CS328 Distributed System Assignment 4 Report

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1. The goal of the Assignment 4

Deployment of Assignment 2 by using Docker Hub. "**Dockerfile and Docker Compose**"

2. Results

Development OS	Deployment OS
macOS 14.2.1	Virtual Machine Ubuntu Linux 20.04

2.1 Result of docker version

macOS	Linux

```
           ■Mac ~ % docker version
Client:
 Cloud integration: v1.0.35+desktop.5
 Version:           24.0.7
 API version:       1.43
 Go version:        go1.20.10
 Git commit:        afdd53b
 Built:             Thu Oct 26 09:04:20 2023
 OS/Arch:           darwin/arm64
 Context:           desktop-linux

Server: Docker Desktop 4.26.1 (131620)
 Engine:
  Version:          24.0.7
  API version:      1.43 (minimum version 1.12)
  Go version:       go1.20.10
  Git commit:       311b9ff
  Built:            Thu Oct 26 09:08:15 2023
  OS/Arch:          linux/arm64
  Experimental:     false
 containerd:
  Version:          1.6.25
  GitCommit:        d8f198a4ed8892c764191ef7b3b06d8a2eeb5c7f
 runc:
  Version:          1.1.10
  GitCommit:        v1.1.10-0-g18a0cb0
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
```

```
      -virtual-machine:~$ docker version
Client: Docker Engine - Community
 Version:           24.0.7
 API version:       1.43
 Go version:        go1.20.10
 Git commit:        afdd53b
 Built:             Thu Oct 26 09:08:26 2023
 OS/Arch:           linux/arm64
 Context:           default

Server: Docker Engine - Community
 Engine:
  Version:          24.0.7
  API version:      1.43 (minimum version 1.12)
  Go version:       go1.20.10
  Git commit:       311b9ff
  Built:            Thu Oct 26 09:08:26 2023
  OS/Arch:          linux/arm64
  Experimental:     false
 containerd:
  Version:          1.6.26
  GitCommit:        3dd1e886e55dd695541fdcd67420c2888645a495
 runc:
  Version:          1.1.10
  GitCommit:        v1.1.10-0-g18a0cb0
 docker-init:
  Version:          0.19.0
  GitCommit:        de40ad0
```

2.2 Result of docker build

Build three times for <u>registry, server, and client</u> by using the same **Dockerfile**, while the **pom.xml** will control the main java file.

- Dockerfile

```
FROM maven:3.8.4-openjdk-11-slim AS build
WORKDIR /usr/src/app
COPY pom.xml .
RUN mvn dependency:go-offline
COPY src/main/java/myrmi src/main/java/myrmi
RUN mvn package

FROM openjdk:8
WORKDIR /usr/app
COPY --from=build /usr/src/app/target/MyRMI_Docker-1.0-SNAPSHOT.jar app.jar
CMD ["java", "-jar", "app.jar"]
```

- pom.xml (part)

```
...
        <plugin>
            <groupId>org.apache.maven.plugins</groupId>
            <artifactId>maven-jar-plugin</artifactId>
            <version>3.1.0</version>
            <configuration>
                <archive>
                    <manifest>
<!--                        <mainClass>myrmi.registry.RegistryMain</mainClass>-->
<!--                        <mainClass>myrmi.server.ServerMain</mainClass>-->
                        <mainClass>myrmi.client.ClientMain</mainClass>
                    </manifest>
                </archive>
            </configuration>
        </plugin>
...
```

