Experimental Evaluation of Page Migration Algorithms

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1 Introduction

This report presents an experimental evaluation of two online algorithms for the **Page Migration** problem:

- **MoveToMin** (deterministic): migrates the page to minimize total distance over the last D requests.
- **CoinFlip** (randomized): migrates to the requested node with probability $\frac{1}{2D}$.

Simulations were performed on 64-node graphs:

- 3D Torus ($4 \times 4 \times 4$)
- 6D Hypercube

Three request distributions were tested: *Uniform*, *Harmonic*, and *Biharmonic*.

Each setting was evaluated over 1,000 iterations with request length 2^{16}.

2 Comparative Analysis (Aggregate Results)

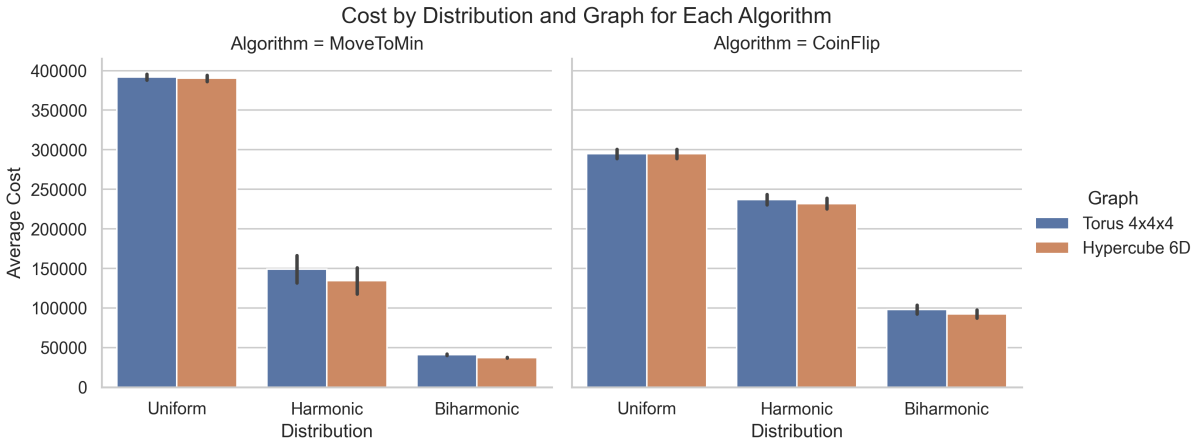

Figure 1: Average cost by distribution and graph, for each algorithm.

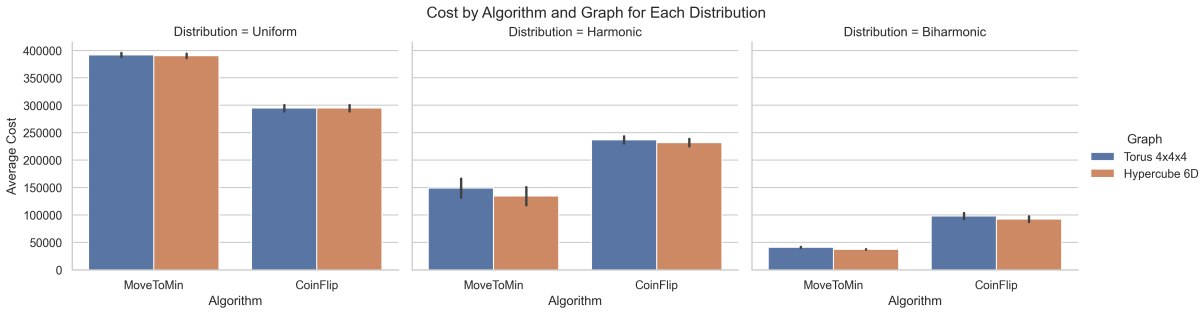

Figure 2: Average cost by algorithm and graph, grouped by distribution.

