

Question – 1

Assignment – 4

Develop a simple MPI program using C/C++ and OpenMPI that uses at least 4 nodes on explorer and utilizes atleast 16 processes on each node (a minimum of 64 processes in total). You are suggested to use the sample batch script provided on Canvas for specifying your OpenMP configuration and running your program.

- a) Start with an integer variable that you will pass to each process, where process 1 prints the value, increments the value by 1 and sends it to process 2. Process 2 prints the value, then increments the value by 1 and sends it to process 3. Repeat this for all 64 processes. When performing printing, print both the integer value, as well as identify which process is printing, and on which node this process is running on.
- b) Next, extend your program such that once the value gets to 64, decrement the value by 2 in each step, and continue to print out the value until the decremented value is zero.

Answer:

(a):

When the command line is entered accordingly, it gives the below output:

Process X on node Y received value: Z

where X is the rank number, Y is the host name and Z is the current value of the token. This output helps visualize the flow of the token across different processes and nodes in the MPI environment

```
[sridhar.pray@explorer-01 ~]$ mpirun -np 64 --oversubscribe ./bounce64
Process 1 on node explorer-01 received value: 0
Process 2 on node explorer-01 received value: 1
Process 3 on node explorer-01 received value: 2
Process 4 on node explorer-01 received value: 3
Process 5 on node explorer-01 received value: 4
Process 6 on node explorer-01 received value: 5
Process 7 on node explorer-01 received value: 6
Process 8 on node explorer-01 received value: 7
Process 9 on node explorer-01 received value: 8
Process 10 on node explorer-01 received value: 9
Process 11 on node explorer-01 received value: 10
Process 12 on node explorer-01 received value: 11
Process 13 on node explorer-01 received value: 12
Process 14 on node explorer-01 received value: 13
Process 15 on node explorer-01 received value: 14
Process 16 on node explorer-01 received value: 15
Process 17 on node explorer-01 received value: 16
Process 18 on node explorer-01 received value: 17
Process 19 on node explorer-01 received value: 18
Process 20 on node explorer-01 received value: 19
Process 21 on node explorer-01 received value: 20
Process 22 on node explorer-01 received value: 21
Process 23 on node explorer-01 received value: 22
Process 24 on node explorer-01 received value: 23
Process 25 on node explorer-01 received value: 24
Process 26 on node explorer-01 received value: 25
Process 27 on node explorer-01 received value: 26
Process 28 on node explorer-01 received value: 27
Process 29 on node explorer-01 received value: 28
Process 30 on node explorer-01 received value: 29
Process 31 on node explorer-01 received value: 30
Process 32 on node explorer-01 received value: 31
Process 33 on node explorer-01 received value: 32
Process 34 on node explorer-01 received value: 33
Process 35 on node explorer-01 received value: 34
Process 36 on node explorer-01 received value: 35
Process 37 on node explorer-01 received value: 36
Process 38 on node explorer-01 received value: 37
Process 39 on node explorer-01 received value: 38
Process 40 on node explorer-01 received value: 39
```

```
Process 40 on node explorer-01 received value: 39
Process 41 on node explorer-01 received value: 40
Process 42 on node explorer-01 received value: 41
Process 43 on node explorer-01 received value: 42
Process 44 on node explorer-01 received value: 43
Process 45 on node explorer-01 received value: 44
Process 46 on node explorer-01 received value: 45
Process 47 on node explorer-01 received value: 46
Process 48 on node explorer-01 received value: 47
Process 49 on node explorer-01 received value: 48
Process 50 on node explorer-01 received value: 49
Process 51 on node explorer-01 received value: 50
Process 52 on node explorer-01 received value: 51
Process 53 on node explorer-01 received value: 52
Process 54 on node explorer-01 received value: 53
Process 55 on node explorer-01 received value: 54
Process 56 on node explorer-01 received value: 55
Process 57 on node explorer-01 received value: 56
Process 58 on node explorer-01 received value: 57
Process 59 on node explorer-01 received value: 58
Process 60 on node explorer-01 received value: 59
Process 61 on node explorer-01 received value: 60
Process 62 on node explorer-01 received value: 61
Process 63 on node explorer-01 received value: 62
```

(b):

```
Process 0 on node explorer-01 received value: 63
Process 1 on node explorer-01 received value: 62
Process 2 on node explorer-01 received value: 60
Process 3 on node explorer-01 received value: 58
Process 4 on node explorer-01 received value: 56
Process 5 on node explorer-01 received value: 54
Process 6 on node explorer-01 received value: 52
Process 7 on node explorer-01 received value: 50
Process 8 on node explorer-01 received value: 48
Process 9 on node explorer-01 received value: 46
```

```
Process 10 on node explorer-01 received value: 44
Process 11 on node explorer-01 received value: 42
Process 12 on node explorer-01 received value: 40
Process 13 on node explorer-01 received value: 38
Process 14 on node explorer-01 received value: 36
Process 15 on node explorer-01 received value: 34
Process 16 on node explorer-01 received value: 32
Process 17 on node explorer-01 received value: 30
Process 18 on node explorer-01 received value: 28
Process 19 on node explorer-01 received value: 26
Process 20 on node explorer-01 received value: 24
Process 21 on node explorer-01 received value: 22
Process 22 on node explorer-01 received value: 20
Process 23 on node explorer-01 received value: 18
Process 24 on node explorer-01 received value: 16
Process 25 on node explorer-01 received value: 14
Process 26 on node explorer-01 received value: 12
Process 27 on node explorer-01 received value: 10
Process 28 on node explorer-01 received value: 8
Process 29 on node explorer-01 received value: 6
Process 30 on node explorer-01 received value: 4
Process 31 on node explorer-01 received value: 2
```

```
[sridhar.pray@explorer-02 ~]$ sbatch run_bounce64.slurm
Submitted batch job 105842
```