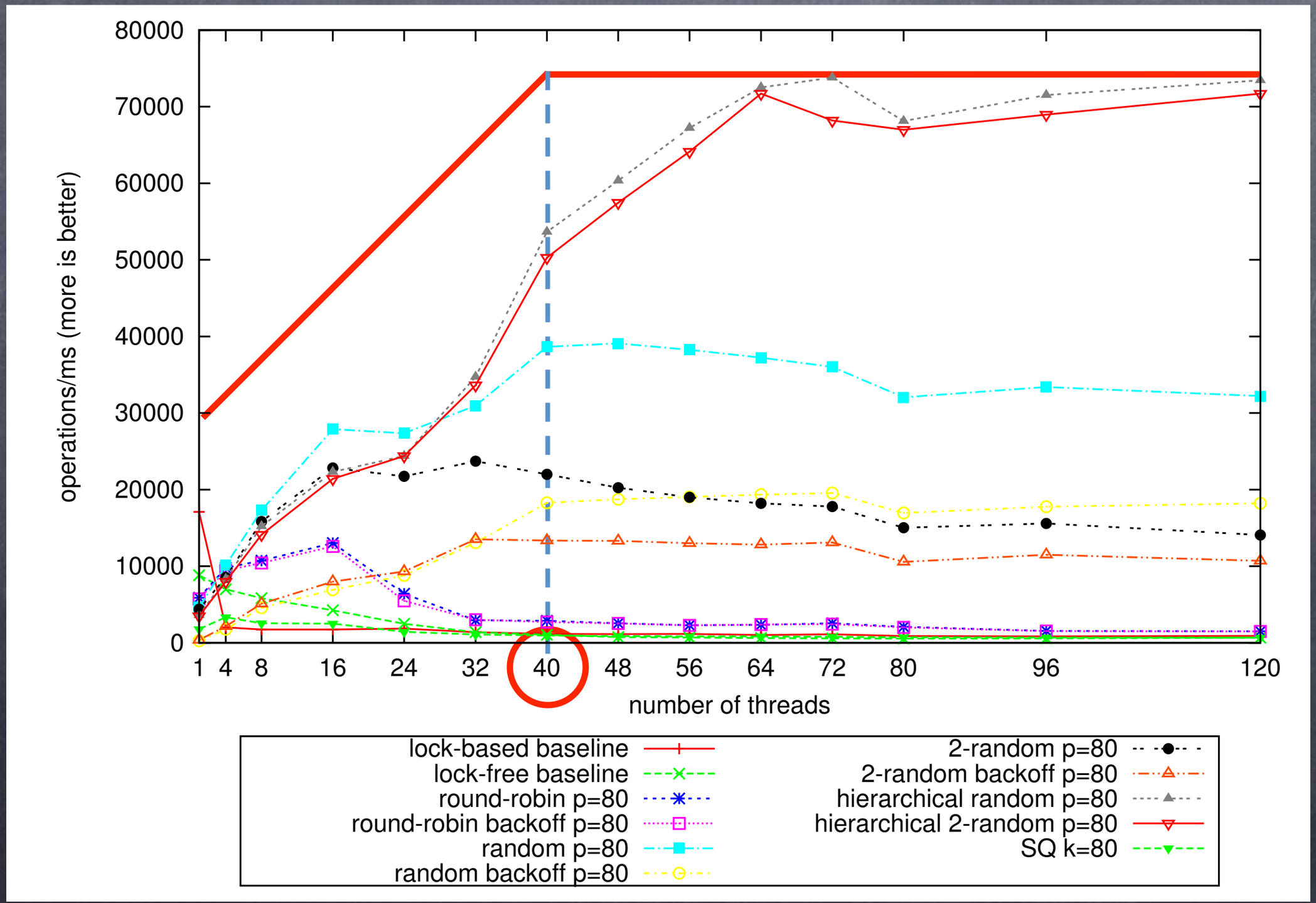


-> memory contention on head and tail pointers!

