

Distributed System

HTTP over MPI

GroupID 3 - ProjectID 4

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What is MPI?

- **M**essage **P**assing **I**nterface
 - + Perform well on distributed memory machines.
 - + The standard **parallel programming** interface.
- Different implementations, interfaces (openmpi, mvapich, mpich) in **C/C++**, **Fortran**, **Python** via MPI4Py.

Message Passing Paradigm

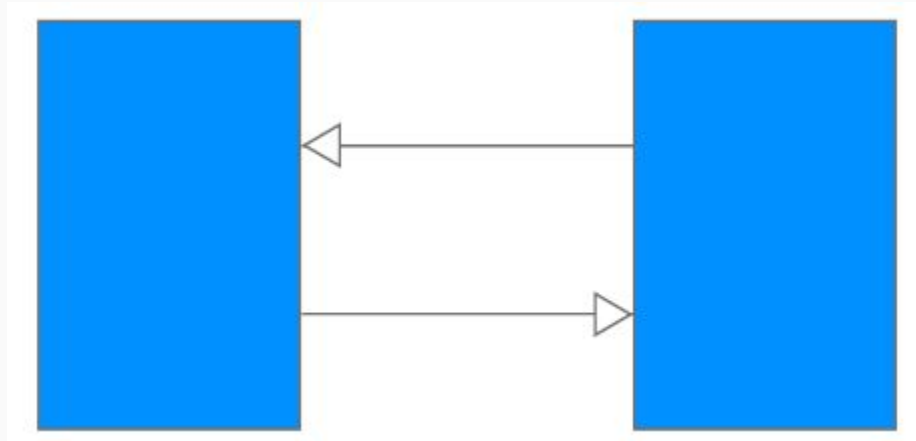
- A parallel MPI program run as **separate processes** with their own address space.
- Data is moved from the address space of one process to that of another process.
- Communication (2 types)
 - + **Point-to-point** involve only two tasks (A to B).
 - + **Collective messages** involve a set of tasks (among A, B, C, D).

Communicators

- MPI uses **communicators** to identify which processes communicate **only within their set**.
- **MPI_COMM_WORLD** is the beginning of the program, defined as all the processes, required for most MPI calls.
- **Rank**
 - + **Unique process ID** within a communicator. (0,1,2,3)
 - + Assigned by the system when the process initializes.
 - + Used to specify **sources** and **destinations** of messages.

Point-to-point communication

- Data transferred between 2 processes

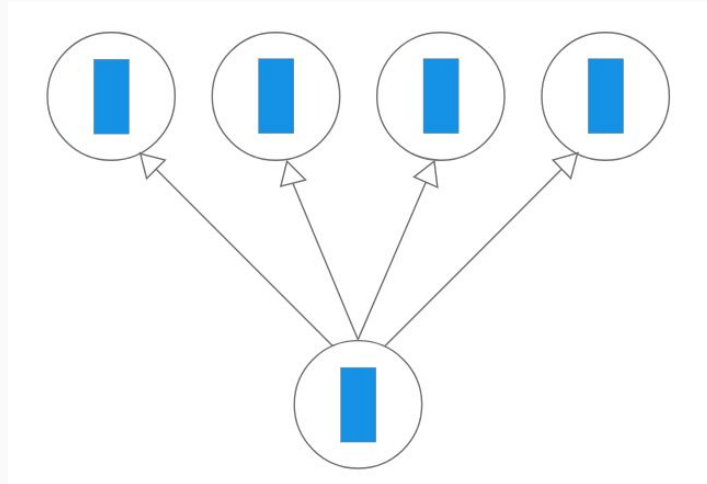


Collective communication

- Broadcast.
- Scatter.
- Gather.
- Reduction.

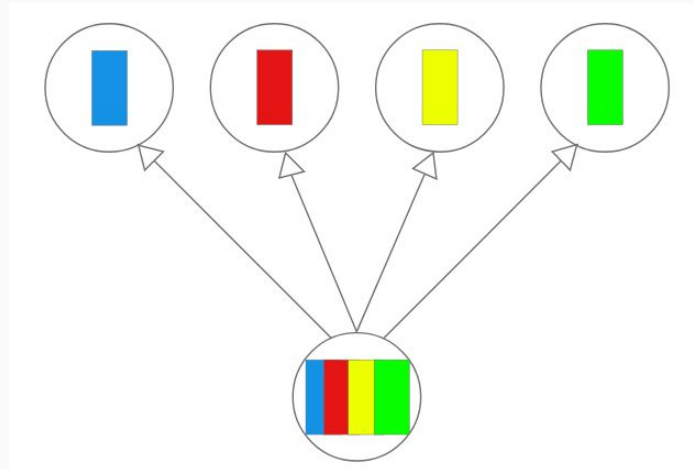
Broadcast communication

- Take one and send it out to all the processes.
- It distributes it to all the processes.



