Parallel Fringe Search

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Design of Parallel and High-Performance Computing

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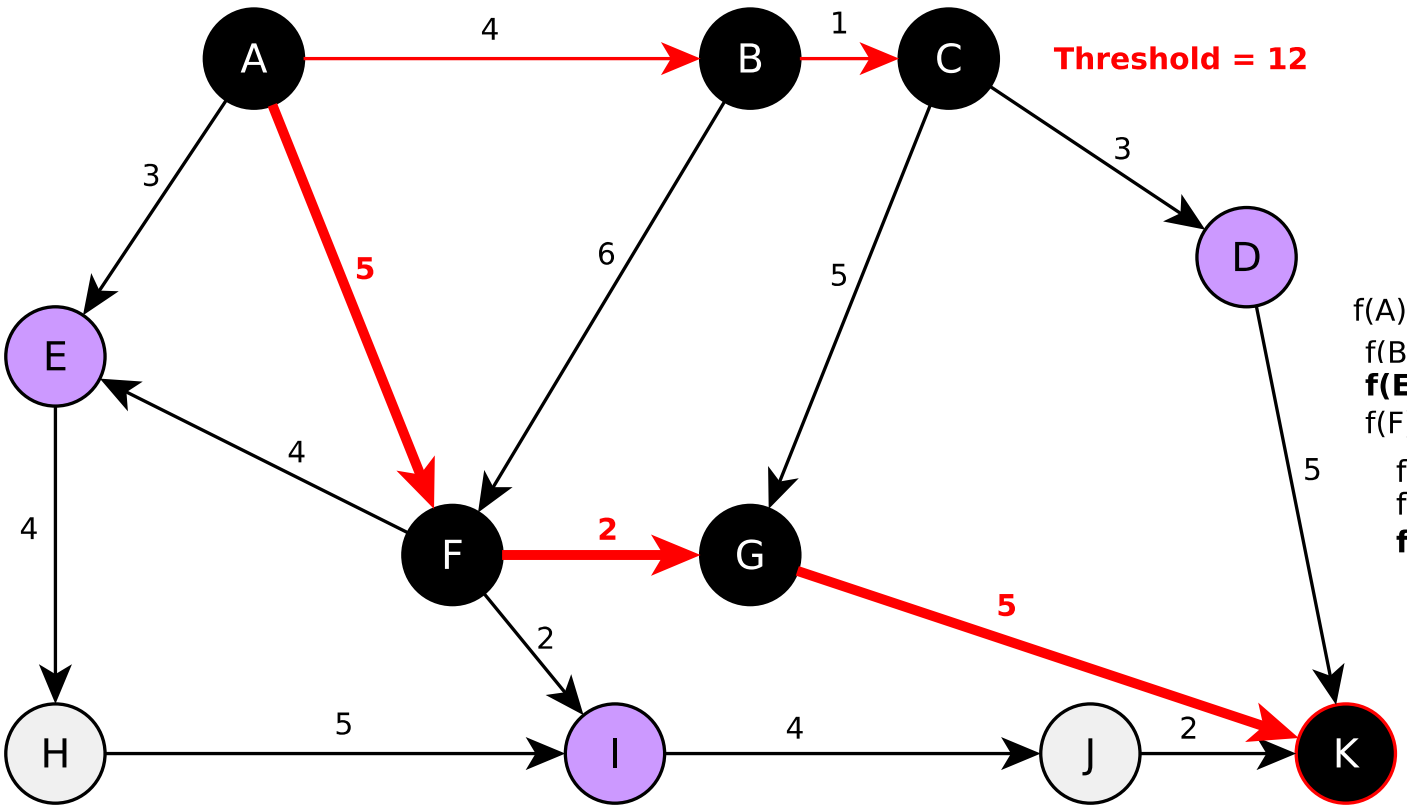
Overview

1. Algorithm
2. What we have done
3. Locking concepts
4. Benchmarks
   - Threshold vs. path length
   - # cores vs. path length
   - Threshold relaxing vs. path length

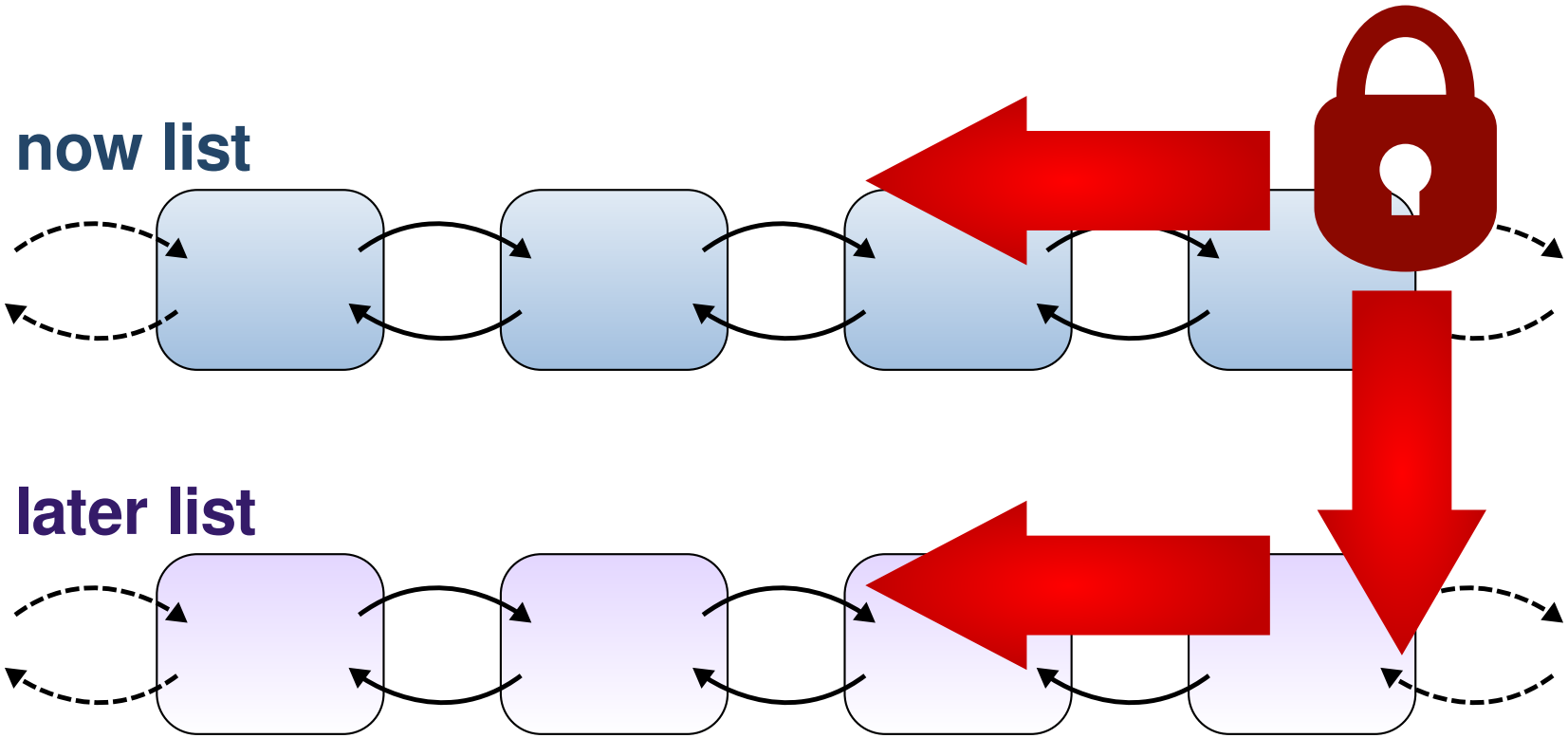
Fringe Search



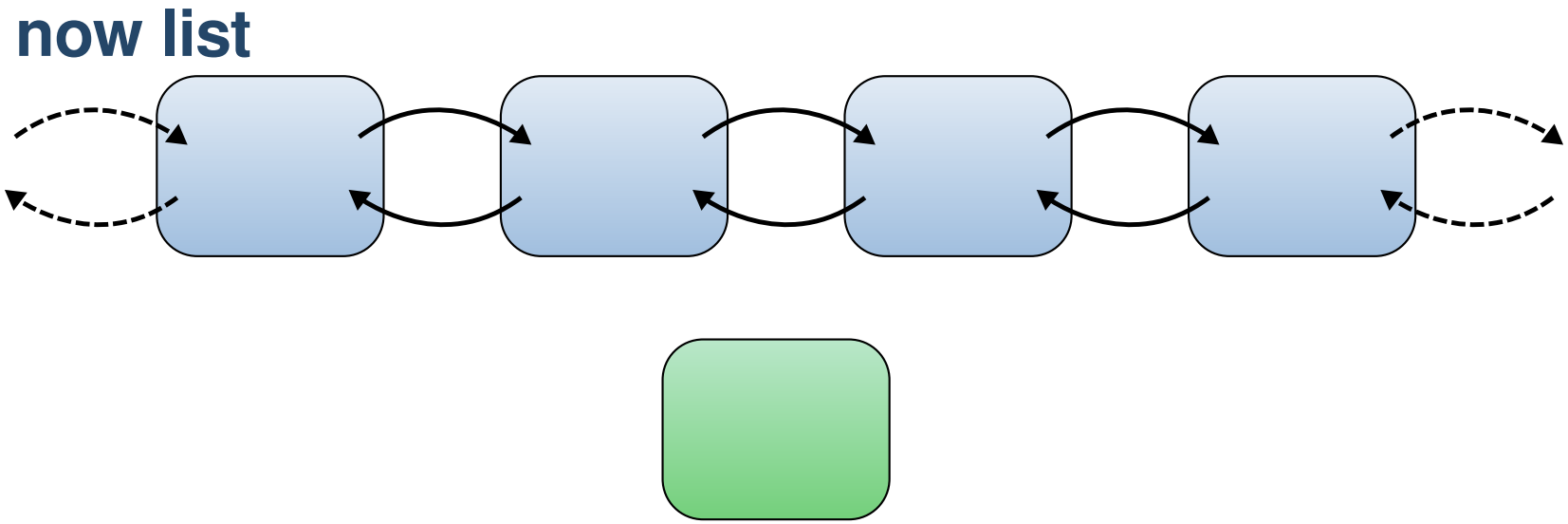
What we have done

- Serial implementation of fringe search (much faster than Boost A*)
- Parallel implementation with Open MP
  - 2 different locking concepts
  - Locks implemented using inline assembly (faster than Open MP locks)
- Benchmarking
  - Strong scaling
  - Weak scaling
  - Path quality

