Team 13 DDS Project- Phase 3

Experiments on operations developed in Phase 2 and Phase 3

In phase 2, we implemented the following operations in Apache Spark:

1.) Geometric union
2.) Convex hull
3.) Farthest pair
4.) Closest pair
5.) Spatial Join query
6.) Spatial Range query

We ran these operations on single cluster and clusters of multiple nodes and noted down the per node CPU usage, per node Memory usage, Run time and the communication cost in the cluster. We also used different data sets.

New Operation developed in Phase 3: Heat Map
System Specification:

Master
Processor: Intel Core i3 CPU M 370 @ 2.40Hz*4
Memory: 2.9GB
OS: 64-bit Ubuntu

Worker-1
Processor: Intel Core i3 CPU @ 1.90GHz × 4
Memory: 5.7 GiB
OS: 64-bit Ubuntu

Worker-2
Processor: Intel Core i5 CPU @ 2.4GHz × 4
Memory: 5.88 GiB
OS: 64-bit Ubuntu

Worker-3
Processor: Intel Core i3 CPU M 370 @ 2.40Hz*4
Memory: 2.9GB
OS: 64-bit Ubuntu

Software Used For Measurement

1. Glances

2. Dstat

DataSet Used

1) **Big Data Set:** Arealm.csv
2) **Small Data Set:** Sample File of size 12kb

1. Geometric Union

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 55.27
2 Nodes: Worker 1 - 41.04 ;Worker 2- 49.6
3 Nodes: Worker 1- 38.26 ;Worker 2- 24.6 ; Worker 3- 18.2
4 Nodes: Worker 1- 31.45 ;Worker 2- 18.63 ;Worker 3-20.04 ; Worker 4 -15.26

B. Memory Utilization (Percentage Increase)

Single Node: Worker1-13.04
2 Nodes: Worker 1 - 6.23 Worker 2-9.8
3 Nodes: Worker 1- 5.1 Worker 2- 8.9 Worker 3-8.1
4 Nodes: Worker 1- 4.72 Worker 2- 6.8 Worker 3-6.2 ;Worker 4 -6.01

C. Run Time (Seconds)

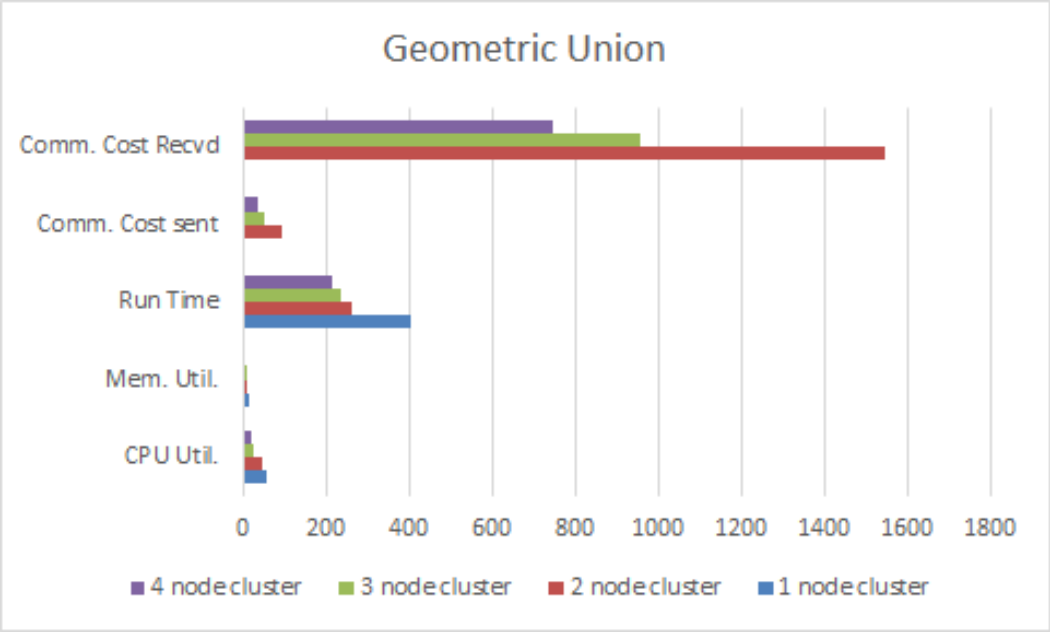
Single Node: 403
2 Nodes: Job 0- 175 Job 1-187
3 Nodes: Job 0- 156 Job 1- 182
4 Nodes: Job 0- 148 Job 1-176

D. Communication Cost

2 Nodes: Worker1 Sent- 88.8 K Worker1 Received- 1573.4K
Worker2 Sent- 97.3 K Worker2 Received- 1512 K

3 Nodes: Worker1 Sent- 53.5 K Worker1 Received- 971 K
Worker2 Sent- 44.3 K Worker2 Received- 945.5 K
Worker3 Sent- 59.5 K Worker3 Received- 958.06 K

