EPAM University Programs

DevOps external course

Module 2 Virtualization and Cloud Basic

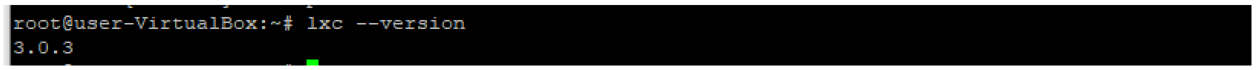
TASK 2.4

Работа с lxc в Ubuntu

Documentation - https://help.ubuntu.com/lts/serverguide/lxd.html

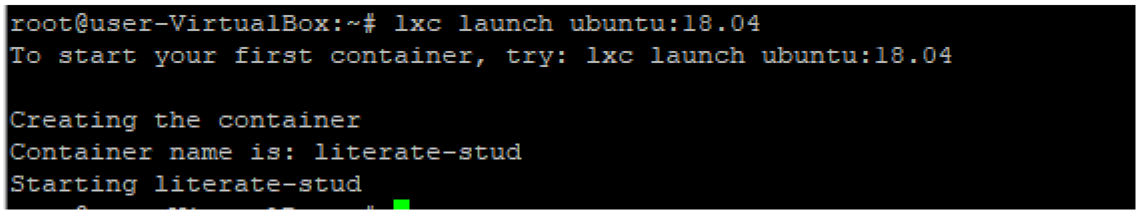
https://linuxcontainers.org/lxd/getting-started-cli/

1. Установить lxc (screenshot)



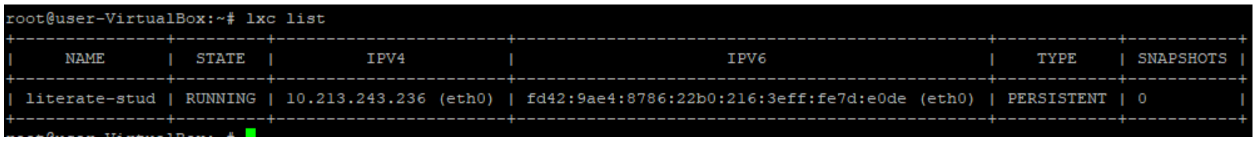
```
root@user-VirtualBox:~# lxc --version
3.0.3
```

2. Запустить lxc launch для любой из версий Убунту (screenshot)



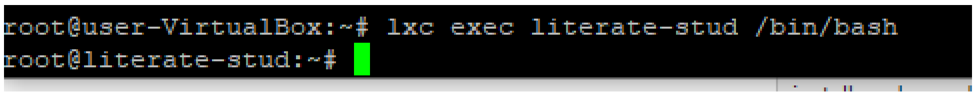
```
root@user-VirtualBox:~# lxc launch ubuntu:18.04
To start your first container, try: lxc launch ubuntu:18.04

Creating the container
Container name is: literate-stud
Starting literate-stud
```

3. По окончании загрузки убедиться, что машина стартовала lxc list (screenshot)



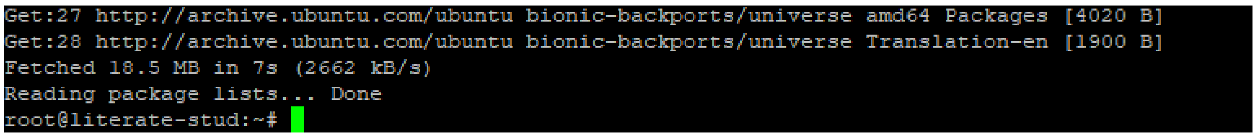
```
root@user-VirtualBox:~# lxc list
+---------------+---------+----------------------+-----------------------------------------------+------------+-----------+
|     NAME      |  STATE  |         IPV4         |                     IPV6                      |    TYPE    | SNAPSHOTS |
+---------------+---------+----------------------+-----------------------------------------------+------------+-----------+
| literate-stud | RUNNING | 10.213.243.236 (eth0) | fd42:9ae4:8786:22b0:216:3eff:fe7d:e0de (eth0) | PERSISTENT | 0         |
+---------------+---------+----------------------+-----------------------------------------------+------------+-----------+
```

4. Зайдите в контейнер с командной строкой bash /bin/bash (screenshot)



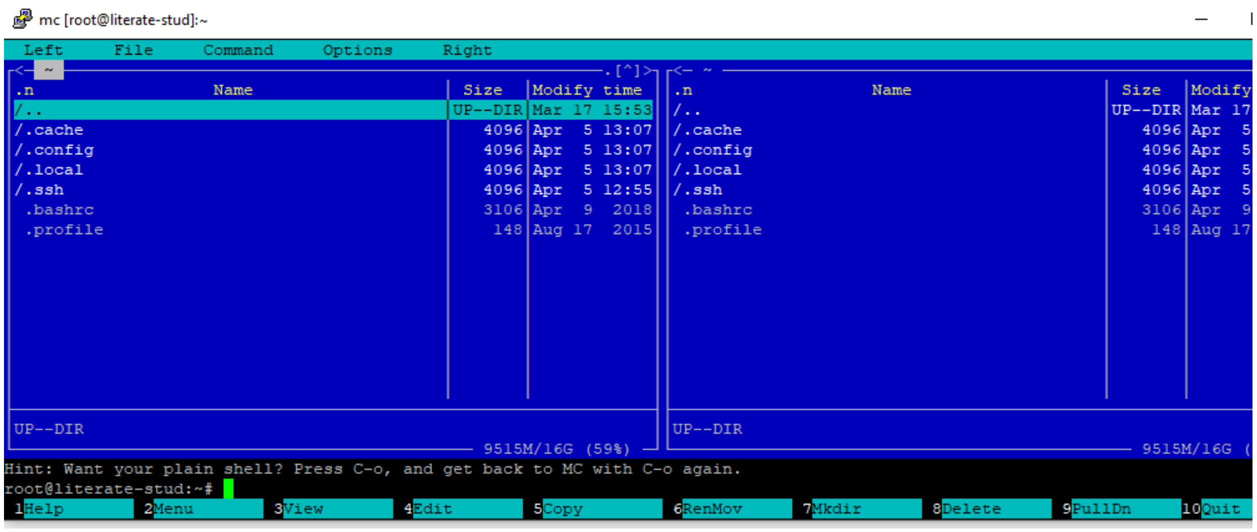
```
root@user-VirtualBox:~# lxc exec literate-stud /bin/bash
root@literate-stud:~#
```