- Result of `docker build -t rock3yu/cs328_a4_client .` (same for registry and server)
  - Usually, the stages 4/6 and 6/6 will cost plenty of time (100~200s)

```
[ ███  ███@Mac MyRMI_Docker % docker build -t rock3yu/cs328_a4_client .
[+] Building 2.8s (17/17) FINISHED                                      docker:desktop-linux
 => [internal] load .dockerignore                                                       0.0s
 => => transferring context: 2B                                                         0.0s
 => [internal] load build definition from Dockerfile                                    0.0s
 => => transferring dockerfile: 386B                                                    0.0s
 => [internal] load metadata for docker.io/library/openjdk:8                            2.7s
 => [internal] load metadata for docker.io/library/maven:3.8.4-openjdk-11-slim          2.4s
 => [auth] library/openjdk:pull token for registry-1.docker.io                          0.0s
 => [auth] library/maven:pull token for registry-1.docker.io                            0.0s
 => [build 1/6] FROM docker.io/library/maven:3.8.4-openjdk-11-slim@sha256:04f8e5ba4a6a74fb7f97940bc7  0.0s
 => [stage-1 1/3] FROM docker.io/library/openjdk:8@sha256:86e863cc57215cfb181bd319736d0baf625fe8f150  0.0s
 => [internal] load build context                                                       0.0s
 => => transferring context: 2.63kB                                                     0.0s
 => CACHED [stage-1 2/3] WORKDIR /usr/app                                                0.0s
 => CACHED [build 2/6] WORKDIR /usr/src/app                                              0.0s
 => CACHED [build 3/6] COPY pom.xml .                                                    0.0s
 => CACHED [build 4/6] RUN mvn dependency:go-offline                                     0.0s
 => CACHED [build 5/6] COPY src/main/java/myrmi src/main/java/myrmi                      0.0s
 => CACHED [build 6/6] RUN mvn package                                                   0.0s
 => CACHED [stage-1 3/3] COPY --from=build /usr/src/app/target/MyRMI_Docker-1.0-SNAPSHOT.jar app.jar  0.0s
 => exporting to image                                                                  0.0s
 => => exporting layers                                                                 0.0s
 => => writing image sha256:d900bb62c6580f3f80cb4e0eeffc19d9868048272b47de08ac530c0f3b36c56a  0.0s
 => => naming to docker.io/rock3yu/cs328_a4_client                                      0.0s

View build details: docker-desktop://dashboard/build/desktop-linux/desktop-linux/zdbpanhntul1cb3v3cdq1q2ad

What's Next?
  View a summary of image vulnerabilities and recommendations → docker scout quickview
```

2.3 Result of docker push, which pushes your customized images to the docker hub

- Result of `docker push rock3yu/cs328_a4_client`

```
 ███  ███@Mac MyRMI_Docker % docker push rock3yu/cs328_a4_client
Using default tag: latest
The push refers to repository [docker.io/rock3yu/cs328_a4_client]
f7cabadf2392: Layer already exists
fe3df3457276: Mounted from rock3yu/cs328_a4_server
df0ca509f290: Mounted from rock3yu/cs328_a4_server
89273ea6b11f: Layer already exists
ee9872ea8036: Mounted from rock3yu/cs328_a4_server
b7b6064a28a9: Layer already exists
8874c5d5df1a: Mounted from rock3yu/cs328_a4_registry
595a656dd8ef: Mounted from rock3yu/cs328_a4_registry
bd245ec49ee5: Layer already exists
latest: digest: sha256:84dbbdadb298de7d56f9247cd85b0e22b5545a7d22511b32fe429282bdeecc62 size: 2211
```

2.4 Result of running application with docker compose

- docker-compose.yaml

```yaml
version: '3'

services:
  registry:
    image: 'rock3yu/cs328_a4_registry'
    networks:
      - myrmi-net

  server:
    image: 'rock3yu/cs328_a4_server'
    depends_on:
```

```yaml
      registry:
        condition: service_started
    networks:
      - myrmi-net
    environment:
      - REGISTRY_HOST=registry
      - SERVER_PORT=9000

  client:
    image: 'rock3yu/cs328_a4_client'
    depends_on:
      registry:
        condition: service_started
      server:
        condition: service_started
    networks:
      - myrmi-net
    environment:
      - REGISTRY_HOST=registry

networks:
  myrmi-net:
    driver: bridge
```

