Parallel Fringe Search

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Design of Parallel and High-Performance Computing

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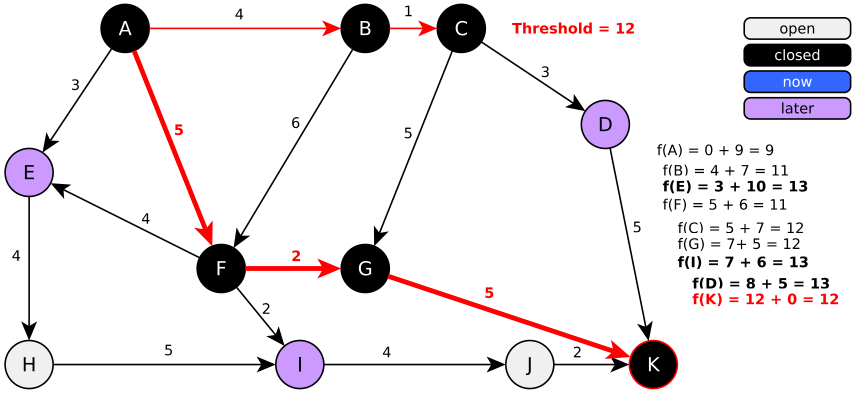
Overview

Fringe Search

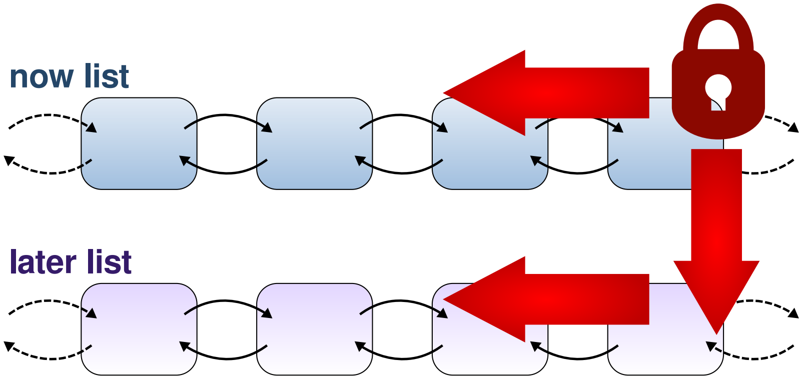


f(A) = 0 + 9 = 9
f(B) = 4 + 7 = 11
f(E) = 3 + 10 = 13
f(F) = 5 + 6 = 11
f(C) = 5 + 7 = 12
f(G) = 7+ 5 = 12
f(I) = 7 + 6 = 13
f(D) = 8 + 5 = 13
f(K) = 12 + 0 = 12

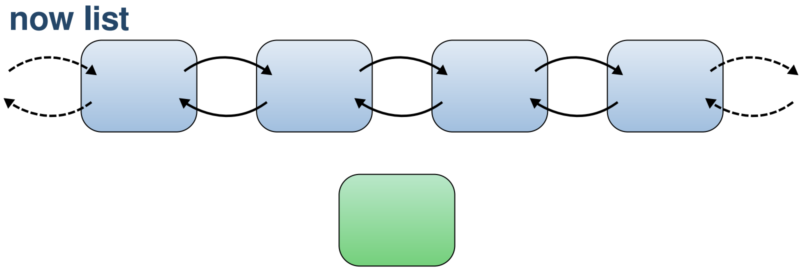
What we have done

- 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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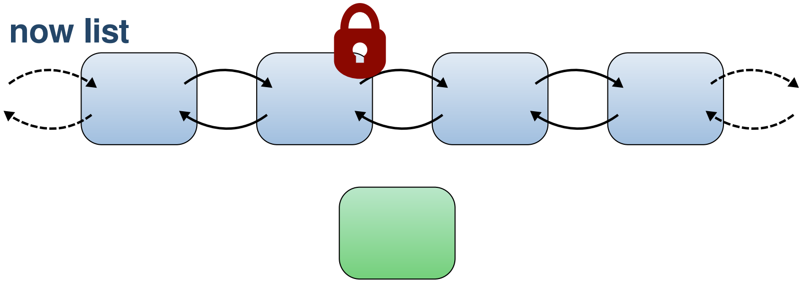