Locking concept: Deadlock prevention



Locking concept: Insert node



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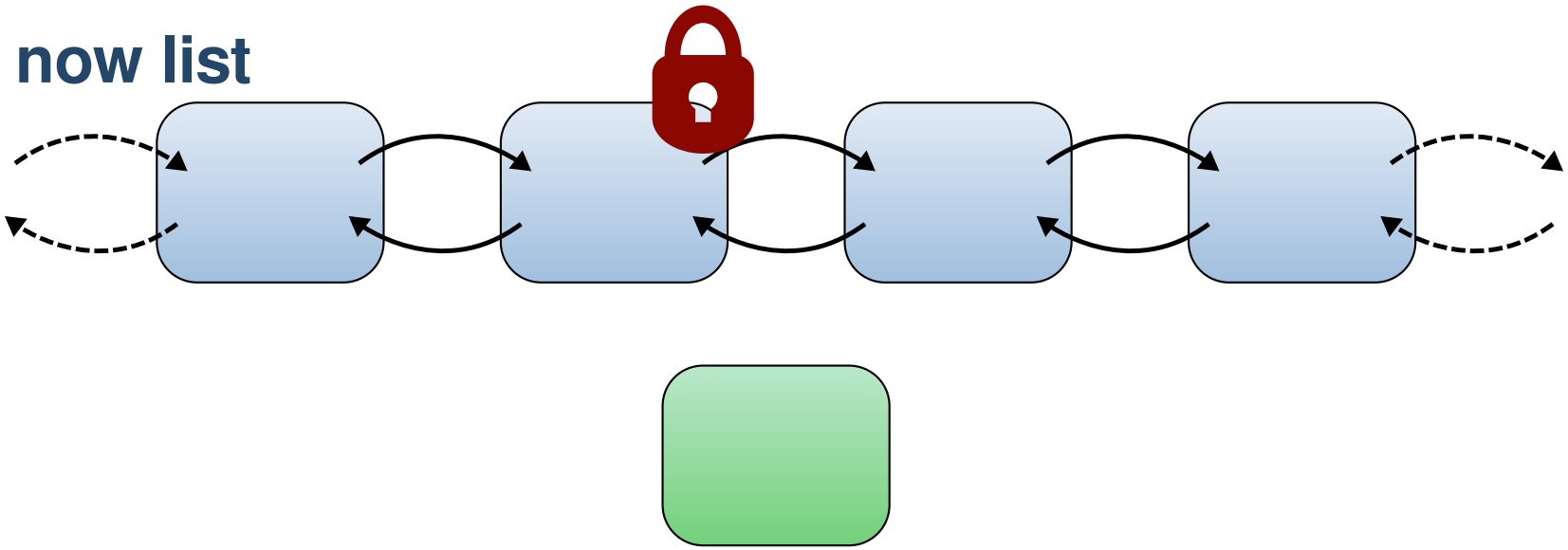

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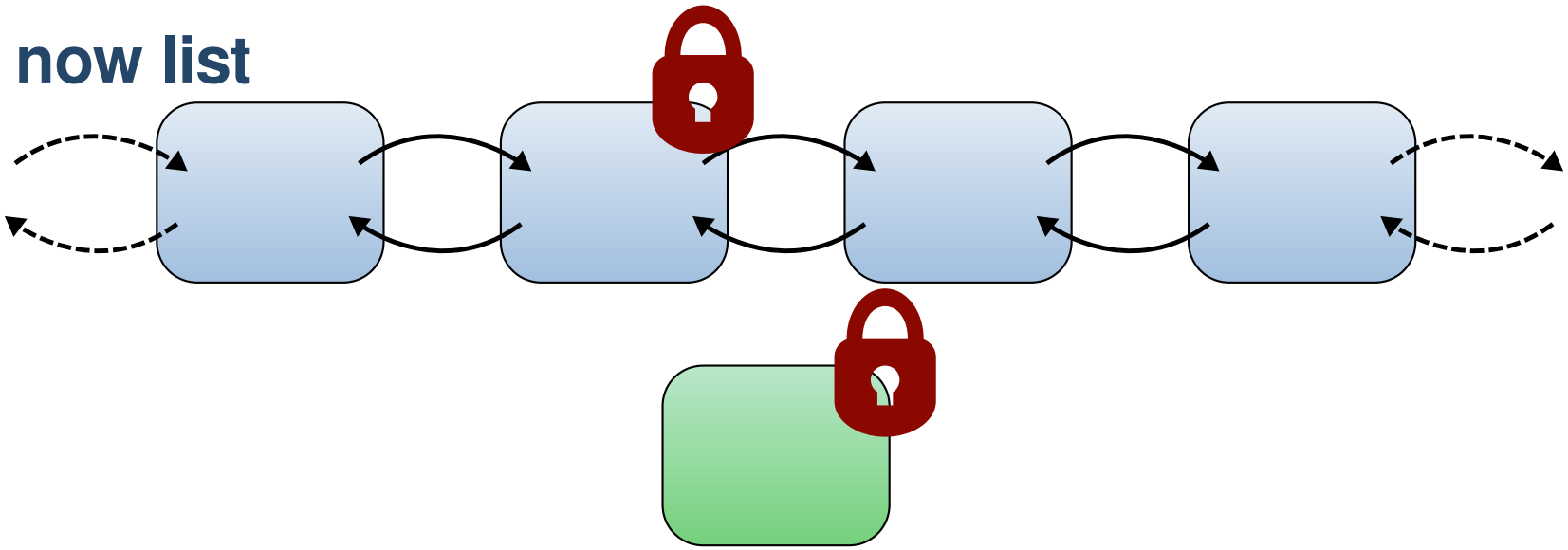

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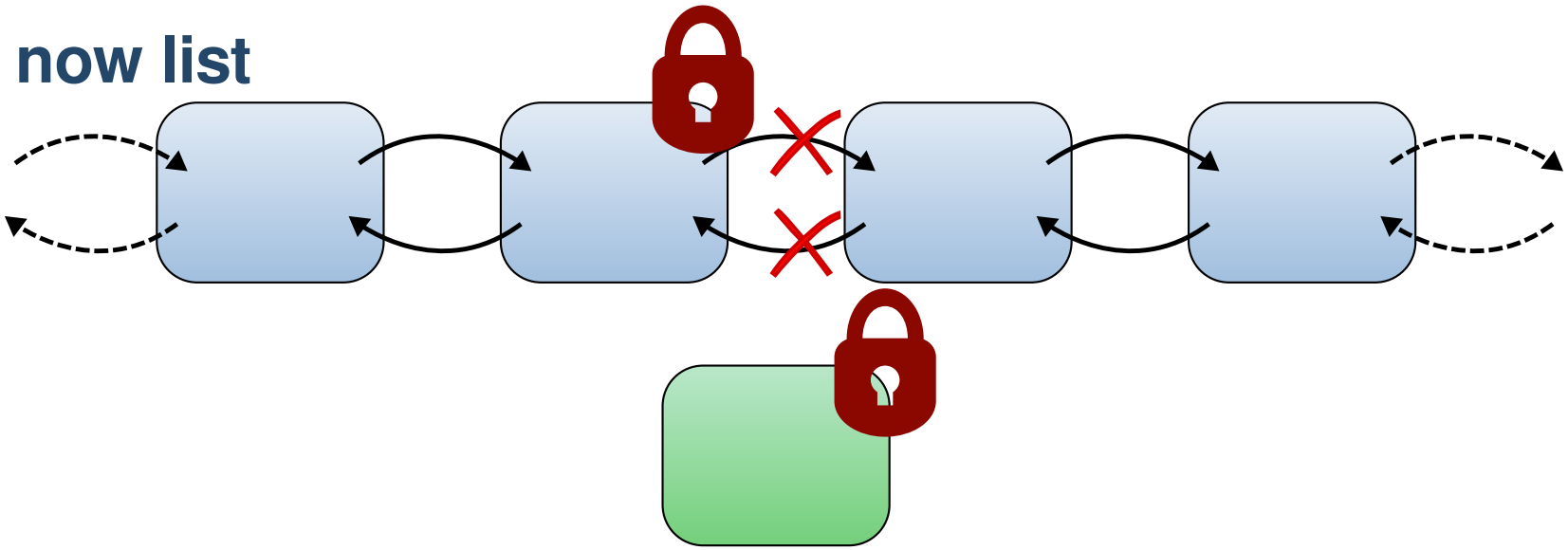