5. Запустите обновление apt-get update (screenshot)



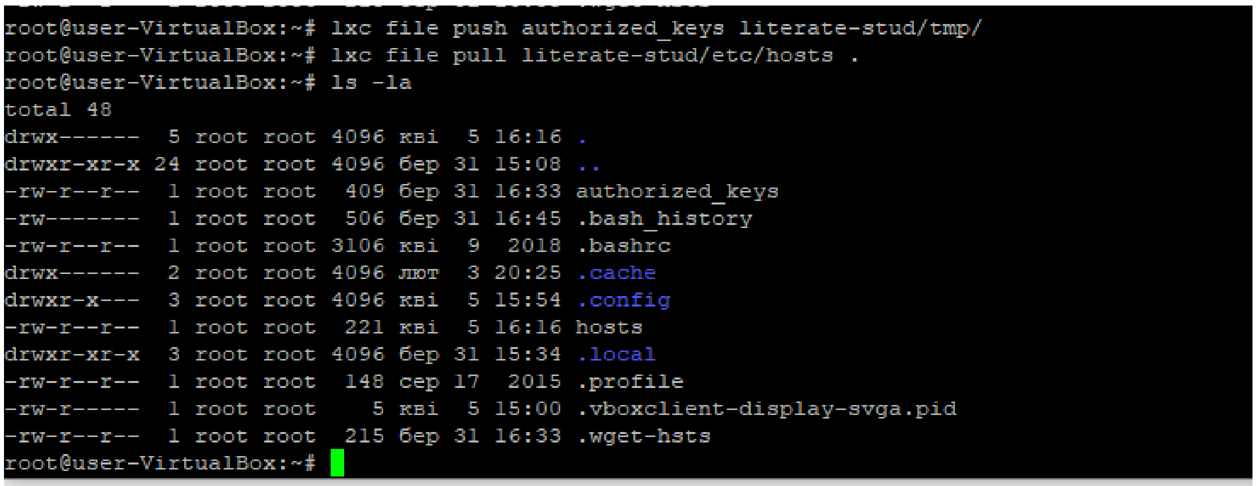
```
Get:27 http://archive.ubuntu.com/ubuntu bionic-backports/universe amd64 Packages [4020 B]
Get:28 http://archive.ubuntu.com/ubuntu bionic-backports/universe Translation-en [1900 B]
Fetched 18.5 MB in 7s (2662 kB/s)
Reading package lists... Done
root@literate-stud:~#
```

6. Установите (apt-get install) любую программу в контейнер. Например mc. Проверьте работоспособность. (screenshot)



```
mc [root@literate-stud]:~
  Left     File     Command     Options     Right
┌<─ ~ ────────────────────────────────────.[^]>┐┌<─ ~ ──────────────────────────────────
.n                      Name            Size  │Modify time  .n                      Name            Size  │Modify
/..                                   UP--DIR│Mar 17 15:53  /..                                   UP--DIR│Mar 17
/.cache                                  4096│Apr  5 13:07  /.cache                                  4096│Apr  5
/.config                                 4096│Apr  5 13:07  /.config                                 4096│Apr  5
/.local                                  4096│Apr  5 13:07  /.local                                  4096│Apr  5
/.ssh                                    4096│Apr  5 12:55  /.ssh                                    4096│Apr  5
 .bashrc                                 3106│Apr  9  2018   .bashrc                                 3106│Apr  9
 .profile                                 148│Aug 17  2015   .profile                                 148│Aug 17

UP--DIR                                                      UP--DIR
                                    9515M/16G (59%)                                          9515M/16G (
Hint: Want your plain shell? Press C-o, and get back to MC with C-o again.
root@literate-stud:~#
 1Help    2Menu    3View    4Edit    5Copy    6RenMov   7Mkdir   8Delete   9PullDn  10Quit
```

7. Загрузите в контейнер файл (screenshot) и скачайте с контейнера другой файл (screenshot).



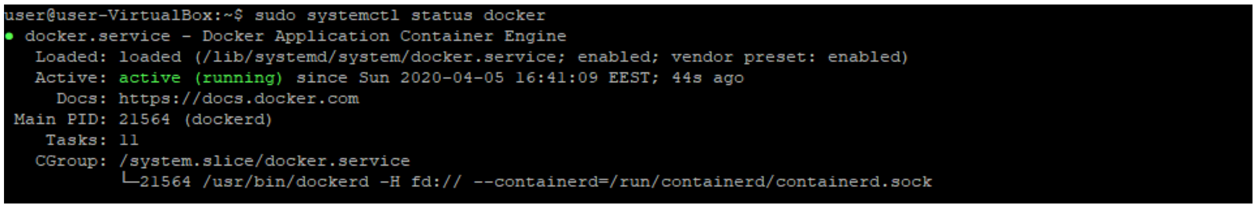
```
root@user-VirtualBox:~# lxc file push authorized_keys literate-stud/tmp/
root@user-VirtualBox:~# lxc file pull literate-stud/etc/hosts .
root@user-VirtualBox:~# ls -la
total 48
drwx------  5 root root 4096 кві   5 16:16 .
drwxr-xr-x 24 root root 4096 бер  31 15:08 ..
-rw-r--r--  1 root root  409 бер  31 16:33 authorized_keys
-rw-------  1 root root  506 бер  31 16:45 .bash_history
-rw-r--r--  1 root root 3106 кві   9  2018 .bashrc
drwx------  2 root root 4096 лют   3 20:25 .cache
drwxr-x---  3 root root 4096 кві   5 15:54 .config
-rw-r--r--  1 root root  221 кві   5 16:16 hosts
drwxr-xr-x  3 root root 4096 бер  31 15:34 .local
-rw-r--r--  1 root root  148 сер  17  2015 .profile
-rw-r-----  1 root root    5 кві   5 15:00 .vboxclient-display-svga.pid
-rw-r--r--  1 root root  215 бер  31 16:33 .wget-hsts
root@user-VirtualBox:~#
```