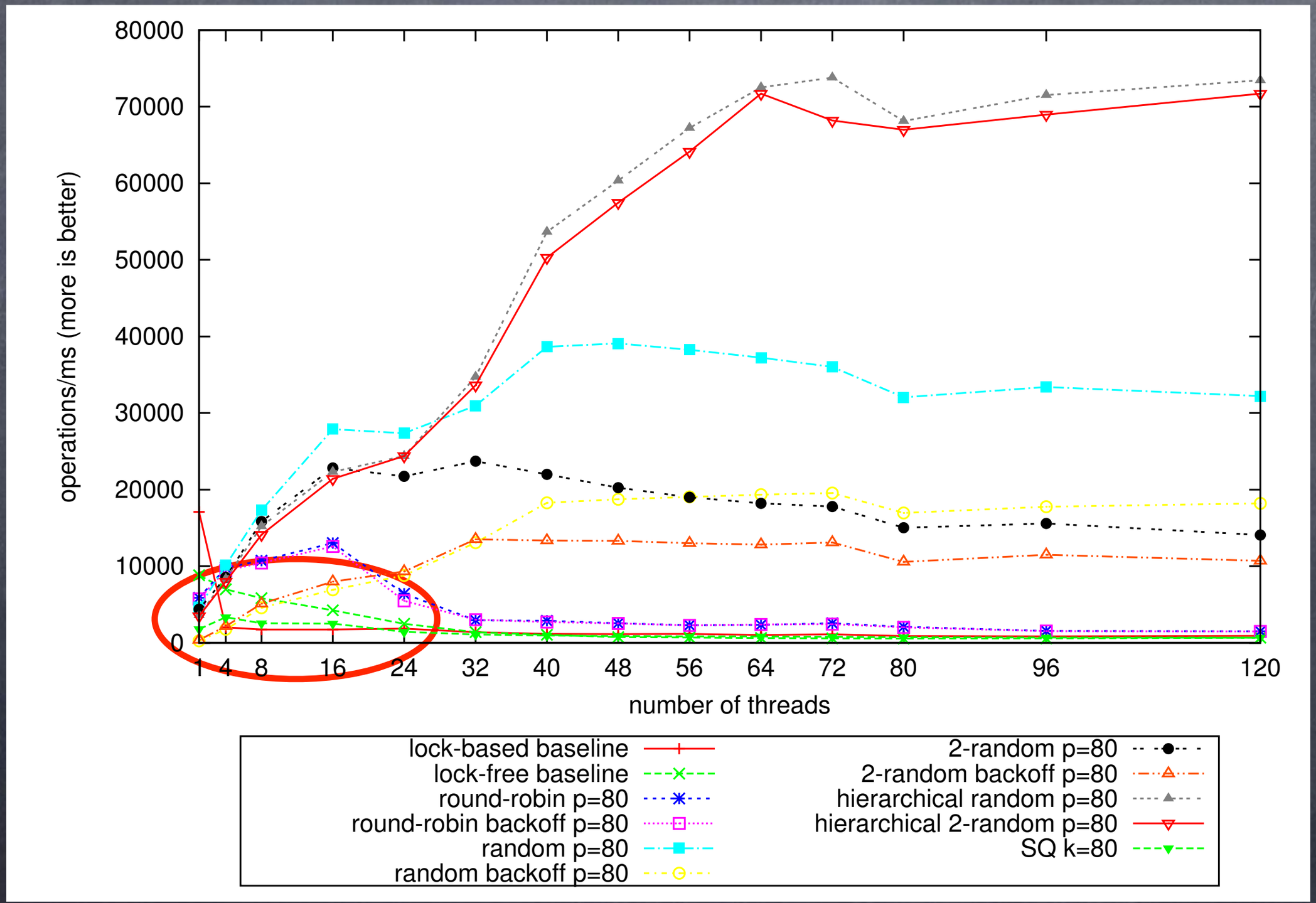
Performance & Scalability



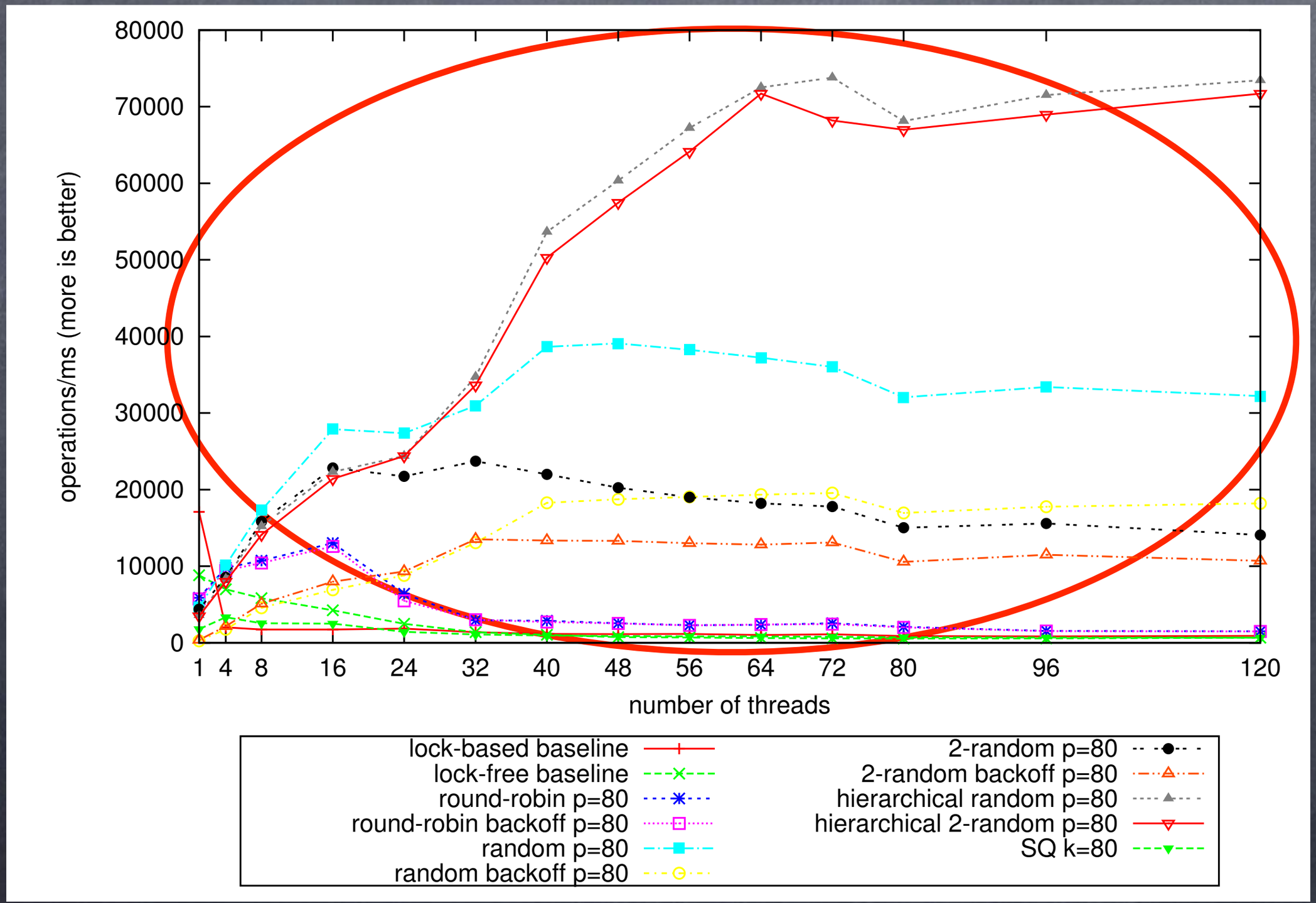
Ideal 40-Core Performance



Regular FIFO Queues



Our "k-FIFO" Queues



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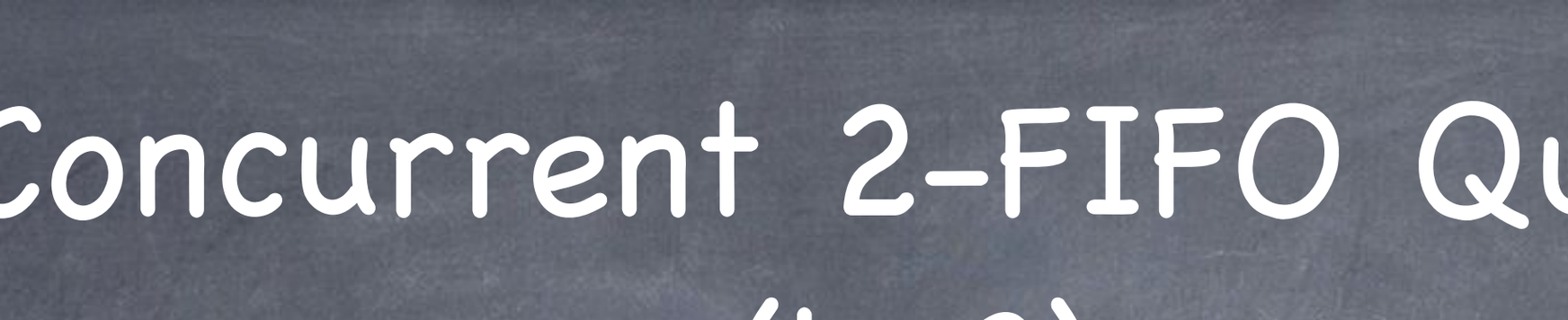
