

Chapter 3.1 : Docker-Compose

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What is docker-compose ?

- Docker Compose is a tool that allows you to define and run multi-container Docker applications.
- It uses a YAML file to configure the application's services, networks, and volumes
- uses a single command to create and start all of the services
- It is a useful tool for setting up and managing complex containerized applications, as it allows you to easily define the different components of your application and how they should be configured.

Benefits of docker-compose ?

- **Simplicity:** Docker Compose allows you to define and start all of the services for your application with a single command. This makes it easy to set up and manage complex containerized applications.
- **Reusability:** You can create a single Compose file that can be used to start your application on any environment that supports Docker. This can help improve consistency across development, testing, and production environments.
- **Isolation:** Each service runs in its own container, providing a high degree of isolation between the different components of your application.
- **Scalability:** Services can be scaled individually, you can bring new instances of a service up or take them down without affecting the rest of the application.
- **Version control:** since the configuration is defined in a file, it is easy to store the file in version control and rollback/update easily.
- **Portability:** Docker Compose works on Windows, Linux, and macOS, which allows for greater portability of applications across different operating systems.
- **Networking :** With Docker Compose, you can create networks and attach services to those networks, allowing you to define how the different components of your application communicate with each other.

Docker-compose file format and naming ?

- The Compose file is a YAML file that defines your application's services, networks, and volumes.
- It must be named **docker-compose.yml** or **docker-compose.yaml**, and should be placed in the root of the project.

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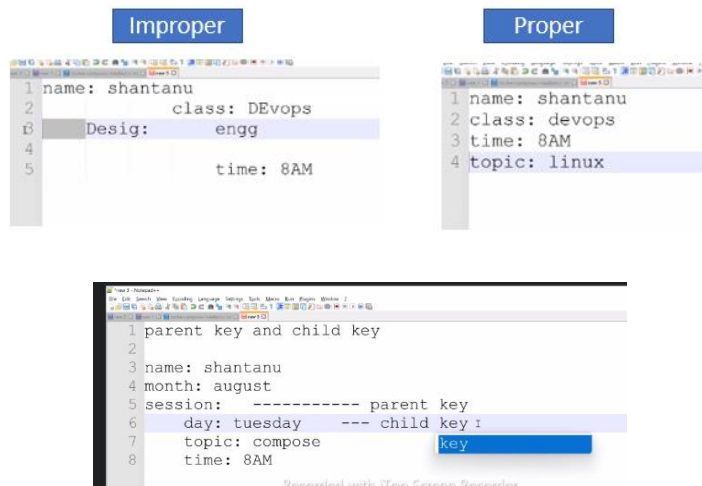
- docker compose for running multiple containers in yaml language
- consist of key=value

name : vishal

class : devops

time : 9:00 AM

- Indentation is very important



- only spaces allowed no tabs.
- Sections are represented by hyphen.
- Service:- A service definition contains configuration that is applied to each container started for that service, much like passing command-line parameters to docker run.
- In simple words collection of everything that i want to tell docker-compose to create a container or multiple containers i.e what is the image you want how many containers etc.
- Here in compose we are not going to refer as a container but as a service.
- Docker compose will not create container it will create service, service will include image, containers, ports etc.
- Compose handles everything as a service

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Sample docker-compose.yml with explanation ?