Работа с Docker в Ubuntu

Documentation - https://www.digitalocean.com/community/tutorials/how-to-install-and-use-docker-on-ubuntu-18-04

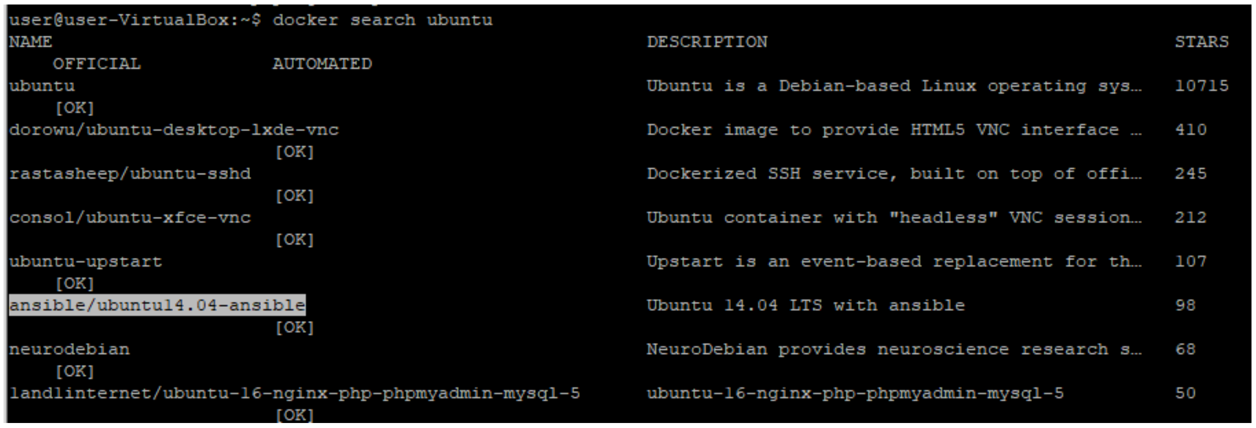
https://docs.docker.com

8. Установить docker (screenshot)



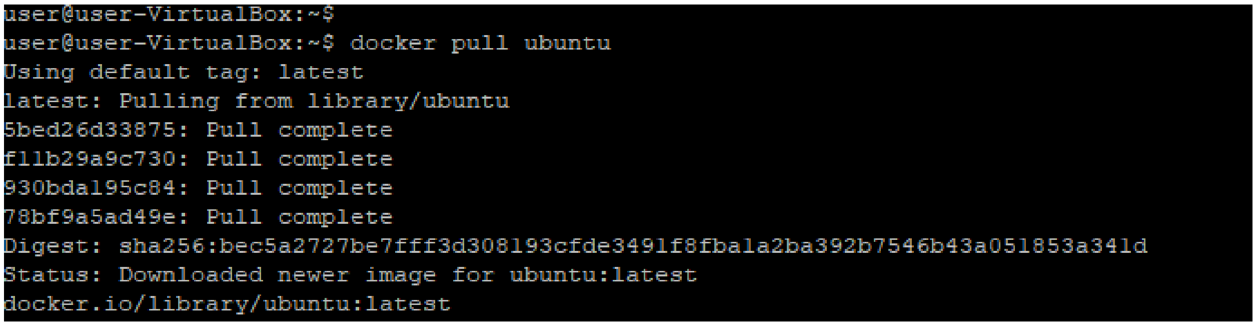
```
user@user-VirtualBox:~$ sudo systemctl status docker
● docker.service - Docker Application Container Engine
   Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
   Active: active (running) since Sun 2020-04-05 16:41:09 EEST; 44s ago
     Docs: https://docs.docker.com
 Main PID: 21564 (dockerd)
    Tasks: 11
   CGroup: /system.slice/docker.service
           └─21564 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock
```

9. Запустить поиск сконфигурированных решений для “ubuntu”(screenshot)



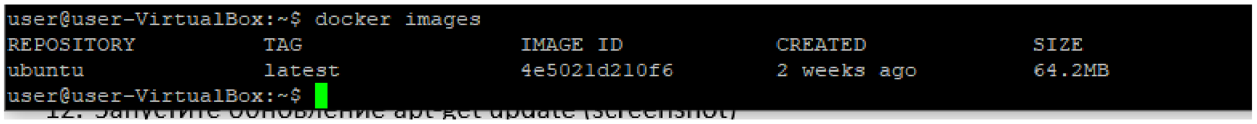
```
user@user-VirtualBox:~$ docker search ubuntu
NAME                                                      DESCRIPTION                                      STARS
    OFFICIAL            AUTOMATED
ubuntu                                                    Ubuntu is a Debian-based Linux operating sys…    10715
    [OK]
dorowu/ubuntu-desktop-lxde-vnc                            Docker image to provide HTML5 VNC interface …    410
                        [OK]
rastasheep/ubuntu-sshd                                    Dockerized SSH service, built on top of offi…    245
                        [OK]
consol/ubuntu-xfce-vnc                                    Ubuntu container with "headless" VNC session…    212
                        [OK]
ubuntu-upstart                                            Upstart is an event-based replacement for th…    107
    [OK]
ansible/ubuntu14.04-ansible                               Ubuntu 14.04 LTS with ansible                    98
                        [OK]
neurodebian                                               NeuroDebian provides neuroscience research s…    68
    [OK]
landlinternet/ubuntu-16-nginx-php-phpmyadmin-mysql-5      ubuntu-16-nginx-php-phpmyadmin-mysql-5           50
                        [OK]
```