4 Nodes: Worker1 Sent- 32.1 K Worker1 Received- 736 K
Worker2 Sent- 38.4 K Worker2 Received- 778.8 K
Worker3 Sent- 31.2 K Worker3 Received- 728.2 K
Worker4 Sent- 43.1 K Worker4 Received- 745.7 K



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)
Single Node: Worker1- 44.5
2 Nodes: Worker 1 - 38.76 ;Worker 2-34.23
3 Nodes: Worker 1- 35.45 ; Worker 2- 24.5 ;Worker 3- 24.4
4 Nodes: Worker 1- 32.26 ; Worker 2- 20.6 ;Worker 3-18.36 ;Worker 4 - 15.63

B. Memory Utilization (Percentage Increase)
Single Node: Worker1- 7.36
2 Nodes: Worker 1 -5.63 ;Worker 2-4.23
3 Nodes: Worker 1- 2.89 ;Worker 2- 3.2 ;Worker 3- 3.1
4 Nodes: Worker 1-1.69 ;Worker 2- 2.36 ;Worker 3- 2.3 ;Worker 4 -1.21

C. Run Time
Single Node: 11.23 seconds
2 Nodes: Job0- 5.6 seconds Job1- 4.45 seconds
3 Nodes: Job0- 4.92 seconds Job1- 3.76 seconds
4 Nodes: Job0- 3.26 seconds Job1- 3.43 seconds

D. Communication Cost
2 Nodes: Worker1 Sent- 23.6K Worker1 Received- 526.4 K
Worker2 Sent- 27.8K Worker2 Received- 514.6 K
3 Nodes: Worker1 Sent- 16.8K Worker1 Received- 387.3K

Worker2 Sent- 12.3K Worker2 Received- 344.1K
Worker3 Sent- 15.7K Worker3 Received- 362K

4 Nodes: Worker1 Sent- 12.9K Worker1 Received- 236.36K
Worker2 Sent- 11.7K Worker2 Received- 242.23K
Worker3 Sent- 15.1K Worker3 Received- 256.23K
Worker4 Sent- 12.9K Worker4 Received- 229.5K

2. CONVEX HULL

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 42.2%
2 Nodes: Worker 1 - 37% ;Worker 2- 40%
3 Nodes: Worker 1- 32% ; Worker 2- 31% ; Worker 3- 21%
4 Nodes: Worker 1- 21% ; Worker 2- 19% ;Worker 3- 15% ;Worker 4 - 19%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 14.1%
2 Nodes: Worker 1 - 7% ;Worker 2- 6%
3 Nodes: Worker 1- 6% ; Worker 2- 4.5% ;Worker 3- 3.2%
4 Nodes: Worker 1- 4.2% ;Worker 2- 4% ;Worker 3- 3.3% ;Worker 4 - 3.7%

C. Run Time

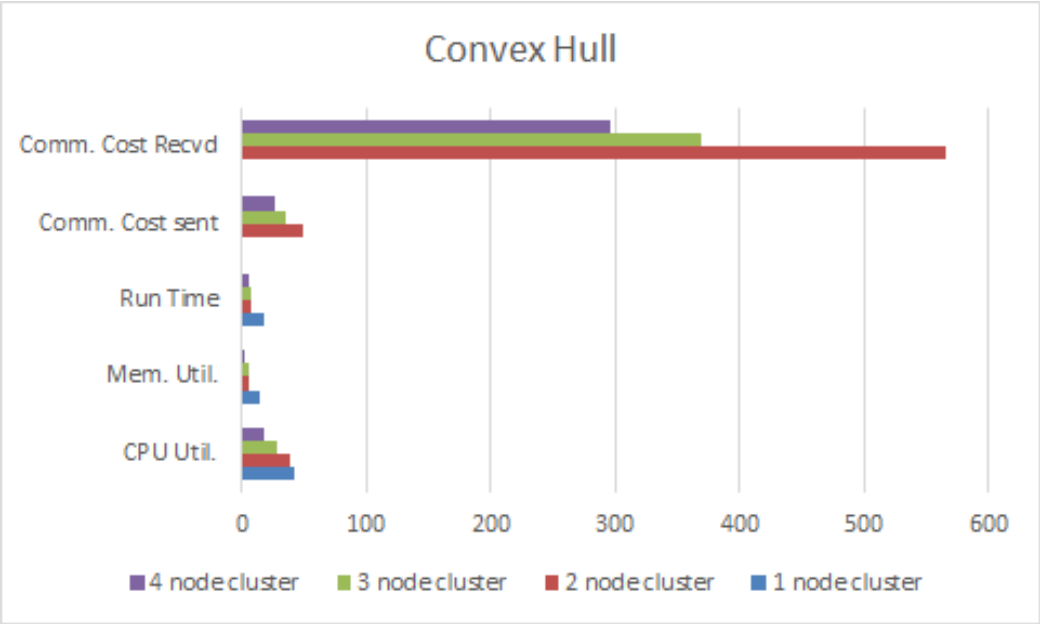
Single Node: 17.24s
2 Nodes: Job0- 9.8s Job 1- 6.9s
3 Nodes: Job0- 7.9s Job1- 6.3s
4 Nodes: Job0- 7.2s Job 1- 6s