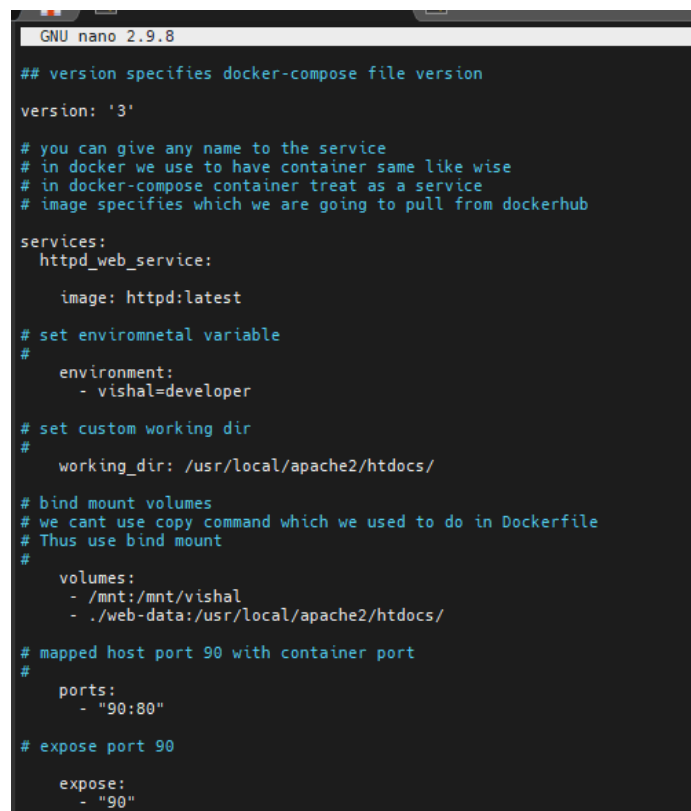
Here I m just adding all things in format in order to understand further

```
version: '3'
services:
  httpd_web_service:
    image: httpd:latest
    environment:
      - vishal=developer

    working_dir: /usr/local/apache2/htdocs/
    volumes:
      - /mnt:/mnt/vishal
      - ./web-data:/usr/local/apache2/htdocs/

    ports:
      - "90:80"

    expose:
      - "90"
```



```
GNU nano 2.9.8

## version specifies docker-compose file version
version: '3'

# you can give any name to the service
# in docker we use to have container same like wise
# in docker-compose container treat as a service
# image specifies which we are going to pull from dockerhub
services:
  httpd_web_service:

    image: httpd:latest

# set enviromnetal variable
#
  environment:
    - vishal=developer

# set custom working dir
#
  working_dir: /usr/local/apache2/htdocs/

# bind mount volumes
# we cant use copy command which we used to do in Dockerfile
# Thus use bind mount
#
  volumes:
    - /mnt:/mnt/vishal
    - ./web-data:/usr/local/apache2/htdocs/

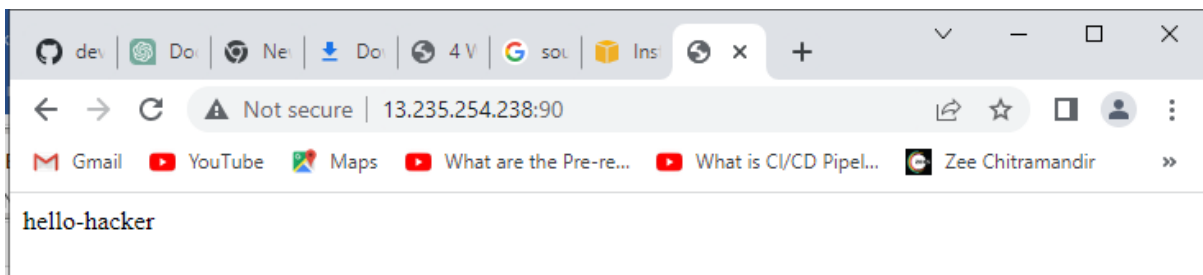
# mapped host port 90 with container port
#
  ports:
    - "90:80"

# expose port 90

  expose:
    - "90"
```