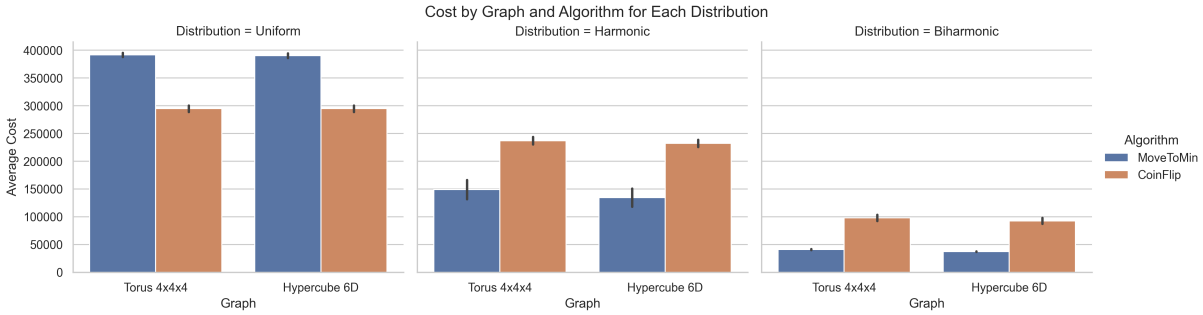

Figure 3: Average cost by graph and algorithm, grouped by distribution.

3 Cost vs. Migration Penalty Factor D (Facet View)

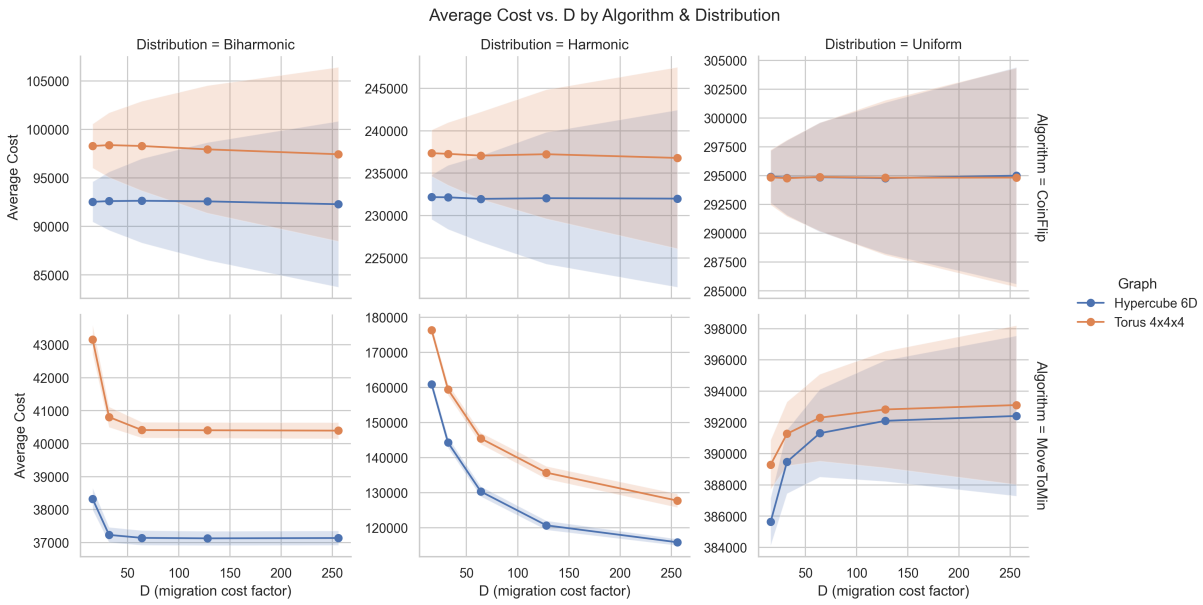

Figure 4: Cost vs. migration penalty factor D, faceted by algorithm and distribution.