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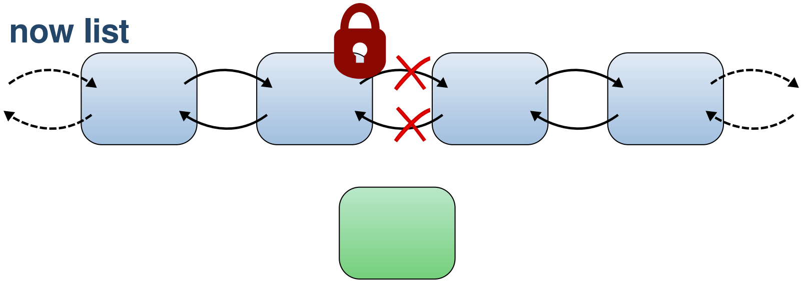

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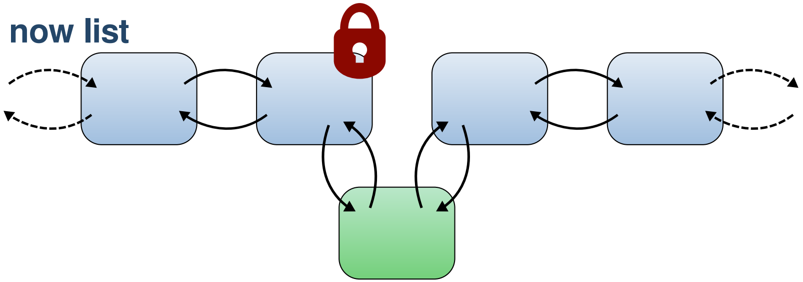

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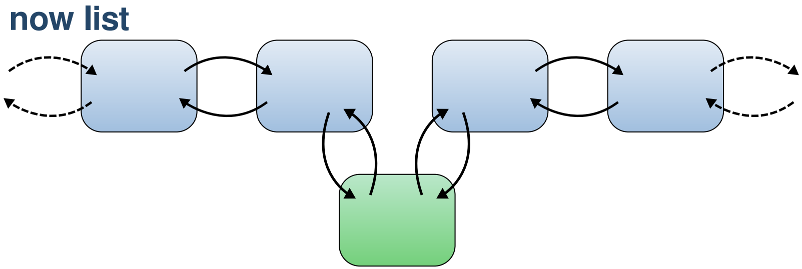
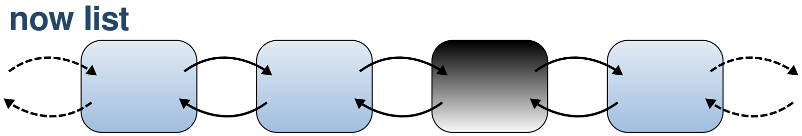
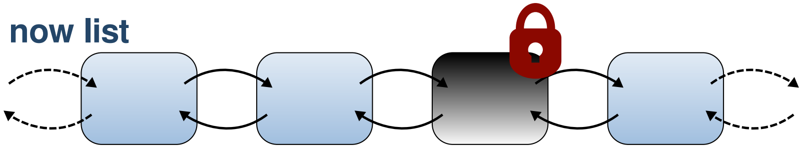


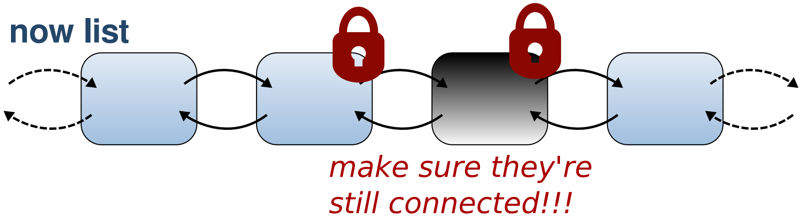
Locking concept: Remove node



Locking concept: Remove node



Locking concept: Remove node



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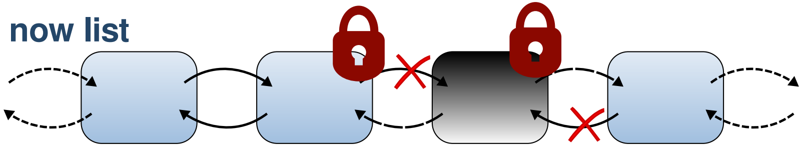

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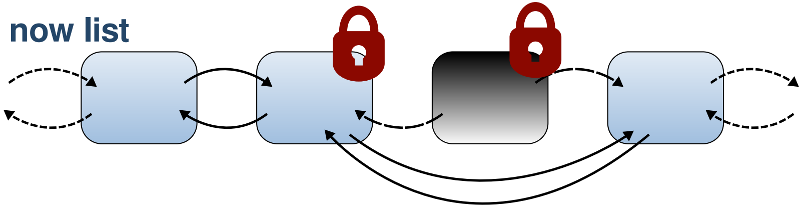