- 0-FIFO queue = regular FIFO queue
- bigger k -> better performance, scalability?

Concurrent 2-FIFO Queue (k=2)

enqueue

head

tail



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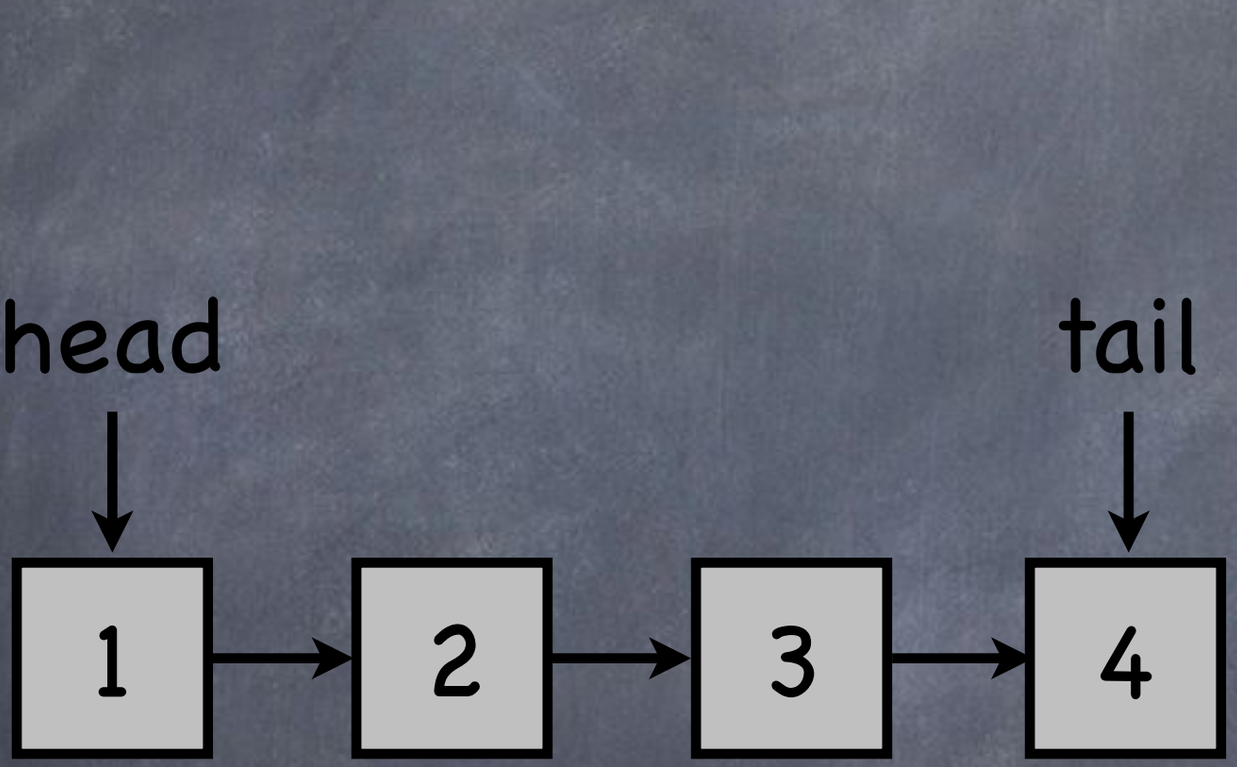

