

# **Containerization of Java Web Application using Docker**

(Hands on Practice from Udemy)

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## **Scenario**

Consider a Multitier Java Web Application Stack consists of tomcat application server, MySQL db, memcache, rabbitmq, nginx is running on VMs/ EC2, with regular deployment and continuous changes. List of below problems are occurs while running.

## **Problems**

- High Capital & Operational Expenditure
- Human errors in deployment
- Not compatible with micro services architecture
- Resource wastage
- Not portable, environment not in sync

## **Solution**

- Listed problems are overcome by creation of containers for services.
- Consumes low resource
- Suits well for micro service architecture
- Deployment via images
- Same container images across all environment
- Reusable and Repeatable

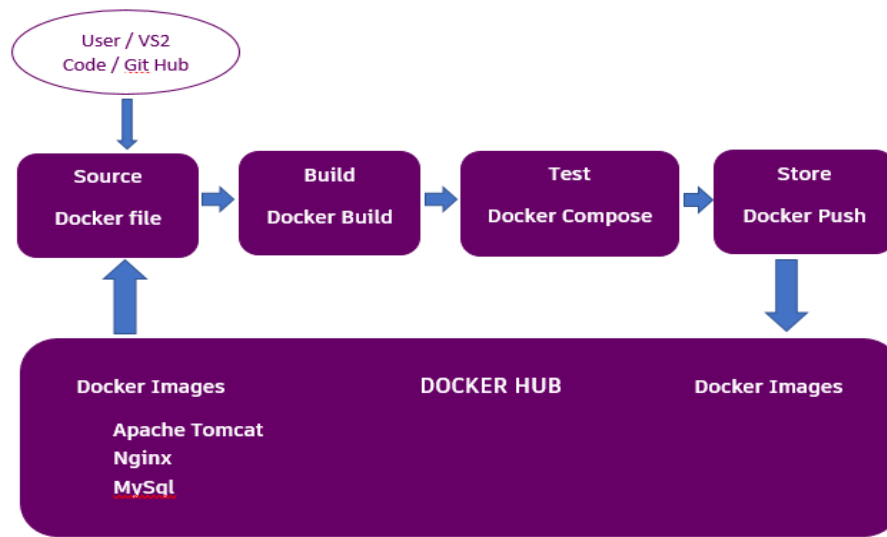
## **Tools to be used**

- Docker as Container run time environment in AWS, maven
- Docker hub, Docker compose

## **Steps to be followed:**

- Create one EC2 instance, and install Docker engine.
- Write the Docker files by using visual studio code editor for tomcat app, database, memcache, rabbitmq and nginx to build docker images and push to git repo.
- Clone the required source code and Docker files from GitHub to our instance.
- Install maven to build the artifacts and locate the war file to the directory where the docker file present for tomcat.
- Build the docker files and the get the images for above.
- Use docker compose, to create the docker containers for tomcat app, database, memcache, rabbitmq and nginx. WAR file will be located at the path `usr/local/tomcat/webapps/ROOT.WAR`.
- Once all the containers up, we need to check whether tomcat is exposing the application through browser with public IP.
- Then push the Docker images whatever built to Docker hub registry.

