Virtual Workshop

MPI Collective Communications: Allreduce Mini-Exercise

Obviously, MPI_MAX isn't the only operation that may be useful in a global computation. Take a look at either of the sample codes below. Once the question mark is removed, either the C or Fortran version of the program will compile correctly. But to make the computed number match the answer calculated by the formula, you will need to substitute a different operation in the call to MPI_Allreduce. Can you deduce the correct operation?

C

```
#include <mpi.h>
#define WCOMM MPI_COMM_WORLD
main(int argc, char **argv){
  int npes, mype, ierr;
  double sum, val; int calc, knt=1;
  ierr = MPI_Init(&argc, &argv);
  ierr = MPI_Comm_size(WCOMM, &npes);
  ierr = MPI_Comm_rank(WCOMM, &mype);

  val  = (double)mype;
  ierr = MPI_Allreduce( \
    &val, &sum, knt, MPI_DOUBLE, MPI_MAX?, WCOMM);

  calc = ((npes - 1) * npes) / 2;
  printf(" PE: %d sum=%5.0f calc=%d\n", mype, sum, calc);
  ierr = MPI_Finalize();
}
```

FORTRAN

```
program allreduce
  include 'mpif.h'
  double precision :: val, sum
  icomm = MPI_COMM_WORLD
  knt = 1
  call mpi_init(ierr)
  call mpi_comm_rank(icomm,mype,ierr)
  call mpi_comm_size(icomm,npes,ierr)

  val = dble(mype)
  call mpi_allreduce(val,sum,knt,MPI_REAL8,MPI_MAX?,icomm,ierr)

  ncalc = ((npes-1)*npes)/2
  print '(" pe#",i5," sum =",f5.0, " calc. sum =",i5)', &
          mype, sum, ncalc
  call mpi_finalize(ierr)
end program
```

If you don't recognize the formula, you can always try changing the MPI operation and testing the program with different numbers of processes until the answer always comes out right. Or, you can peek at the correct operation by hovering here.

The above code is small enough that you can run a small number of processes directly on a Stampede2 login node. Prior to compiling, do "module swap mvapich2 impi", and before running with mpiexec or mpirun, start up an Intel MPI daemon with "mpd &". Remember to kill the daemon with "mpdallexit" when you are done.

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Mark (M) my place in this topic