

Лабораторная работа №3

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Установка Docker

Vagrantfile для запуска виртуальной машины:

```
Vagrantfile
1 Vagrant.configure("2") do |config|
2   config.vbguest.auto_update = false
3   config.vm.box = "ubuntu/jammy64"
4   config.vm.define "lab3"
5
6   config.vm.provision "shell", privileged: true, path: "https://get.docker.com"
7 end
```

Просмотр существующих images:

```
vagrant@ubuntu-jammy:~$ sudo docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
```

Запуск контейнера Ubuntu:

```
vagrant@ubuntu-jammy:~$ sudo docker run ubuntu
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
a48641193673: Pull complete
Digest: sha256:6042500cf4b44023ea1894effe7890666b0c5c7871ed83a97c36c76ae560bb9b
Status: Downloaded newer image for ubuntu:latest
```

Image появился на системе:

```
vagrant@ubuntu-jammy:~$ sudo docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
ubuntu latest 174c8c134b2a 8 days ago 77.9MB
```

Удаление image:

```
vagrant@ubuntu-jammy:~$ sudo docker rmi 174c
Error response from daemon: conflict: unable to delete 174c8c134b2a (must be forced) - image is
being used by stopped container b0a1988927bb
vagrant@ubuntu-jammy:~$ sudo docker rmi -f 174c
Untagged: ubuntu:latest
Untagged: ubuntu@sha256:6042500cf4b44023ea1894effe7890666b0c5c7871ed83a97c36c76ae560bb9b
Deleted: sha256:174c8c134b2a94b5bb0b37d9a2b6ba0663d82d23ebf62bd51f74a2fd457333da
```

Запуск контейнера:

```
vagrant@ubuntu-jammy:~$ sudo docker run ubuntu
Unable to find image 'ubuntu:latest' locally
latest: Pulling from library/ubuntu
a48641193673: Already exists
Digest: sha256:6042500cf4b44023ea1894effe7890666b0c5c7871ed83a97c36c76ae560bb9b
Status: Downloaded newer image for ubuntu:latest
vagrant@ubuntu-jammy:~$ sudo docker images -q
174c8c134b2a
```

Запуск в интерактивном режиме:

```
vagrant@ubuntu-jammy:~$ sudo docker run -it ubuntu /bin/bash
root@dad5756db53d:/#
```

Список запущенных контейнеров:

```
vagrant@ubuntu-jammy:~$ sudo docker run -it ubuntu /bin/bash &
[2] 13665

CONTAINER ID   IMAGE      COMMAND                  CREATED          STATUS          PORTS          NAMES
c88656705e16   ubuntu    "/bin/bash"             14 seconds ago   Up 13 seconds             infallible_kel
dysn

vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE      COMMAND                  CREATED          STATUS          PORTS          NAMES
c88656705e16   ubuntu    "/bin/bash"             7 seconds ago   Up 6 seconds             infallible_kel
dysn
38cb289ece82   ubuntu    "/bin/bash"             43 seconds ago   Exited (137) 20 seconds ago exciting_davinci
dad5756db53d   ubuntu    "/bin/bash"             About a minute ago Exited (0) 46 seconds ago jolly_hofstadter
40f01e9f5b5c   ubuntu    "/bin/bash"             About a minute ago Exited (0) About a minute ago upbeat_lamport
b0a1988927bb   ubuntu    "/bin/bash"             3 minutes ago   Exited (0) 3 minutes ago hungry_chandrasekhar
```