## Workflow



## Build output by maven screenshot

```
root@ip-172-31-43-245: ~/handson
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0/plexus-utils-3.0.jar
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-interpolation/1.15/plexus-interpolation-1.15.jar (60 kB at 155 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-filtering/1.0-beta-2/maven-filtering-1.0-beta-2.jar
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-archiver/2.1/plexus-archiver-2.1.jar (184 kB at 422 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/com/thoughtworks/xstream/xstream/1.3.1/xstream-1.3.1.jar (431 kB at 838 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/xpp3/xpp3_min/1.1.4c/xpp3_min-1.1.4c.jar (25 kB at 36 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/apache/maven/shared/maven-filtering/1.0-beta-2/maven-filtering-1.0-beta-2.jar (33 kB at 45 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0/plexus-utils-3.0.jar (226 kB at 279 kB/s)
[INFO] Packaging webapp
[INFO] Assembling webapp [vprofile] in [/root/handson/target/vprofile-v1]
[INFO] Processing war project
[INFO] Copying webapp resources [/root/handson/src/main/webapp]
[INFO] Webapp assembled in [213 msecs]
[INFO] Building war: /root/handson/target/vprofile-v1.war
[INFO] WEB-INF/web.xml already added, skipping
[INFO]
[INFO] --- jacoco-maven-plugin:0.7.2.201409121644:report (jacoco-site) @ vprofile ---
[INFO] Analyzed bundle 'Visualpathit VProfile Webapp' with 7 classes
[INFO]
[INFO] --- maven-install-plugin:2.4:install (default-install) @ vprofile ---
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0.5/plexus-utils-3.0.5.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0.5/plexus-utils-3.0.5.pom (2.5 kB at 7.2 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus/3.1/plexus-3.1.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus/3.1/plexus-3.1.pom (19 kB at 50 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-digest/1.0/plexus-digest-1.0.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-digest/1.0/plexus-digest-1.0.pom (1.1 kB at 3.0 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-components/1.1.7/plexus-components-1.1.7.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-components/1.1.7/plexus-components-1.1.7.pom (5.0 kB at 14 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-container-default/1.0-alpha-8/plexus-container-default-1.0-alpha-8.pom
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-container-default/1.0-alpha-8/plexus-container-default-1.0-alpha-8.pom (7.3 kB at 21 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0.5/plexus-utils-3.0.5.jar
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0.5/plexus-utils-3.0.5.jar (12 kB at 33 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-digest/1.0/plexus-digest-1.0.jar
Downloaded from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-digest/1.0/plexus-digest-1.0.jar (12 kB at 33 kB/s)
Downloading from central: https://repo.maven.apache.org/maven2/org/codehaus/plexus/plexus-utils/3.0.5/plexus-utils-3.0.5.jar (230 kB at 505 kB/s)
[INFO] Installing /root/handson/target/vprofile-v1.war to /root/.m2/repository/com/visualpathit/vprofile/v1/vprofile-v1.war
[INFO] Installing /root/handson/pom.xml to /root/.m2/repository/com/visualpathit/vprofile/v1/vprofile-v1.pom
[INFO]
[INFO] BUILD SUCCESS
[INFO]
[INFO] Total time: 02:44 min
[INFO] Finished at: 2022-06-14T13:45:04Z
[INFO]
root@ip-172-31-43-245:~/handson#
```

## Screenshot of List of containers created from Docker images by Docker compose up

```
root@ip-172-31-42-24: ~/handson/compose
-e, --env list          Set environment variables
--env-file list        Read in a file of environment variables
-i, --interactive       Keep STDIN open even if not attached
--privileged           Give extended privileges to the container
-t, --tty              Allocate a pseudo-TTY
-u, --user string       Username or UID (format: <name|uid>[:<group|gid>])
-w, --workdir string   Working directory inside the container
root@ip-172-31-42-24:~/handson/compose# docker exec -w compose_vproapp_1
"docker exec" requires at least 2 arguments.
See 'docker exec --help'.

Usage: docker exec [OPTIONS] CONTAINER COMMAND [ARG...]

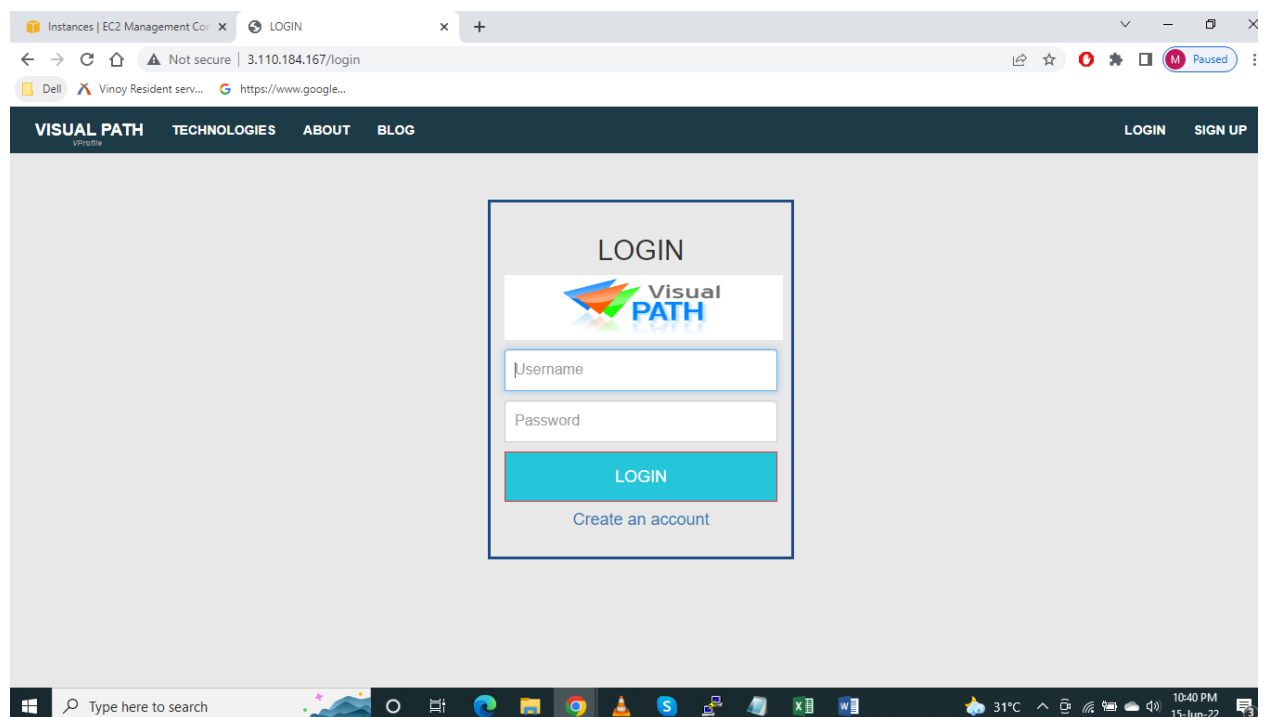
Run a command in a running container
root@ip-172-31-42-24:~/handson/compose# docker exec -w compose_vproapp_1 pwd
"docker exec" requires at least 2 arguments.
See 'docker exec --help'.

Usage: docker exec [OPTIONS] CONTAINER COMMAND [ARG...]

Run a command in a running container
root@ip-172-31-42-24:~/handson/compose# docker container ls
CONTAINER ID   IMAGE                                NAMES                        COMMAND                        CREATED        STATUS        PORTS
3c078b6d3400   arunkumarmr90/docker-handson:vl    compose_vproapp_1          "catalina.sh run"           15 minutes ago Up 15 minutes 0.0.0.0:8080->8080/tcp, :::8080->8080/tcp
0a99f8c32b31   rabbitmq                             "docker-entrypoint.s..." 7 hours ago    Up 7 hours    4369/tcp, 5671-5672/tcp, 15691-15692/tcp, 25672/tcp, 0.0.0.0:15672->15672/tcp, :::15672->15672/tcp
81a7f5eeaaaf   arunkumarmr90/dockerhandsondb:vl    "docker-entrypoint.s..." 7 hours ago    Up 7 hours    0.0.0.0:3306->3306/tcp, :::3306->3306/tcp, 33060/tcp
b9c16c4db50   memcached                             "docker-entrypoint.s..." 7 hours ago    Up 7 hours    0.0.0.0:11211->11211/tcp, :::11211->11211/tcp
7f8c7aedd392   arunkumarmr90/dockerhandsonweb:vl    "/docker-entrypoint..." 7 hours ago    Up 7 hours    0.0.0.0:80->80/tcp, :::80->80/tcp

root@ip-172-31-42-24:~/handson/compose# docker exec -it 3c078b6d3400 /bin/bash
root@83c078b6d3400:/usr/local/tomcat# ls
BUILDING.txt  CONTRIBUTING.md  LICENSE  NOTICE  README.md  RELEASE-NOTES  RUNNING.txt  bin  conf  lib  logs  native-jni-lib  temp  webapps  webapps.dist  work
root@83c078b6d3400:/usr/local/tomcat# cd webapps
root@83c078b6d3400:/usr/local/tomcat/webapps# ls
ROOT  ROOT.war
```