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```
[root@ip-172-31-42-150 ~]# ls
docker-compose.yml  web-data
[root@ip-172-31-42-150 ~]# cd web-data/
[root@ip-172-31-42-150 web-data]# ls
[root@ip-172-31-42-150 web-data]# echo "hello-hacker" >> index.html
[root@ip-172-31-42-150 web-data]# cat *
hello-hacker
[root@ip-172-31-42-150 web-data]# cd ../
[root@ip-172-31-42-150 ~]# ls
docker-compose.yml  web-data
[root@ip-172-31-42-150 ~]# vi docker-compose.yml
[root@ip-172-31-42-150 ~]# cd /mnt
[root@ip-172-31-42-150 mnt]# ls
amol  project1  project1@tmp  slave1  slave1@tmp  temp  tools  tools@tmp  vishal  website  website@tmp
[root@ip-172-31-42-150 mnt]# cd
[root@ip-172-31-42-150 ~]# ls
docker-compose.yml  web-data
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# docker-compose -d up
unknown shorthand flag: 'd' in -d
[root@ip-172-31-42-150 ~]# docker-compose up -d
[+] Running 6/6
  # httpd web service Pulled
  # 8740c948ff4d Pull complete
  # 70698c657149 Pull complete
  # 00df85967755 Pull complete
  # 8b82f5d16994 Pull complete
  # f6a4ba6de68a Pull complete
[+] Running 2/2
  # Network root_default Created
  # Container root-httpd_web_service-1 Started
[root@ip-172-31-42-150 ~]# docker-compose ps -a
NAME                IMAGE                COMMAND                SERVICE        CREATED        STATUS        PORTS
root-httpd_web_service-1  httpd:latest        "httpd-foreground"    httpd_web_service  17 seconds ago  Up 16 seconds  90/tcp, 0.0.0.0:90→80/tcp, :::90→80/tcp
[root@ip-172-31-42-150 ~]# docker-compose exec httpd_web_service bash
root@e070fafi3d43:/usr/local/apache2/htdocs# ls
index.html
root@e070fafi3d43:/usr/local/apache2/htdocs# cd /mnt
root@e070fafi3d43:/mnt# ls
vishal
root@e070fafi3d43:/mnt# cd vishal
root@e070fafi3d43:/mnt/vishal# ls
amol  project1  project1@tmp  slave1  slave1@tmp  temp  tools  tools@tmp  vishal  website  website@tmp
root@e070fafi3d43:/mnt/vishal#
```



Ok Lets come the point ,

Docker-compose commands ??

- **docker-compose up**: starts the services defined in the **docker-compose.yml** file. You can add the **-d** option to run the services in detached mode.
- **docker-compose down**: stops the services defined in the **docker-compose.yml** file and removes the associated containers, networks, and volumes.
- **docker-compose start service-name**: starts the stopped service.
- **docker-compose stop service-name**: stops the running service.
- **docker-compose restart service-name**: restarts the running service.
- **docker-compose ps**: shows the status of the services defined in the **docker-compose.yml** file.
- **docker-compose logs**: shows the logs of the running services.
- **docker-compose exec**: runs a command in a running container. For example, **docker-compose exec service-name bash** runs the **bash** command

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Q. docker-compose.yml and Dockerfile combination.

vi Dockerfile

```
FROM centos
RUN cd /etc/yum.repos.d/
RUN sed -i 's/mirrorlist/#mirrorlist/g' /etc/yum.repos.d/CentOS-*
RUN sed -i 's|#baseurl=http://mirror.centos.org|baseurl=http://vault.centos.org|g' /etc/yum.repos.d/CentOS-*
```

Vi docker-compose.yml

```
version: '3'
services:
  centos:
    build: .
    working_dir: /mnt/vishal
    command:
      - sh
      - -c
      - |
        yum update -y && yum install tree -y
        touch /mnt/vishal/file1 /mnt/vishal/file2
        tail -f /dev/null
    volumes:
      - ./data:/mnt/vishal
    expose:
      - "90"
    ports:
      - "8080:90"
```

In docker file , base image = centos , update pakages repos

In docker-compose.yml , set working dir , create file1 file2 , create and bind mount volume with host /data, expose 90 , mapped host port 8080 with container port 90

Alternatively why tail -f /dev/null : it is because to keep container running continuously by keep executing this one , if I don't do that then container will exit after completing all the task

