

High Performance Python Lab

Term 2 2020/2021

Lecture 6. MPI finished, working on Lab assignments and
HW defense

Communicators

communicator = process group + communication context

- ▶ Predefined instances

- ▶ `COMM_WORLD`
- ▶ `COMM_SELF`
- ▶ `COMM_NULL`

- ▶ Accessors

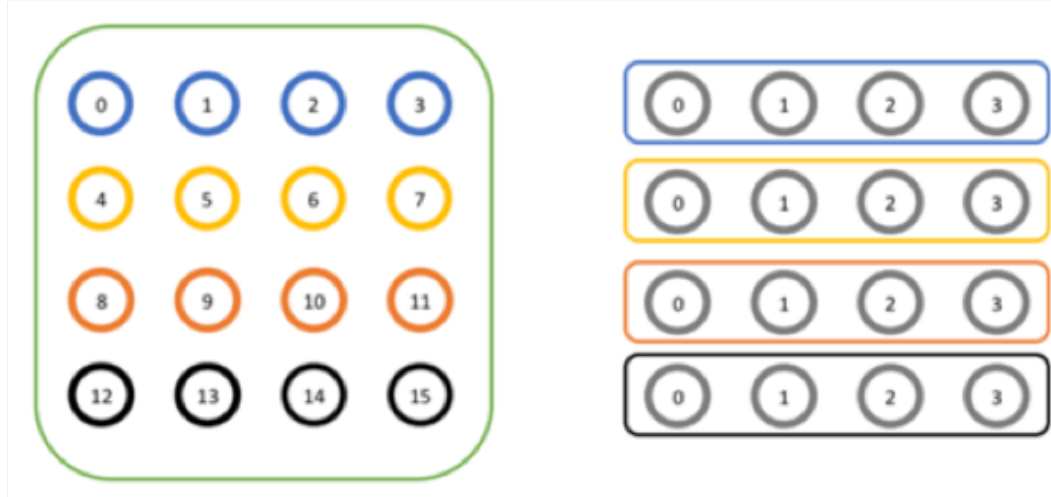
- ▶ `rank = comm.Get_rank() # or comm.rank`
- ▶ `size = comm.Get_size() # or comm.size`
- ▶ `group = comm.Get_group()`

- ▶ Constructors

- ▶ `newcomm = comm.Dup()`
- ▶ `newcomm = comm.Create(group)`
- ▶ `newcomm = comm.Split(color, key)`

Communicators. C syntax

```
MPI_Comm_split(  
    MPI_Comm comm,  
    int color,  
    int key,  
    MPI_Comm* newcomm)
```



Virtual topology

- so far we have been addressing in 1D (ranks from 0 to N-1)
- What if we have 1e6 processes working on a 3D grid?

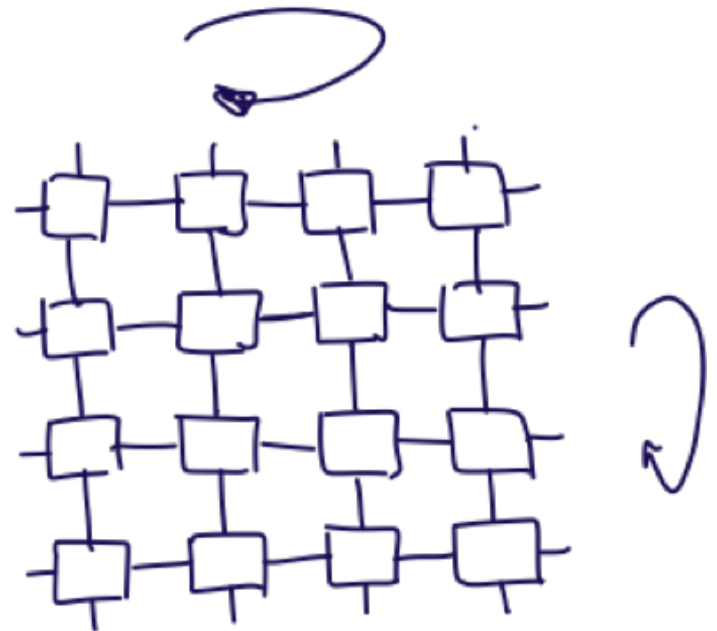
Декартова Топология

0 (0, 0)	1 (0, 1)	2 (0, 2)
3 (1, 0)	4 (1, 1)	5 (1, 2)

Virtual topology

```
MPI_Cart_create(MPI_Comm comm_old,  
                int ndims,  
                int *dims,  
                int *periods,  
                int reorder,  
                MPI_Comm *comm_2D)
```

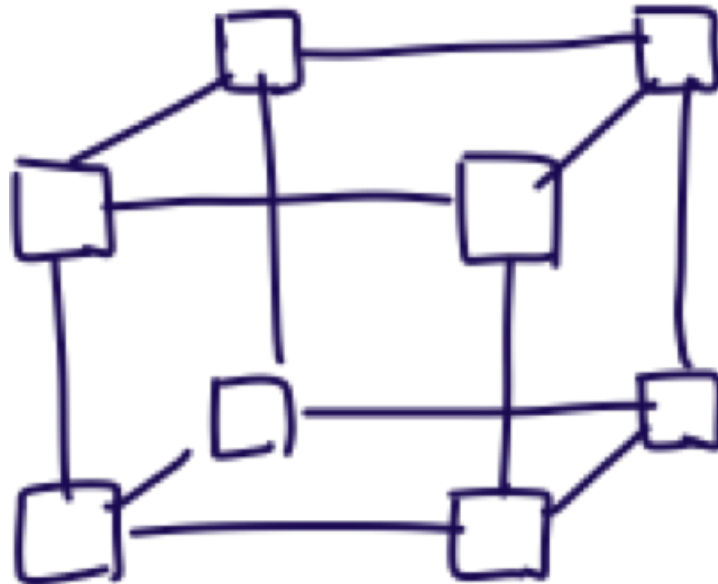
```
MPI_Comm comm_2D;  
int ndim = 2;  
int dims[2], periods[2];  
dims[0] = 4;  
dims[1] = 4;  
periods[0] = 1;  
periods[1] = 1;  
MPI_Cart_create(MPI_COMM_WORLD,  
                ndim, &dims, &periods,  
                0, &comm_2D);
```



Cube topology

```
# This is to create default communicator and get the rank
comm = MPI.COMM_WORLD
rank = comm.Get_rank()
cartesian3d = comm.Create_cart(dims = [2,2,2],periods =[False,False,False],reorder=False)

coord3d = cartesian3d.Get_coords(rank)
print ("In 3D topology, Processor ",rank, " has coordinates ",coord3d)
```



MPI4PY Parallel I/O

```
from mpi4py import MPI
import numpy as np
amode = MPI.MODE_WRONLY | MPI.MODE_CREATE
comm = MPI.COMM_WORLD
fh = MPI.File.Open(comm, "./datafile.contig", amode)
buffer = np.empty(10, dtype=np.int)
buffer[:] = comm.Get_rank()
offset = comm.Get_rank()*buffer.nbytes
fh.Write_at_all(offset, buffer)
fh.Close()
```