## Screenshot of final output of web app running via Docker containers



## EC2 instance configured with docker engine – screenshot

The screenshot displays the AWS Management Console interface for the EC2 service. On the left, the navigation menu includes options like 'New EC2 Experience', 'EC2 Dashboard', 'EC2 Global View', 'Events', 'Tags', 'Limits', 'Instances', 'Instance Types', 'Launch Templates', 'Spot Requests', 'Savings Plans', 'Reserved Instances', 'Dedicated Hosts', 'Capacity Reservations', and 'Images'. The main content area shows a list of instances with columns for Name, Instance ID, Instance state, Instance type, and Status check. A single instance, 'Dockerengine 1', is listed with ID 'i-0e328d944bb0fa29b', state 'Running', type 't2.micro', and '2/2 checks passed'. Below this, the 'Instance: i-0e328d944bb0fa29b (Dockerengine 1)' details are expanded, showing tabs for Details, Security, Networking, Storage, Status checks, Monitoring, and Tags. The 'Details' tab is active, displaying the Instance ID, Public IPv4 address (3.110.184.167), Private IPv4 addresses (172.31.42.24), Instance state (Running), and Public IPv4 DNS (ec2-3-110-184-167.ap-south-1.compute.amazonaws.com). The bottom of the screen shows the Windows taskbar with various application icons and the system clock indicating 10:44 PM on 15-Jun-22.

Name	Instance ID	Instance state	Instance type	Status check
Dockerengine 1	i-0e328d944bb0fa29b	Running	t2.micro	2/2 checks passed

Instance: i-0e328d944bb0fa29b (Dockerengine 1)		
Details	Security	Networking
<strong>Instance summary</strong>		
Instance ID i-0e328d944bb0fa29b (Dockerengine 1)	Public IPv4 address 3.110.184.167   <a href="#">open address</a>	Private IPv4 addresses 172.31.42.24
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-3-110-184-167.ap-south-1.compute.amazonaws.com   <a href="#">open address</a>