10. Скачать любой из образов на локальную машину. (screenshot)



```
user@user-VirtualBox:~$
user@user-VirtualBox:~$ docker pull ubuntu
Using default tag: latest
latest: Pulling from library/ubuntu
5bed26d33875: Pull complete
f11b29a9c730: Pull complete
930bda195c84: Pull complete
78bf9a5ad49e: Pull complete
Digest: sha256:bec5a2727be7fff3d308193cfde3491f8fba1a2ba392b7546b43a051853a341d
Status: Downloaded newer image for ubuntu:latest
docker.io/library/ubuntu:latest
```

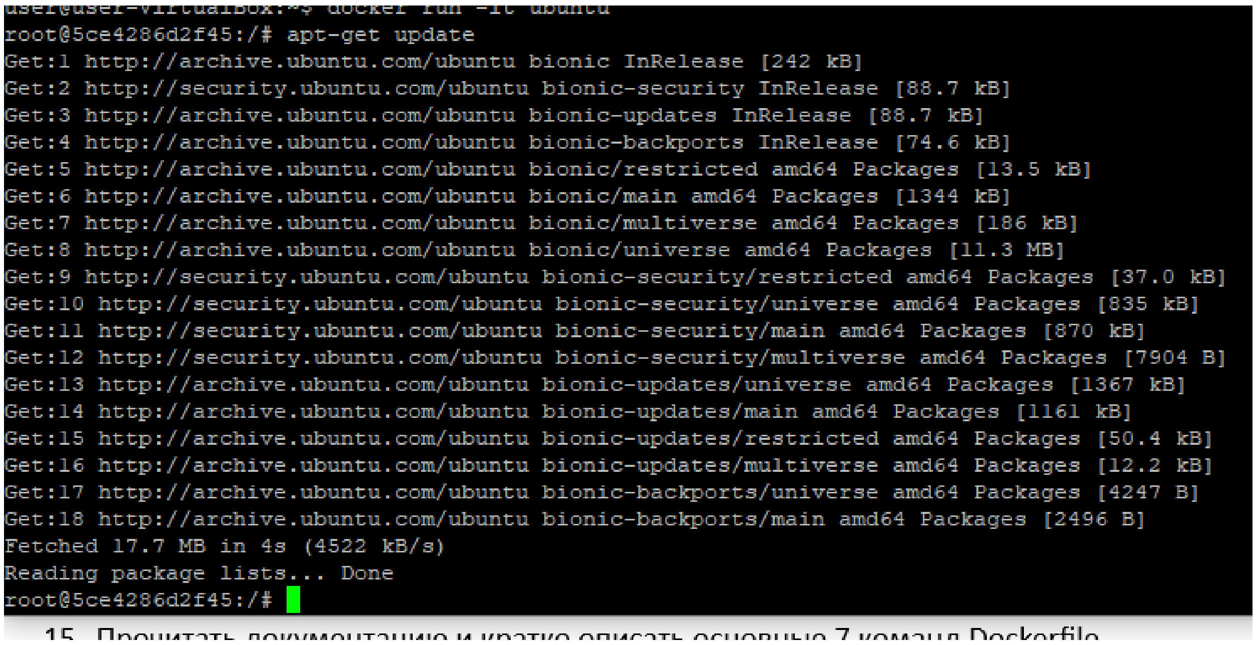
11. Запустить команду просмотра загруженных на компьютер образов. (screenshot)



```
user@user-VirtualBox:~$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
ubuntu              latest              4e5021d210f6        2 weeks ago         64.2MB
user@user-VirtualBox:~$
```

12. Запустите обновление apt-get update (screenshot)

