Floyd-Warshall vs Square-Sum Path Finding Methods

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Equations

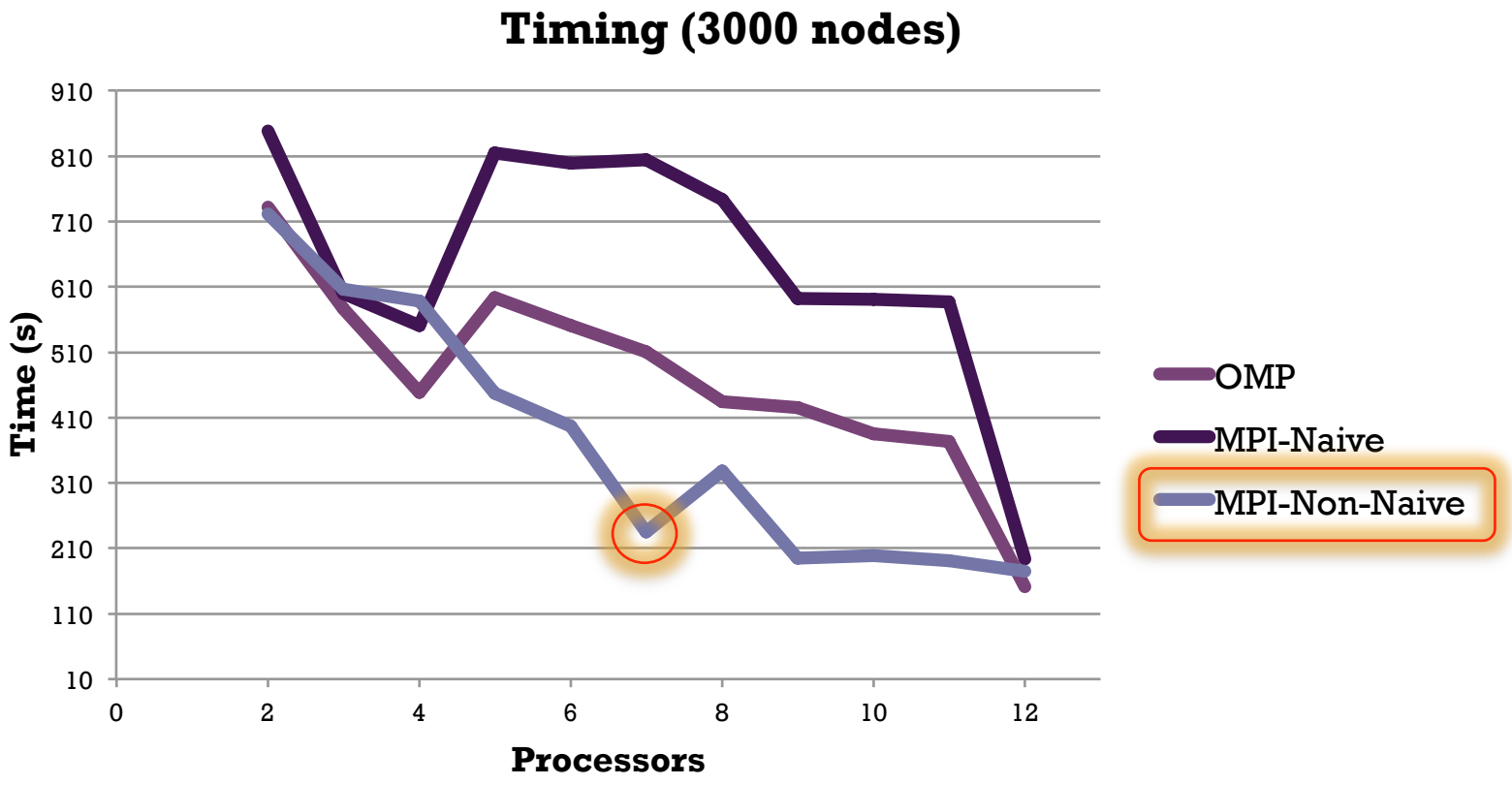
- Square-Sum (Project 3)
  - Time Complexity $O(n^3 \log(n))$