```
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# ls
data  docker-compose.yml  Dockerfile
[root@ip-172-31-42-150 ~]# rm -rf data
[root@ip-172-31-42-150 ~]# ls
docker-compose.yml  Dockerfile
[root@ip-172-31-42-150 ~]# clear
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# ls
docker-compose.yml  Dockerfile
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# docker-compose up
[+] Running 2/2
  # Network root_default      Created
  # Container root-centos-1   Created
Attaching to root-centos-1
root-centos-1 | CentOS Linux 8 - AppStream          34 MB/s | 8.4 MB   00:00
root-centos-1 | CentOS Linux 8 - BaseOS             33 MB/s | 4.6 MB   00:00
root-centos-1 | CentOS Linux 8 - Extras             146 kB/s | 10 kB    00:00
root-centos-1 | Dependencies resolved.
root-centos-1 | =====
root-centos-1 | Package                Arch    Version                               Repo    Size
root-centos-1 | =====
root-centos-1 | Upgrading:
root-centos-1 | bash                   x86_64  4.4.20-2.el8                         baseos  1.5 M
root-centos-1 | bind-export-libs       x86_64  32:9.11.26-6.el8                     baseos  1.1 M
root-centos-1 | binutils                x86_64  2.30-108.el8_5.1                     baseos  5.8 M
root-centos-1 | ca-certificates        noarch  2021.2.50-80.0.el8_4                 baseos  390 k
root-centos-1 | centos-gpg-keys        noarch  1:8-3.el8                             baseos  12 k
root-centos-1 | centos-linux-release   noarch  8.5-1.2111.el8                       baseos  22 k
root-centos-1 | centos-linux-repos     noarch  8-3.el8                               baseos  20 k
root-centos-1 | chkconfig              x86_64  1.19.1-1.el8                         baseos  198 k
root-centos-1 | coreutils-single       x86_64  8.30-12.el8                           baseos  629 k
root-centos-1 | crypto-policies        noarch  20210617-1.gitc776d3e.el8           baseos  63 k
```

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```

root-centos-1 | Total | 1.4 MB/s | 59 kB | 00:00
root-centos-1 | Running transaction check
root-centos-1 | Transaction check succeeded.
root-centos-1 | Running transaction test
root-centos-1 | Transaction test succeeded.
root-centos-1 | Running transaction
root-centos-1 |   Preparing      :                                1/1
root-centos-1 |   Installing     : tree-1.7.0-15.el8.x86_64      1/1
root-centos-1 |   Running scriptlet: tree-1.7.0-15.el8.x86_64      1/1
root-centos-1 |   Verifying      : tree-1.7.0-15.el8.x86_64      1/1
root-centos-1 |
root-centos-1 | Installed:
root-centos-1 |   tree-1.7.0-15.el8.x86_64
root-centos-1 |
root-centos-1 | Complete!

^p^[^Z
[35]+ Stopped docker-compose up
[root@ip-172-31-42-150 ~]# ls
data docker-compose.yml Dockerfile
[root@ip-172-31-42-150 ~]# cd data
[root@ip-172-31-42-150 data]# ls
file1 file2
[root@ip-172-31-42-150 data]# cd ../
[root@ip-172-31-42-150 ~]# ls
data docker-compose.yml Dockerfile
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# ls
data docker-compose.yml Dockerfile
[root@ip-172-31-42-150 ~]# docker-compose ps
NAME                IMAGE                COMMAND                SERVICE                CREATED                ST
root-centos-1       root-centos          "sh -c 'yum update -..." centos                  6 minutes ago         Up
[root@ip-172-31-42-150 ~]# docker-compose exec centos bash
[root@6698b06d2073 vishal]# ls
file1 file2
[root@6698b06d2073 vishal]# cd ../
[root@6698b06d2073 mnt]# pwd
/mnt
[root@6698b06d2073 mnt]# tree
.
├── vishal
│   └── file2
└── file1

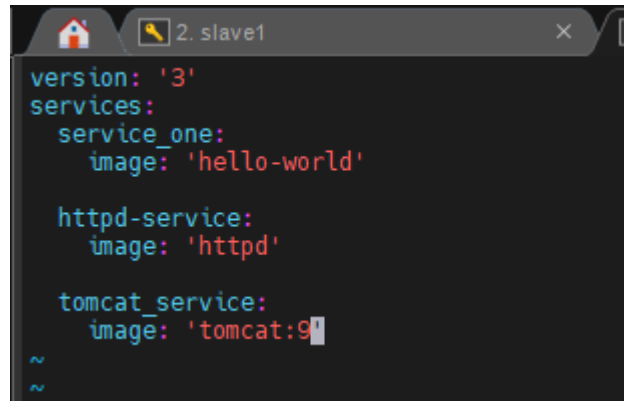
1 directory, 2 files
[root@6698b06d2073 mnt]# read escape sequence
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]#

```

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Q. running multiple services/containers