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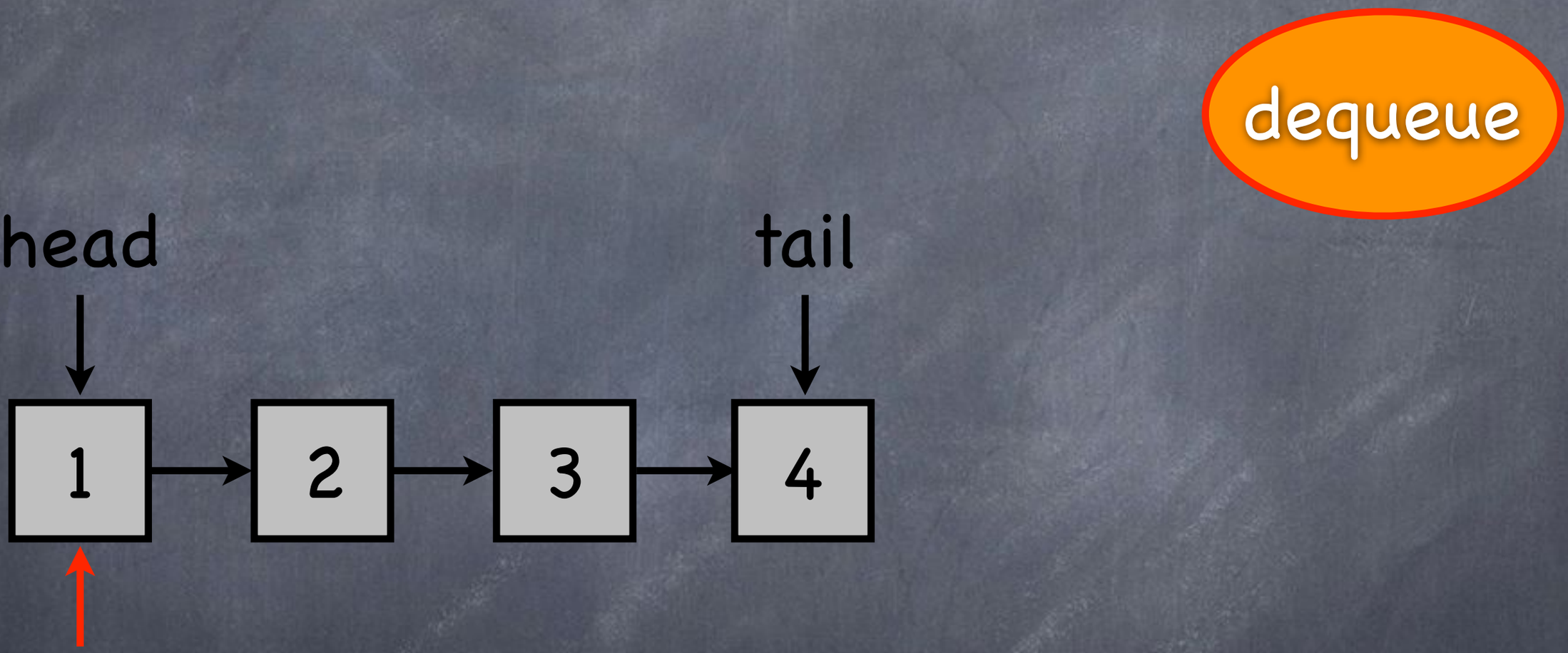

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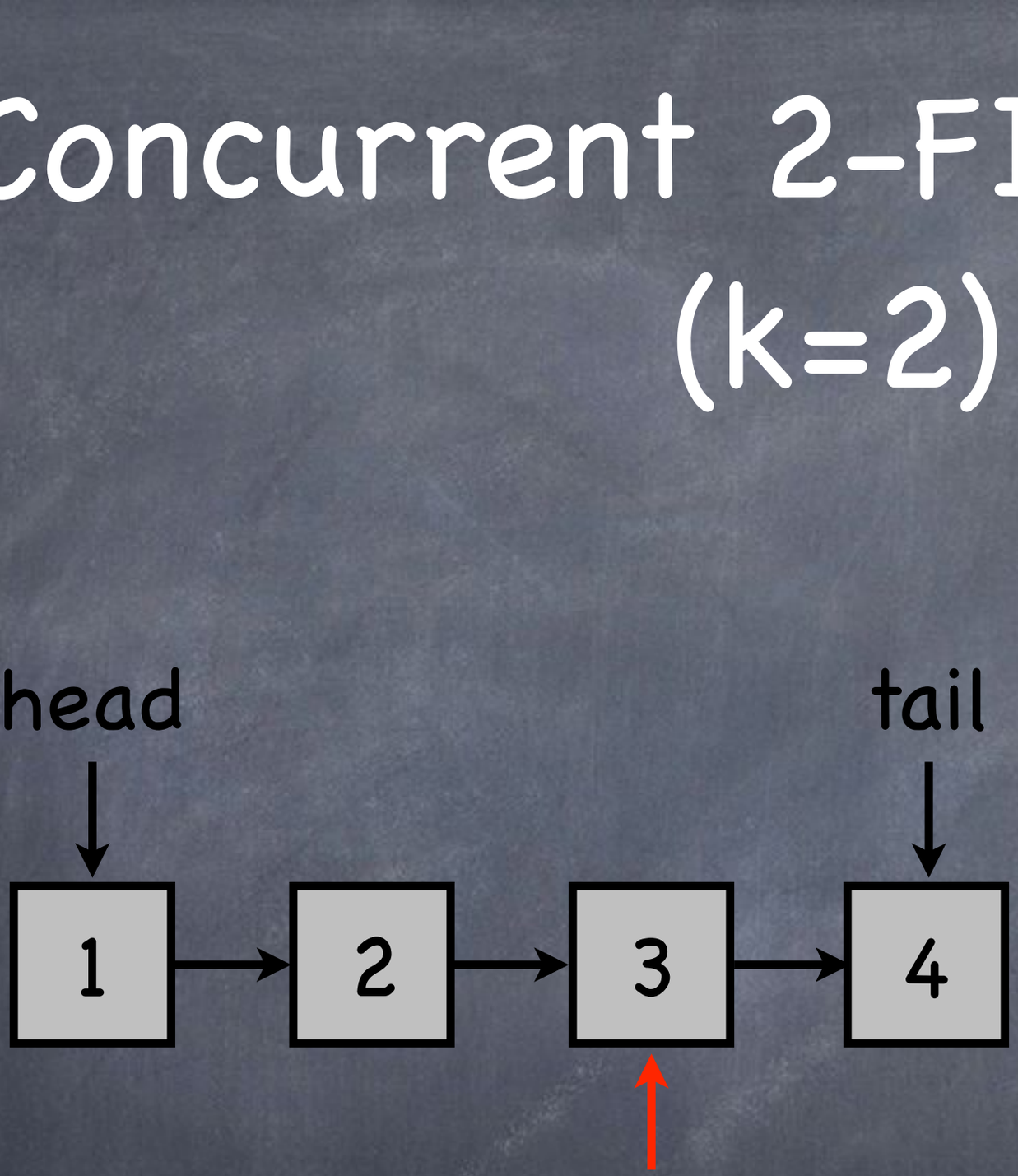