Список всех контейнеров на системе:

```
vagrant@ubuntu-jammy:~$ sudo docker ps -a
CONTAINER ID   IMAGE      COMMAND                  CREATED          STATUS          PORTS          NAMES
c88656705e16   ubuntu    "/bin/bash"             7 seconds ago   Up 6 seconds             infallible_kel
dysn
38cb289ece82   ubuntu    "/bin/bash"             43 seconds ago   Exited (137) 20 seconds ago exciting_davinci
dad5756db53d   ubuntu    "/bin/bash"             About a minute ago Exited (0) 46 seconds ago jolly_hofstadter
40f01e9f5b5c   ubuntu    "/bin/bash"             About a minute ago Exited (0) About a minute ago upbeat_lamport
b0a1988927bb   ubuntu    "/bin/bash"             3 minutes ago   Exited (0) 3 minutes ago hungry_chandrasekhar
```

```
vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS              PORTS              NAMES
8960b28ca6db  ubuntu   "/bin/bash"             2 minutes ago       Up 51 seconds      80/tcp             sharp_shaw

vagrant@ubuntu-jammy:~$ sudo docker top 896
UID            PID          PPID           C                STIME          TTY            TIME            CMD
root           53969        53945          0                05:23          pts/0          00:00:00        /bin/bash

vagrant@ubuntu-jammy:~$ sudo docker stop 896
896

vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS              PORTS              NAMES
8960b28ca6db  ubuntu   "/bin/bash"             3 minutes ago       Up 2 seconds       80/tcp             sharp_shaw

vagrant@ubuntu-jammy:~$ sudo docker start 896
896

vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS              PORTS              NAMES
8960b28ca6db  ubuntu   "/bin/bash"             3 minutes ago       Up 2 seconds       80/tcp             sharp_shaw

vagrant@ubuntu-jammy:~$
```

Статистика контейнера:

CONTAINER ID	NAME	CPU %	MEM USAGE / LIMIT	MEM %	NET I/O	BLOCK I/O	PIDS
8960b28ca6db	sharp_shaw	0.00%	824KiB / 957.4MiB	0.08%	876B / 0B	0B / 0B	1

Подключение к контейнеру:

```
vagrant@ubuntu-jammy:~$ sudo docker attach 896
root@8960b28ca6db:/# ls
bin boot dev etc home lib lib32 lib64 libx32 media mnt opt p
root@8960b28ca6db:/#
```

Приостановка, возобновление и удаление контейнера:

```
vagrant@ubuntu-jammy:~$ sudo docker pause 896
896

vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS              PORTS              NAMES
8960b28ca6db  ubuntu   "/bin/bash"             4 minutes ago       Up 8 seconds (Paused)      80/tcp             sharp_shaw

vagrant@ubuntu-jammy:~$ sudo docker unpause 896
896

vagrant@ubuntu-jammy:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS              PORTS              NAMES
8960b28ca6db  ubuntu   "/bin/bash"             4 minutes ago       Up 20 seconds          80/tcp             sharp_shaw

vagrant@ubuntu-jammy:~$ sudo docker rm 896
Error response from daemon: You cannot remove a running container 8960b28ca6db1c73133951bac2f71c6f07ac694101e2b01c6300da973cef before attempting removal or force remove
vagrant@ubuntu-jammy:~$ sudo docker stop 896
sudo docker rm 896896
vagrant@ubuntu-jammy:~$ sudo docker rm 896
896
```

Контейнеризация приложений

Установка git:

```
vagrant@ubuntu-jammy:~$ sudo apt install git
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
git is already the newest version (1:2.34.1-1ubuntu1.10).
git set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 10 not upgraded.
vagrant@ubuntu-jammy:~$ git clone https://github.com/docker/getting-started.git
Cloning into 'getting-started'...
remote: Enumerating objects: 967, done.
remote: Counting objects: 100% (10/10), done.
remote: Compressing objects: 100% (10/10), done.
remote: Total 967 (delta 3), reused 1 (delta 0), pack-reused 957
Receiving objects: 100% (967/967), 5.27 MiB | 7.91 MiB/s, done.
Resolving deltas: 100% (514/514), done.
```

Созданный Dockerfile:

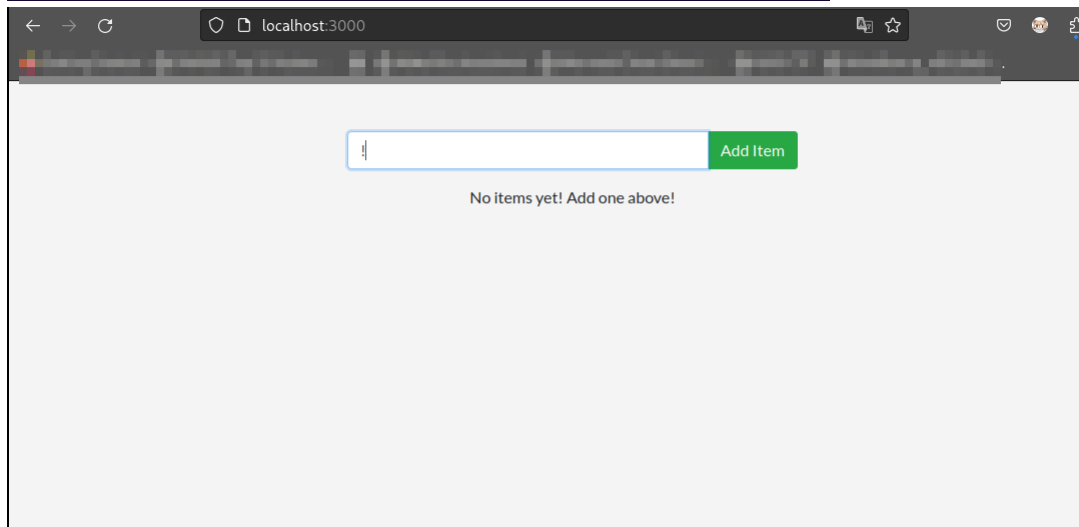
```
vagrant@ubuntu-jammy:~/getting-started/app$ cat Dockerfile
FROM node:18-alpine
WORKDIR /app
COPY . .
RUN yarn install --production
CMD ["node", "src/index.js"]
EXPOSE 3000
```

Сборка docker пакета:

```
vagrant@ubuntu-jammy:~/getting-started/app$ sudo docker build . -t getting-start3ed
[+] Building 32.5s (9/9) FINISHED
=> [internal] load .dockerignore                                docker:default
=> => transferring context: 2B                                  0.0s
=> [internal] load build definition from Dockerfile             0.0s
=> => transferring dockerfile: 150B                             0.0s
=> [internal] load metadata for docker.io/library/node:18-alpine 2.0s
=> [1/4] FROM docker.io/library/node:18-alpine@sha256:b1a0356f7d6b86c958a06949d3db3f7fb27f95f627aa6157cb98bc65c801efa2 10.3s
=> => resolve docker.io/library/node:18-alpine@sha256:b1a0356f7d6b86c958a06949d3db3f7fb27f95f627aa6157cb98bc65c801efa2 0.0s
=> => sha256:b1a0356f7d6b86c958a06949d3db3f7fb27f95f627aa6157cb98bc65c801efa2 1.43kB / 1.43kB 0.0s
=> => sha256:8842b060b01af71c082cee310b428a2d825e940d9fd9e450e05d726aea66a480 1.16kB / 1.16kB 0.0s
=> => sha256:f3776b60850deec9eb1da7746fa20b3f000bf153408dc896d6606704c83f948d 7.14kB / 7.14kB 0.0s
=> => sha256:661ff4d9561e3fd050929ee5097067c34bafc523ee60f5294a37fd08056a73ca 3.41MB / 3.41MB 1.1s
=> => sha256:0f158788f409a5dec9495205daf4aa17df26d8219d6dc12acab5949342866fe 40.24MB / 40.24MB 5.6s
=> => sha256:f028dff98271801e449c3ebac94a319851128c0ec687e13e00a68b2d98ec4700 2.34MB / 2.34MB 0.6s
=> => sha256:18f25c33705ddc3351cc4893fdc0a38405bdd0741643798918fa2b0146fd5a9d 451B / 451B 0.8s
=> => extracting sha256:661ff4d9561e3fd050929ee5097067c34bafc523ee60f5294a37fd08056a73ca 0.1s
=> => extracting sha256:0f158788f409a5dec9495205daf4aa17df26d8219d6dc12acab5949342866fe 1.5s
=> => extracting sha256:f028dff98271801e449c3ebac94a319851128c0ec687e13e00a68b2d98ec4700 0.6s
=> => extracting sha256:18f25c33705ddc3351cc4893fdc0a38405bdd0741643798918fa2b0146fd5a9d 0.0s
=> [internal] load build context                                0.3s
=> => transferring context: 4.59MB                             0.3s
=> [2/4] WORKDIR /app                                          0.8s
=> [3/4] COPY . .                                              0.4s
=> [4/4] RUN yarn install --production                        15.8s
=> exporting to image                                          2.7s
=> => exporting layers                                         2.6s
=> => writing image sha256:0a073944e86cbbfa112b8d654040b0607dcb5246f326351c8ab66b61192a39d7 0.1s
=> => naming to docker.io/library/getting-start3ed           0.0s
```