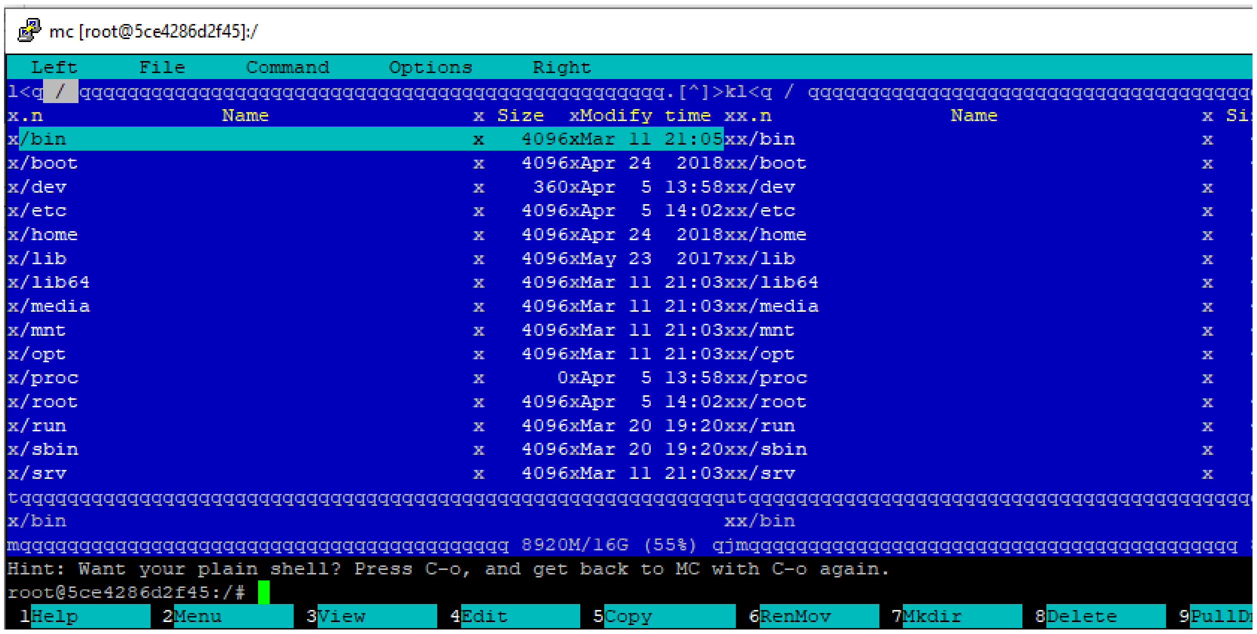
12. Запустите обновление apt-get update (screenshot)



```
user@user-VirtualBox:~$ docker run -it ubuntu
root@5ce4286d2f45:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu bionic InRelease [242 kB]
Get:2 http://security.ubuntu.com/ubuntu bionic-security InRelease [88.7 kB]
Get:3 http://archive.ubuntu.com/ubuntu bionic-updates InRelease [88.7 kB]
Get:4 http://archive.ubuntu.com/ubuntu bionic-backports InRelease [74.6 kB]
Get:5 http://archive.ubuntu.com/ubuntu bionic/restricted amd64 Packages [13.5 kB]
Get:6 http://archive.ubuntu.com/ubuntu bionic/main amd64 Packages [1344 kB]
Get:7 http://archive.ubuntu.com/ubuntu bionic/multiverse amd64 Packages [186 kB]
Get:8 http://archive.ubuntu.com/ubuntu bionic/universe amd64 Packages [11.3 MB]
Get:9 http://security.ubuntu.com/ubuntu bionic-security/restricted amd64 Packages [37.0 kB]
Get:10 http://security.ubuntu.com/ubuntu bionic-security/universe amd64 Packages [835 kB]
Get:11 http://security.ubuntu.com/ubuntu bionic-security/main amd64 Packages [870 kB]
Get:12 http://security.ubuntu.com/ubuntu bionic-security/multiverse amd64 Packages [7904 B]
Get:13 http://archive.ubuntu.com/ubuntu bionic-updates/universe amd64 Packages [1367 kB]
Get:14 http://archive.ubuntu.com/ubuntu bionic-updates/main amd64 Packages [1161 kB]
Get:15 http://archive.ubuntu.com/ubuntu bionic-updates/restricted amd64 Packages [50.4 kB]
Get:16 http://archive.ubuntu.com/ubuntu bionic-updates/multiverse amd64 Packages [12.2 kB]
Get:17 http://archive.ubuntu.com/ubuntu bionic-backports/universe amd64 Packages [4247 B]
Get:18 http://archive.ubuntu.com/ubuntu bionic-backports/main amd64 Packages [2496 B]
Fetched 17.7 MB in 4s (4522 kB/s)
Reading package lists... Done
root@5ce4286d2f45:/#
```

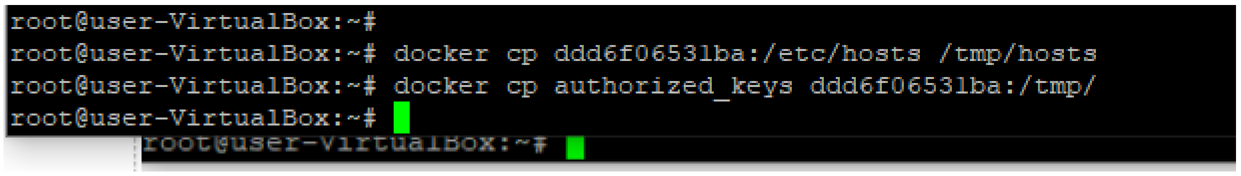
15. Прочитать документацию и кратко описать основные 7 команд Dockerfile

13. Установите (apt-get install) любую программу в контейнер. Например mc. Проверьте работоспособность. (screenshot)

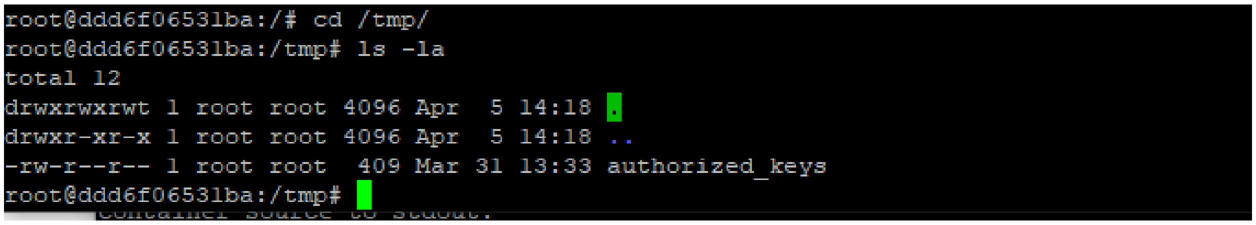


```
mc [root@5ce4286d2f45]:/
  Left      File      Command      Options      Right
l<q / qqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq.[^]>kl<q / qqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq
x.n                Name                    x Size  xModify time xx.n                Name            x Si
x/bin                                      x  4096xMar 11 21:05xx/bin                               x
x/boot                                     x  4096xApr 24  2018xx/boot                              x
x/dev                                      x   360xApr  5 13:58xx/dev                               x
x/etc                                      x  4096xApr  5 14:02xx/etc                               x
x/home                                     x  4096xApr 24  2018xx/home                              x
x/lib                                      x  4096xMay 23  2017xx/lib                               x
x/lib64                                    x  4096xMar 11 21:03xx/lib64                             x
x/media                                    x  4096xMar 11 21:03xx/media                             x
x/mnt                                      x  4096xMar 11 21:03xx/mnt                               x
x/opt                                      x  4096xMar 11 21:03xx/opt                               x
x/proc                                     x     0xApr  5 13:58xx/proc                              x
x/root                                     x  4096xApr  5 14:02xx/root                              x
x/run                                      x  4096xMar 20 19:20xx/run                               x
x/sbin                                     x  4096xMar 20 19:20xx/sbin                              x
x/srv                                      x  4096xMar 11 21:03xx/srv                               x
tqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqutqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq
x/bin                                                         xx/bin
mqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq 8920M/16G (55%) qjmqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq
Hint: Want your plain shell? Press C-o, and get back to MC with C-o again.
root@5ce4286d2f45:/#
 1Help     2Menu     3View     4Edit     5Copy     6RenMov    7Mkdir     8Delete    9PullDn
```