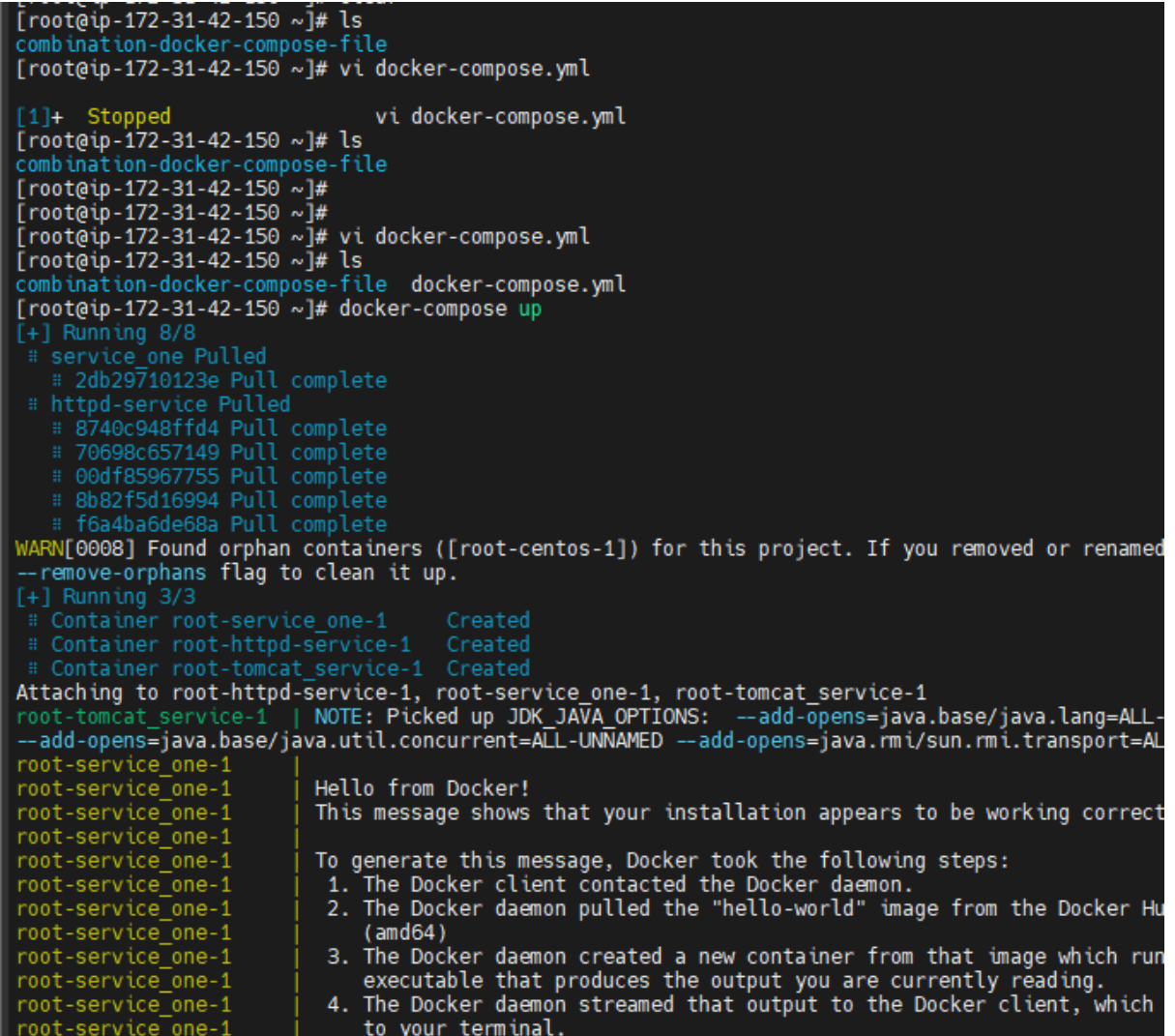
vi docker-compose.yml



```
version: '3'
services:
  service_one:
    image: 'hello-world'

  httpd-service:
    image: 'httpd'

  tomcat_service:
    image: 'tomcat:9'
```



```
[root@ip-172-31-42-150 ~]# ls
combination-docker-compose-file
[root@ip-172-31-42-150 ~]# vi docker-compose.yml

[1]+  Stopped                  vi docker-compose.yml
[root@ip-172-31-42-150 ~]# ls
combination-docker-compose-file
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]#
[root@ip-172-31-42-150 ~]# vi docker-compose.yml
[root@ip-172-31-42-150 ~]# ls
combination-docker-compose-file  docker-compose.yml
[root@ip-172-31-42-150 ~]# docker-compose up
[+] Running 8/8
  # service_one Pulled
  # 2db29710123e Pull complete
  # httpd-service Pulled
  # 8740c948ffd4 Pull complete
  # 70698c657149 Pull complete
  # 00df85967755 Pull complete
  # 8b82f5d16994 Pull complete
  # f6a4ba6de68a Pull complete
WARN[0008] Found orphan containers ([root-centos-1]) for this project. If you removed or renamed
--remove-orphans flag to clean it up.
[+] Running 3/3
  # Container root-service_one-1   Created
  # Container root-httpd-service-1 Created
  # Container root-tomcat_service-1 Created
Attaching to root-httpd-service-1, root-service_one-1, root-tomcat_service-1
root-tomcat_service-1 | NOTE: Picked up JDK_JAVA_OPTIONS: --add-opens=java.base/java.lang=ALL-
--add-opens=java.base/java.util.concurrent=ALL-UNNAMED --add-opens=java.rmi/sun.rmi.transport=AL
root-service_one-1    |
root-service_one-1    | Hello from Docker!
root-service_one-1    | This message shows that your installation appears to be working correct
root-service_one-1    |
root-service_one-1    | To generate this message, Docker took the following steps:
root-service_one-1    | 1. The Docker client contacted the Docker daemon.
root-service_one-1    | 2. The Docker daemon pulled the "hello-world" image from the Docker Hub
root-service_one-1    |    (amd64)
root-service_one-1    | 3. The Docker daemon created a new container from that image which run
root-service_one-1    |    executable that produces the output you are currently reading.
root-service_one-1    | 4. The Docker daemon streamed that output to the Docker client, which
root-service_one-1    |    to your terminal.
```