Запуск контейнера с приложением:

```
vagrant@ubuntu-jammy:~$ sudo docker run -dp 3000:3000 getting-start3ed
f3e6405e382298cde0c08e3f087275cc7356026234cc0ff9e7a451da97f3181a
vagrant@ubuntu-jammy:~$
```



Создание сети:

```
vagrant@ubuntu-jammy:~$ sudo docker network create todo-app
b8d35c112f6d281542eafa59401fe8ca6c9e7c39402ffc0f735df3c3e7e9da3
vagrant@ubuntu-jammy:~$ sudo docker run -d --network todo-app --network-alias mysql -v todo-mysql-data:/var/lib/mysql -e MYSQL_ROOT_PASSWORD=secret -e
MYSQL_DATABASE=todos mysql:8.0
Unable to find image 'mysql:8.0' locally
8.0: Pulling from library/mysql
bce031bc522d: Pull complete
9d95fc125cf8: Pull complete
22412d6d690f: Pull complete
79d453aad0eb: Pull complete
1b6cca7a391d: Pull complete
f9e7ae943297: Pull complete
af3e28b094a2: Pull complete
db237bdcf1c0: Pull complete
4b3c3f5cb4f4: Pull complete
394dbd7e05eb: Pull complete
18a167e598b0: Pull complete
Digest: sha256:c80ef5968b6baf12e9ba95412d4725971207228e5274518db92e26d0e169372b
Status: Downloaded newer image for mysql:8.0
1398c9e204c5c8469b2d55db1830c06c78dac06d6f2d3c3647acd9ad434071a9
```

Запуск контейнера MySQL и подключение его к сети:

```
vagrant@ubuntu-jammy:~$ sudo docker ps
sudo CONTAINER ID   IMAGE      COMMAND                  CREATED        STATUS        PORTS                    NAMES
1398c9e204c5      mysql:8.0   "docker-entrypoint.s..." 25 seconds ago Up 23 seconds 3306/tcp, 33060/tcp     clever_rosalind
vagrant@ubuntu-jammy:~$ ocker^C
vagrant@ubuntu-jammy:~$
vagrant@ubuntu-jammy:~$ sudo docker exec -it 1398 mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 8.0.35 MySQL Community Server - GPL

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql>
```

Демонстрация что существует таблица todos:

```
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| performance_schema |
| sys |
| todos |
+-----+
5 rows in set (0.38 sec)

mysql> exit
Bye
```

Запуск контейнера nicolaka/netshoot:

```
vagrant@ubuntu-jammy:~$ sudo docker run -it --network todo-app nicolaka/netshoot
Unable to find image 'nicolaka/netshoot:latest' locally
latest: Pulling from nicolaka/netshoot
8a49fdb3b6a5: Pull complete
f08cc7654b42: Pull complete
bacdb080ad6d: Pull complete
df75a2676b1d: Pull complete
d30ac41fb6a9: Pull complete
3f3eebe79603: Pull complete
086410b5650d: Pull complete
4f4fb700ef54: Pull complete
5a7fe97d184f: Pull complete
a6d1b2d7a50e: Pull complete
599a1c27c63: Pull complete
dd5e50b27eb9: Pull complete
2681a5bf3176: Pull complete
2517e0a2f862: Pull complete
7b5061a1528d: Pull complete
Digest: sha256:a7c92e1a2fb9287576a16e107166fee7f9925e15d2c1a683dbb1f4370ba9bfe8
Status: Downloaded newer image for nicolaka/netshoot:latest
dP      dP      dP
88      88      88
88d888b. .d8888P .d8888b. 88d888b. .d8888b. .d8888b. d8888P
88' `88 88oooo8 88 Y8oooo. 88' `88 88' `88 88' `88 88
88 88 88. ... 88 88 88 88 88. .88 88. .88 88
dP dP `88888P' dP `88888P' dP dP `88888P' `88888P' dP

Welcome to Netshoot! (github.com/nicolaka/netshoot)
Version: 0.11
```

```
4bbc5b6dfc7e ➡ dig mysql
; <<>> DiG 9.18.13 <<>> mysql
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 24022
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;mysql.                IN      A

;; ANSWER SECTION:
mysql.                600     IN      A      172.18.0.2

;; Query time: 0 msec
;; SERVER: 127.0.0.11#53(127.0.0.11) (UDP)
;; WHEN: Thu Dec 21 05:41:44 UTC 2023
;; MSG SIZE rcvd: 44
```