D. Communication Cost

2 Nodes: Worker1Sent- 42k Worker1Received- 621k
Worker2Sent- 58k Worker2Received- 511k
3 Nodes: Worker1Sent- 31k Worker1Received- 318k
Worker2Sent- 38k Worker2Received- 480k
Worker3Sent- 29k Worker3Received- 311k

4 Nodes: Worker1 Sent- 31k Worker1 Received- 319k
Worker2 Sent- 27k Worker2 Received- 250k

Worker3 Sent- 18k Worker3 Received- 218k
Worker4 Sent- 30k Worker4 Received- 400k



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 38%

2 Nodes: Worker 1 - 31% ;Worker 2- 36%

3 Nodes: Worker 1- 24% ;Worker 2- 24.5% ;Worker 3- 34.1%

4 Nodes: Worker 1- 21% ;Worker 2- 23% ;Worker 3- 18% ;Worker 4 - 27%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 11.4%

2 Nodes: Worker 1 - 9.7% ;Worker 2- 8%

3 Nodes: Worker 1- 3.4% ;Worker 2- 8.1% ;Worker 3- 7.1%

4 Nodes: Worker 1- 6.2% ;Worker 2- 3.4% ;Worker 3- 5%; Worker 4 - 5%

C. Run Time

Single Node: 5.3s

2 Nodes: Job0- 4.3s Job1- 3.7s

3 Nodes: Job0- 3.54s Job1- 3.2s

4 Nodes: Job0- 3.1s Job1- 2.8s

D. Communication Cost

2 Nodes: Worker1Sent- 26k Worker1Received- 211k
Worker2Sent- 15k Worker2Received- 180k

3 Nodes: Worker1Sent- 17k Worker1Received- 126k

Worker2Sent- 15k Worker2Received- 149k
Worker3Sent- 9k Worker3Received- 170k

4 Nodes: Worker1Sent- 12k Worker1Received- 86k
Worker2Sent- 8k Worker2Received- 73k
Worker3Sent- 18k Worker3Received- 72k
Worker4Sent- 6k Worker4Received- 117k

3. FARTHEST PAIR

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 48.7
2 Nodes: Worker 1 - 32.5; Worker 2- 31.2
3 Nodes: Worker 1- 27.2; Worker 2- 27.8; Worker 3- 17.6
4 Nodes: Worker 1- 22.7; Worker 2- 24.4; Worker 3- 13.5 Worker 4 - 14.6

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 13.3
2 Nodes: Worker 1 - 9.8; Worker 2- 6.5
3 Nodes: Worker 1- 7.3; Worker 2- 4.5; Worker 3- 5.6
4 Nodes: Worker 1- 6.7; Worker 2- 4.1; Worker 3- 4.2;
Worker 4 - 3.9

C. Run Time (seconds)

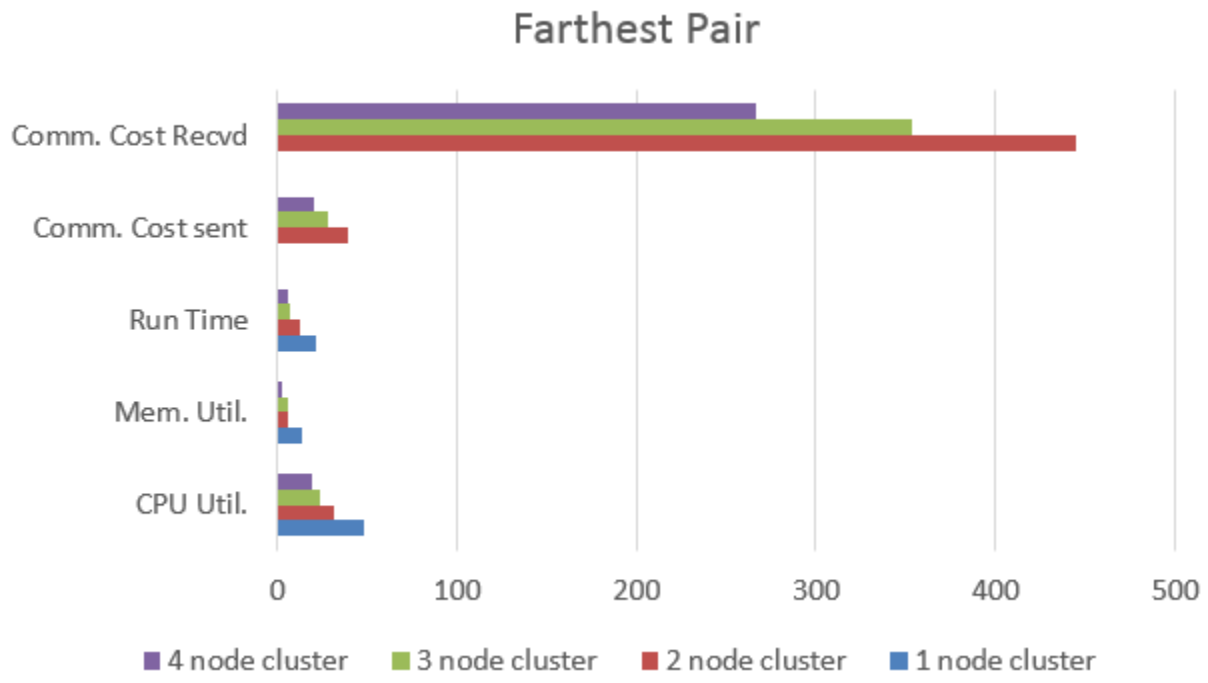
Single Node: 21.76
2 Nodes: Job0- 15.57 Job1- 8.89
3 Nodes: Job0- 6.3 Job1- 6.8
4 Nodes: Job0- 5.57 Job1- 6.2