$$l_{ij}^{s+1} = \min_k \{ l_{ik}^{s} + l_{kj}^{s} \}.$$

- Floyd-Warshall
  - Time Complexity $O(n^3)$

$$d_{ij} = \min\left(d_{ij}, d_{ik} + d_{kj}\right)$$

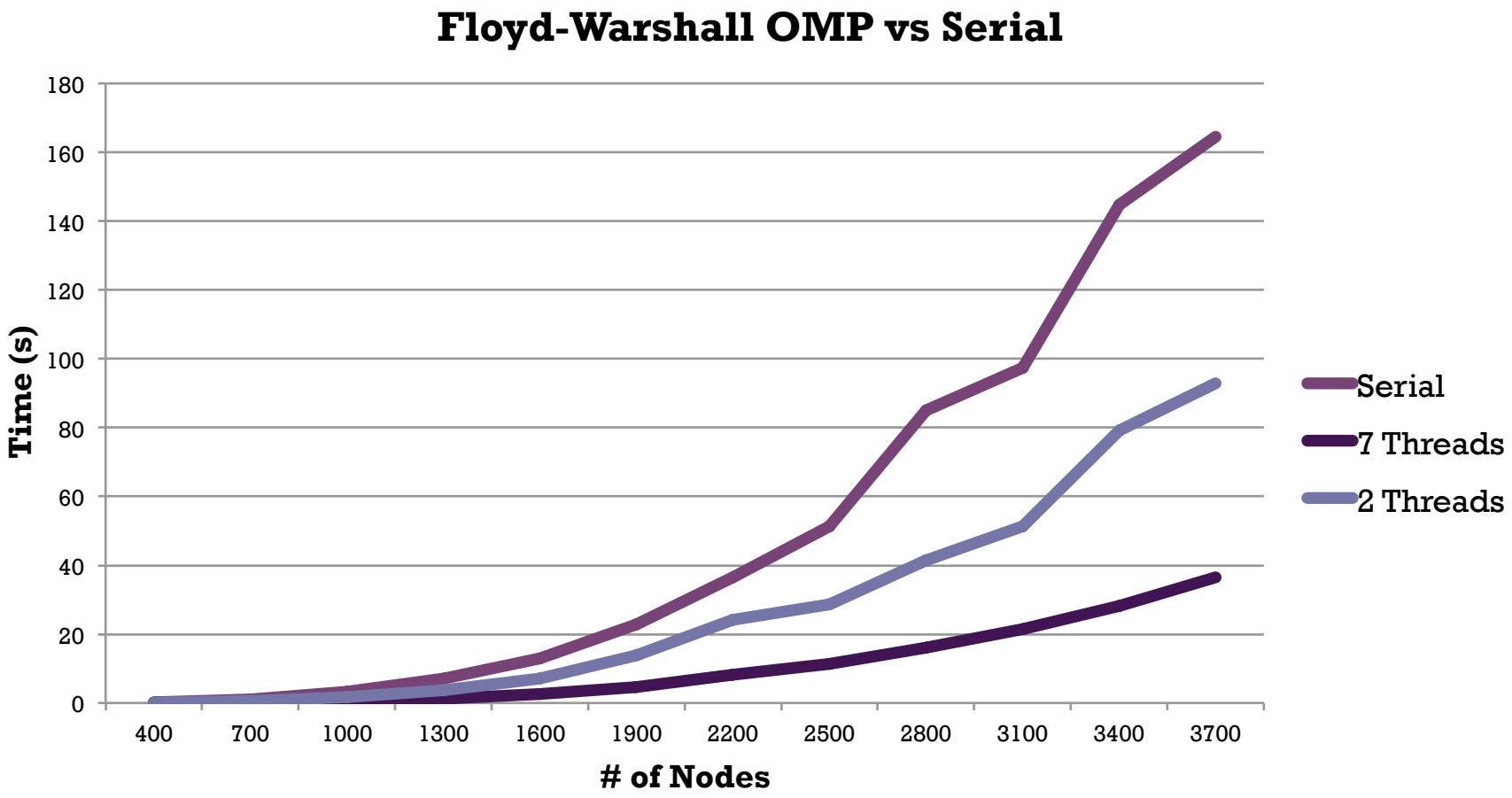
Flash Back @ Square Sum