Установленная версия docker compose:

```
vagrant@ubuntu-jammy:~$ sudo docker compose version
Docker Compose version v2.21.0
```

Созданный docker-compose файл:

```

docker-compose.yml
1 services:
2   app:
3     image: node:18-alpine
4     command: sh -c "yarn install && yarn run dev"
5     ports:
6       - 3000:3000
7     working_dir: /app
8     volumes:
9       - ./:/app
10    environment:
11      MYSQL_HOST: mysql
12      MYSQL_USER: root
13      MYSQL_PASSWORD: secret
14      MYSQL_DB: todos
15  mysql:
16    image: mysql:8.0
17    volumes:
18      - todo-mysql-data:/var/lib/mysql
19    environment:
20      MYSQL_ROOT_PASSWORD: secret
21      MYSQL_DB: todos
22
23 volumes:
24   todo-mysql-data:

```

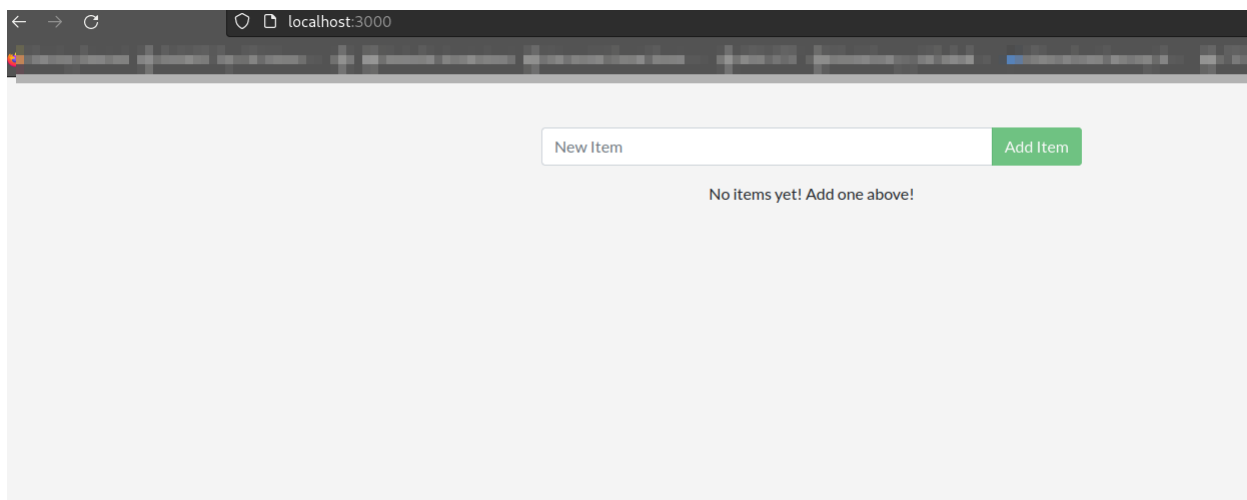
Запуск приложения:

```

vagrant@buntu-jammy:~/getting-started/app$ sudo docker compose up
[+] Running 3/3
✔ Network app_default      Created                                0.0s
✔ Container app-app-1      Created                                0.6s
✔ Container app-mysql-1    Created                                0.6s
Attaching to app-app-1, app-mysql-1
app-mysql-1 | 2023-12-21 06:23:24+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 8.0.35-1.el8 started.
app-app-1   | yarn install v1.22.19
app-app-1   | [1/4] Resolving packages...
app-mysql-1 | 2023-12-21 06:23:26+00:00 [Note] [Entrypoint]: Switching to dedicated user 'mysql'
app-app-1   | success Already up-to-date.
app-app-1   | Done in 0.48s.
app-mysql-1 | 2023-12-21 06:23:26+00:00 [Note] [Entrypoint]: Entrypoint script for MySQL Server 8.0.35-1.el8 started.
app-mysql-1 | '/var/lib/mysql/mysql.sock' -> '/var/run/mysqld/mysqld.sock'
app-app-1   | yarn run v1.22.19
app-app-1   | $ nodemon src/index.js
app-mysql-1 | 2023-12-21T06:23:26.701515Z 0 [Warning] [MY-011068] [Server] The syntax '--skip-host-cache' is deprecated and will be removed in a future release.
app-mysql-1 | Please use SET GLOBAL host_cache_size=0 instead.
app-mysql-1 | 2023-12-21T06:23:26.702490Z 0 [System] [MY-010116] [Server] /usr/sbin/mysqld (mysqld 8.0.35) starting as process 1
app-mysql-1 | 2023-12-21T06:23:26.787596Z 1 [System] [MY-013576] [InnoDB] InnoDB initialization has started.
app-app-1   | [nodemon] 2.0.20
app-app-1   | [nodemon] to restart at any time, enter `rs`
app-app-1   | [nodemon] watching path(s): *.*
app-app-1   | [nodemon] watching extensions: js,mjs,json
app-app-1   | [nodemon] starting `node src/index.js`
app-mysql-1 | 2023-12-21T06:23:29.190284Z 1 [System] [MY-013577] [InnoDB] InnoDB initialization has ended.
app-mysql-1 | 2023-12-21T06:23:31.486137Z 0 [Warning] [MY-010068] [Server] CA certificate ca.pem is self signed.
app-mysql-1 | 2023-12-21T06:23:31.486442Z 0 [System] [MY-013602] [Server] Channel mysql_main configured to support TLS. Encrypted connections are now supported
app-mysql-1 | for this channel.
app-mysql-1 | 2023-12-21T06:23:31.503139Z 0 [Warning] [MY-011810] [Server] Insecure configuration for --pid-file: Location '/var/run/mysqld' in the path is accessible to all OS users. Consider choosing a different directory.
app-mysql-1 | 2023-12-21T06:23:31.643018Z 0 [System] [MY-011323] [Server] X Plugin ready for connections. Bind-address: '::' port: 33060, socket: /var/run/mysqld/mysqld.sock
app-mysql-1 | 2023-12-21T06:23:31.643038Z 0 [System] [MY-010931] [Server] /usr/sbin/mysqld: ready for connections. Version: '8.0.35' socket: '/var/run/mysqld/mysqld.sock' port: 3306 MySQL Community Server - GPL.
app-app-1   | Waiting for mysql:3306.
app-app-1   | Connected!
app-app-1   | Connected to mysql db at host mysql
app-app-1   | Listening on port 3000