D. Communication Cost

2 Nodes: Worker1 Sent- 40k Worker1 Received- 730k
Worker2 Sent- 39k Worker2 Received- 260k

3 Nodes: Worker1 Sent- 25k Worker1 Received- 340k
Worker2 Sent- 26k Worker2 Received- 401k
Worker3 Sent- 35k Worker3 Received- 320k

4 Nodes: Worker1 Sent- 15k Worker1 Received- 310k
Worker2 Sent- 16k Worker2 Received- 340k
Worker3 Sent- 32k Worker3 Received- 198k
Worker4 Sent- 19k Worker4 Received- 219k



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 39

2 Nodes: Worker 1 - 36.3; Worker 2- 34.5

3 Nodes: Worker 1- 23.4; Worker 2- 23.45; Worker 3- 24.17

4 Nodes: Worker 1- 18.7; Worker 2- 12.8%; Worker 3- 20.3%; Worker 4 - 15.6%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 12

2 Nodes: Worker 1 - 9; Worker 2- 8

3 Nodes: Worker 1- 2.78; Worker 2- 6.43; Worker3- 6.4

4 Nodes: Worker 1- 3.45; Worker 2- 3.56; Worker 3- 5.7 ;
Worker 4 - 2.4

C. Run Time

Single Node: 2.53s

2 Nodes: Job0- 1.93s Job1- 3.13s

3 Nodes: Job0- 1.13s Job1- 1.19s

4 Nodes: Job0- 0.92s Job1- 0.89s

D. Communication Cost

2 Nodes: Worker1Sent- 14k Worker1Received- 86k
Worker2Sent- 29k Worker2Received- 136k

3 Nodes: Worker1Sent- 15k Worker1Received- 90k
Worker2Sent- 13k Worker2Received- 100k
Worker3Sent- 15k Worker3Received- 89k

4 Nodes: Worker1Sent- 6.3k Worker1Receied- 89k
Worker2Sent- 4.5k Worker2Received- 74k
Worker3Sent- 11k Worker3Received- 42k
Worker4Sent- 9k Worker4Received- 36k

4. CLOSEST PAIR

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 43.7%

2 Nodes: Worker 1 - 41% ;Worker 2- 42.6%

3 Nodes: Worker 1- 41.7% ;Worker 2- 32% ;Worker 3- 40%

4 Nodes: Worker 1- 34% ;Worker 2- 28% ;Worker 3- 27% ;Worker 4 - 29%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 11%