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```

root-tomcat_service-1 | 12-Jan-2023 08:49:28.256 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
MED
root-tomcat_service-1 | 12-Jan-2023 08:49:28.257 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.257 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
onf/logging.properties
root-tomcat_service-1 | 12-Jan-2023 08:49:28.263 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
aderLogManager
root-tomcat_service-1 | 12-Jan-2023 08:49:28.266 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.266 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
bresources
root-tomcat_service-1 | 12-Jan-2023 08:49:28.267 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
SK=0027
root-tomcat_service-1 | 12-Jan-2023 08:49:28.267 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.268 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.268 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.269 INFO [main] org.apache.catalina.startup.VersionLoggerListener.log
root-tomcat_service-1 | 12-Jan-2023 08:49:28.310 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycle
.0].
root-tomcat_service-1 | 12-Jan-2023 08:49:28.311 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycle
se], random [true], UDS [true].
root-tomcat_service-1 | 12-Jan-2023 08:49:28.311 INFO [main] org.apache.catalina.core.AprLifecycleListener.lifecycle
e]
root-tomcat_service-1 | 12-Jan-2023 08:49:28.347 INFO [main] org.apache.catalina.core.AprLifecycleListener.initial
root-tomcat_service-1 | 12-Jan-2023 08:49:29.180 INFO [main] org.apache.coyote.AbstractProtocol.init Initializing
root-tomcat_service-1 | 12-Jan-2023 08:49:29.317 INFO [main] org.apache.catalina.startup.Catalina.load Server init
root-tomcat_service-1 | 12-Jan-2023 08:49:29.487 INFO [main] org.apache.catalina.core.StandardService.startInternal
root-tomcat_service-1 | 12-Jan-2023 08:49:29.490 INFO [main] org.apache.catalina.core.StandardEngine.startInternal
root-tomcat_service-1 | 12-Jan-2023 08:49:29.509 INFO [main] org.apache.coyote.AbstractProtocol.start Starting Pro
root-tomcat_service-1 | 12-Jan-2023 08:49:29.549 INFO [main] org.apache.catalina.startup.Catalina.start Server sta
^P^Z
[2]+  Stopped                  docker-compose up
[root@ip-172-31-42-150 ~]# docker-compose ps

```

NAME	IMAGE	COMMAND	SERVICE	CREATED	STATUS
root-centos-1	root-centos	"sh -c 'yum update -'"	centos	25 minutes ago	Up 25
root-httpd-service-1	httpd	"httpd-foreground"	httpd-service	23 seconds ago	Up 21
root-tomcat_service-1	tomcat:9	"catalina.sh run"	tomcat_service	23 seconds ago	Up 22

```

[root@ip-172-31-42-150 ~]#

```