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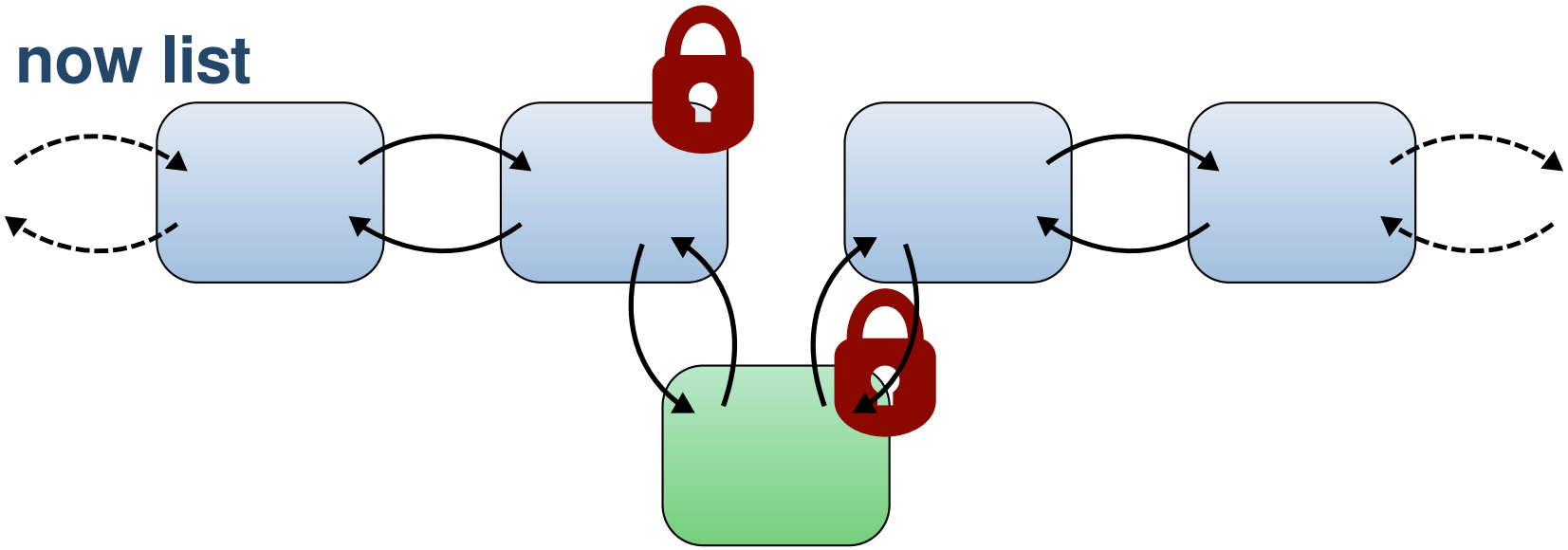

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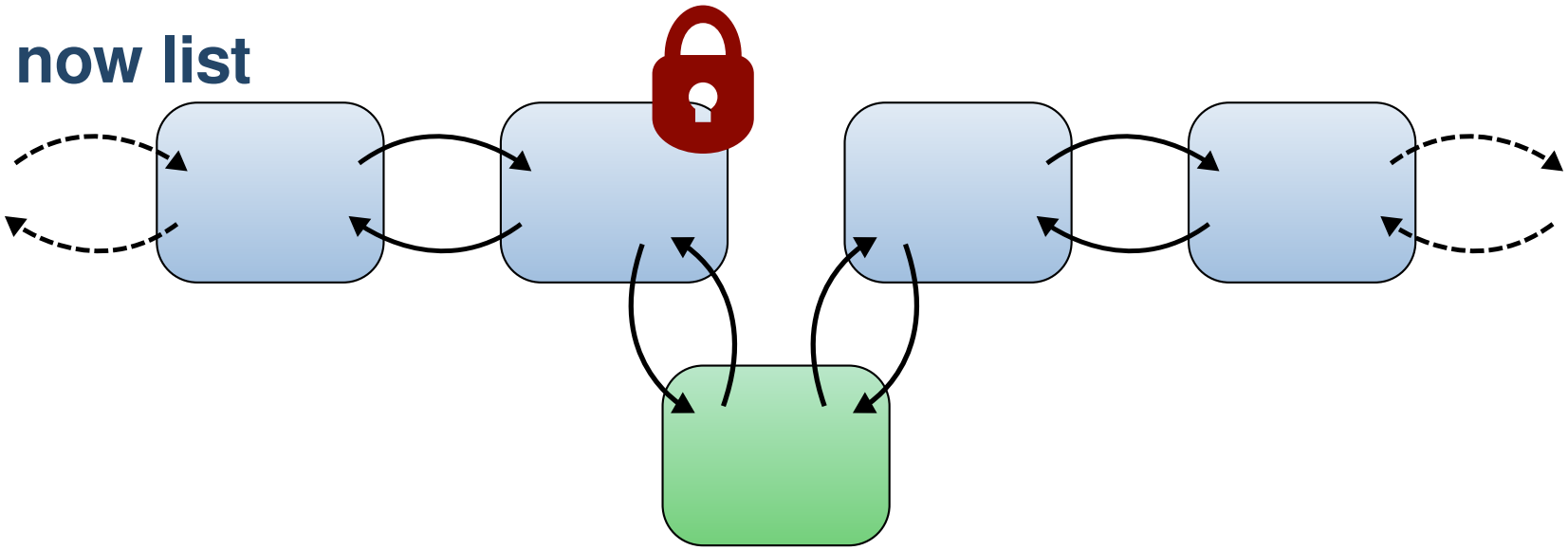

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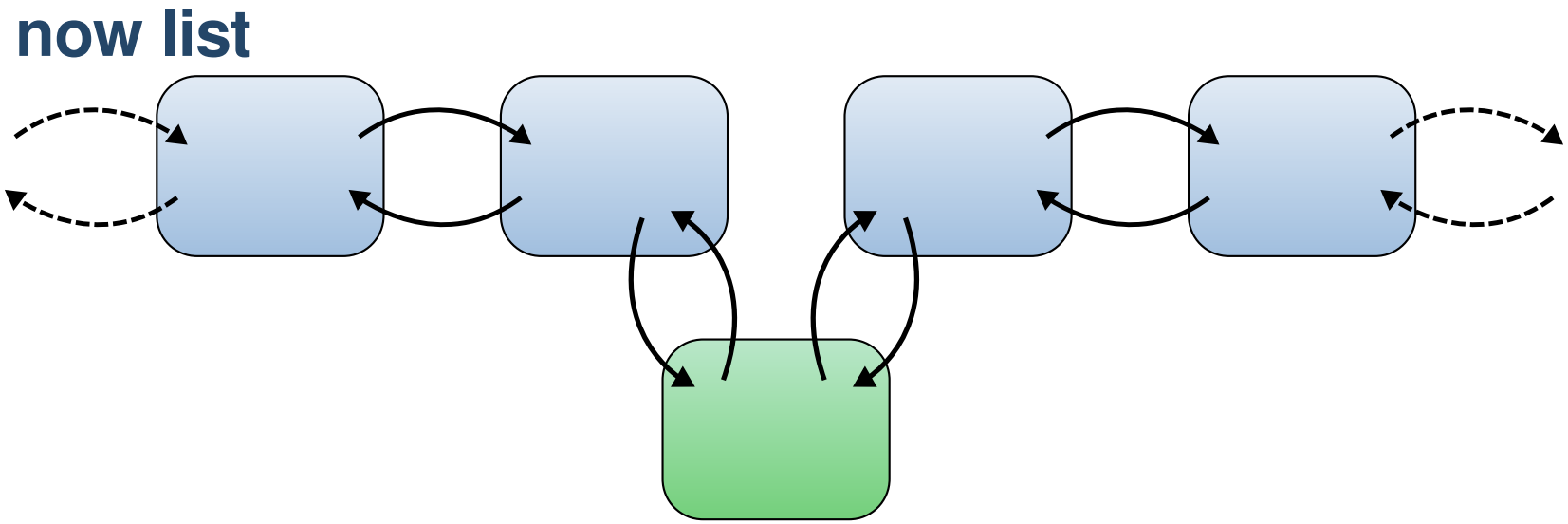
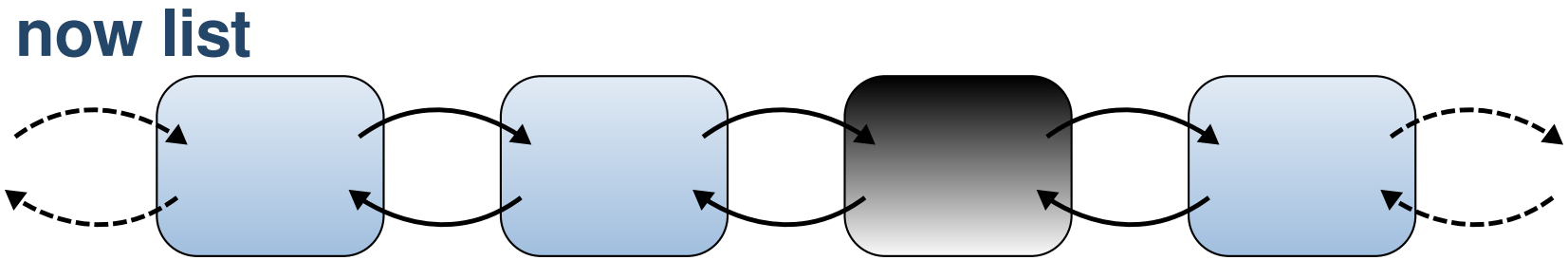