4 Cost vs. D (Split Figures)

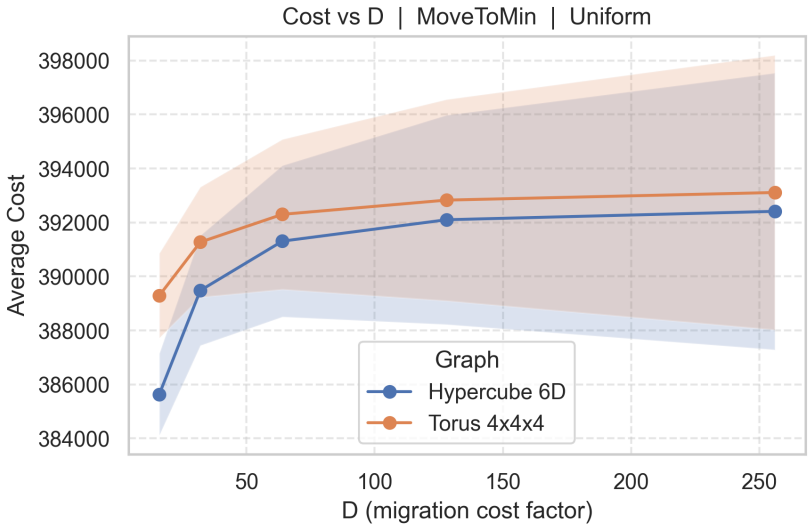

Figure 5: MoveToMin under Uniform distribution.

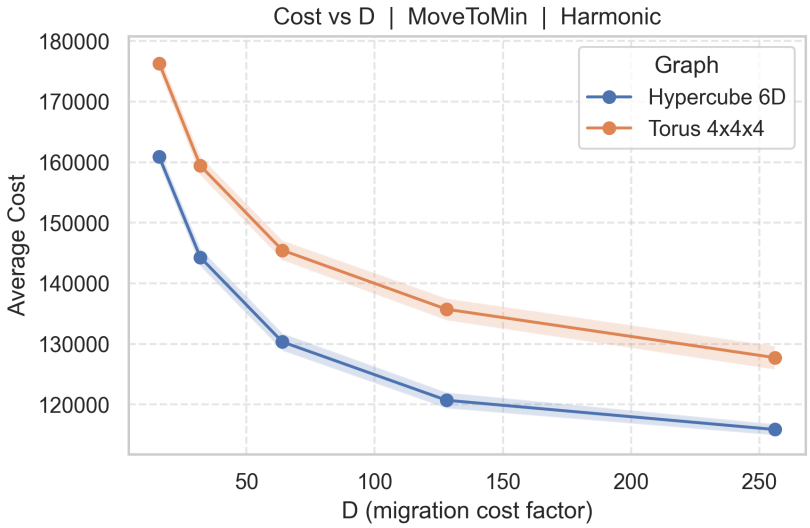

Figure 6: MoveToMin under Harmonic distribution.

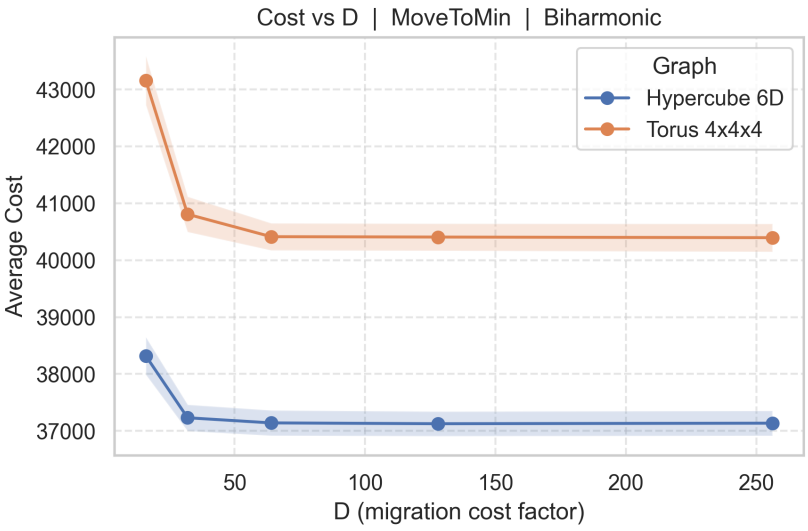

Figure 7: MoveToMin under Biharmonic distribution.