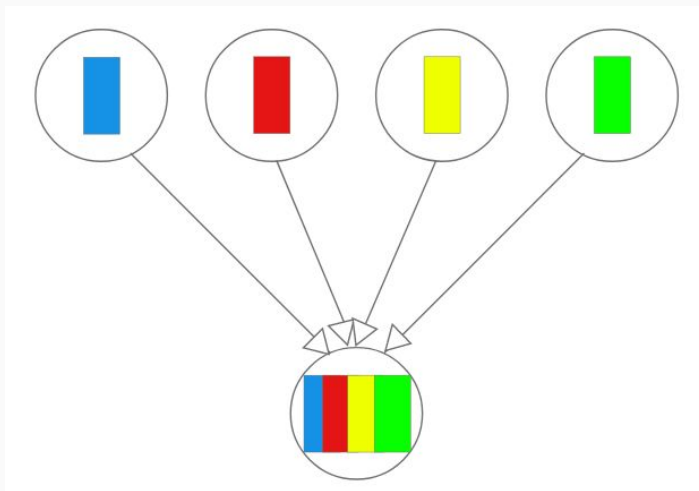
Scatter communication

- Take one and decompose it into multiple.
- Send one of those out to each process.



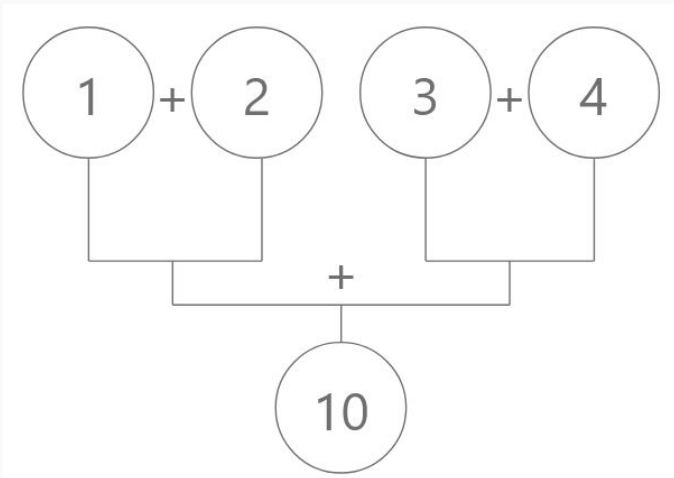
Gather communication

- **Reverse** of the scatter communication,
- Take one from each process and gather them into a single one.



Reduction communication

- Do operation in **parallel**.
- Addition (+), subtraction (-), multiply (*), divide (/), max, min,...



Method

- **MPI4Py** is very similar to the MPI standard C++ interface.
- Communication with Python objects.
- Lost in performance, gain in **shorter** development time.
- Platform: **Google Colab**.

Application with HTTP

- **HTTP** (Hyper**T**ext **T**ransfer **P**rotocol)
- Client/Server
- **Parallel programming** with MPI

Transferring messages

- Point-to-point communication
- `comm.send()`
- `comm.recv()`

Transferring messages

```
[ ] %%file share.py

from mpi4py import MPI
import time


comm = MPI.COMM_WORLD

rank = comm.rank
size = comm.size
name = MPI.Get_processor_name()
message = "Hello"


if rank == 0:
    data = message
    comm.send(data, dest=1)

    print("from node", rank, "sent data")
    time.sleep(5)

elif comm.rank == 1:
    data = comm.recv(source=0)
    print("Node", rank, "received mess", data)
```

 Overwriting share.py

```
[ ] ! mpiexec -np 2 --allow-run-as-root python share.py
```

 from node 0 sent data
Node 1 received mess Hello

Parallel programming (HTTP request)

- Collective communication
- `comm.scatter()`
- `comm.gather()`

Parallel programming (HTTP request)

```
[ ] %%file gather.py

import requests
from mpi4py import MPI

comm = MPI.COMM_WORLD

rank = comm.rank
size = comm.size
name = MPI.Get_processor_name()

sendbuf = []
root = 0
if comm.rank==0:
    urls = [
        "https://httpbin.org/ip",
        "https://httpbin.org/xml",
        "https://httpbin.org/json",
        "https://httpbin.org/image",
    ]
    sendbuf = urls

v = comm.scatter(sendbuf, root)
print("I got the url")
v = requests.get(v).content

recvbuf = comm.gather(v, root)
if comm.rank == 0:
    for i in recvbuf:
        print(i)
```



Overwriting gather.py



```
[ ] ! mpiexec -np 4 --allow-run-as-root python gather.py
```



```
I got the url
I got the url
I got the url
I got the url
b'{"origin": "35.247.24.83"}\n'
b'<?xml version="1.0" encoding="us-ascii">\n<
b'{"slideshow": {"author": "Yours Truly",
b'{"message": "Client did not request a supported me
```


Evaluation

- Quick system response
- Efficiency

State of the art



http over mpi

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Implementation of MPI over HTTP

menting a message passing interface **over HTTP**[1]. This provides a platform independent implementation of **MPI** and also develops a base for web based ...
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Peter Sloot, Marian Bubak, Alfons Hoekstra - 1999 - Computers

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Recent Advances in Parallel Virtual Machine and Message ...

Alexey Lastovetsky, Tahar Kechadi, Jack Dongarra - 2008 - Computers

15th European PVM/MPI Users' Group Meeting, Dublin, Ireland, September ... MVAPICH: **MPI over InfiniBand** and **iWARP**, <http://mvapich.cse.ohio-state.edu> 3.

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Parallel Virtual File System, Version 2, <http://www.pvfs.org/pvfs2/>, November 2003, SDP

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Mới



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Phụ đề



Món Chay ngon tuyệt Đậu Hũ Khìa Nước Dừa mặn ngọt dễ làm tốn

Demo