Locking concept: Remove node



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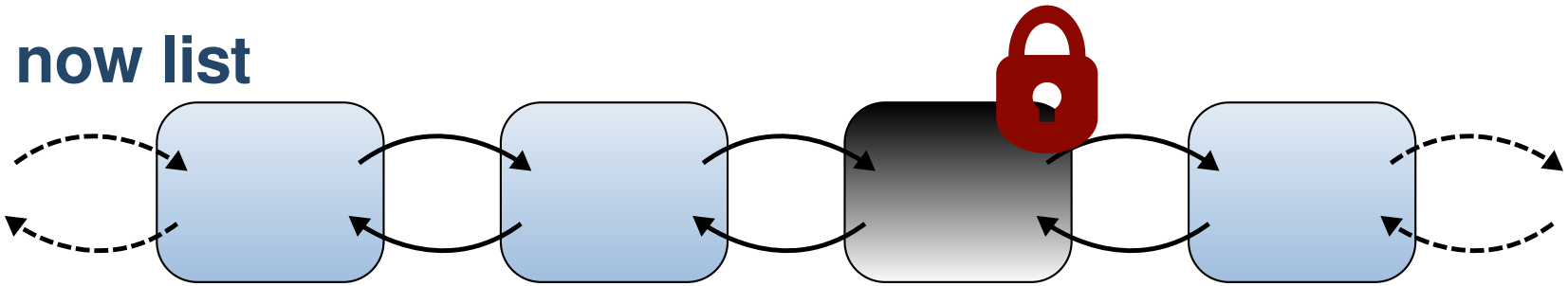

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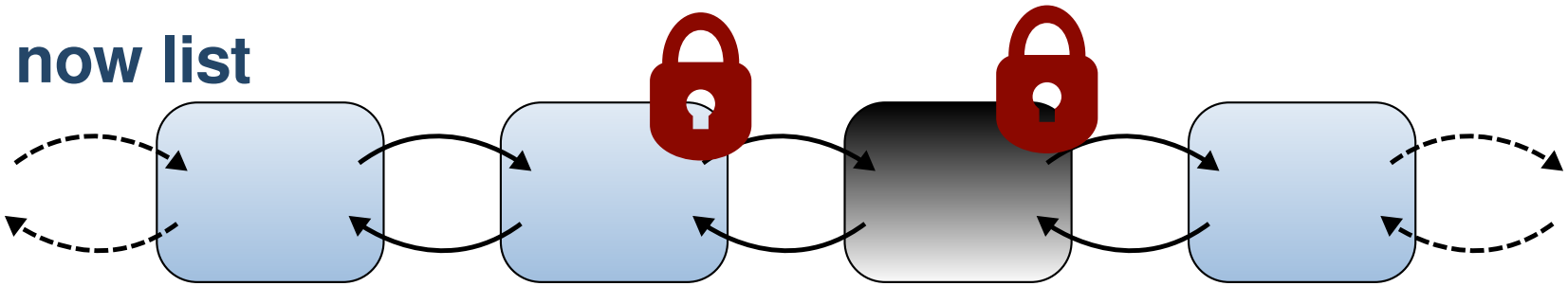

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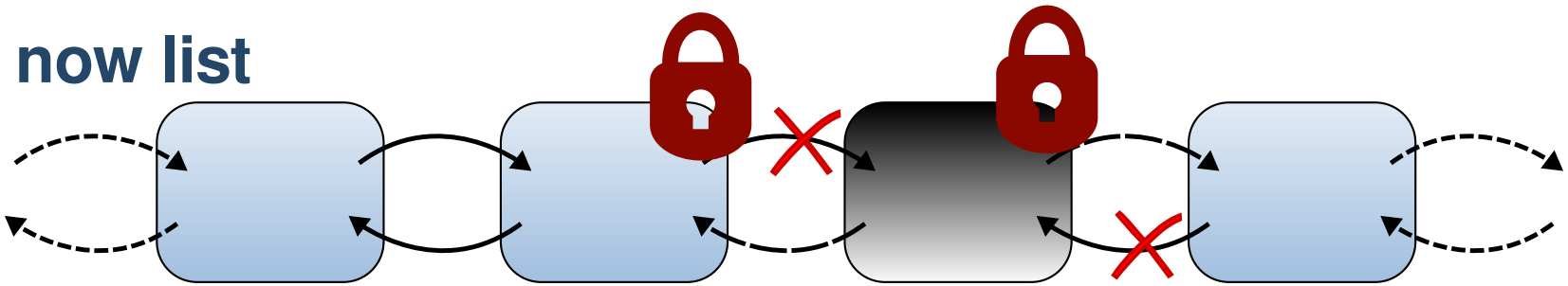

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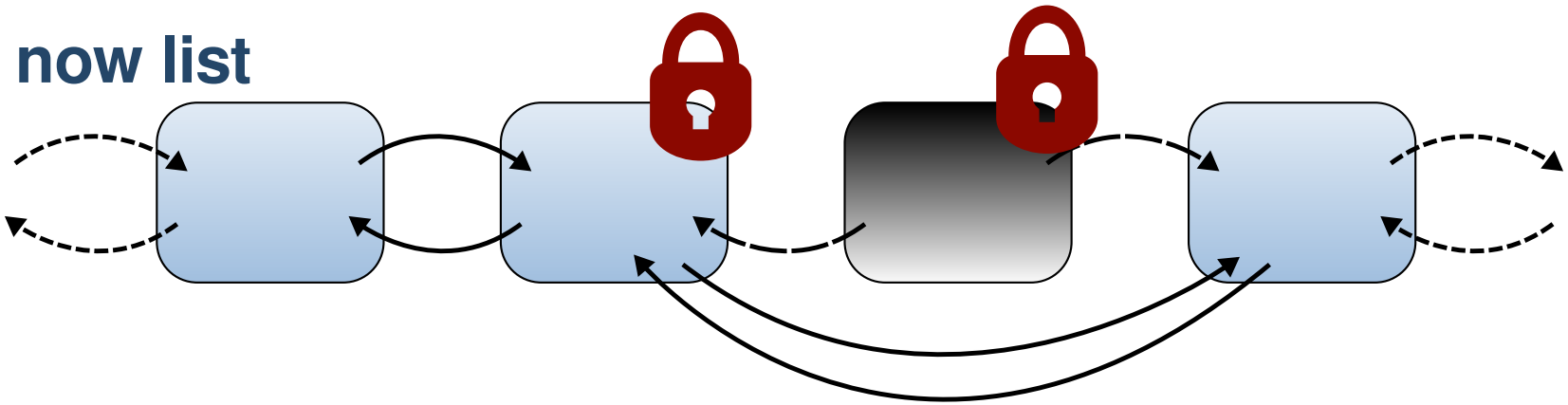

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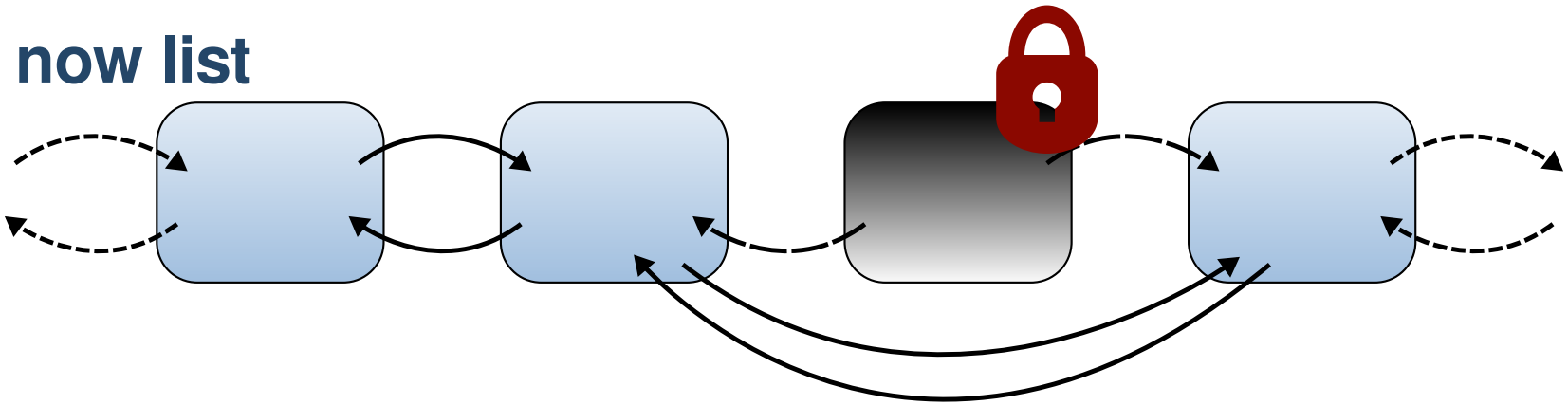