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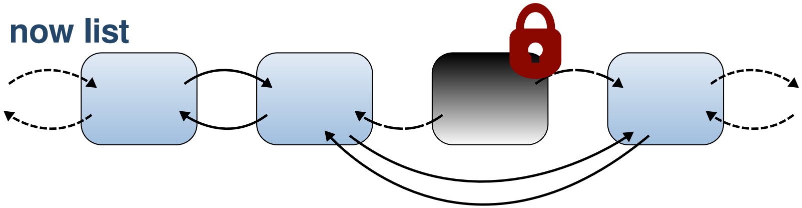

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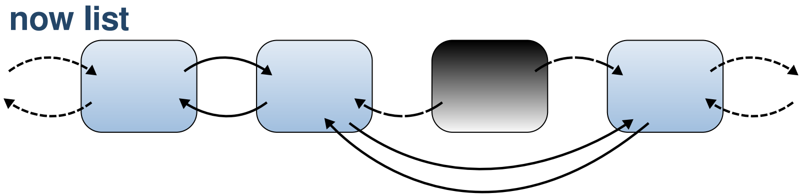
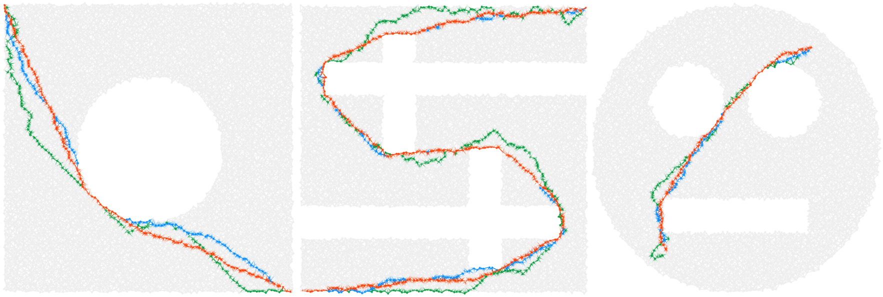


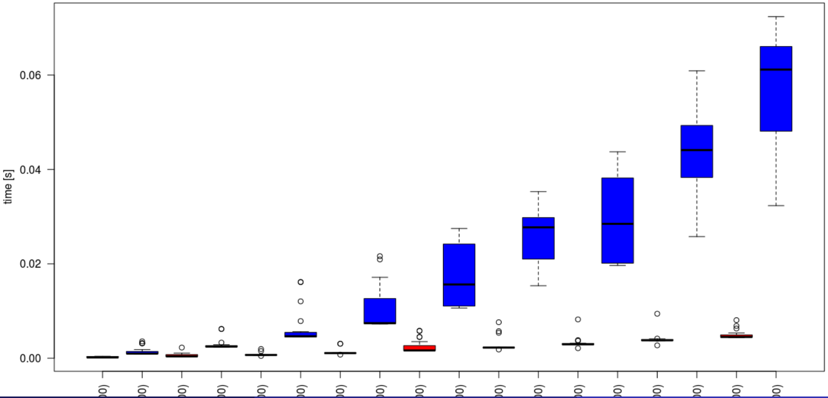
Threshold vs. Path Length

- Threshold = Threshold + **0.1**
- Threshold = Threshold + **1**
- Threshold = Threshold + **10**



Benchmark runtime

- Runtime vs. A* from Boost Graph Library
- Using "cross graph" and 400 - 10'000 nodes
- Threshold += 1
- 20 runs per size
- Intel Core 2 P9600 @ 2.53 GHZ



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Benchmark path length

# Nodes	A-Star	Fringe	Difference	Difference in %
400	69.731	70.6903	0.9593	1.37 %
900	101.071	102.638	1.567	1.55 %
1600	133.304	136.326	3.022	2.27 %
2500	165.47	167.891	2.421	1.46 %
3600	195.363	198.115	2.752	1.41 %
4900	227.957	231.554	3.597	1.58 %
6400	258.5	261.49	2.99	1.16 %
8100	288.961	293.483	4.522	1.56 %
10000	321.263	325.853	4.59	1.43 %

Project Status

What we still have to do:

- Implement parallel version
- Benchmarking (strong/weak scaling)
- Threshold fine-tuning
- Write report

The End