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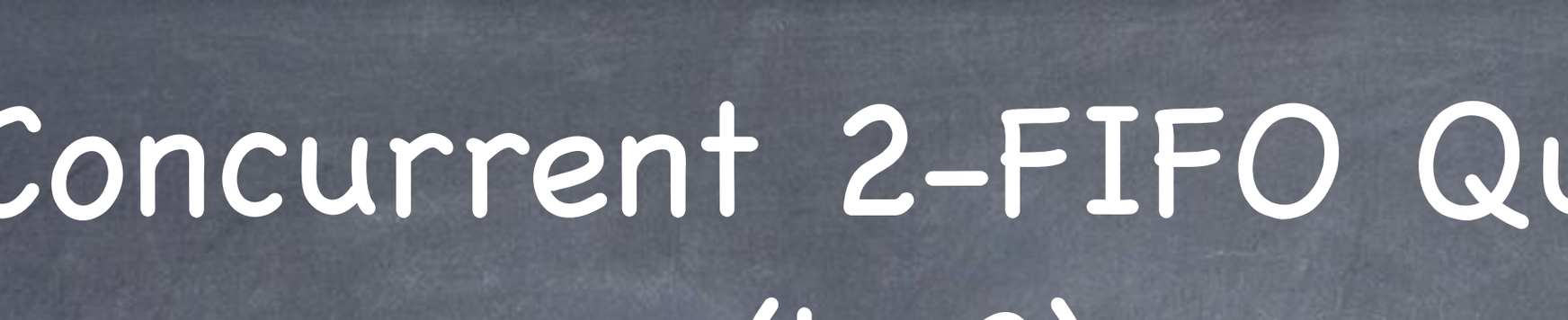

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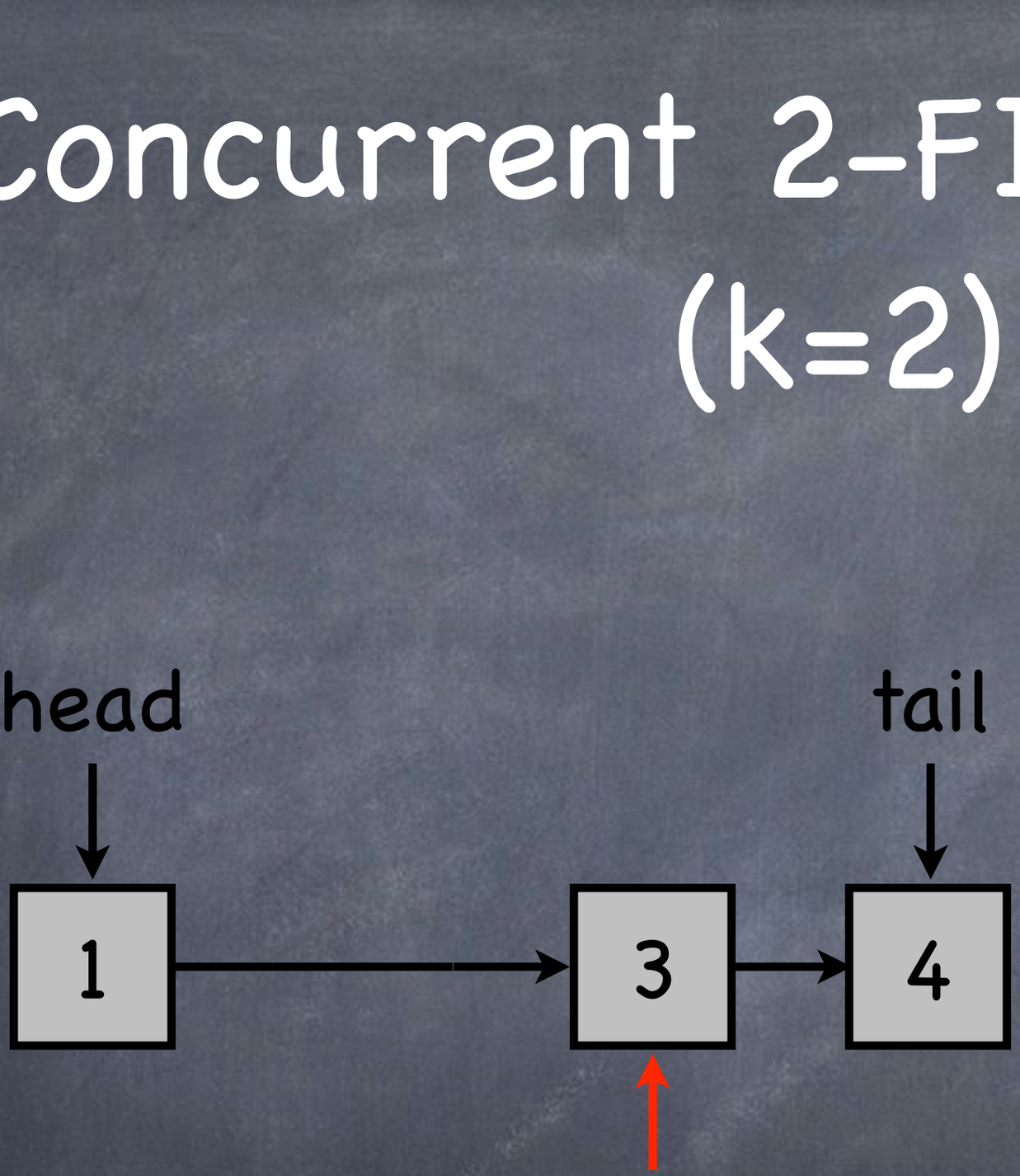