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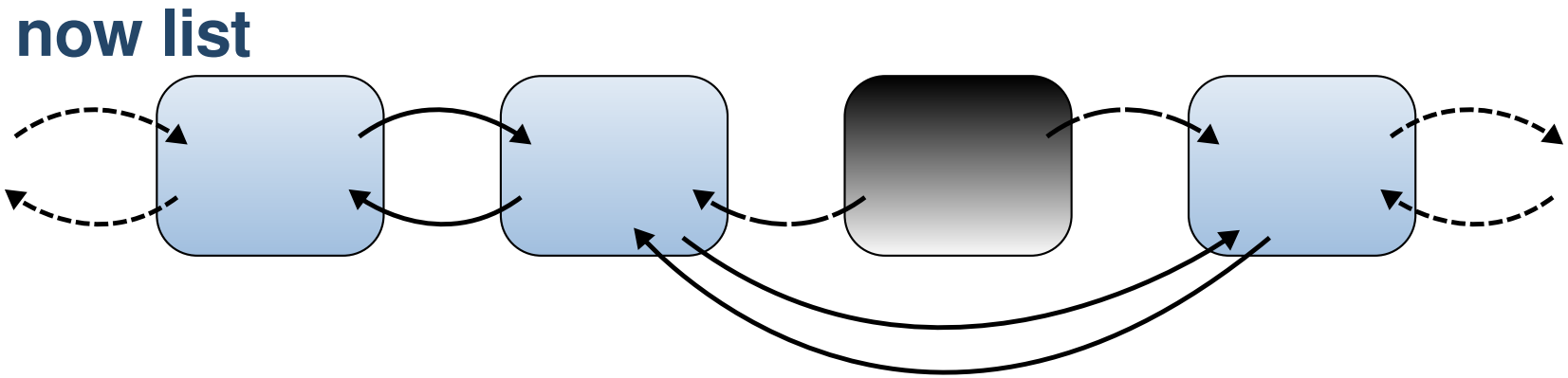


Locking concept: 2 concepts for removing nodes

Normal:

- Lock node and predecessor as shown before and remove it right away

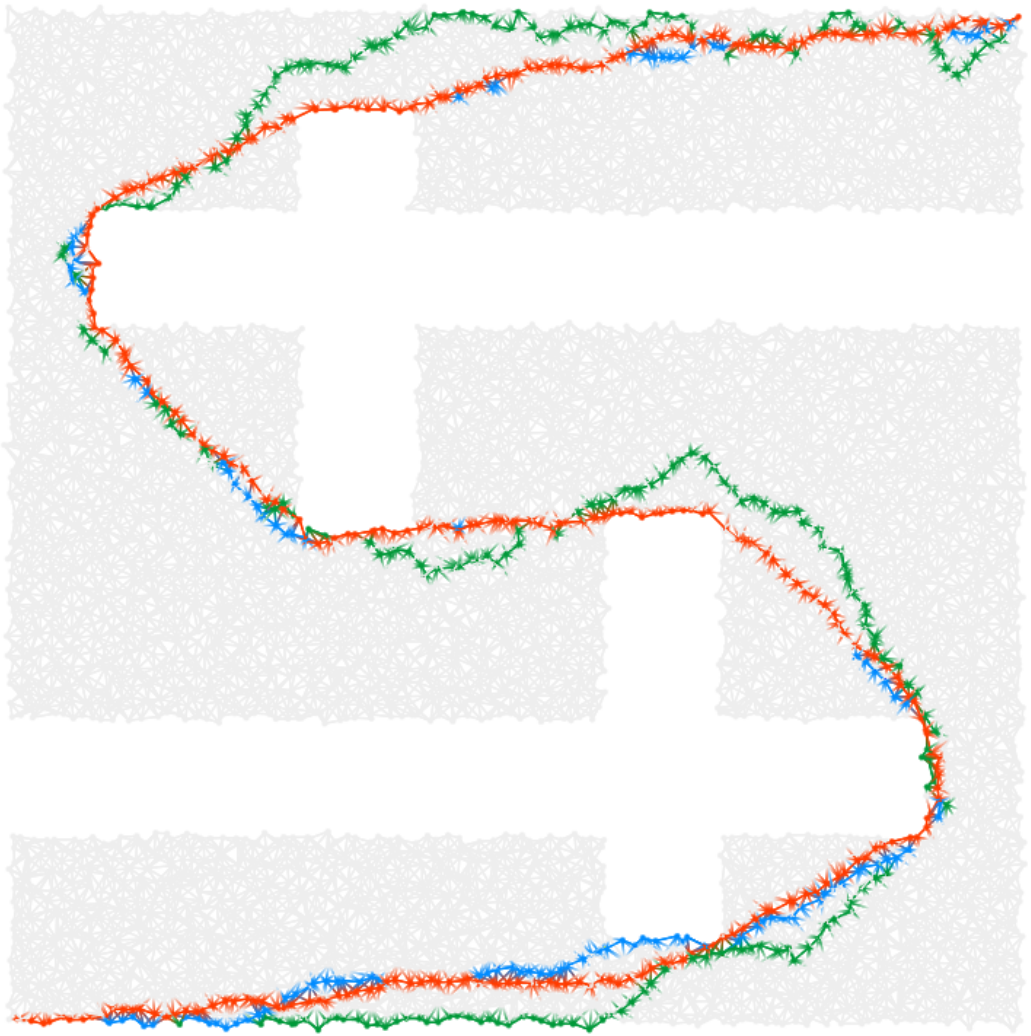
Lazy locking:

- Don't lock anything and just mark the node as removed
- Other threads will clean up and remove it later

Threshold vs. path length

Threshold update

- threshold += **0.1**
- threshold += **1**
- threshold += **10**



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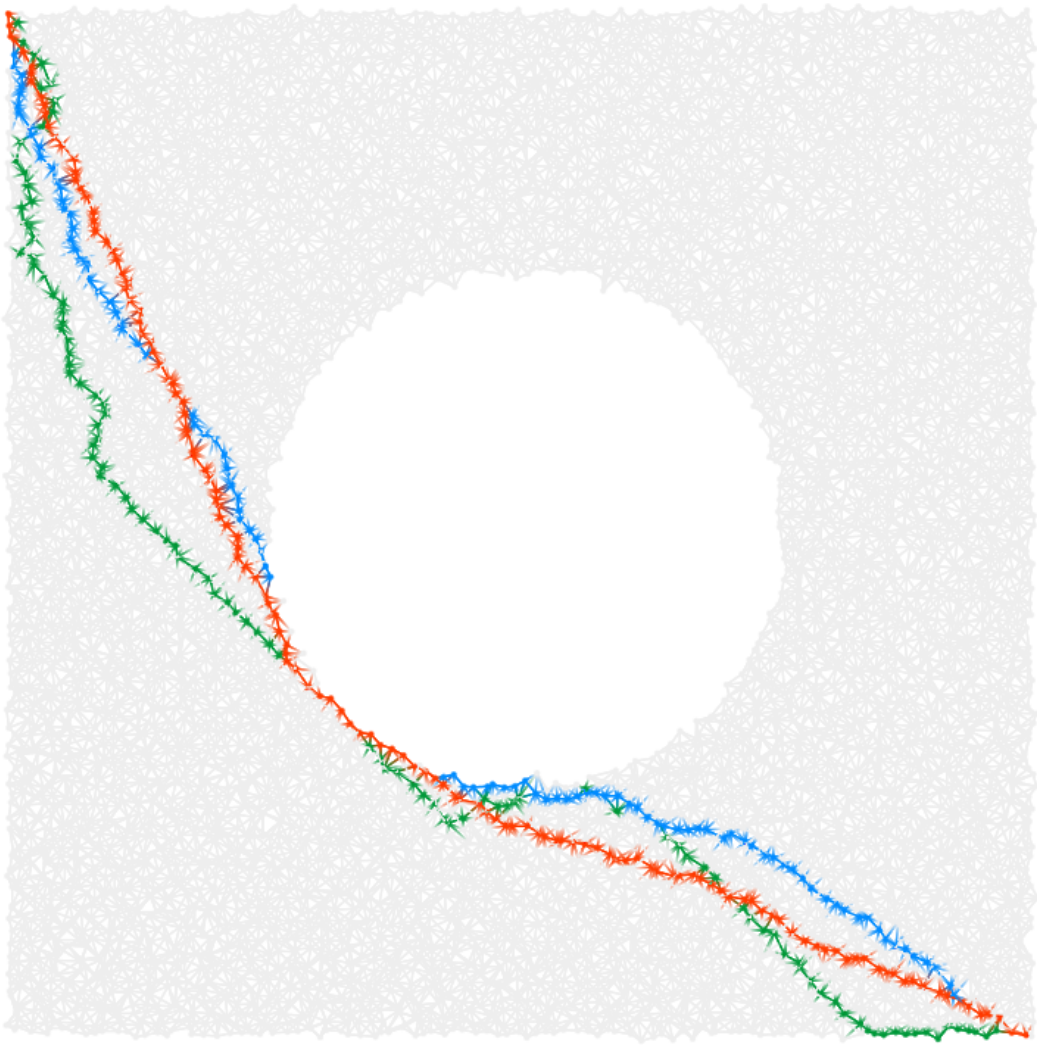