2 Nodes: Worker 1 - 7.2% ;Worker 2- 8.7%

3 Nodes: Worker 1- 8% ;Worker 2- 3.3% ;Worker 3- 6.4%

4 Nodes: Worker 1- 4% ;Worker 2- 3% ;Worker 3- 4% ;Worker 4 - 5%

C. Run Time

Single Node: 16.47s

2 Nodes: Job0- 10.2s Job1- 11.9s

3 Nodes: Job0- 7.64s Job1- 10.9s

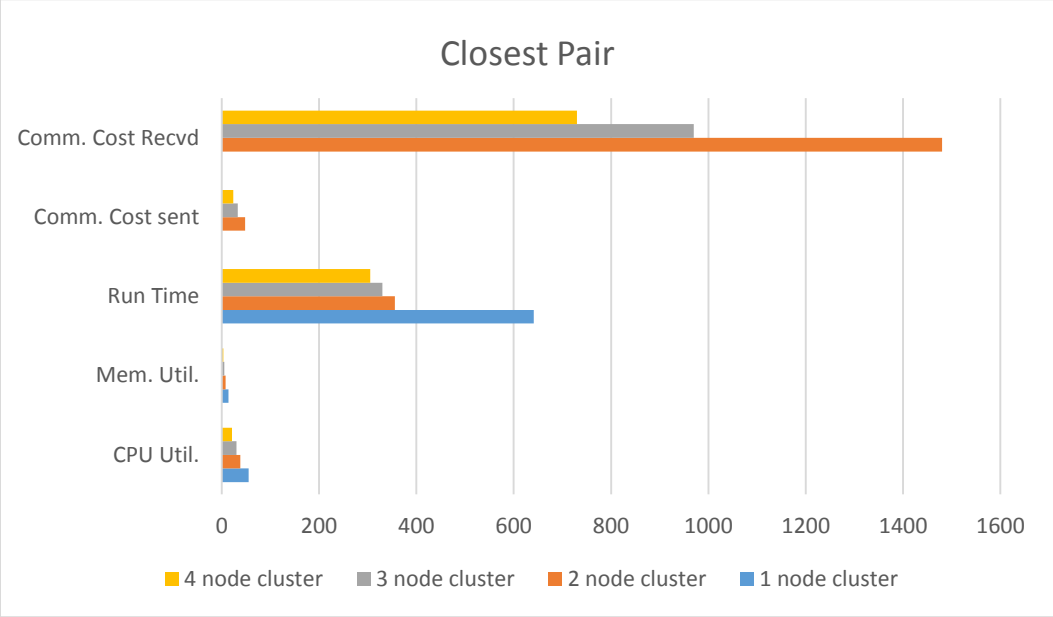
4 Nodes: Job0- 6.4s Job1- 7.3s

D. Communication Cost

2 Nodes: Worker1Sent- 35k Worker1Received- 698k
Worker2Sent- 37k Worker2Received- 239k

3 Nodes: Worker1Sent- 19k Worker1Received- 310k
Worker2Sent- 23k Worker2Received- 381k
Worker3Sent- 29k Worker3Received- 280k

4 Nodes: Worker1Sent- 12k Worker1Received- 298k
Worker2Sent- 13k Worker2Received- 325k
Worker3Sent- 31k Worker3Received- 218k
Worker4Sent- 16k Worker4Received- 239k



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 36%

2 Nodes: Worker 1 - 35.3% ;Worker 2- 32%

3 Nodes: Worker 1- 23.3% ;Worker 2- 27.1% ;Worker 3- 32.1%

4 Nodes: Worker 1- 18.2% ;Worker 2- 13.8% ; Worker 3- 21% ;Worker 4 - 14.6%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 9%

2 Nodes: Worker 1 - 9% ;Worker 2- 8%

3 Nodes: Worker 1- 3.1% ;Worker 2- 8% ;Worker 3- 5.4%

4 Nodes: Worker 1- 6% ;Worker 2- 3.4% ;Worker 3- 5.7% ;Worker 4 - 2.4%

C. Run Time

Single Node: 1.67s

2 Nodes: Job0- 1.48s Job1- 1.39s
3 Nodes: Job0- 1.1s Job1- 1.09s
4 Nodes: Job0- 0.89s Job1- 0.92s

D. Communication Cost

2 Nodes: Worker1Sent- 12k Worker1Received- 80k
Worker2Sent- 27k Worker2Received- 141k
3 Nodes: Worker1Sent- 10k Worker1Received- 88k
Worker2Sent- 14k Worker2Received- 110k
Worker3Sent- 18k Worker3Received- 100k

4 Nodes: Worker1Sent- 7k Worker1Receied- 97k
Worker2Sent- 4k Worker2Received- 68k
Worker3Sent- 13k Worker3Received- 32k
Worker4Sent- 8k Worker4Received- 39k

5. SPATIAL RANGE QUERY

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 43
2 Nodes: Worker 1 - 39 ; Worker 2- 28
3 Nodes: Worker 1- 26 ;Worker 2- 25 ;Worker 3- 33
4 Nodes: Worker 1- 24 ;Worker 2- 22 ;Worker 3- 26 ;Worker 4 - 24

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 9.4
2 Nodes: Worker 1 - 7.1 ;Worker 2- 8
3 Nodes: Worker 1- 6 ;Worker 2- 3.3 ;Worker 3- 3.2
4 Nodes: Worker 1- 5.5 ;Worker 2- 2.7 ;Worker 3- 3.0 ;Worker 4 - 2.9