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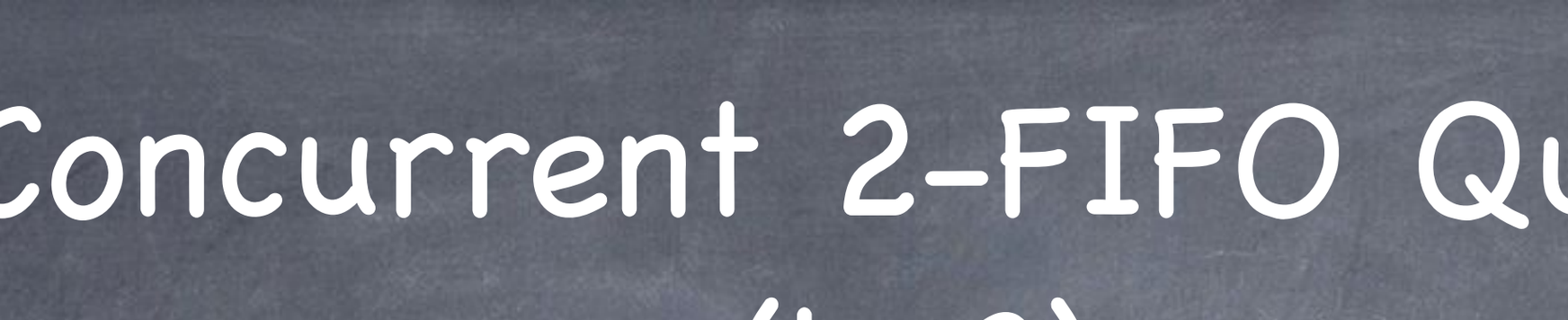