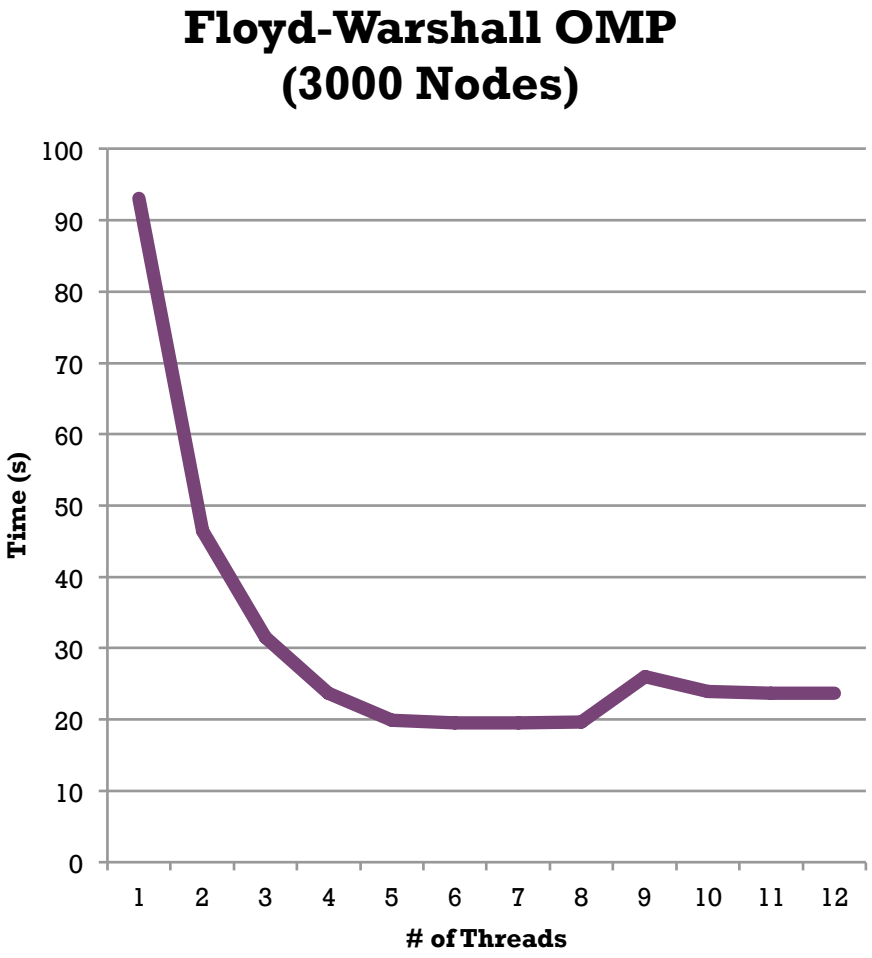
Floyd-Warshall: Hypothesis

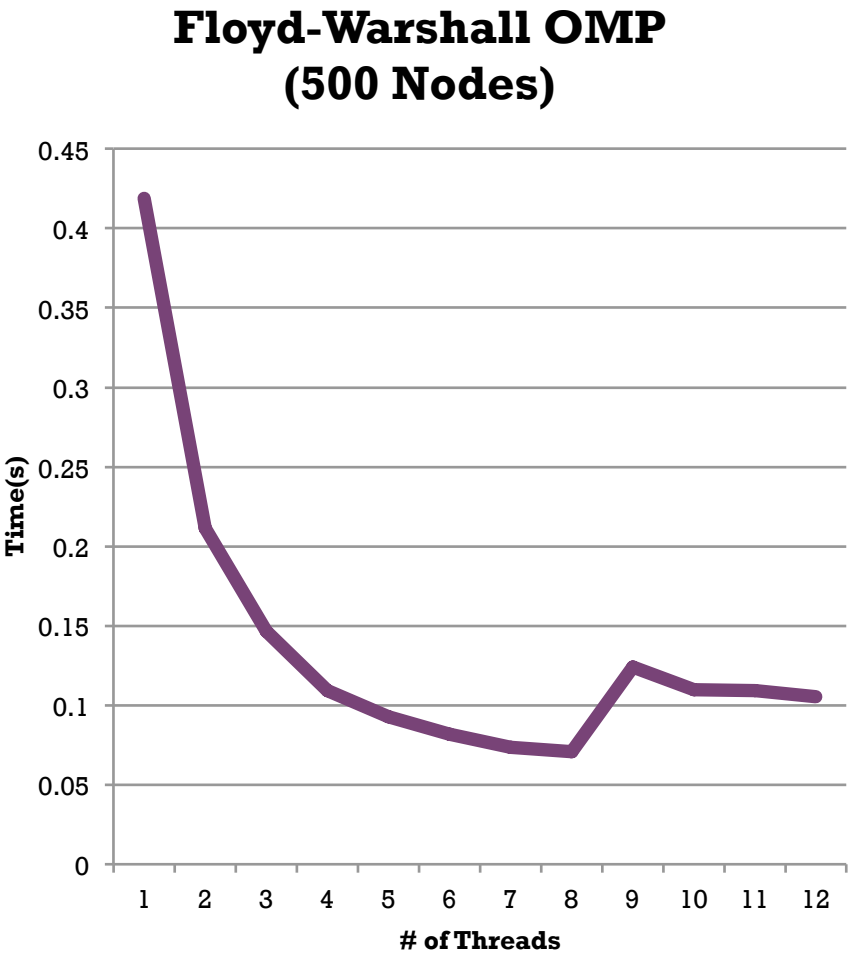
- Computation Time: Floyd-Warshall < Square-Sum
- Computation Time: FW = C * (SS / log(# of nodes)) for some constant C.