C. Run Time (Seconds)

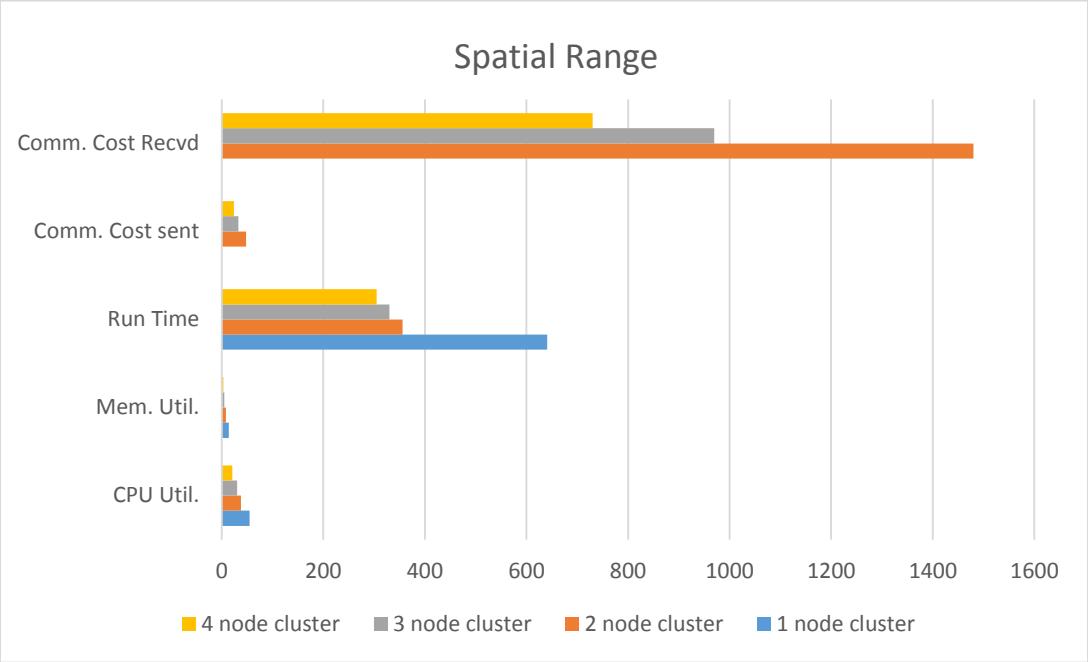
Single Node: 20.96
2 Nodes: Job0- 9.8 Job1- 8.1
3 Nodes: Job0- 4.94 Job1- 4.56
4 Nodes: Job0- 3.67 Job1- 3.21

D. Communication Cost

2 Nodes: Worker1Sent- 48.8K Worker1Received- 370.8K
Worker2Sent- 47.2K Worker2Received- 367.9K
3 Nodes: Worker1Sent- 32.5K Worker1Received- 247.2K

Worker2Sent- 29.8K Worker2Received- 238.5K
Worker3Sent- 33.3K Worker3Received- 262.4K

4 Nodes: Worker1Sent- 24.4 K Worker1Received- 185.4K
Worker2Sent- 22.7K Worker2Received- 162.7K
Worker3Sent- 19.9K Worker3Received- 191.2K
Worker4Sent- 26.7K Worker4Received- 178.2K



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 40.5
2 Nodes: Worker1- 37.5 Worker2- 25
3 Nodes: Worker1- 25.2 ;Worker2- 26 ;Worker3- 27.5
4 Nodes: Worker1- 22 ;Worker2- 23.7 ;Worker3- 24 ;Worker4- 21.8

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 7.9
2 Nodes: Worker1- 5.6 ;Worker2- 6.4
3 Nodes: Worker1- 2.8 ;Worker2- 4 ;Worker3- 3.3
4 Nodes: Worker1- 2.5 ;Worker2- 3.1 ;Worker3- 2.9 ;Worker4- 3.2

C. Run Time (Seconds)

Single Node: 3.2
2 Nodes: Job0- 1.7 Job1- 1.5
3 Nodes: Job0- 0.9 Job1- 0.8

4 Nodes: Job0- 0.54 Job1- 0.4

D. Communication Cost

2 Nodes: Worker1Sent- 21.1K Worker1Received- 170.2K
Worker2Sent- 23.5K Worker2Received- 165.5K
3 Nodes: Worker1Sent- 14K Worker1Received- 113.6K
Worker2Sent- 13.7K Worker2Received- 118.2K
Worker3Sent- 12.5K Worker3Received- 121K

4 Nodes: Worker1Sent- 10.55K Worker1Received- 85.K
Worker2Sent- 9.78K Worker2Received- 92.5K
Worker3Sent- 10.21K Worker3Received- 97.8K
Worker4Sent- 8.9K Worker4Received- 72.1K

6. SPATIAL JOIN QUERY

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1-55%
2 Nodes: Worker 1 - 30% ;Worker 2- 43%
3 Nodes: Worker 1- 36% ;Worker 2- 26.5% ;Worker 3- 37%
4 Nodes: Worker 1- 23% ;Worker 2- 24% ;Worker 3- 25% ;Worker 4 - 11%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 15%
2 Nodes: Worker 1 - 8.5% ;Worker 2- 12%
3 Nodes: Worker 1- 7.9% ;Worker 2- 4% ;Worker 3- 9%
4 Nodes: Worker 1- 3.5% ;Worker 2- 3.2% ;Worker 3- 4.5% ;Worker 4 - 4.9%

C. Run Time

Single Node: 720.88 seconds
2 Nodes: Job0- 430.01 seconds Job1- 425.67 seconds
3 Nodes: Job0- 390 seconds Job1- 400 seconds
4 Nodes: Job0- 362.05 seconds Job1- 378 seconds

