

Lab Manual # 9

Objective:

To study the MPI collective operations, Data Movement

Theory:

Collective Operations:

MPI_Send and MPI_Recv are "point-to-point" communications functions. That is, they involve one sender and one receiver. MPI includes a large number of subroutines for performing "collective" operations. Collective operations are performed by MPI routines that are called by each member of a group of processes that want some operation to be performed for them as a group. A collective function may specify one-to-many, many-to-one, or many-to-many message transmission. MPI supports three classes of collective operations:

- Synchronization,
- Data Movement
- Collective Computation

These classes are not mutually exclusive, of course, since blocking data movement functions also serve to synchronize process activity, and some MPI routines perform both data movement and computation.

Collective Data Movement:

There are several routines for performing collective data distribution tasks:

- **MPI_Bcast:** The subroutine MPI_Bcast sends a message from one process to all processes in a communicator.
- **MPI_Gather, MPI_Gatherv:** Gather data from participating processes into a single structure
- **MPI_Scatter, MPI_Scatterv:** break a structure into portions and distribute those portions to other processes
- **MPI_Allgather, MPI_Allgatherv:** gather data from different processes into a single structure that is then sent to all participants (Gather-to-all)
- **MPI_Alltoall, MPI_Alltoallv:** gather data and then scatter it to all participants (All-to-allscatter/gather)

The routines with "V" suffixes move variable-sized blocks of data.

MPI_Bcast:

- The subroutine MPI_Bcast sends a message from one process to all processes in a communicator.
- In a program all processes must execute a call to MPI_BCAST. There is no separate MPI call to receive a broadcast

Message Passing Interface Lab Manual

Rachel S Tattersall



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