CSE4001 - Parallel and Distributed Computing

Lab 21+22

Lab Assignment- 5

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QUESTION:

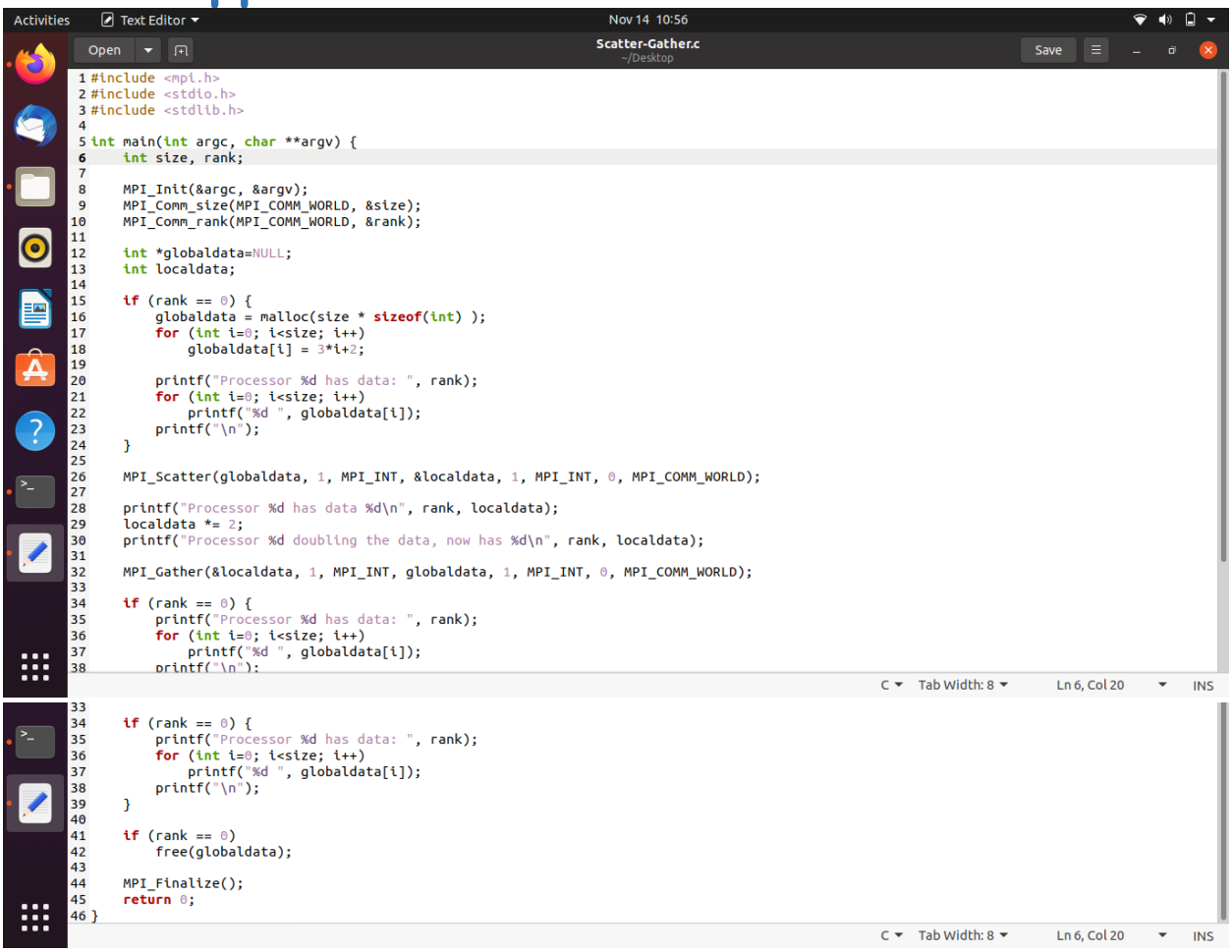
Write a C program to handle message passing in the MPI application interface using Group Operators: Scatter and Gather.