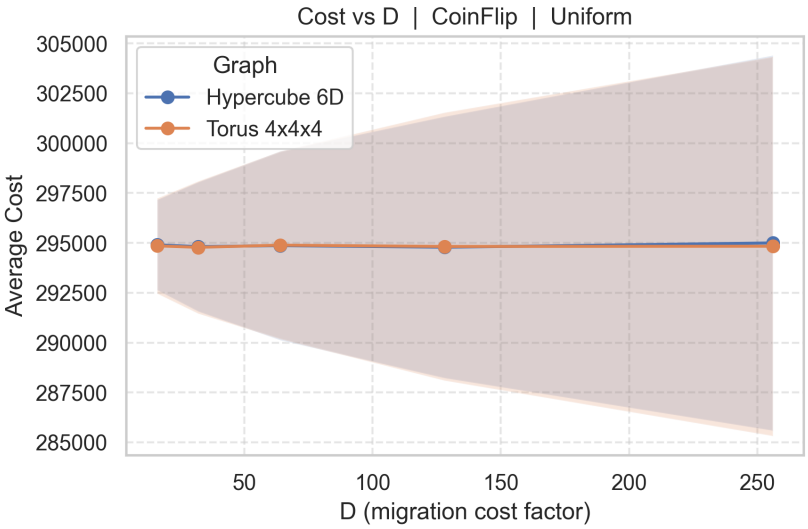

Figure 8: CoinFlip under Uniform distribution.

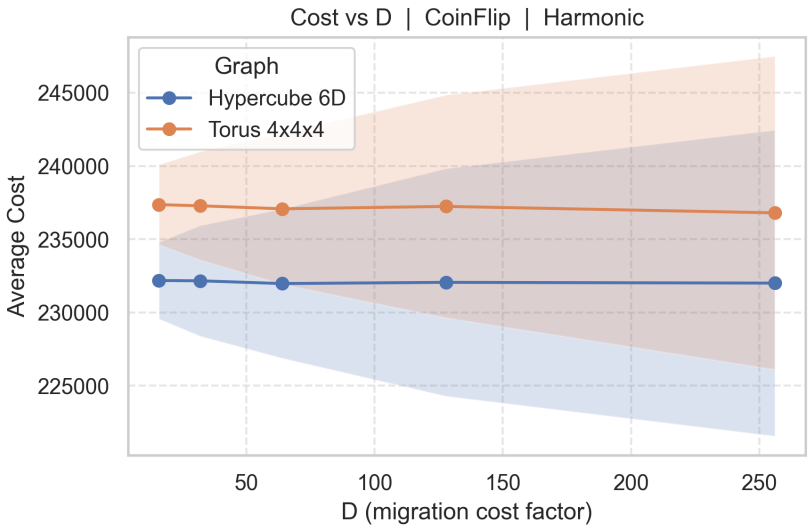

Figure 9: CoinFlip under Harmonic distribution.

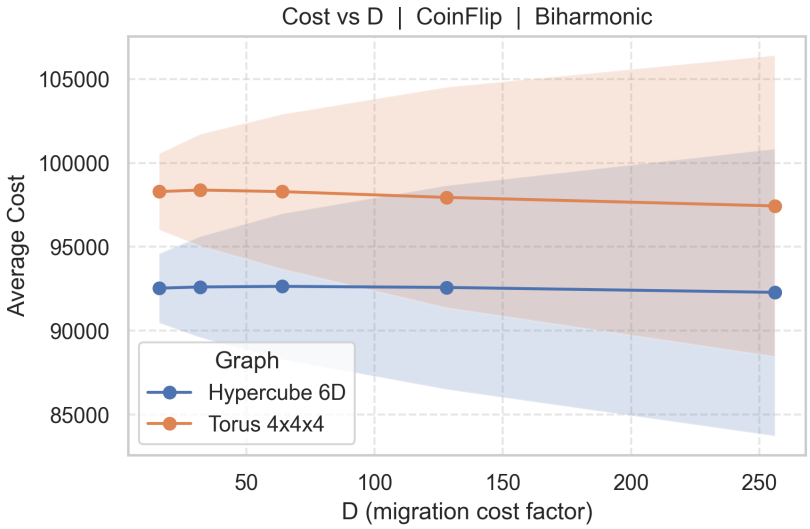

Figure 10: CoinFlip under Biharmonic distribution.

5 Observations

- **Distribution impact:** Costs are generally lower for harmonic and biharmonic distributions compared to uniform.
- **MoveToMin:** Strongly benefits from biased distributions (especially biharmonic).
- **CoinFlip:** More stable across all distributions but generally has higher cost for small D.
- **Graph topology:** No consistent winner, though the Torus often exhibits lower access costs under localized distributions.

6 Conclusion

These experiments highlight the tradeoffs between deterministic and randomized page migration strategies. The MoveToMin algorithm is better suited for highly skewed request patterns, while CoinFlip offers simplicity and robustness at the cost of higher variance.