```

Демонстрация:



Финальный vagrantfile:

```
1 Vagrant.configure("2") do |config|
2   config.vbguest.auto_update = false
3   config.vm.box = "ubuntu/jammy64"
4
5   config.vm.provision "shell", privileged: true, path: "https://get.docker.com"
6   config.vm.provision "shell", privileged: true, inline: <<-SHELL
7     sudo apt -y install git
8     git clone https://github.com/docker/getting-started.git
9   SHELL
10
11   config.vm.define "Dockerfile" do |df|
12     df.vm.network "forwarded_port", guest: 3000, host: 3000
13     df.vm.provision "shell", inline: <<-SHELL
14       cp /vagrant/.vagrant/Dockerfile getting-started/app/Dockerfile
15       cd getting-started/app
16       sudo docker build . -t getting-started
17       sudo docker run -dp 3000:3000 getting-started
18
19       sudo docker network create todo-app
20       sudo docker run -d --network todo-app --network-alias mysql -v todo-mysql-mysql-data:/var/lib/mysql -e MYSQL_ROOT_PASSWORD=secret -e MYSQL_DATABASE=todos mysql:8.0
21       sudo docker pull nicolaka/netshoot
22     SHELL
23   end
24
25   config.vm.define "Docker-Compose" do |dc|
26     dc.vm.network "forwarded_port", guest: 3000, host: 3001
27     dc.vm.provision "shell", inline: <<-SHELL
28       cp /vagrant/.vagrant/docker-compose.yml getting-started/app/docker-compose.yml
29       cd getting-started/app
30       sudo docker compose up -d
31     SHELL
32   end
33 end
```