ICSI 520 Distributed & Parallel Computing - Fall 2019

Homework 8

Santhosh Ranganathan (NetID: SR582413)

sranganathan2@albany.edu

UAlbany Cluster Results:

|  |  |  |
| --- | --- | --- |
| **Number of cores (p)** | **Matrix Size** | **Distributed execution time (microseconds)** |
| 4 | 2x2 | 777.0 |
| 4 | 4x4 | 798.0 |
| 4 | 4x4 | 819.8 |
| 16 | 2654.4 |
| 4 | 4x8 | 881.0 |
| 16 | 2750.6 |
| 4 | 8x8 | 980.4 |
| 16 | 2668.0 |
| 4 | 8x2 | 856.8 |
| 9 | 3x9 | 1864.4 |
| 4 | 2x10 | 836.4 |
| 4 | 10x4 | 888.2 |
| 4 | 4x10 | 900.2 |
| 4 | 6x4 | 868.8 |
| 9 | 9x3 | 1857.2 |
| 4 | 10x6 | 962.0 |
| 4 | 8x16 | 1132.6 |
| 16 | 2766.2 |
| 4 | 8x10 | 1010.4 |
| 9 | 9x6 | 1990.0 |
| 4 | 8x2 | 828.8 |
| 9 | 12x9 | 2025.6 |
| 4 | 12x20 | 1455.4 |
| 16 | 2714.6 |
| 4 | 24x32 | 2808.4 |
| 16 | 3247.6 |
| 9 | 18x6 | 2016.6 |
| 9 | 24x21 | 2534.4 |

salloc -n 20

mpirun -n 16 Homework8\_Distributed.out 24 32 100

(Averaging 5 runs) (Game of Life run for 100 iterations)

StarCluster Results:

|  |  |  |
| --- | --- | --- |
| **Number of cores (p)** | **Matrix Size** | **Distributed execution time (microseconds)** |
| 4 | 2x2 | 55086.6 |
| 4 | 4x4 | 55752.2 |
| 4 | 4x4 | 56182.2 |
| 16 | 139242.6 |
| 4 | 4x8 | 53466.2 |
| 16 | 139475.4 |
| 4 | 8x8 | 54775.6 |
| 16 | 177582.2 |
| 4 | 8x2 | 69773.6 |
| 9 | 3x9 | 141649.4 |
| 4 | 2x10 | 64068.4 |
| 4 | 10x4 | 63689.0 |
| 4 | 4x10 | 61782.8 |
| 4 | 6x4 | 59839.0 |
| 9 | 9x3 | 114417.2 |
| 4 | 10x6 | 63841.2 |
| 4 | 8x16 | 60673.4 |
| 16 | 143843.6 |
| 4 | 8x10 | 59421.4 |
| 9 | 9x6 | 113063.4 |
| 4 | 8x2 | 60876.0 |
| 9 | 12x9 | 112806.2 |
| 4 | 12x20 | 60212.2 |
| 16 | 153223.6 |
| 4 | 24x32 | 59382.2 |
| 16 | 159650.4 |
| 9 | 18x6 | 123842.6 |
| 9 | 24x21 | 120675.4 |

mpirun -n 16 ./Homework8\_Distributed.out 24 32 100

(Averaging 5 runs)

(Game of Life run for 100 iterations on 16 node cluster created using StarCluster)

Explanation:

My implementation of distributed Game of Life distributes work to n processes where n is a perfect square. The Game of Life grid is divided into rxr sub grids (where r is square root of n) and each rank exchanges edge and corner cells with surrounding processes according to rank. UAlbany Cluster results are observed to be much faster than StarCluster results and this is likely due to the different nodes being closer and thus able to share information faster. Increasing the number of processes increases communication required and thus we see longer execution times (eg. 16 v 4). Game of Life is computationally inexpensive and thus any distributed version requiring exchange of information for each iteration is going to be significantly slower than serial implementation.