- Result of running on VM Ubuntu (same result running on macOS)
    - docker-copose.yaml in a random directory
    - Manual termination (ctrl+c) of *registry*, *server*, *and client* exited with code 0

```
        -virtual-machine:~/Downloads$ ls
CS328_DistributedSys  docker-compose.yaml
        -virtual-machine:~/Downloads$ docker compose up
[+] Running 3/3
 ✔ Container downloads-registry-1  Recreated                                    0.5s
 ✔ Container downloads-server-1    Recreated                                    0.5s
 ✔ Container downloads-client-1    Recreated                                    0.0s
Attaching to downloads-client-1, downloads-registry-1, downloads-server-1
downloads-registry-1  | Stub created to 0.0.0.0:11099, object key = 0
downloads-registry-1  | RMI Registry is running...
downloads-server-1    | [172.19.0.2, 172.19.0.3, 9000]
downloads-server-1    | ---- getRegistry start... ----
downloads-server-1    | Stub created to 172.19.0.2:11099, object key = 0
downloads-server-1    | ---- getRegistry done ----
downloads-server-1    | ---- exportObject start... ----
downloads-server-1    | Stub created to 172.19.0.3:9000, object key = 1259475182
downloads-server-1    | ---- exportObject done ----
downloads-registry-1  | RegistryImpl: rebind(Mortgage)
downloads-server-1    | RegistryStub invoke rebind
downloads-server-1    | Mortgage Server is ready to listen...
downloads-client-1    | [172.19.0.2]
downloads-client-1    | Stub created to 172.19.0.2:11099, object key = 0
downloads-registry-1  | RegistryImpl: lookup(Mortgage)
downloads-client-1    | RegistryStub invoke lookup
downloads-client-1    | Usage: java Client principal annualInterest years
downloads-client-1    |
downloads-client-1    | For example: java Client 80000 .065 15
downloads-client-1    |
downloads-client-1    | You will get the output like the following:
downloads-client-1    |
downloads-client-1    | The principal is $80000
downloads-client-1    | The annual interest rate is 6.5%
downloads-client-1    | The term is 15 years
downloads-client-1    | Your monthly payment is $696.89
downloads-client-1 exited with code 0
^CGracefully stopping... (press Ctrl+C again to force)
Aborting on container exit...
[+] Stopping 3/3
 ✔ Container downloads-client-1    Stopped                                      0.0s
 ✔ Container downloads-server-1    Stopped                                      0.5s
 ✔ Container downloads-registry-1  Stopped                                      0.5s
canceled
```

2.5 Result of docker ps -a when the server and registry are running

```
        -virtual-machine:~/Downloads$ docker ps -a
CONTAINER ID   IMAGE                       COMMAND              CREATED         STATUS                     PORTS     NAMES
1b1daea0e539   rock3yu/cs328_a4_client     "java -jar app.jar"   6 minutes ago   Exited (0) 22 seconds ago            downloads-client-1
48540bb170ab   rock3yu/cs328_a4_server     "java -jar app.jar"   6 minutes ago   Up 22 seconds                        downloads-server-1
74b261ec9e57   rock3yu/cs328_a4_registry   "java -jar app.jar"   6 minutes ago   Up 22 seconds                        downloads-registry-1
6b4246d519d3   rock3yu/cs328_a4_client     "java -jar app.jar"   14 hours ago    Exited (0) 14 hours ago              myrmi_docker-client-1
534b08d8cad9   rock3yu/cs328_a4_server     "java -jar app.jar"   14 hours ago    Exited (143) 14 hours ago            myrmi_docker-server-1
2d23237cc7b8   rock3yu/cs328_a4_registry   "java -jar app.jar"   14 hours ago    Exited (143) 14 hours ago            myrmi_docker-registry-1
b91a0e2e57b5   hello-world                 "/hello"             3 days ago      Exited (0) 3 days ago                xenodochial_newton
0a261794103e   dockersamples/visualizer    "/sbin/tini -- node …" 2 weeks ago    Created                              eager_curie
2eeabfff219b   dockersamples/visualizer    "/sbin/tini -- node …" 2 weeks ago    Created                              silly_lehmann
```

2.6 Result of successfully running remote method invocation from the client

- image same to 2.4

- the output of *registry, server, and client* is as expected

3. Link to the published docker images on Docker Hub

https://hub.docker.com/repository/docker/rock3yu/cs328_a4_registry

https://hub.docker.com/repository/docker/rock3yu/cs328_a4_server

https://hub.docker.com/repository/docker/rock3yu/cs328_a4_client