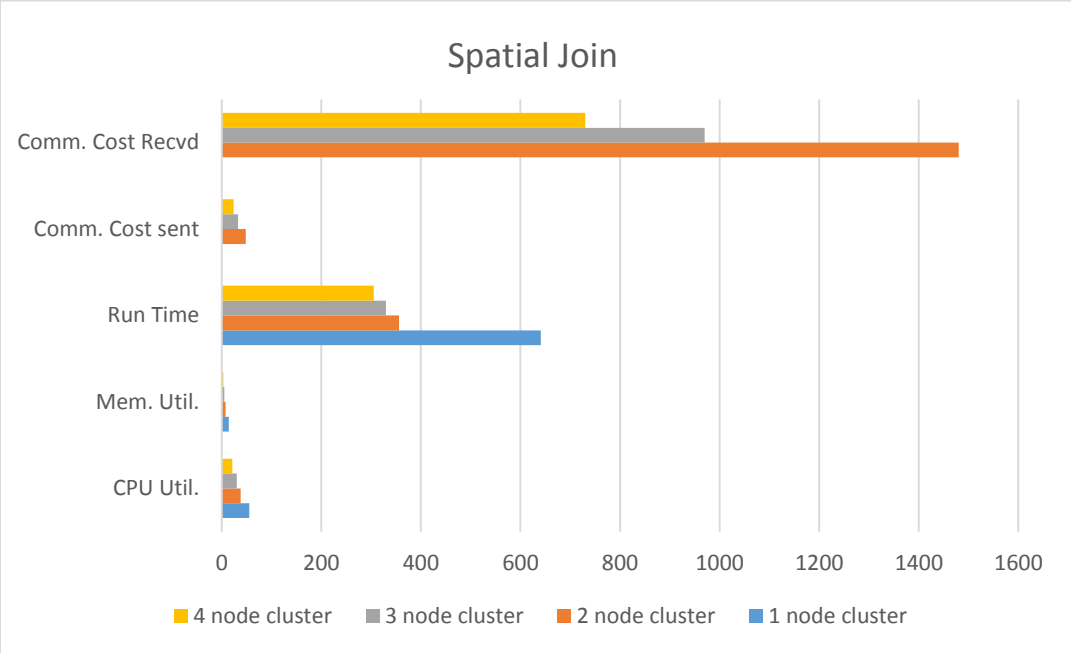
D. Communication Cost

2 Nodes: Worker1Sent- 78.8 K Worker1Received- 1472.4K
Worker2Sent- 77.3 K Worker2Received- 1470 K

3 Nodes: Worker1Sent- 50.5 K Worker1Received- 981 K

Worker2Sent- 48.3 K Worker2Received- 975.5 K
Worker3Sent- 51.5 K Worker3Received- 978.06 K

4 Nodes: Worker1Sent- 35.1 K Worker1Received- 740 K
Worker2Sent- 39.4 K Worker2Received- 730.8 K
Worker3Sent- 34.2 K Worker3Received- 736.2 K
Worker4Sent- 40.1 K Worker4Received- 729.7 K



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 47%
2 Nodes: Worker 1 - 35% ;Worker 2- 22%
3 Nodes: Worker 1- 30% ;Worker 2- 28% ;Worker 3- 23%
4 Nodes: Worker 1- 20% ;Worker 2- 5% ;Worker 3- 8% ;Worker 4 - 15%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 8%
2 Nodes: Worker 1 - 3% ;Worker 2- 4%
3 Nodes: Worker 1- 2.3% ;Worker 2- 2.4% ;Worker 3- 4%
4 Nodes: Worker 1- 1.5% ;Worker 2- 2.3% ;Worker 3- 1.5% ;Worker 4 - 2.1%

C. Run Time

Single Node: 9.7 seconds
2 Nodes: Job0- 4.6 seconds Job1- 3.78 seconds
3 Nodes: Job0- 4.1 seconds Job1- 3.2 seconds

4 Nodes: Job0- 3.61 seconds Job1- 3.06 seconds

D. Communication Cost

2 Nodes: Worker1Sent- 25K Worker1Received- 506.4 K
Worker2Sent- 26K Worker2Received- 504.6 K

3 Nodes: Worker1Sent- 17K Worker1Received- 337.3K
Worker2Sent- 16.3K Worker2Received- 334.1K
Worker3Sent- 14.7K Worker3Received- 332K

4 Nodes: Worker1Sent- 13.9K Worker1Received- 256.1K
Worker2Sent- 12.7K Worker2Received- 253K
Worker3Sent- 14.1K Worker3Received- 259K
Worker4Sent- 13K Worker4Received- 249.5K

7. HEAT MAP

(i.) Big Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 55%
2 Nodes: Worker 1 - 37% ;Worker 2- 39%
3 Nodes: Worker 1- 33% ;Worker 2- 25.9% ;Worker 3- 37%
4 Nodes: Worker 1- 12.9% ;Worker 2- 23% ;Worker 3- 13.6% ;Worker 4 - 26%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 14.11%
2 Nodes: Worker 1 - 4.5% ;Worker 2- 14%
3 Nodes: Worker 1- 9% ;Worker 2- 2.5% ;Worker 3- 4.4%
4 Nodes: Worker 1- 3.7% ;Worker 2- 2.9% ;Worker 3- 6.7% ;Worker 4 - 3.1%