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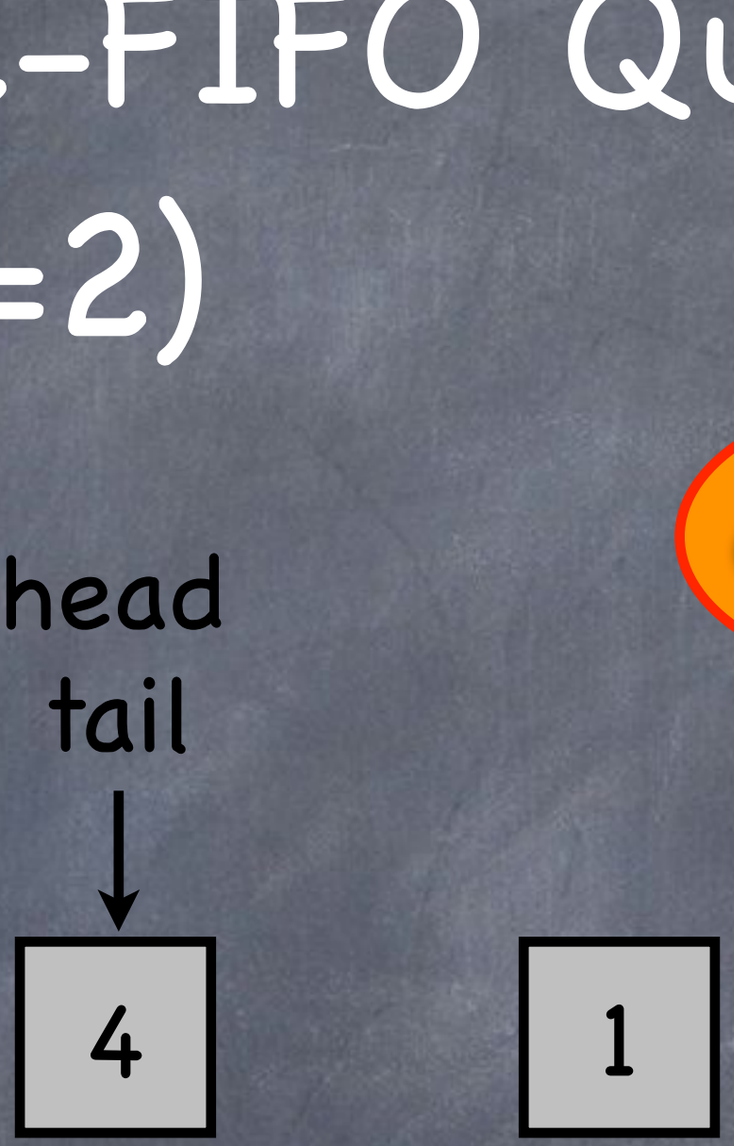
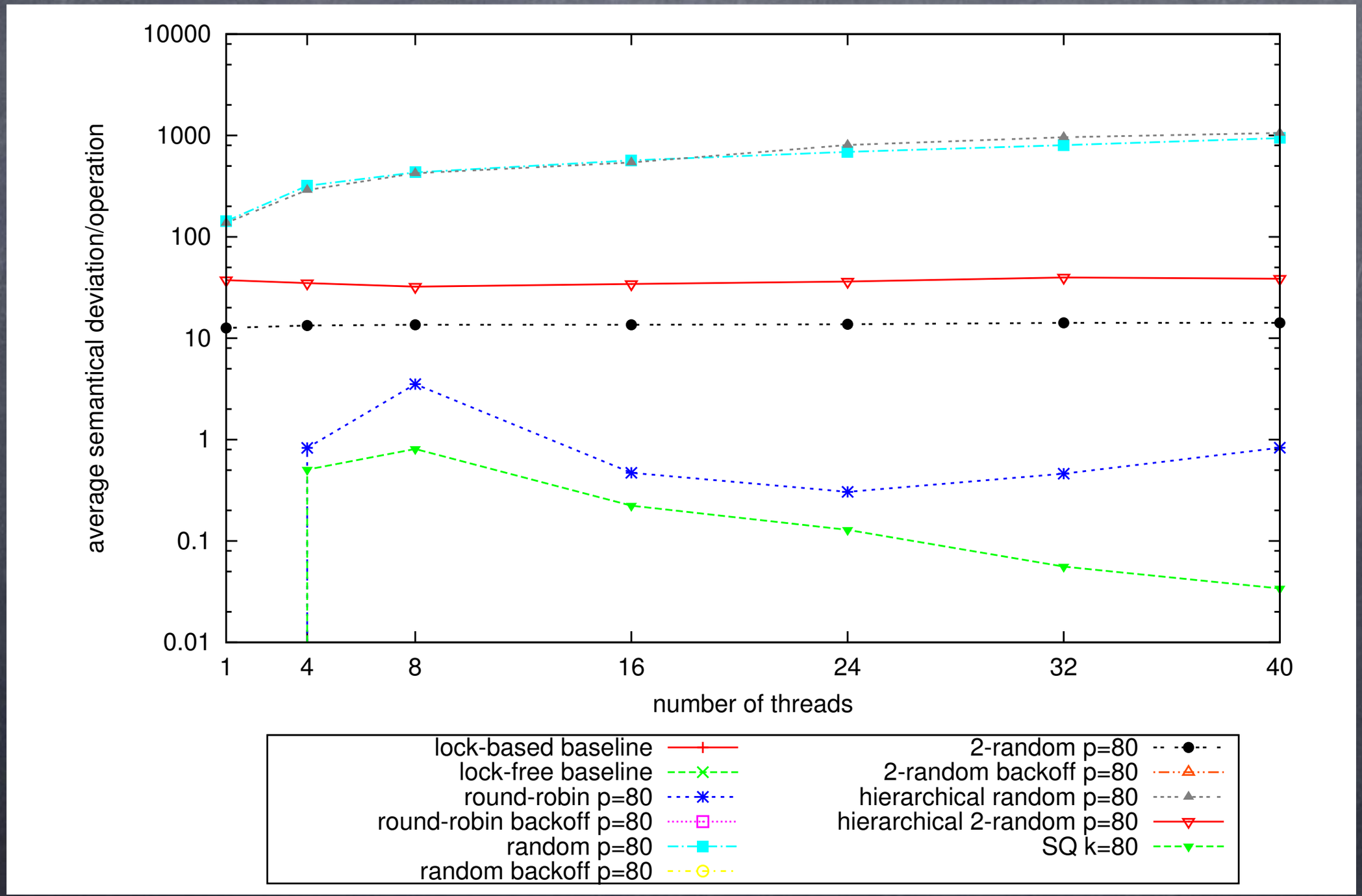


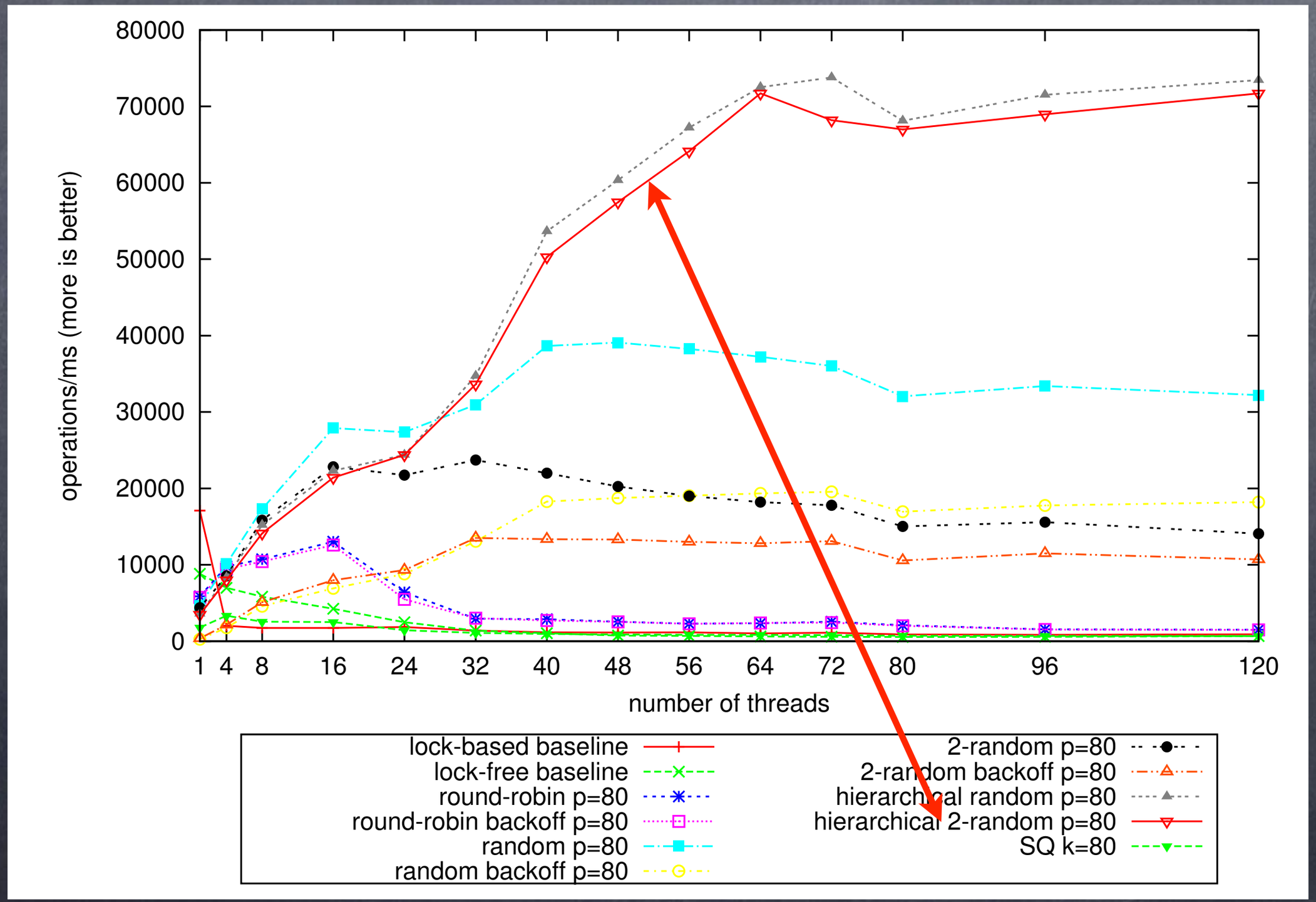
We call k
the worst-case semantical
deviation (WCSD) of
a k-FIFO queue from
a regular FIFO queue

