FIT5139 Advanced distributed and parallel systems

Assignment – task 2

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# Part 1

The program mpi\_vessel.c is a C program written with MPI library to achieve parallel. This program is written to simulate multiple vessels striking when there is at least one odd vessel and two even vessels occupied same location in a 1000 locations map.

In this program, each processor represents a vessel and the processor rank represents the number of each vessel. The total structure of this program is consisted of a large while loop which controls the program running time and the final result printing out section. This program is completed in 100 seconds. Also, it could be 60 seconds and it depends. The more the running time is, the more sample generated. This will increase the accuracy of striking rate in this situation. And at the start of each loop, root processor (processor 0) will broadcast its time region to other processors which can modify the system time record and make all processor run in synchronize of a sample.

In the outer while loop, there is an inner while loop to generate samples. Each while loop will generate one sample and every loop root processor will broadcast its time to other processor to be synchronize. This synchronizing period is 0.005s. CPU clock period exist tiny difference in different core. If there is no synchronizing method, a long time separate running will increase the gap of different core which might cause confusion in the system and decrease the efficiency of the algorithm.

In the inner while loop, each processor generates a random value from 0 to 999 which represents 1000 locations. And send the generated locations to root processor using blocking send method (MPI\_Send) of MPI for further processing. In root processor, it will generate a map structure which used to record 1000 position and, in each location, it records occupied vessels numbers and the rank of each vessel. To record strike, we can only need to choose the location contains at least three vessels and then, judge the even and odd number in this location.

# Part 2

There are two kinds of communication. First is time communication and the second is vessel communication. For the first communication, master processor broadcast (MPI\_Bcast) its timer to all other processors. The receiver of the MPI\_Bcast is the same function.

MPI\_Bcast( void \*buffer, int count, MPI\_Datatype datatype, int root,

MPI\_Comm comm )

For MPI\_Bcast, the root processor sends buffer and other processor which is not root use same function to receive and it’s a blocking broadcast. It used to synchronize all the processors in the system. It contains two subparts. The first one to using broadcast to synchronize for one 0.005s sample. And the second one is synchronizing in each occupying. The second communication type is other processors send (MPI\_Send) its generated number to master processor and master received (MPI\_Recv) also in blocking communication scheme.

# Part 3

This program records the striking in 100 seconds. In this program, we record the total strike numbers and the total samples. These two metrics can calculate the striking rate in the period. We find out that, it’s very hard to strike if there are only 2 or 4 vessels even increasing the programing time. With the number of vessel increasing, the striking rate also increasing. We increase the vessel into 6, it starts to striking and when the vessel increased into 10, striking happens in almost in every running. We also find out that with the increasing of vessels, the sample number will decrease. The reason could be that the blocking communication will waste more time with the increasing of processors.