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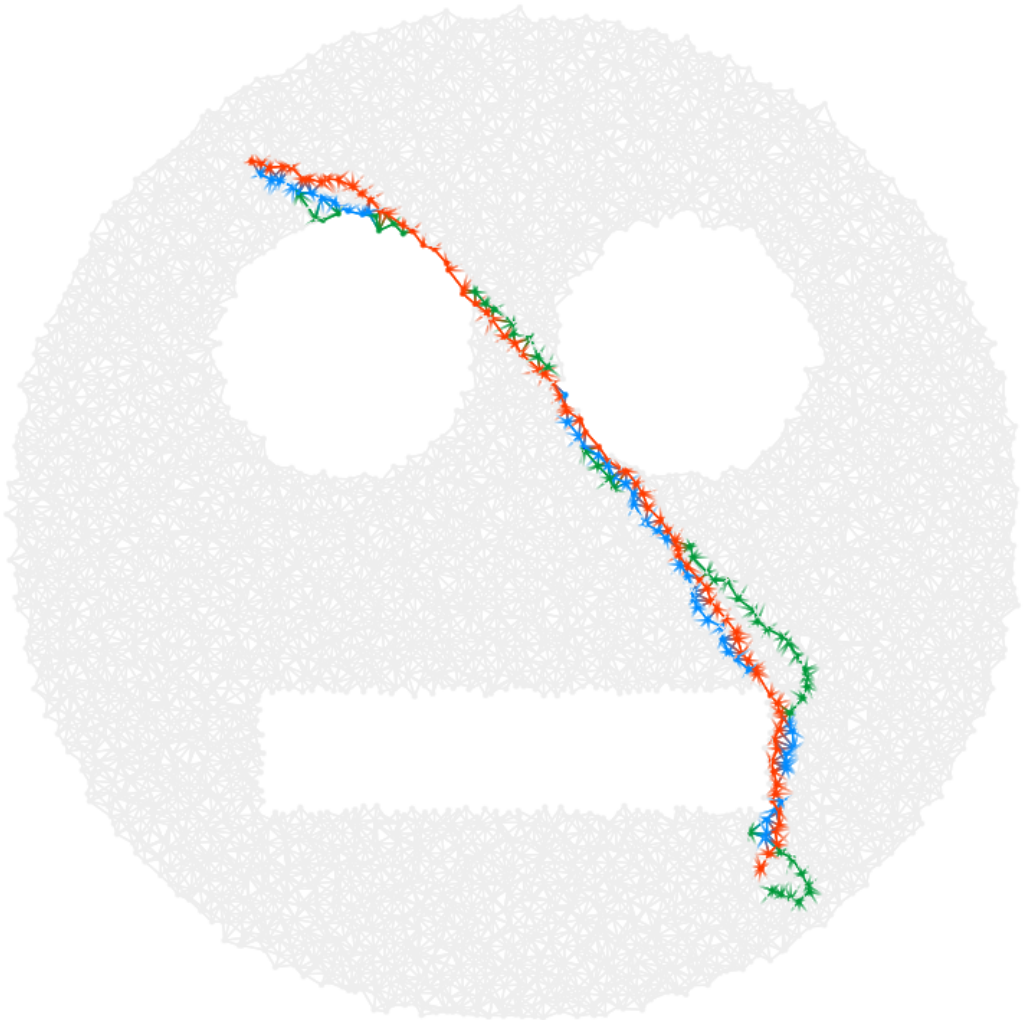

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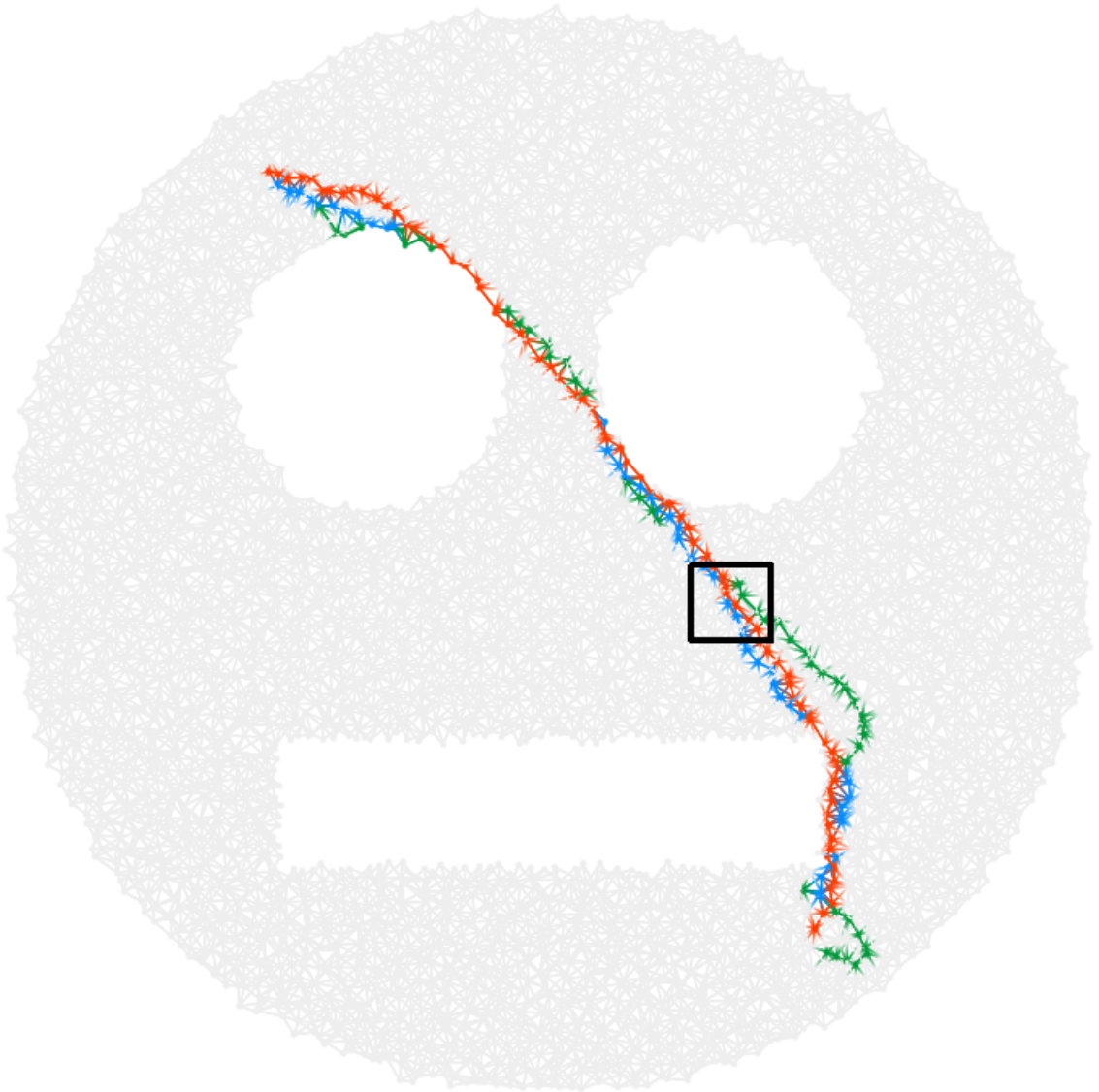

