

PartA

1. Preparing for the Environment

Create the redis-culster directory:

```
pen_warren@wus-MacBook-Pro: redis-culster % ls
docker-compose.yml  part_a.md  setup_redis_cluster.sh
pen_warren@wus-MacBook-Pro: redis-culster %
```

Prepare the `docker-compose.yml` file

Code block

```
1  services:
2    redis-7001:
3      image: redis:7
4      container_name: redis-7001
5      command: redis-server /usr/local/etc/redis/redis.conf
6      ports:
7        - "7001:7001"
8        - "17001:17001"
9      volumes:
10       - ../7001/redis.conf:/usr/local/etc/redis/redis.conf
11       - ../7001:/data
12     networks:
13       - redis-net
14
15   redis-7002:
16     image: redis:7
17     container_name: redis-7002
18     command: redis-server /usr/local/etc/redis/redis.conf
19     ports:
20       - "7002:7002"
21       - "17002:17002"
22     volumes:
23       - ../7002/redis.conf:/usr/local/etc/redis/redis.conf
24       - ../7002:/data
25     networks:
26       - redis-net
27
28   redis-7003:
29     image: redis:7
30     container_name: redis-7003
```

```
31     command: redis-server /usr/local/etc/redis/redis.conf
32     ports:
33         - "7003:7003"
34         - "17003:17003"
35     volumes:
36         - ./7003/redis.conf:/usr/local/etc/redis/redis.conf
37         - ./7003:/data
38     networks:
39         - redis-net
40
41     redis-7004:
42         image: redis:7
43         container_name: redis-7004
44         command: redis-server /usr/local/etc/redis/redis.conf
45         ports:
46             - "7004:7004"
47             - "17004:17004"
48         volumes:
49             - ./7004/redis.conf:/usr/local/etc/redis/redis.conf
50             - ./7004:/data
51         networks:
52             - redis-net
53
54     redis-7005:
55         image: redis:7
56         container_name: redis-7005
57         command: redis-server /usr/local/etc/redis/redis.conf
58         ports:
59             - "7005:7005"
60             - "17005:17005"
61         volumes:
62             - ./7005/redis.conf:/usr/local/etc/redis/redis.conf
63             - ./7005:/data
64         networks:
65             - redis-net
66
67     redis-7006:
68         image: redis:7
69         container_name: redis-7006
70         command: redis-server /usr/local/etc/redis/redis.conf
71         ports:
72             - "7006:7006"
73             - "17006:17006"
74         volumes:
75             - ./7006/redis.conf:/usr/local/etc/redis/redis.conf
76             - ./7006:/data
77         networks:
```

```
78         - redis-net
79
80     networks:
81         redis-net:
82             driver: bridge
```

Prepare the `setup_redis_cluster.sh`, For each node, create a `redis.conf`:

Code block

```
1  #!/bin/bash
2
3  # List of Redis ports for cluster nodes
4  ports=(7001 7002 7003 7004 7005 7006)
5
6  # Loop through each port and create configuration
7  for port in "${ports[@]}; do
8      # Create folder for this node
9      mkdir -p ${port}
10
11     # Write redis.conf file
12     cat > ${port}/redis.conf <<EOF
13 port ${port}
14 bind 0.0.0.0
15 cluster-enabled yes
16 cluster-config-file nodes.conf
17 cluster-node-timeout 5000
18 cluster-announce-ip redis-${port}
19 cluster-announce-port ${port}
20 cluster-announce-bus-port 1${port}
21 appendonly yes
22 protected-mode no
23 EOF
24
25     echo "Created configuration for node ${port}"
26 done
27
28 echo "All Redis configurations have been created."
```

2. Create Redis Node Directories

Execute the `setup_redis_cluster.sh`

We will use 6 nodes (3 masters, 3 replicas):

```
pen_warren@wus-MacBook-Pro redis-culster % ./setup_redis_cluster.sh
Created configuration for node 7001
Created configuration for node 7002
Created configuration for node 7003
Created configuration for node 7004
Created configuration for node 7005
Created configuration for node 7006
All Redis configurations have been created.
pen_warren@wus-MacBook-Pro redis-culster % ls
7001          7003          7005          docker-compose.yml  setup_redis_cluster.sh
7002          7004          7006          part_a.md
```

to execute the `docker-compose up -d`

```
All Redis configurations have been created.
pen_warren@wus-MacBook-Pro redis-culster % docker-compose up -d
[+] Running 7/7
✓ Network redis-culster_redis-net Created
✓ Container redis-7005 Started
✓ Container redis-7001 Started
✓ Container redis-7003 Started
✓ Container redis-7004 Started
✓ Container redis-7002 Started
✓ Container redis-7006 Started
pen_warren@wus-MacBook-Pro redis-culster %
```