CODE:

```
#include <mpi.h>
#include <stdio.h>
#include <stdlib.h>
int main(int argc, char **argv) {
   int size, rank;
   MPI_Init(&argc, &argv);
   MPI_Comm_size(MPI_COMM_WORLD, &size);
   MPI_Comm_rank(MPI_COMM_WORLD, &rank);
   int *globaldata=NULL;
   int localdata;
   if (rank == 0) {
      globaldata = malloc(size * sizeof(int) );
      for (int i=0; i<size; i++)
         globaldata[i] = 3*i+2;
      printf("Processor %d has data: ", rank);
      for (int i=0; i<size; i++)
         printf("%d ", globaldata[i]);
      printf("\n");
   }
   MPI_Scatter(globaldata, 1, MPI_INT, &localdata, 1, MPI_INT, 0,
MPI_COMM_WORLD);
   printf("Processor %d has data %d\n", rank, localdata);
   localdata *= 2;
```

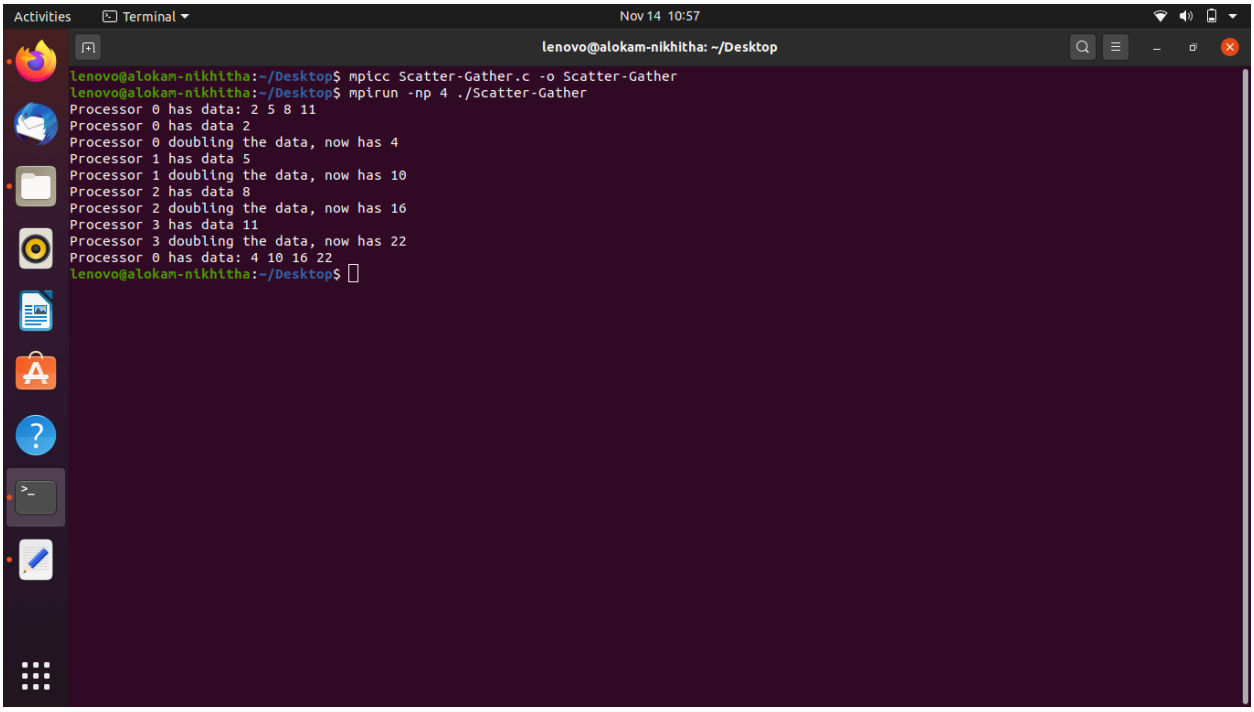
```
    printf("Processor %d doubling the data, now has %d\n", rank, localdata);

    MPI_Gather(&localdata, 1, MPI_INT, globaldata, 1, MPI_INT, 0,
MPI_COMM_WORLD);
    if (rank == 0) {
        printf("Processor %d has data: ", rank);
        for (int i=0; i<size; i++)
            printf("%d ", globaldata[i]);
        printf("\n");
    }
    if (rank == 0)
        free(globaldata);
    MPI_Finalize();
    return 0;
}
```

Code Snippets:

