Speeding Up the Garfield++

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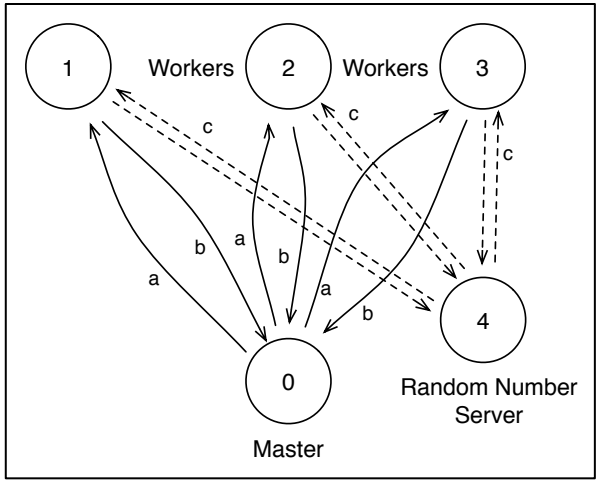
Previous work

- Event-level parallelism
- Adapted Garfield to client/ server model using the MPI programming paradigm. Master distributes the workload and gathers the results back.
- Random number generation distribution over the network

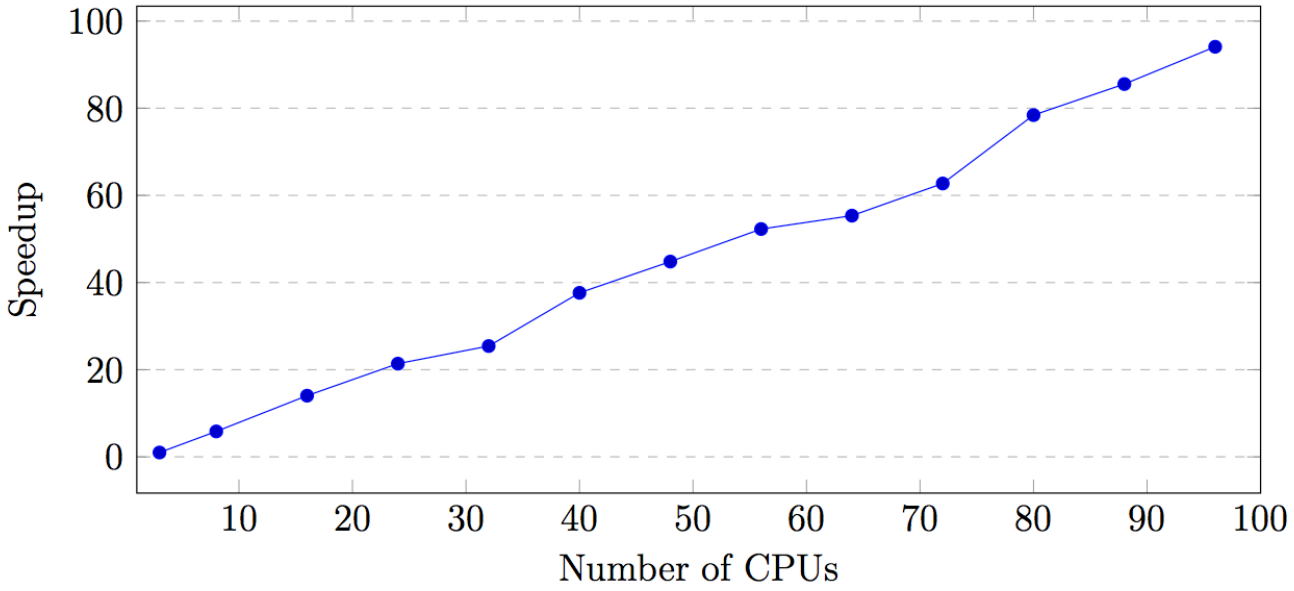


Previous Work: Speed up

Performance was evaluated on the HPC cluster at Texas A&M University at Qatar.