C. Run Time

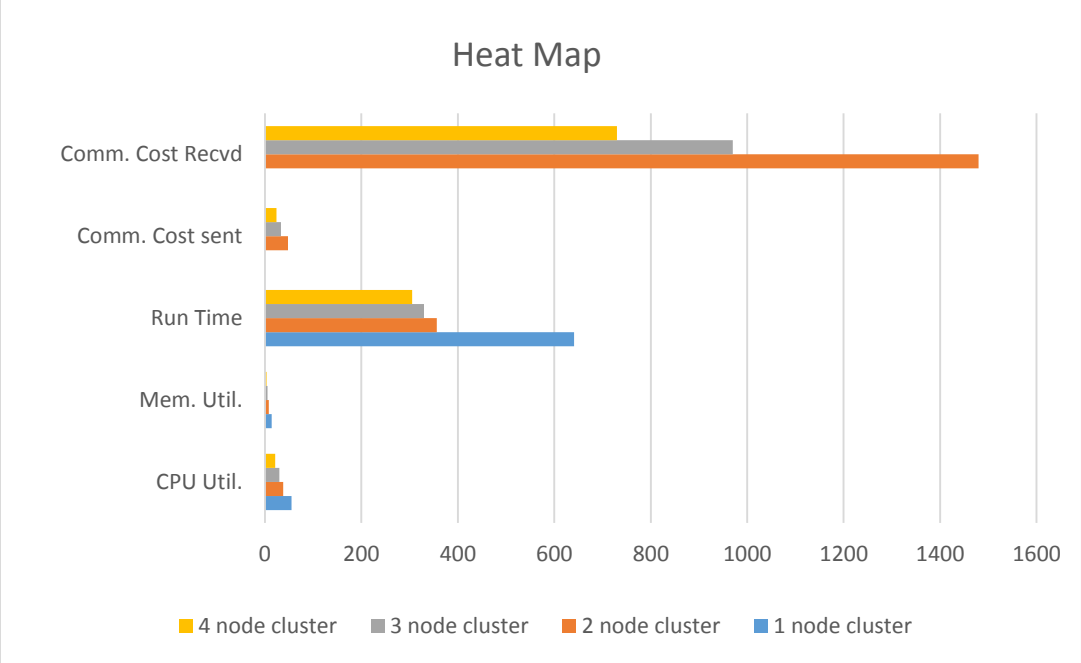
Single Node: 641 seconds
2 Nodes: Job0- 356.19 seconds Job1- 378.54 seconds
3 Nodes: Job0- 341.10 seconds Job1- 323.77 seconds
4 Nodes: Job0- 310 seconds Job1- 302 seconds

D. Communication Cost

2 Nodes: Worker1Sent- 49.2K Worker1Received- 1484.8K
Worker2Sent- 48.5K Worker2Received- 1396.5K

3 Nodes: Worker1Sent- 32.8K Worker1Received- 988.8K
Worker2Sent- 34.5K Worker2Received- 970.5K
Worker3Sent- 33.3K Worker3Received- 957.8K

4 Nodes: Worker1Sent- 24.7K Worker1Received- 743.7K
Worker2Sent- 22.8K Worker2Received- 727.2K
Worker3Sent- 25.6K Worker3Received- 785K
Worker4Sent- 24.2K Worker4Received- 712.2K



(ii.) Small Data Set

A. CPU Utilization (Percentage Increase)

Single Node: Worker1- 50%
2 Nodes: Worker 1 - 34% ;Worker 2- 33%
3 Nodes: Worker 1- 30% ;Worker 2- 28% ;Worker 3- 32%
4 Nodes: Worker 1- 24% ;Worker 2- 31% ;Worker 3- 15% ;Worker 4 - 21%

B. Memory Utilization (Percentage Increase)

Single Node: Worker1- 6.7%
2 Nodes: Worker 1 - 5.5% ;Worker 2- 4.2%

3 Nodes: Worker 1- 2.3% ;Worker 2- 3.4% ;Worker 3- 4%
4 Nodes: Worker 1- 1.3% ;Worker 2- 2.1% ;Worker 3- 0.5% ;Worker 4 - 2.4%

C. Run Time

Single Node: 9.2 seconds
2 Nodes: Job0- 4.2 seconds Job1- 3.7 seconds
3 Nodes: Job0- 4.1 seconds Job1- 3.2 seconds
4 Nodes: Job0- 3.05 seconds Job1- 2.98 seconds

D. Communication Cost

2 Nodes: Worker1Sent- 27K Worker1Received- 506.7K
Worker2Sent- 25.4K Worker2Received- 545.5K

3 Nodes: Worker1Sent- 19.1K Worker1Received- 337.7K
Worker2Sent- 18.5K Worker2Received- 323.2K
Worker3Sent- 17.1K Worker3Received- 345.5K

4 Nodes: Worker1Sent- 13.3K Worker1Received- 247.9K
Worker2Sent- 15.1K Worker2Received- 256.2K
Worker3Sent- 11.2K Worker3Received- 221.6K
Worker4Sent- 14K Worker4Received- 233K