Obstruction degree: measuring concurrency in shared memory systems

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Research challenge

How to predict the performance of concurrent algorithms before implementing them

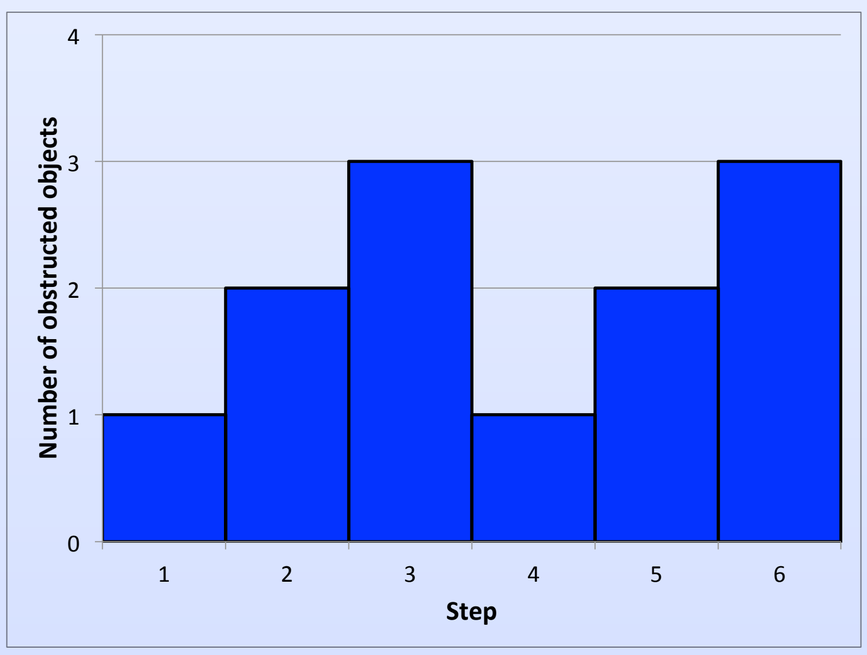
Complexity theory has limited applicability for concurrent algorithms

Objective

- Reason about the algorithm, not the implementation
- Make predictions about performance under concurrency, i.e. scalability
- Define a metric that is simple to compute
- Output a single number showing how concurrent the algorithm is

Obstruction degree

Plot the number of objects to which the algorithm needs atomic access at any step

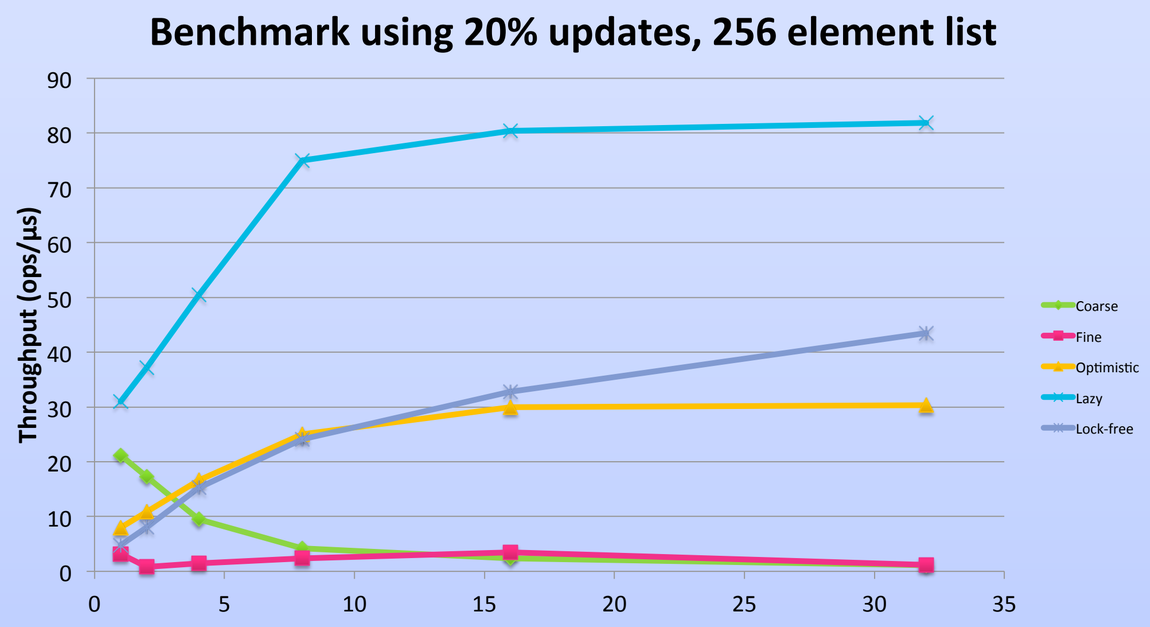


Obstruction degree = area under the plot

Algorithm	Obstruction degree
Basic TM algorithm	n^2
Two-phase locking	n^2
Basic elastic transactions	n
Hand-over-hand locking	n

Experimental results - Linked list

Algorithm	Find	Insert	Remove
Coarse	n^2	n^2	n^2
Fine	n	n	n
Optimistic	1	1	1
Lazy	0	1	1
Lock-free	0	0	0



Conclusion

Low obstruction degree

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High concurrency

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Scalability

Further reading

Rachid Guerraoui and Mihai Letia. Obstruction degree: measuring concurrency in shared memory systems. Tech. rep. EPFL-REPORT-177869, EPFL, 2012.URL: http://http://infoscience.epfl.ch/record/177869