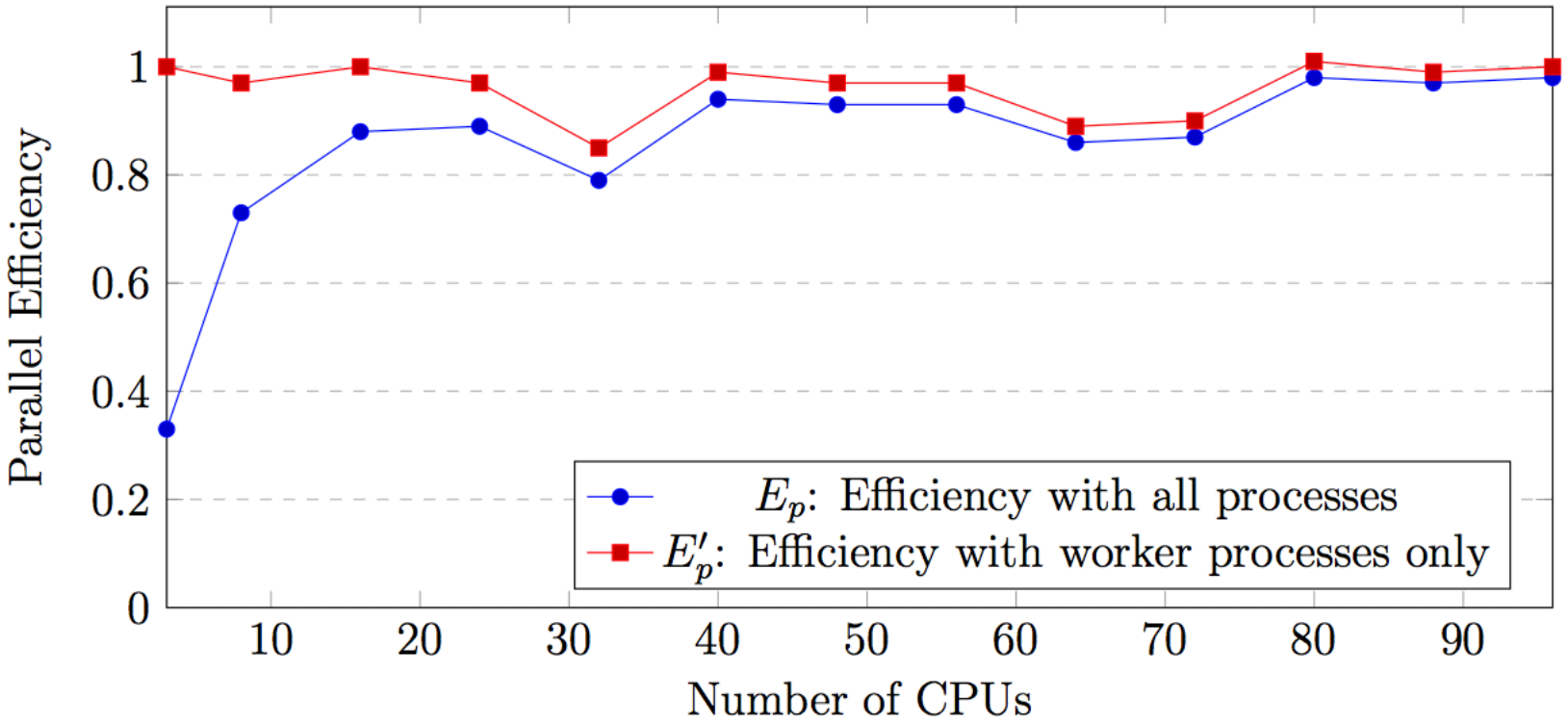
The HPC cluster (named RAAD) is a 42+ TFLOP, 2208-core Intel Xeon system.

$$Speedup = S_p = \frac{T_s}{T_p}$$



Pervious Work: Parallel efficiency

$$Efficiency = E_p = \frac{T_s}{p * T_p}$$



Present work

- Optimization of the track-level (serial) simulation
- Identified the hotspots
  - Observation: 90% of the simulation time appears to be spent in finding the elements in the electric field.
- Simple code optimizations showed speedup of more than 3x speedup.
- Offload the element finding to the GPU.
- Discover other hotspots that can be accelerated using the GPU
- We can do the same for Garfield (Fortran)

Conference

- International Computational Science and Engineering Conference, Doha May 11-12, 2015
- http://icsec.qatar.tamu.edu