HPC Project 3

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I implemented the original edition on class as sieve0, part 1 as sieve1 and so on.
The results are mutually verified. The correct number of primes within 10^10 is 455052511.

Performance of each version:

Run Time (seconds)				
# of Proc	Sieve0	Sieve1	Sieve2	Sieve3
32 (1 node)	33.143088	16.182538	16.092023	6.408964
64 (2 nodes)	18.266663	8.560392	8.245190	3.242349
128 (4 nodes)	9.209137	4.870914	4.120074	1.684220
256 (8 nodes)	7.139763	3.485822	3.406382	0.825508

By increasing the number of processes, the run time can be reduced by 50% in general.
Sieve1 picks out all the even numbers so the performance has been doubled.
Sieve2 let each process calculate its own prime number array so that we can eliminate broadcast overhead. However, we did not observe significant improvement in sieve2. Perhaps the reason is that the slack time of waiting for communication is small.
Sieve3 divides the numbers into smaller blocks in order to utilize cache and register just like previous projects. The effect is overwhelming good as we can observe almost 3 times faster than sieve2.

How To Run

Compile

$ module load openmpi-3.0/gcc-4.8.5
$ make all

Run

$ sbatch 1node.sh
$ sbatch 2node.sh
$ sbatch 4node.sh
$ sbatch 8node.sh