The result:

```
pen_warren@wus-MacBook-Pro redis-culster % docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED        STATUS        PORTS                                                                                                                                            NAMES
477033ebf11c   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7005->7005/tcp, [::]:7005->7005/tcp, 0.0.0.0:17005->17005/tcp, [::]:17005->17005/tcp   redis-7005
bfea557e0e8b   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7003->7003/tcp, [::]:7003->7003/tcp, 0.0.0.0:17003->17003/tcp, [::]:17003->17003/tcp   redis-7003
6b1454c1ae90   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7002->7002/tcp, [::]:7002->7002/tcp, 0.0.0.0:17002->17002/tcp, [::]:17002->17002/tcp   redis-7002
dd98796b847c   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7006->7006/tcp, [::]:7006->7006/tcp, 0.0.0.0:17006->17006/tcp, [::]:17006->17006/tcp   redis-7006
7788f91ef840   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7004->7004/tcp, [::]:7004->7004/tcp, 0.0.0.0:17004->17004/tcp, [::]:17004->17004/tcp   redis-7004
6a797bda4a23   redis:7        "docker-entrypoint.s..." 2 minutes ago   Up 2 minutes   0.0.0.0:7001->7001/tcp, [::]:7001->7001/tcp, 0.0.0.0:17001->17001/tcp, [::]:17001->17001/tcp   redis-7001
```

3. Create the Cluster

Code block

```
1 docker-compose exec redis-7001 redis-cli --cluster create \
2   redis-7001:7001 redis-7002:7002 redis-7003:7003 \
3   redis-7004:7004 redis-7005:7005 redis-7006:7006 \
4   --cluster-replicas 1
```

The excution result:

```

pen_warren@wus-MacBook-Pro redis-culster % docker-compose exec redis-7001 redis-cli --cluster create \
redis-7001:7001 redis-7002:7002 redis-7003:7003 \
redis-7004:7004 redis-7005:7005 redis-7006:7006 \
--cluster-replicas 1
>>> Performing hash slots allocation on 6 nodes...
Master[0] -> Slots 0 - 5460
Master[1] -> Slots 5461 - 10922
Master[2] -> Slots 10923 - 16383
Adding replica redis-7005:7005 to redis-7001:7001
Adding replica redis-7006:7006 to redis-7002:7002
Adding replica redis-7004:7004 to redis-7003:7003
M: c49a3904ed41e017fa2c3e4ee462d95d2bd0568a redis-7001:7001
slots:[0-5460] (5461 slots) master
M: 1c9d36bee6b78cb1e248df30895fc584ec84fe86 redis-7002:7002
slots:[5461-10922] (5462 slots) master
M: 23016eb6c1bc6d4fd17b933f5454d31ad4544bcb redis-7003:7003
slots:[10923-16383] (5461 slots) master
S: 69b1ad4c700352b554a3f75e3d0529c844008e5d redis-7004:7004
replicates 23016eb6c1bc6d4fd17b933f5454d31ad4544bcb
S: 42f02ad65982f92278f4712144c822b6ad9ebe66 redis-7005:7005
replicates c49a3904ed41e017fa2c3e4ee462d95d2bd0568a
S: e3833bd1ee00f47b81a93c1b63d34c516cd634e6 redis-7006:7006
replicates 1c9d36bee6b78cb1e248df30895fc584ec84fe86
Can I set the above configuration? (type 'yes' to accept): yes
>>> Nodes configuration updated
>>> Assign a different config epoch to each node
>>> Sending CLUSTER MEET messages to join the cluster
Waiting for the cluster to join

>>> Performing Cluster Check (using node redis-7001:7001)
M: c49a3904ed41e017fa2c3e4ee462d95d2bd0568a redis-7001:7001
slots:[0-5460] (5461 slots) master
1 additional replica(s)
S: e3833bd1ee00f47b81a93c1b63d34c516cd634e6 redis-7006:7006
slots: (0 slots) slave
replicates 1c9d36bee6b78cb1e248df30895fc584ec84fe86
M: 1c9d36bee6b78cb1e248df30895fc584ec84fe86 redis-7002:7002
slots:[5461-10922] (5462 slots) master
1 additional replica(s)
S: 69b1ad4c700352b554a3f75e3d0529c844008e5d redis-7004:7004
slots: (0 slots) slave
replicates 23016eb6c1bc6d4fd17b933f5454d31ad4544bcb
M: 23016eb6c1bc6d4fd17b933f5454d31ad4544bcb redis-7003:7003
slots:[10923-16383] (5461 slots) master
1 additional replica(s)
S: 42f02ad65982f92278f4712144c822b6ad9ebe66 redis-7005:7005
slots: (0 slots) slave
replicates c49a3904ed41e017fa2c3e4ee462d95d2bd0568a
[OK] All nodes agree about slots configuration.