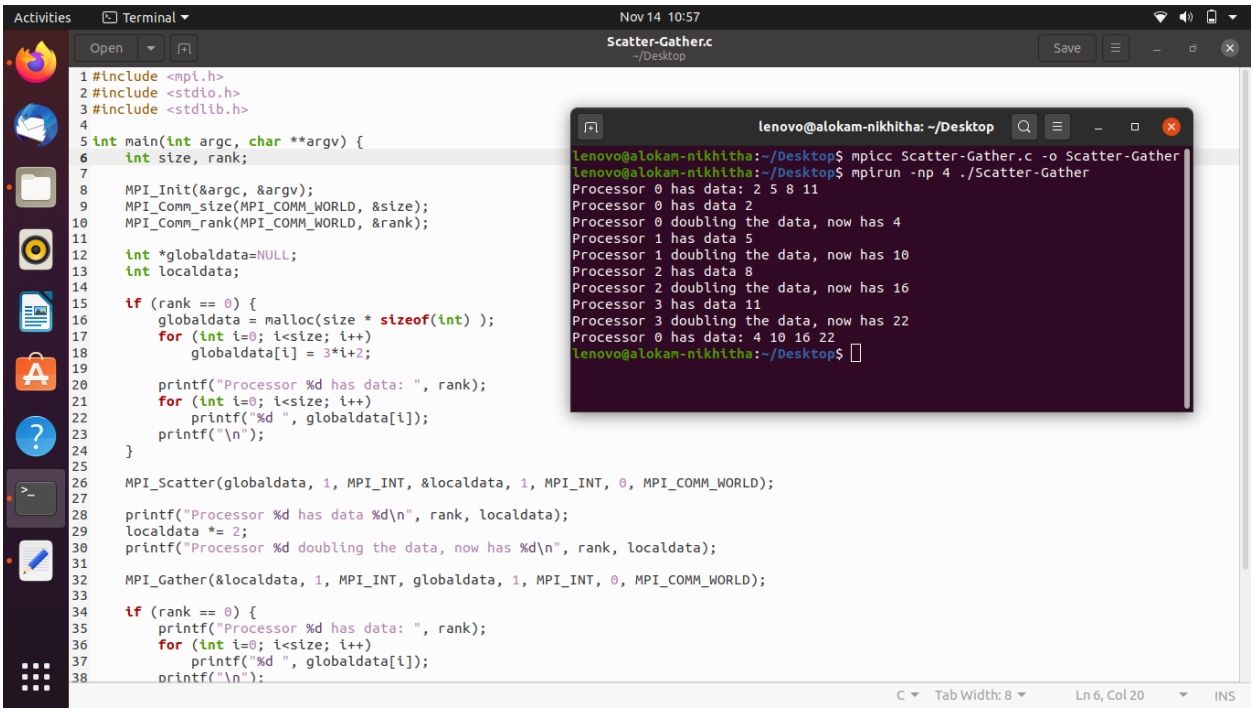



```c
#include <mpi.h>
#include <stdio.h>
#include <stdlib.h>

int main(int argc, char **argv) {
    int size, rank;

    MPI_Init(&argc, &argv);
    MPI_Comm_size(MPI_COMM_WORLD, &size);
    MPI_Comm_rank(MPI_COMM_WORLD, &rank);

    int *globaldata=NULL;
    int localdata;

    if (rank == 0) {
        globaldata = malloc(size * sizeof(int) );
        for (int i=0; i<size; i++)
            globaldata[i] = 3*i+2;

        printf("Processor %d has data: ", rank);
        for (int i=0; i<size; i++)
            printf("%d ", globaldata[i]);
        printf("\n");
    }

    MPI_Scatter(globaldata, 1, MPI_INT, &localdata, 1, MPI_INT, 0, MPI_COMM_WORLD);

    printf("Processor %d has data %d\n", rank, localdata);
    localdata *= 2;
    printf("Processor %d doubling the data, now has %d\n", rank, localdata);

    MPI_Gather(&localdata, 1, MPI_INT, globaldata, 1, MPI_INT, 0, MPI_COMM_WORLD);

    if (rank == 0) {
        printf("Processor %d has data: ", rank);
        for (int i=0; i<size; i++)
            printf("%d ", globaldata[i]);
        printf("\n");
    }

    if (rank == 0) {
        printf("Processor %d has data: ", rank);
        for (int i=0; i<size; i++)
            printf("%d ", globaldata[i]);
        printf("\n");
    }

    if (rank == 0)
        free(globaldata);

    MPI_Finalize();
    return 0;
}
```

OUTPUT:



OUTPUT WITH CODE:



Result and Inferences:

- **We are passing the messages using MPI_Scatter and MPI_Gather Commands.**
- **Initialized the value in array as 3i+2 where i is the index of the array.**
- **We doubled its value during using different allocation named ldata.**
- **We used MPI_Gather command to read data of ldata allocation.**
- **Finally, We print the values of our initial allocation to check for the results.**