14. Загрузите в контейнер файл (screenshot) и скачайте с контейнера другой файл (screenshot).



```
root@user-VirtualBox:~#
root@user-VirtualBox:~# docker cp ddd6f06531ba:/etc/hosts /tmp/hosts
root@user-VirtualBox:~# docker cp authorized_keys ddd6f06531ba:/tmp/
root@user-VirtualBox:~#
          root@user-VirtualBox:~#
```


```
root@ddd6f06531ba:/# cd /tmp/
root@ddd6f06531ba:/tmp# ls -la
total 12
drwxrwxrwt 1 root root 4096 Apr  5 14:18 .
drwxr-xr-x 1 root root 4096 Apr  5 14:18 ..
-rw-r--r-- 1 root root  409 Mar 31 13:33 authorized_keys
root@ddd6f06531ba:/tmp#
```

15. Прочитать документацию и кратко описать основные 7 команд Dockerfile

1) FROM

FROM [--platform=<platform>] <image> [AS <name>]

FROM ubuntu:18.04

The `FROM` instruction initializes a new build stage and sets the *Base Image* for subsequent instructions. As such, a valid `Dockerfile` must start with a `FROM` instruction. The image can be any valid image – it is especially easy to start by **pulling an image** from the *Public Repositories*.

2) COPY

COPY . /app

COPY has two forms:

- `COPY [--chown=<user>:<group>] <src>... <dest>`
- `COPY [--chown=<user>:<group>] ["<src>",... "<dest>"]` (this form is required for paths containing whitespace)

The `COPY` instruction copies new files or directories from `<src>` and adds them to the filesystem of the container at the path `<dest>`.

Multiple `<src>` resources may be specified but the paths of files and directories will be interpreted as relative to the source of the context of the build.

3) RUN

RUN make /app

RUN has 2 forms:

- `RUN <command>` (*shell* form, the command is run in a shell, which by default is `/bin/sh -c` on Linux or `cmd /S /C` on Windows)
- `RUN ["executable", "param1", "param2"]` (*exec* form)

The `RUN` instruction will execute any commands in a new layer on top of the current image and commit the results. The resulting committed image will be used for the next step in the `Dockerfile`.

4) CMD

```
CMD python /app/app.py
```

The `CMD` instruction has three forms:

- `CMD ["executable","param1","param2"]` (*exec* form, this is the preferred form)
- `CMD ["param1","param2"]` (as *default parameters to ENTRYPOINT*)
- `CMD command param1 param2` (*shell* form)

There can only be one `CMD` instruction in a `Dockerfile`. If you list more than one `CMD` then only the last `CMD` will take effect.

The main purpose of a `CMD` is to provide defaults for an executing container. These defaults can include an executable, or they can omit the executable, in which case you must specify an `ENTRYPOINT` instruction as well.

5) EXPOSE

```
EXPOSE 80/tcp
```

```
EXPOSE <port> [<port>/<protocol>...]
```

The `EXPOSE` instruction informs Docker that the container listens on the specified network ports at runtime. You can specify whether the port listens on TCP or UDP, and the default is TCP if the protocol is not specified.

The `EXPOSE` instruction does not actually publish the port. It functions as a type of documentation between the person who builds the image and the person who runs the container, about which ports are intended to be published. To actually publish the port when running the container, use the `-p` flag on `docker run` to publish and map one or more ports, or the `-P` flag to publish all exposed ports and map them to high-order ports.

6) ENTRYPOINT

```
ENTRYPOINT ["/usr/sbin/apache2ctl", "-D", "FOREGROUND"]
```

ENTRYPOINT has two forms:

- `ENTRYPOINT ["executable", "param1", "param2"]` (*exec* form, preferred)
- `ENTRYPOINT command param1 param2` (*shell* form)

An `ENTRYPOINT` allows you to configure a container that will run as an executable.

Command line arguments to `docker run <image>` will be appended after all elements in an *exec* form `ENTRYPOINT`, and will override all elements specified using `CMD`. This allows arguments to be passed to the entry point, i.e., `docker run <image> -d` will pass the `-d` argument to the entry point. You can override the `ENTRYPOINT` instruction using the `docker run --entrypoint` flag.

7) VOLUME

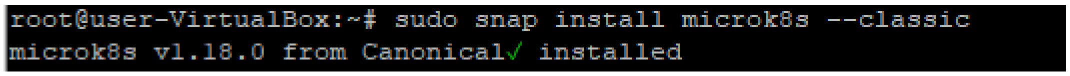
VOLUME ["/data"]

The `VOLUME` instruction creates a mount point with the specified name and marks it as holding externally mounted volumes from native host or other containers. The value can be a JSON array, `VOLUME ["/var/log/"]`, or a plain string with multiple arguments, such as `VOLUME /var/log` or `VOLUME /var/log /var/db`.

