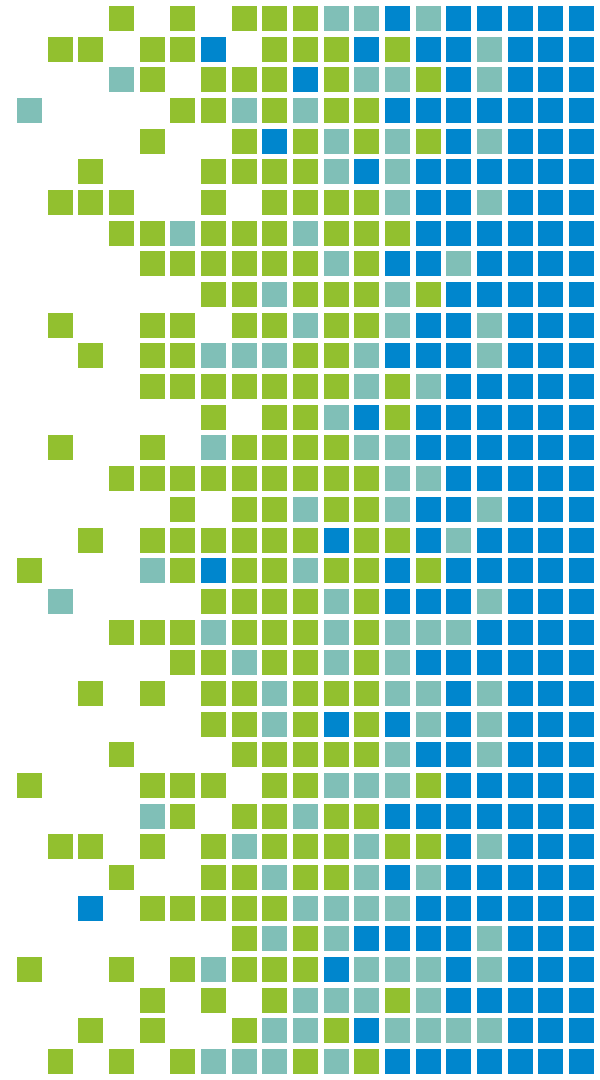# PRACE Course: Intermediate MPI

9-11 November 2022

MPI Error Handling

MPI Error Handling

- MPI programs is error prone:
  - Compiler errors: Incorrect/Missing arguments
  - Runtime errors: Crash, Potential deadlock
  - Wrong results: Type mismatch, Buffer usage/space, Data size/type/layout, Count errors
  - Portability errors
  - Hardware failures*

- The behaviour of an MPI routine which detects an error depends on the error-handler associated with the communicator involved

- A successful MPI routine will always return `MPI_SUCCESS`

*Marc Snir et al., Addressing failures in exascale computing

MPI Error Handling

- Two error handling modes
  - `MPI_ERRORS_ARE_FATAL`: default, abort if error detected
  - `MPI_ERRORS_RETURN`: return error code, Fortran: last argument and C: function result

- MPI Error Handling Functions
  - `MPI_Comm_set_errhandler()`: set the error handler
  - `MPI_Error_class()`: map error codes into error classes
  - `MPI_Error_string()`: returns a string for a given error code, Maximum length `MPI_MAX_ERROR_STRING`

Example- MPI Error Handling

```
MPI_Comm_set_errhandler(MPI_COMM_WORLD, MPI_ERRORS_RETURN);

ierror= MPI_Send(&buf, 1, MPI_INT, dest, tag, MPI_COMM_WORLD);

if (ierror != MPI_SUCCESS) {
  MPI_Error_class(ierror, &errclass);
  if (errclass== MPI_ERR_RANK){
    fprintf(stderr,"Invalid rank used in MPI send call\n");
    MPI_Error_string(ierror, errbuffer, &errbuflen);
    fprintf(stderr, errbuffer);
    MPI_Abort(MPI_COMM_WORLD, 0);
  }
}
```

Return Error Codes

MPI_SUCCESS	No error
MPI_ERR_UNKNOWN	Unknown error
MPI_ERR_BUFFER	Invalid buffer pointer
MPI_ERR_COUNT	Invalid count argument
MPI_ERR_TYPE	Invalid datatype argument
MPI_ERR_TAG	Invalid tag argument
MPI_ERR_COMM	Invalid communicator
MPI_ERR_RANK	Invalid rank
MPI_ERR_REQUEST	Invalid request (handle)

https://www.mpi-forum.org/docs/mpi-3.1/mpi31-report/node222.htm

Return Error Codes

Before Error Handling included in the source code

```
bgursoy@login2 C]$ mpirun -np 2 ./a.out
 am 0 before send ping
login2:04622] *** An error occurred in MPI_Send
login2:04622] *** reported by process [2680094721,0]
login2:04622] *** on communicator MPI_COMM_WORLD
login2:04622] *** MPI_ERR_RANK: invalid rank
login2:04622] *** MPI_ERRORS_ARE_FATAL (processes in this communicator will now abort,
login2:04622] ***    and potentially your MPI job)
bgursoy@login2 C]$
```

```
[bgursoy@login2 C]$ mpirun -np 2 ./a.out
I am 0 before send ping
Invalid rank used in MPI send call
MPI_ERR_RANK: invalid rank------------------------------------------------
-----
MPI_ABORT was invoked on rank 0 in communicator MPI_COMM_WORLD
with errorcode 0.

NOTE: invoking MPI_ABORT causes Open MPI to kill all MPI processes.
You may or may not see output from other processes, depending on
exactly when Open MPI kills them.
--------------------------------------------------------------------
```