

Introduction to MPI with Python

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Python Bindings for MPI Calls

- The mpi4py Python module provides wrappers for calling MPI library functions from Python
- Two types of data supported:
 - “Native” Python types → pickle, send, unpickle
=> function names start with lower case character
 - NumPy arrays/buffers → send directly
=> function names start with upper case character
- Object oriented approach using “communicator objects” → MPI calls become member functions
- Many functions have default arguments

Computing Pi in Python

```
#!/usr/bin/env python
from math import pi
from time import time

tstart = time()
num = 1000000
sum = 0.0
width = 1.0/num

for i in range(0,num):
    x = (float(i) + 0.5) * width
    f_x = 4.0 / (1.0 + x*x)
    sum += f_x
tend = time()

print("Pi is approximately ", sum*width, " versus ", pi)
print("Error ", (sum*width) - pi)
print("Time ", tend - tstart)
```

Computing Pi in Parallel Python (1)

```
#!/usr/bin/env python
from mpi4py import MPI    # MPI_Init() called during import
from math import pi
from time import time

comm = MPI.COMM_WORLD
size = comm.Get_size()    # MPI_Comm_get_size()
rank = comm.Get_rank()    # MPI_Comm_get_rank()

tstart = time()
num = 1000000
sum = 0.0
width = 1.0/num

for i in range(rank, num, size):
    x = (float(i) + 0.5) * width
    f_x = 4.0 / (1.0 + x*x)
    sum += f_x
```

Computing Pi in Parallel Python (2)

```
[...]  
  
tend = time()  
  
tot_sum = comm.reduce(sum, MPI.SUM) # defaults: root=0, tag=0  
  
if rank == 0:  
    print("Pi is approximately ", tot_sum*width, " versus ", pi)  
    print("                Error ", (tot_sum*width) - pi)  
    print("                Time   ", tend - tstart)
```

- Call to `MPI_Finalize()` automatic during exit
- mpi4py docs at: <https://mpi4py.readthedocs.io/>
- Installation with: `python -m pip install mpi4py`

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