Работа с Kubernetes в Ubuntu

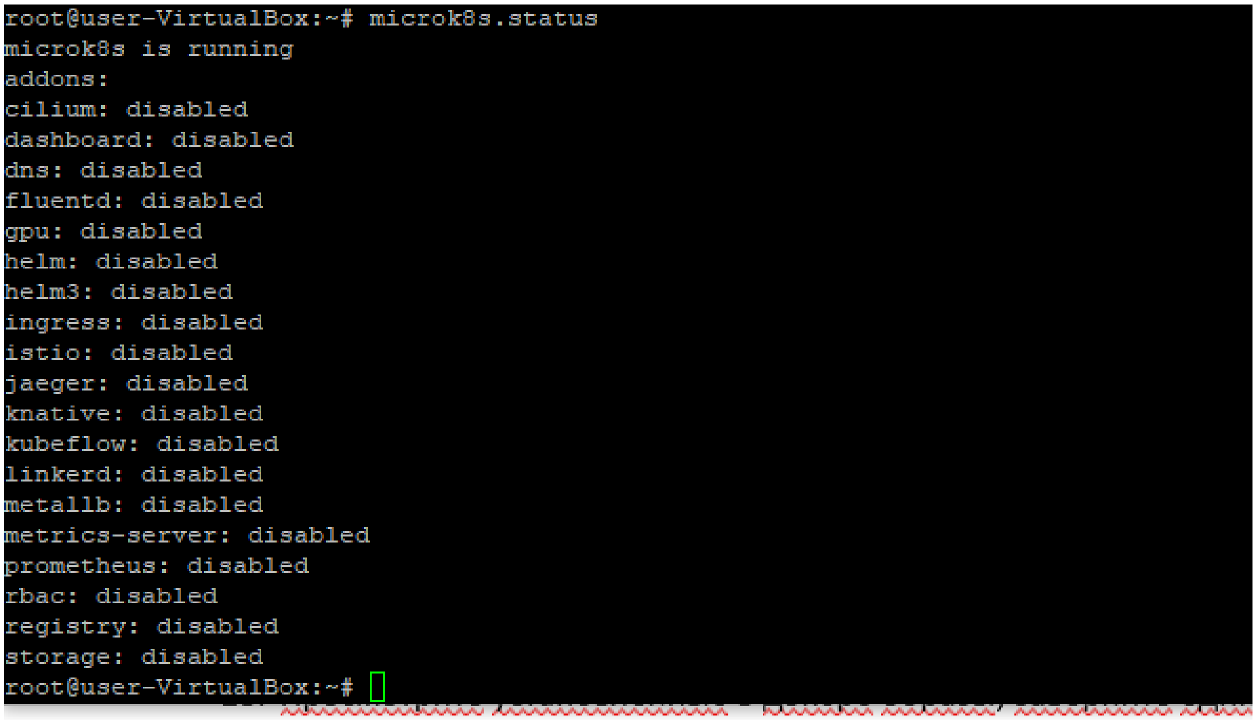
https://ubuntu.com/kubernetes/install ; https://microk8s.io/docs/

16. Установить microk8s (screenshot)

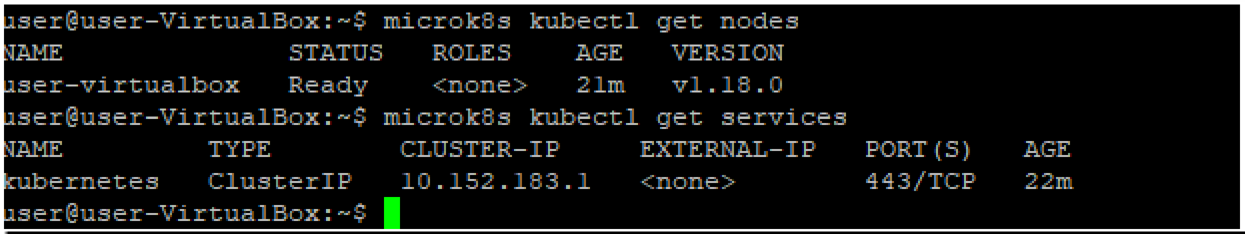


```
root@user-VirtualBox:~# sudo snap install microk8s --classic
microk8s v1.18.0 from Canonical✓ installed
```

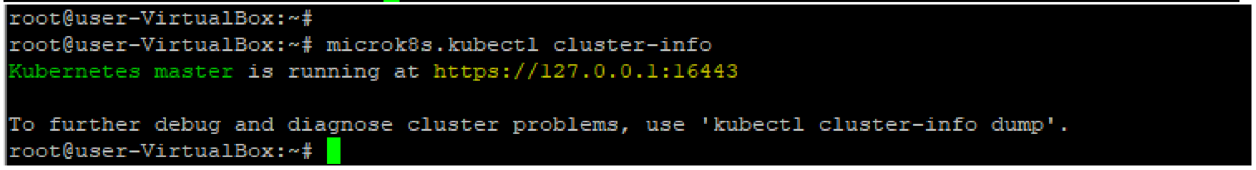
17. Проверьте статус (screenshot) и команды менеджера кластера (screenshot).



```
root@user-VirtualBox:~# microk8s.status
microk8s is running
addons:
cilium: disabled
dashboard: disabled
dns: disabled
fluentd: disabled
gpu: disabled
helm: disabled
helm3: disabled
ingress: disabled
istio: disabled
jaeger: disabled
knative: disabled
kubeflow: disabled
linkerd: disabled
metallb: disabled
metrics-server: disabled
prometheus: disabled
rbac: disabled
registry: disabled
storage: disabled
root@user-VirtualBox:~#
```

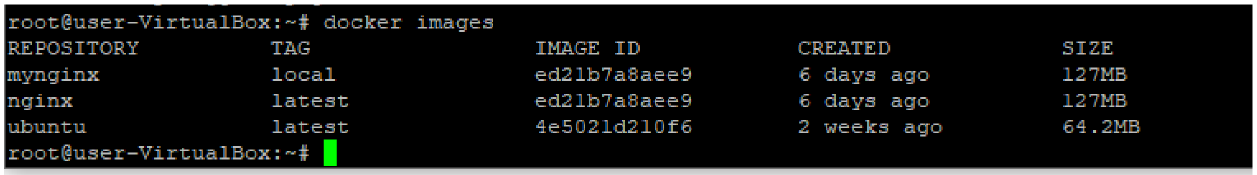


```
user@user-VirtualBox:~$ microk8s kubectl get nodes
NAME               STATUS   ROLES    AGE   VERSION
user-virtualbox    Ready    <none>   21m   v1.18.0
user@user-VirtualBox:~$ microk8s kubectl get services
NAME         TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.152.183.1   <none>        443/TCP   22m
user@user-VirtualBox:~$
```