The actual semantical deviation (ASD) is the semantical deviation of a k-FIFO queue when applied to a given workload

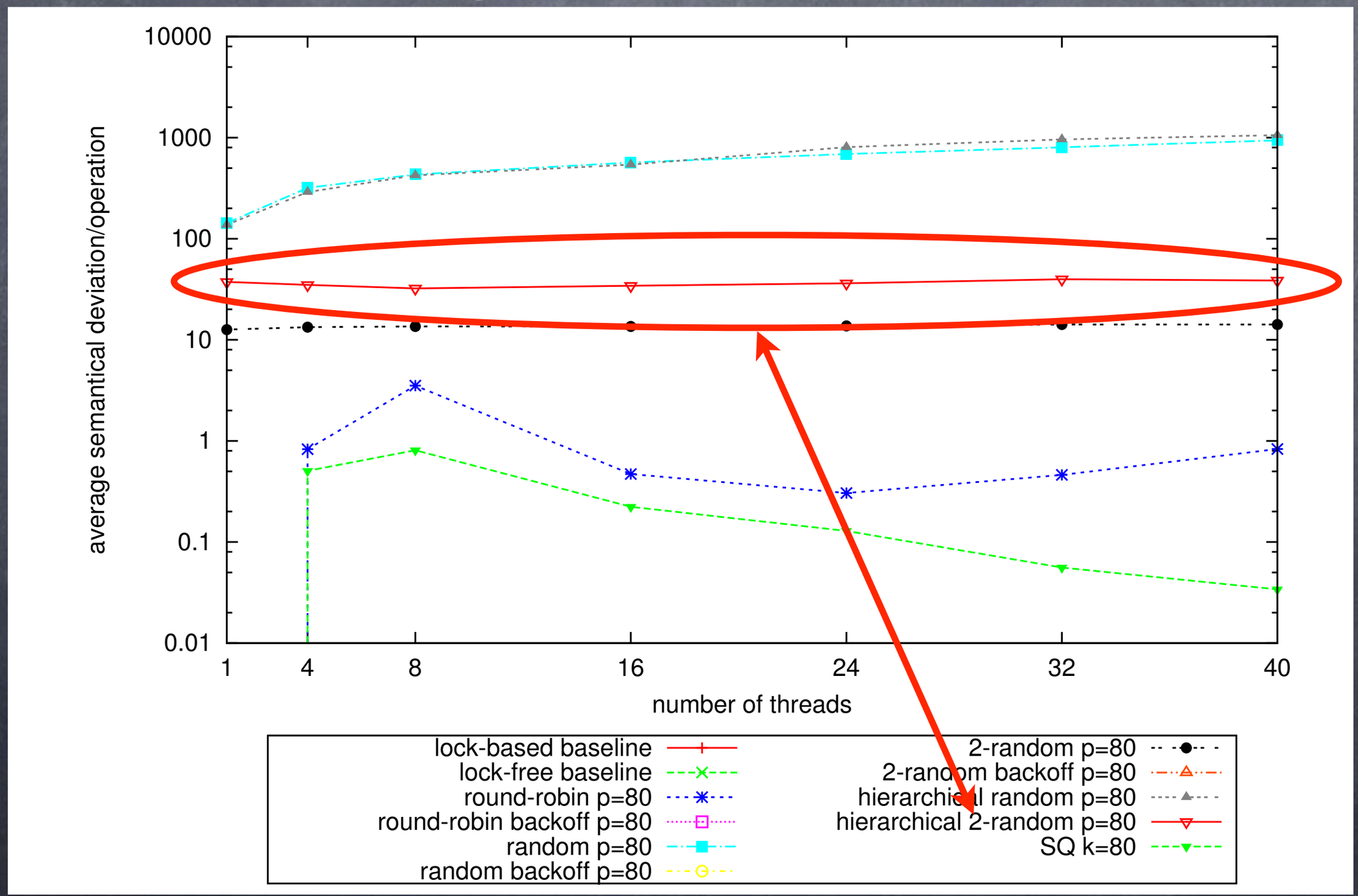
Actual Semantical Deviation



A bit slower than the best performer but one order of magnitude less semantical deviation



Here k may be around 50 on average: best tradeoff



Questions?