```

4. Verify Cluster

Code block

- 1 docker **exec** -it redis-7001 redis-cli -c -p 7001 cluster info
- 2 docker **exec** -it redis-7001 redis-cli -c -p 7001 cluster nodes

```
pen_warren@wus-MacBook-Pro redis-culster % docker exec -it redis-7001 redis-cli -c -p 7001 cluster info
cluster_state:ok
cluster_slots_assigned:16384
cluster_slots_ok:16384
cluster_slots_pfail:0
cluster_slots_fail:0
cluster_known_nodes:6
cluster_size:3
cluster_current_epoch:6
cluster_my_epoch:1
cluster_stats_messages_ping_sent:328
cluster_stats_messages_pong_sent:339
cluster_stats_messages_sent:667
cluster_stats_messages_ping_received:334
cluster_stats_messages_pong_received:328
cluster_stats_messages_meet_received:5
cluster_stats_messages_received:667
total_cluster_links_buffer_limit_exceeded:0
pen_warren@wus-MacBook-Pro redis-culster % docker exec -it redis-7001 redis-cli -c -p 7001 cluster node
(error) ERR unknown subcommand 'node'. Try CLUSTER HELP.
pen_warren@wus-MacBook-Pro redis-culster % docker exec -it redis-7001 redis-cli -c -p 7001 cluster nodes
c49a3904ed41e017fa2c3e4ee462d95d2bd0568a redis-7001:7001@17001 myself,master - 0 0 1 connected 0-5460
e3833bd1ee00f47b81a93c1b63d34c516cd634e6 redis-7006:7006@17006 slave 1c9d36bee6b78cb1e248df30895fc584ec84fe86 0 1761243163544 2 connected
1c9d36bee6b78cb1e248df30895fc584ec84fe86 redis-7002:7002@17002 master - 0 1761243163752 2 connected 5461-10922
69b1ad4c700352b554a3f75e3d0529c844008e5d redis-7004:7004@17004 slave 23016eb6c1bc6d4fd17b933f5454d31ad4544bcb 0 1761243165518 3 connected
23016eb6c1bc6d4fd17b933f5454d31ad4544bcb redis-7003:7003@17003 master - 0 1761243164796 3 connected 10923-16383
42f02ad65982f92278f4712144c822b6ad9ebe66 redis-7005:7005@17005 slave c49a3904ed41e017fa2c3e4ee462d95d2bd0568a 0 1761243164000 1 connected
pen_warren@wus-MacBook-Pro redis-culster %
```

5. Insert data into cluster

Design a UserProfile Entity

Field	Type	Description
user_id	string	Unique ID of the user
username	string	User' s display name
email	string	User email address
last_login_time	string	Timestamp of last login

Example key-value in Redis:

Code block

```
1 Key: user:1
2 Value:
{"user_id":"1","username":"pengwu","email":"pengwu@example.com","last_login_time":"2025-10-23 10:00:00"}
```

Connect to a master node and insert data:

Code block

```
1 docker exec -it redis-7001 redis-cli -c -p 7001
```

The execution results:

```
pen_warren@wus-MacBook-Pro redis-culster % docker exec -it redis-7001 redis-cli -c -p 7001 127.0.0.1:7001> █
```

Code block

```
1 SET user:1
  '{"user_id":"1","username":"pengwu","email":"pengwu@example.com","last_login_time":"2025-10-23 10:00:00"}'
2 SET user:2
  '{"user_id":"2","username":"alice","email":"alice@example.com","last_login_time":"2025-10-23 10:05:00"}'
3 SET user:3
  '{"user_id":"3","username":"bob","email":"bob@example.com","last_login_time":"2025-10-23 10:10:00"}'
```

Inter data:

```
pen_warren@wus-MacBook-Pro redis-culster % docker exec -it redis-7001 redis-cli -c -p 7001 127.0.0.1:7001> SET user:1 '{"user_id":"1","username":"pengwu","email":"pengwu@example.com","last_login_time":"2025-10-23 10:00:00"}'
-> Redirected to slot [10778] located at redis-7002:7002
OK
redis-7002:7002> SET user:2 '{"user_id":"2","username":"alice","email":"alice@example.com","last_login_time":"2025-10-23 10:05:00"}'
OK
redis-7002:7002> SET user:3 '{"user_id":"3","username":"bob","email":"bob@example.com","last_login_time":"2025-10-23 10:10:00"}'
-> Redirected to slot [2648] located at redis-7001:7001
OK
redis-7001:7001> █
```

Check data insertion:

```
OK
redis-7001:7001> GET user:1
-> Redirected to slot [10778] located at redis-7002:7002
"{\"user_id\":\"1\",\"username\":\"pengwu\",\"email\":\"pengwu@example.com\",\"last_login_time\":\"2025-10-23 10:00:00\"}"
redis-7002:7002> GET user:2
"{\"user_id\":\"2\",\"username\":\"alice\",\"email\":\"alice@example.com\",\"last_login_time\":\"2025-10-23 10:05:00\"}"
redis-7002:7002> GET user:3
-> Redirected to slot [2648] located at redis-7001:7001
"{\"user_id\":\"3\",\"username\":\"bob\",\"email\":\"bob@example.com\",\"last_login_time\":\"2025-10-23 10:10:00\"}"
redis-7001:7001> █
```