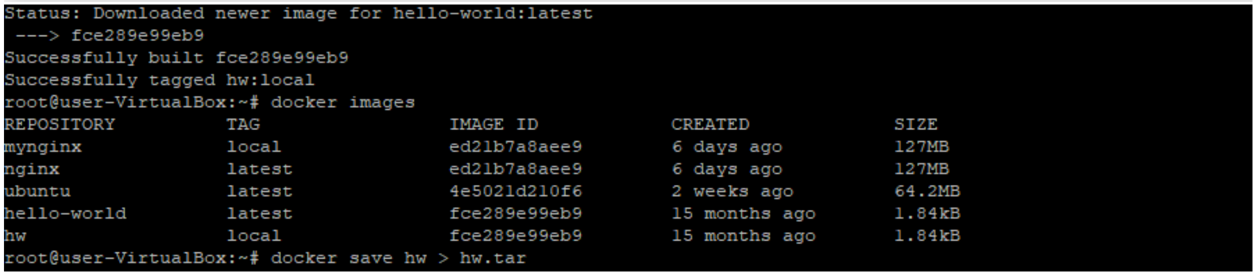


```
root@user-VirtualBox:~#
root@user-VirtualBox:~# microk8s.kubectl cluster-info
Kubernetes master is running at https://127.0.0.1:16443

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
root@user-VirtualBox:~#
```

18. Просмотрите установленные в докере образы; заверните один из них в образ *.tar

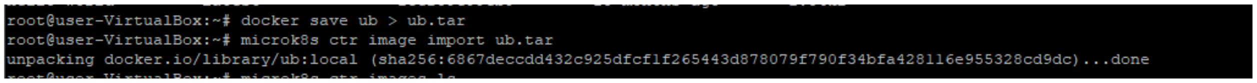


```
root@user-VirtualBox:~# docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
mynginx             local               ed21b7a8aee9        6 days ago          127MB
nginx               latest              ed21b7a8aee9        6 days ago          127MB
ubuntu              latest              4e5021d210f6        2 weeks ago         64.2MB
root@user-VirtualBox:~#
```



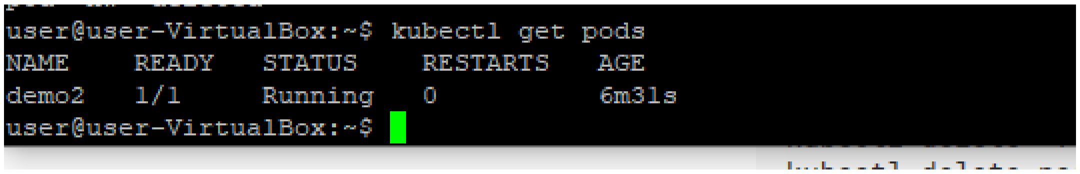
```
Status: Downloaded newer image for hello-world:latest
 ---> fce289e99eb9
Successfully built fce289e99eb9
Successfully tagged hw:local
root@user-VirtualBox:~# docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
mynginx             local               ed21b7a8aee9        6 days ago          127MB
nginx               latest              ed21b7a8aee9        6 days ago          127MB
ubuntu              latest              4e5021d210f6        2 weeks ago         64.2MB
hello-world         latest              fce289e99eb9        15 months ago       1.84kB
hw                  local               fce289e99eb9        15 months ago       1.84kB
root@user-VirtualBox:~# docker save hw > hw.tar
```

19. Импортируйте образ в Kubernetes (screenshot)

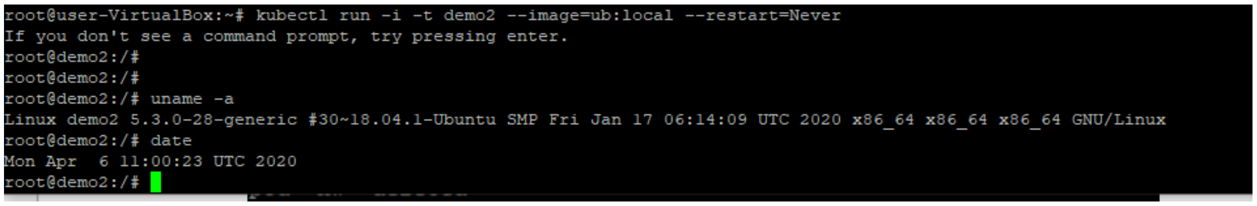


```
root@user-VirtualBox:~# docker save ub > ub.tar
root@user-VirtualBox:~# microk8s ctr image import ub.tar
unpacking docker.io/library/ub:local (sha256:6867deccdd432c925dfcf1f265443d878079f790f34bfa428116e955328cd9dc)...done
```

20. Запустите образ и убедитесь, что он работает. (screenshot)



```
user@user-VirtualBox:~$ kubectl get pods
NAME     READY   STATUS    RESTARTS   AGE
demo2    1/1     Running   0          6m31s
user@user-VirtualBox:~$
```



```
root@user-VirtualBox:~# kubectl run -i -t demo2 --image=ub:local --restart=Never
If you don't see a command prompt, try pressing enter.
root@demo2:/#
root@demo2:/#
root@demo2:/# uname -a
Linux demo2 5.3.0-28-generic #30~18.04.1-Ubuntu SMP Fri Jan 17 06:14:09 UTC 2020 x86_64 x86_64 x86_64 GNU/Linux
root@demo2:/# date
Mon Apr  6 11:00:23 UTC 2020
root@demo2:/#
```