

# MPI commands explanation

## 1. Pull base image

```
docker pull husseinabdallah2/mpi4py-cluster:master
```

## 2. Create 4 containers by running commands 4 times

```
docker run -dit husseinabdallah2/mpi4py-cluster:master
docker run -dit husseinabdallah2/mpi4py-cluster:master
docker run -dit husseinabdallah2/mpi4py-cluster:master
docker run -dit husseinabdallah2/mpi4py-cluster:master
```

## 3. List all containers and ip

```
PS D:\comp6231-distributed-systems-design> docker ps
CONTAINER ID   IMAGE                                COMMAND                  CREATED        STATUS        PORTS          NAMES
fb3729c13631   husseinabdallah2/mpi4py-cluster:master "/bin/bash"            3 days ago    Up 2 days                    elegant_kapitsa
235f825c5be6   husseinabdallah2/mpi4py-cluster:master "/bin/bash"            3 days ago    Up 2 days                    heuristic_golick
afe24602ef26   husseinabdallah2/mpi4py-cluster:master "/bin/bash"            3 days ago    Up 2 days                    pensive_jemison
250ae9b27c01   husseinabdallah2/mpi4py-cluster:master "/bin/bash"            3 days ago    Up 2 days                    crazy_ride
```

```
PS D:\comp6231-distributed-systems-design\3> (docker ps -q | ForEach-Object { docker inspect $_ --format '{{.NetworkSettings.IPAddress}}' }).replace(/,/," ")
172.17.0.5 elegant_kapitsa
172.17.0.4 heuristic_golick
172.17.0.3 pensive_jemison
172.17.0.2 crazy_ride
```

## 4. Use container **crazy\_ride** as master node, ssh to container

```
docker exec -it crazy_ride /bin/bash
```

## 5. Start ssh service

```
service ssh start
```

## 6. Create machinefile at path ~/ with the IP addresses of all nodes

```
172.17.0.3
172.17.0.4
172.17.0.4
```

## 7. Generate ssh key

```
ssh-keygen -t rsa
```

## 8. Copy ssh key to each worker node

```
sh-copy-id -i ~/.ssh/id_rsa.pub root@172.17.0.3
sh-copy-id -i ~/.ssh/id_rsa.pub root@172.17.0.4
sh-copy-id -i ~/.ssh/id_rsa.pub root@172.17.0.5
```

## 9. From host ssh to worker container to start their ssh service

```
docker exec -it <worker_container_id> /bin/bash
service ssh start
```

## 10. In each worker container, add master container ip to /etc/hosts

```
nano /etc/hosts

# add following
172.17.0.2 250ae9b27c01
```

## 11. From host copy all mpi python script and csv data file to each container

```
docker cp . crazy_ride:/root/
docker cp . pensive_jemison:/root/
docker cp . heuristic_golick:/root/
docker cp . elegant_kapitsa:/root/
```

## 12. Inside master node, run any mpi scripts from Q1 to Q4

```
root@250ae9b27c01:~# mpiexec -n 3 -machinefile ~/machinefile python
~/Q1_T3.py
Worker 1 is assigned chunk 192512096 ../datasets/Combined_Flights_2021.csv
Worker slave 1 is done. Sending back to master
Worker 2 is assigned chunk 192512035 ../datasets/Combined_Flights_2021.csv
Worker slave 2 is done. Sending back to master
received from Worker slave 1
received from Worker slave 2
{('Southwest Airlines Co.',): 2326, ('American Airlines Inc.',): 759,
 ('Republic Airlines',): 704, ('United Air Lines Inc.',): 633, ('JetBlue
 Airways',): 487, ('GoJet Airlines, LLC d/b/a United Express',): 428,
 ('Spirit Air Lines',): 316, ('SkyWest Airlines Inc.',): 297, ('Delta Air
 Lines Inc.',): 295, ('Air Wisconsin Airlines Corp',): 286, ('Commutair Aka
 Champlain Enterprises, Inc.',): 202, ('Comair Inc.',): 202, ('Mesa
 Airlines Inc.',): 160, ('Envoy Air',): 135, ('Capital Cargo
 International',): 132, ('Alaska Airlines Inc.',): 127, ('Endeavor Air
 Inc.',): 80, ('Frontier Airlines Inc.',): 79, ('Allegiant Air',): 50,
```

```
('Horizon Air',): 42, ('Hawaiian Airlines Inc.',): 36}  
Airline had the most canceled flights in September 2021 ('Southwest  
Airlines Co.',)
```