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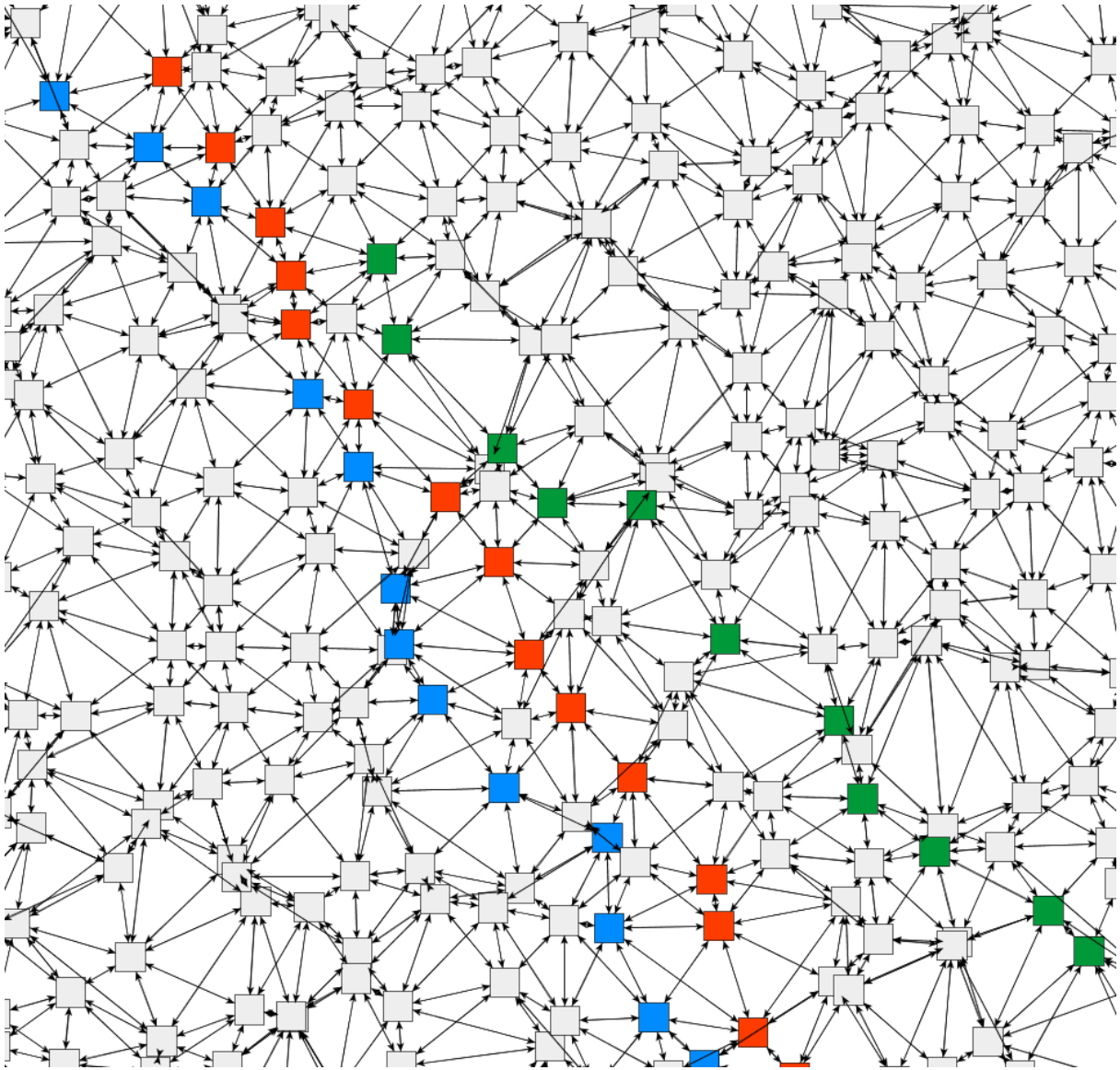
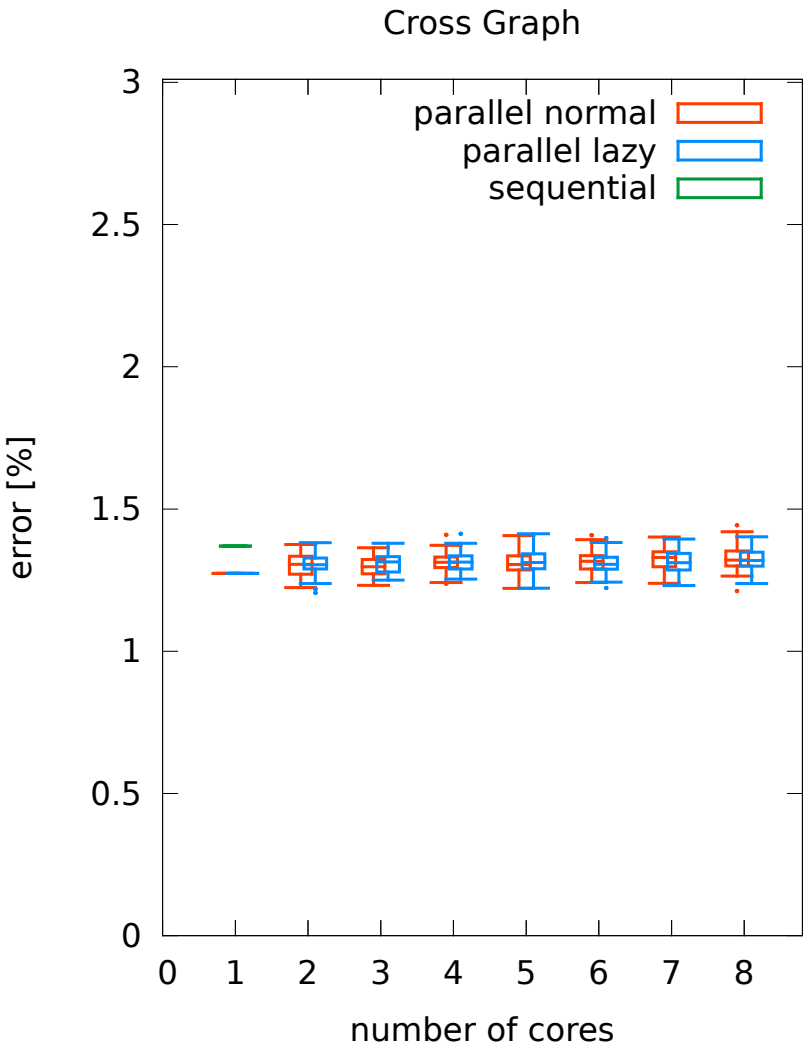
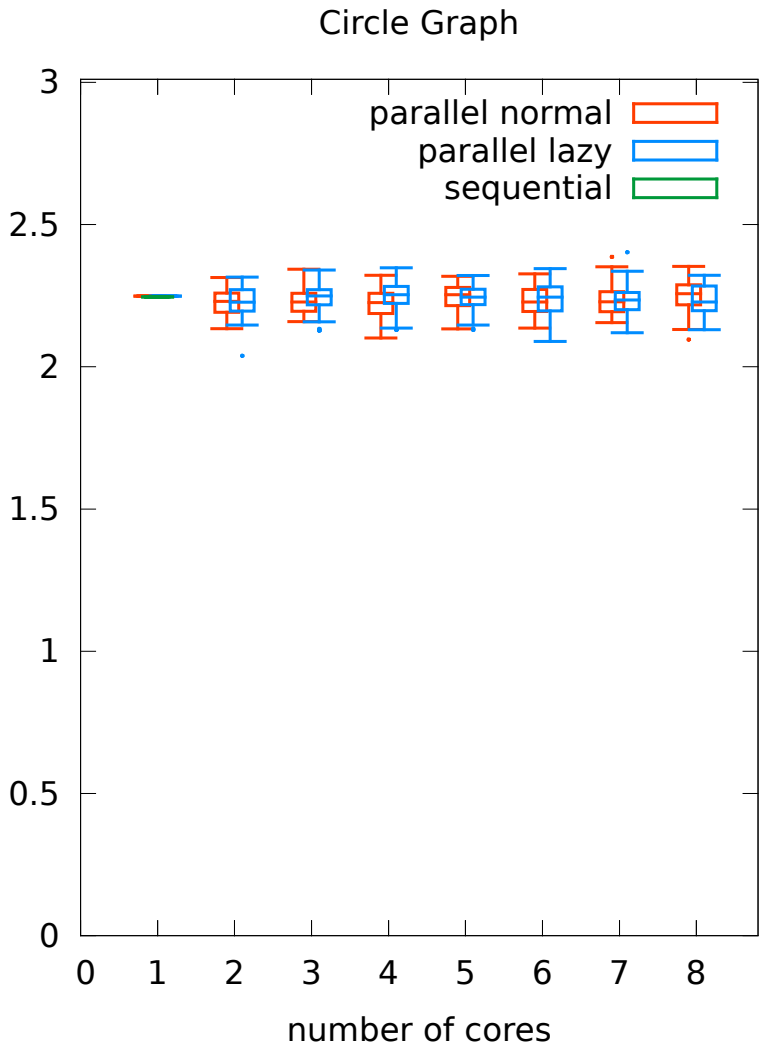