Floyd-Warshall vs No. of Nodes

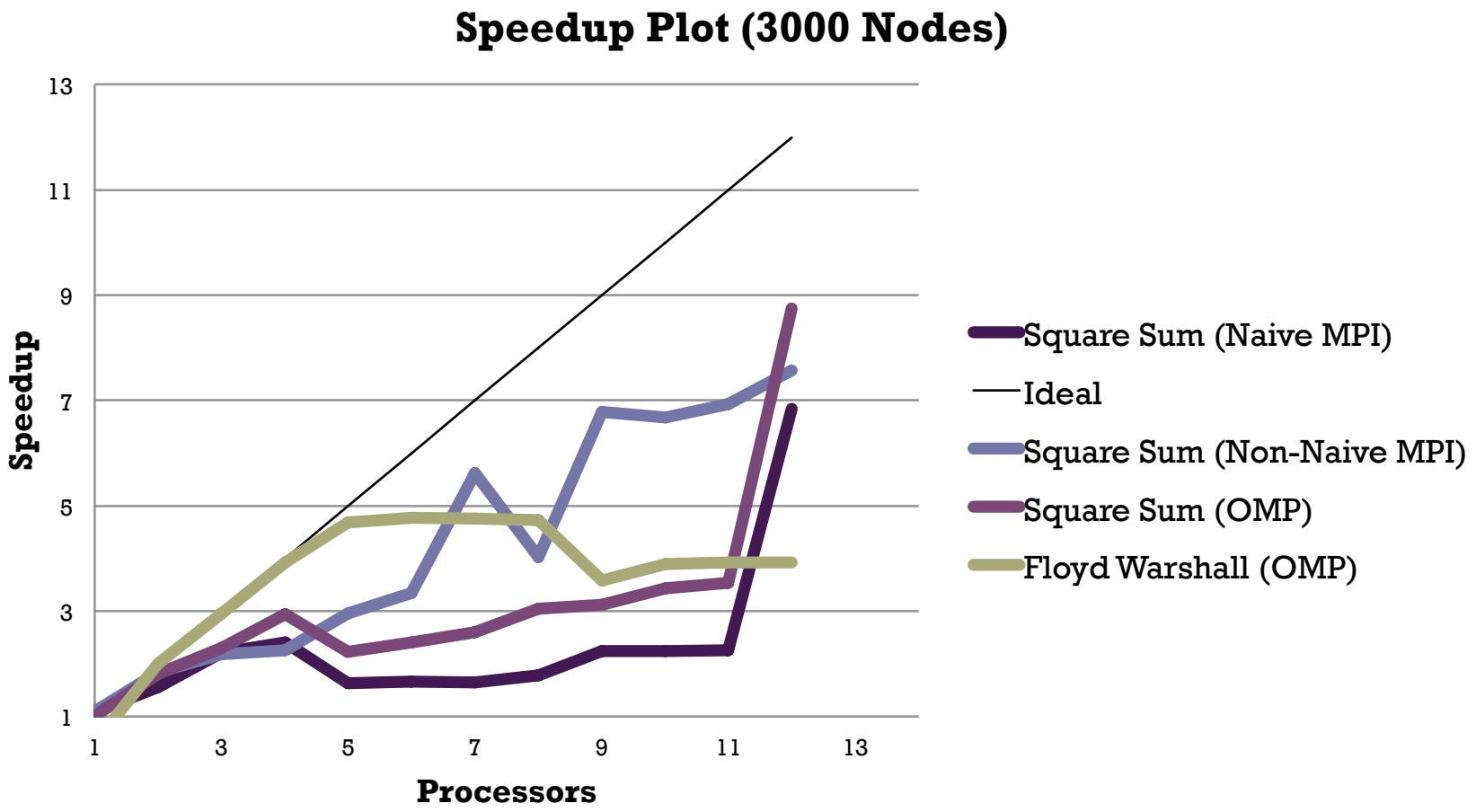


Floyd-Warshall vs No. of Threads

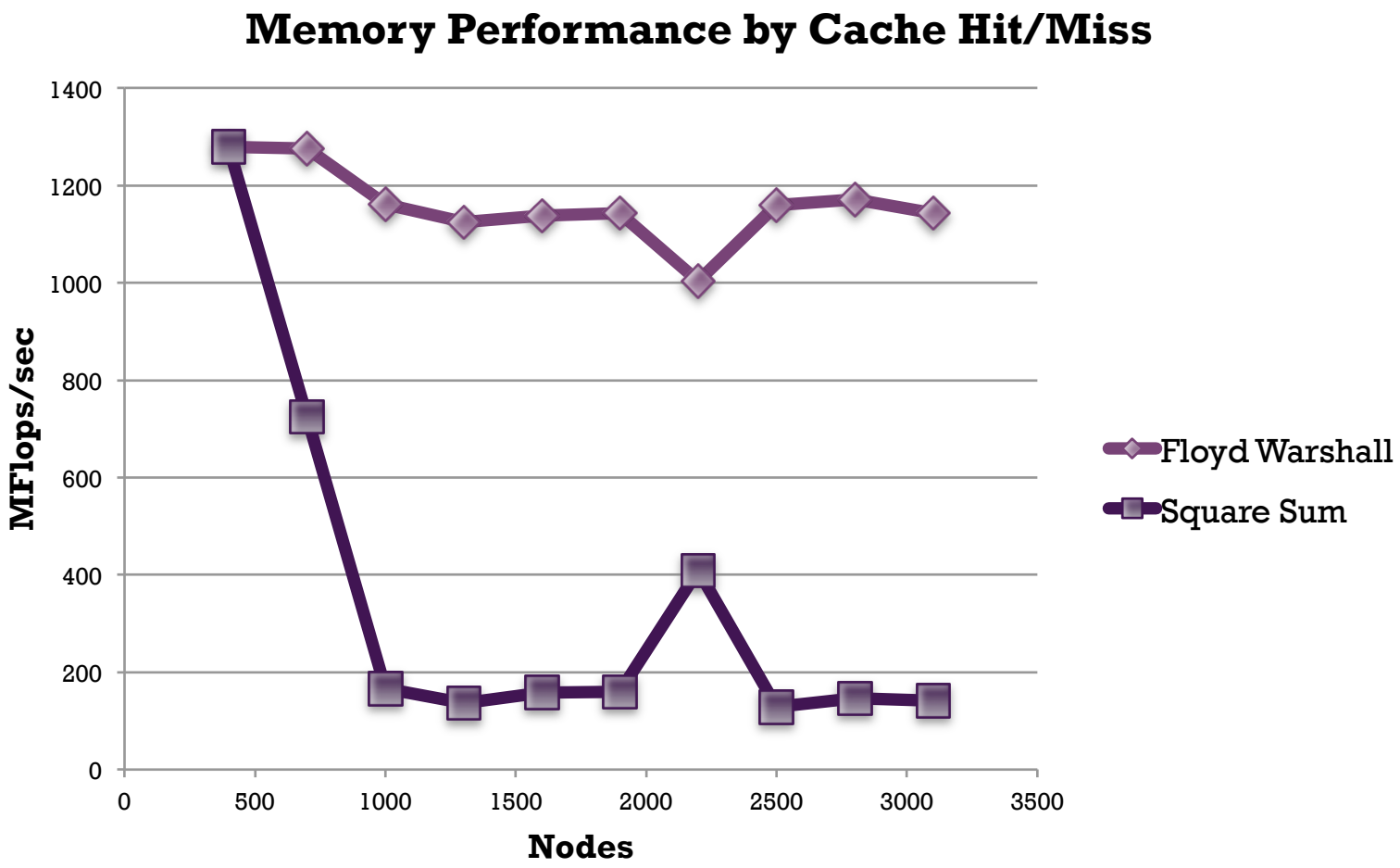




Floyd-Warshall vs Square-Sum: Speedup



Floyd-Warshall vs Square-Sum: Serial Code



Conclusion & Looking forward to..

- FW: Parallelized Inner 2 Loops >> 2/3rd of the speedup
- FW: 2/3rd of the speedup >> Speed-up up to max 5 threads
- FW: Rarely any cache miss >> No need for blocking.
- FW OMP implementation has..
  - Max memory usage with rare cache miss;
  - Max improvement in performance at 5 threads;
  - Much faster than Square-Sum serial, OMP, and MPI codes.
  - Much faster than Floyd-Warshall serial.
- Amortized Computation Time:
  - FW Serial > C * (SS Serial / log(n))
  - FW OMP <= C * (SS OMP or MPI / log(n))

Looking forward to…

- SS: Blocked Version for Square-Sum
- FW: MPI Version for Floyd-Warshall

Acknowledgements

- Professor Bindel

THANKS!