Path length error: # cores

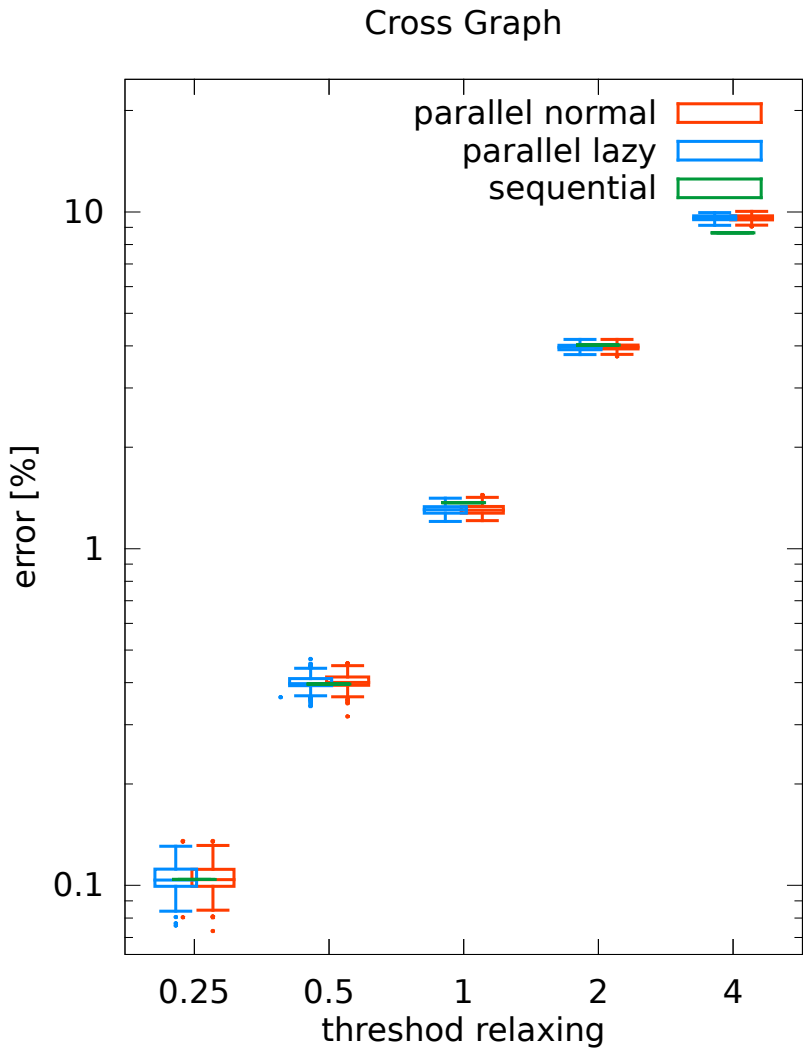


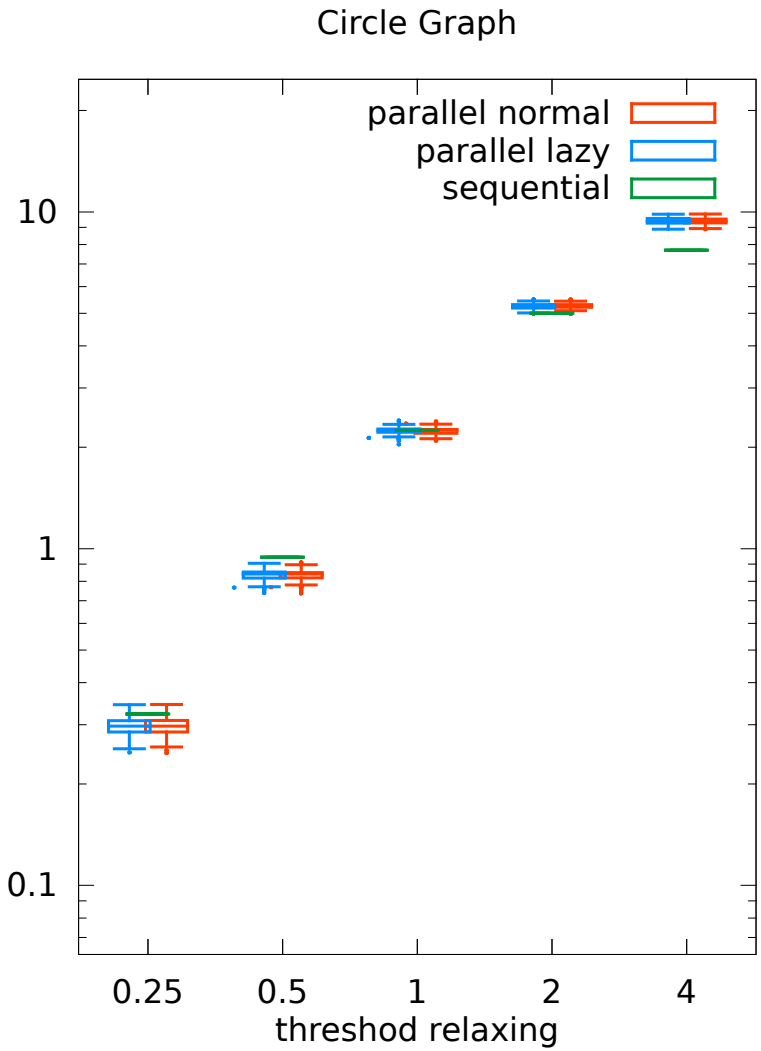


- relative error in path length compared to A*
- 2048 x 2048 nodes

- threshold relaxing: +1
- 50 runs on 1 node of kanifushi.inf.ethz.ch

Path length error: threshold relaxing

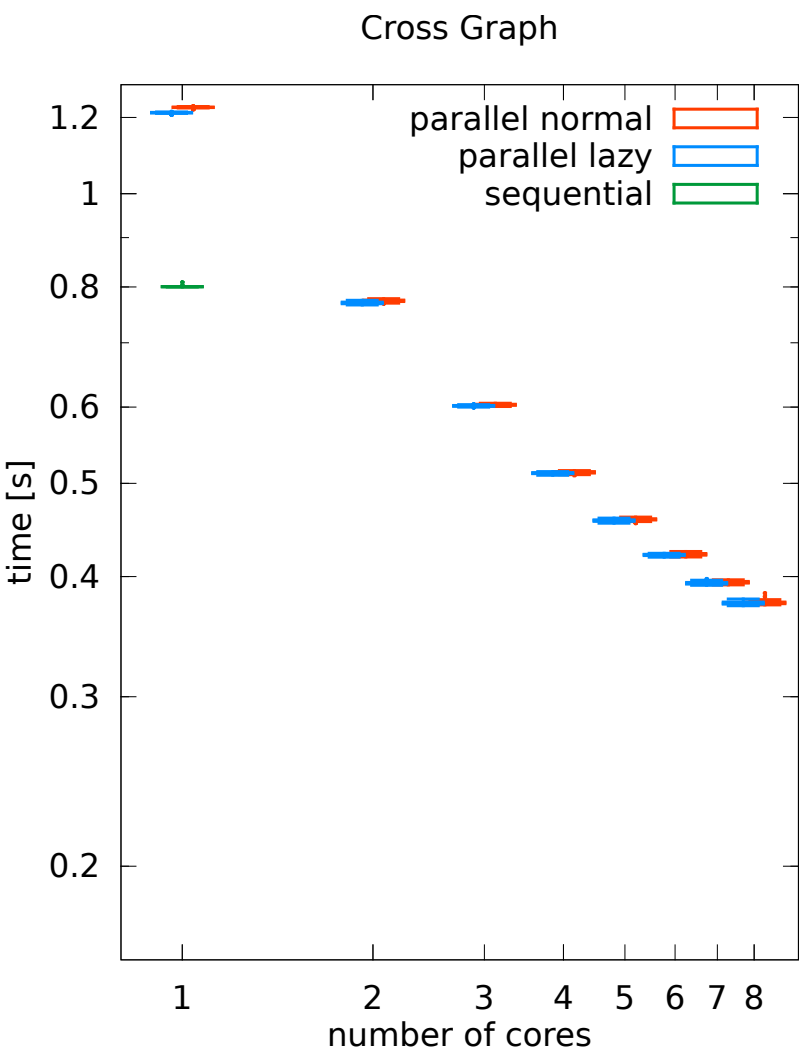




- relative error in path length compared to A*
- 2048 x 2048 nodes

- As we have seen before # cores doesn't matter
- 50 runs on 1 node of kanifushi.inf.ethz.ch

Strong scaling



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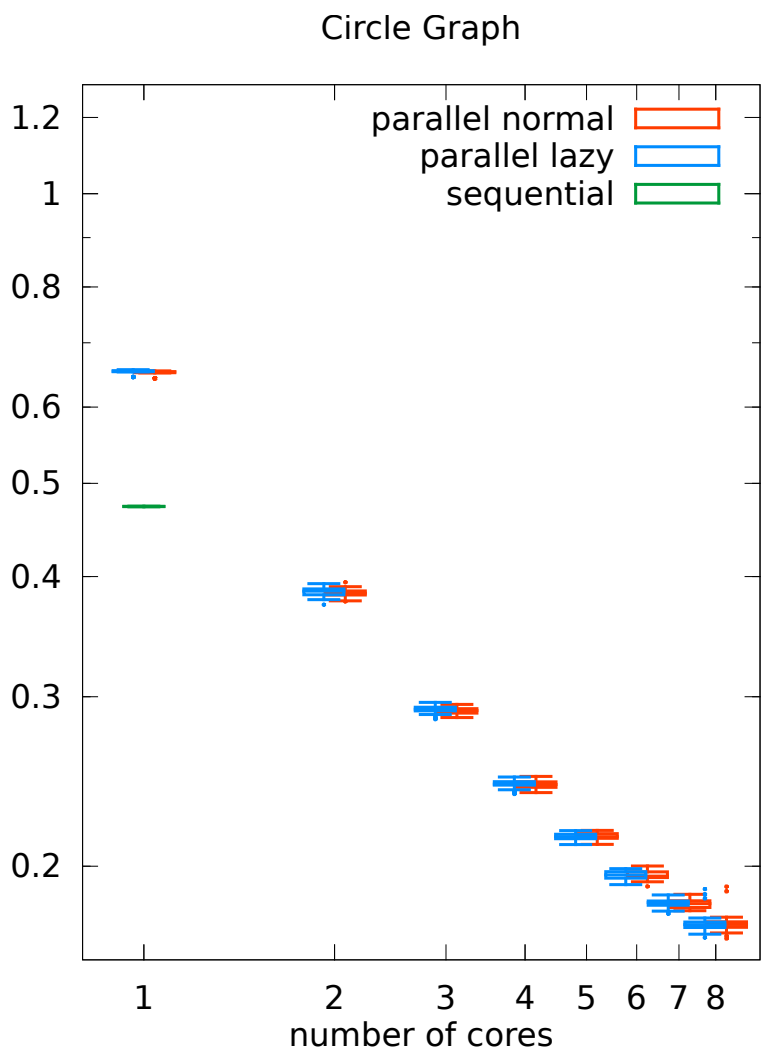

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The End