



Introduction

Docker is an application that makes it simple and easy to run application processes in a container, which are like virtual machines, only more portable, more resource-friendly, and more dependent on the host operating system. For a detailed introduction to the different components of a Docker container, check out The Docker Ecosystem: An Introduction to Common Components.

There are two methods for installing Docker on Ubuntu 16.04. One method involves installing it on an existing installation of the operating system. The other involves spinning up a server with a tool called Docker Machine that auto-installs Docker on it.

In this tutorial, you'll learn how to install and use it on an existing installation of Ubuntu 16.04.

Prerequisites

To follow this tutorial, you will need the following:

- One Ubuntu 16.04 server set up with a non-root user with sudo privileges and a basic firewall, as explained in the Initial Setup Guide for Ubuntu 16.04
- An account on <u>Docker Hub</u> if you wish to create your own images and push them to Docker Hub, as shown in Steps 7 and 8

Step 1 — Installing Docker

The Docker installation package available in the official Ubuntu 16.04 repository may not be the latest version. To get this latest version, install Docker from the official Docker repository. This section shows you how to do just that.

First, in order to ensure the downloads are valid, add the GPG key for the official Docker repository to your system:

```
$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
```

Add the Docker repository to APT sources:

```
$ sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -
```

Next, update the package database with the Docker packages from the newly added repo:

```
$ sudo apt-get update
```

Make sure you are about to install from the Docker repo instead of the default Ubuntu 16.04 repo:

```
$ apt-cache policy docker-ce
```

You should see output similar to the follow:

Output of apt-cache policy docker-ce

```
docker-ce:
   Installed: (none)
   Candidate: 18.06.1~ce~3-0~ubuntu
   Version table:
      18.06.1~ce~3-0~ubuntu 500
```

Notice that docker-ce is not installed, but the candidate for installation is from the Docker repository for Ubuntu 16.04 (xenial).

Finally, install Docker:

```
$ sudo apt-get install -y docker-ce
```

Docker should now be installed, the daemon started, and the process enabled to start on boot. Check that it's running:

\$ sudo systemctl status docker

The output should be similar to the following, showing that the service is active and running:

Output

Installing Docker now gives you not just the Docker service (daemon) but also the docker command line utility, or the Docker client. We'll explore how to use the docker command later in this tutorial.

Step 2 — Executing the Docker Command Without Sudo (Optional)

By default, running the docker command requires root privileges — that is, you have to prefix the command with sudo. It can also be run by a user in the docker group, which is automatically created during the installation of Docker. If you attempt to run the docker command without prefixing it with sudo or without being in the docker group, you'll get an output like this:

```
Output
```

```
docker: Cannot connect to the Docker daemon. Is the docker daemon running on this host?. See 'docker run --help'.
```

If you want to avoid typing sudo whenever you run the docker command, add your username to the docker group:

```
$ sudo usermod -aG docker ${USER}
```

To apply the new group membership, you can log out of the server and back in, or you can type the following:

```
$ su - ${USER}
```

You will be prompted to enter your user's password to continue. Afterwards, you can confirm that your user is now added to the docker group by typing:

```
$ id -nG
```

Output

sammy sudo docker

If you need to add a user to the docker group that you're not logged in as, declare that username explicitly using:

```
$ sudo usermod -aG docker username
```

The rest of this article assumes you are running the docker command as a user in the docker user group. If you choose not to, please prepend the commands with sudo.

Step 3 — Using the Docker Command

With Docker installed and working, now's the time to become familiar with the command line utility. Using docker consists of passing it a chain of options and commands followed by arguments. The syntax takes this form:

```
$ docker [option] [command] [arguments]
```

To view all available subcommands, type:

\$ docker

As of Docker 18.06.1, the complete list of available subcommands includes:

Output

attach Attach local standard input, output, and error streams to a running container

build Build an image from a Dockerfile

commit Create a new image from a container's changes

cp Copy files/folders between a container and the local filesystem

create Create a new container

diff Inspect changes to files or directories on a container's filesystem

events Get real time events from the server exec Run a command in a running container

export Export a container's filesystem as a tar archive

history Show the history of an image

images List images

info Display system-wide information

inspect Return low-level information on Docker objects

kill Kill one or more running containers

load Load an image from a tar archive or STDIN

login Log in to a Docker registry
logout Log out from a Docker registry
logs Fetch the logs of a container

pause Pause all processes within one or more containers

port List port mappings or a specific mapping for the container

ps List containers

pull Pull an image or a repository from a registry push Push an image or a repository to a registry

rename Rename a container

restart Restart one or more containers
rm Remove one or more containers
rmi Remove one or more images

run Run a command in a new container

save Save one or more images to a tar archive (streamed to STDOUT by default)

search Search the Docker Hub for images start Start one or more stopped containers

stats Display a live stream of container(s) resource usage statistics

stop Stop one or more running containers

top Display the running processes of a container

unpause Unpause all processes within one or more containers

update Update configuration of one or more containers

version Show the Docker version information

wait Block until one or more containers stop, then print their exit codes

To view the switches available to a specific command, type:

\$ docker docker-subcommand --help

To view system-wide information about Docker, use:

Step 4 — Working with Docker Images

Docker containers are run from Docker images. By default, it pulls these images from Docker Hub, a Docker registry managed by Docker, the company behind the Docker project. Anybody can build and host their Docker images on Docker Hub, so most applications and Linux distributions you'll need to run Docker containers have images that are hosted on Docker Hub.

To check whether you can access and download images from Docker Hub, type:

\$ docker run hello-world

In the output, you should see the following message, which indicates that Docker is working correctly:

Output

Hello from Docker!

This message shows that your installation appears to be working correctly.

You can search for images available on Docker Hub by using the docker command with the search subcommand. For example, to search for the Ubuntu image, type:

\$ docker search ubuntu

The script will crawl Docker Hub and return a listing of all images whose name matches the search string. In this case, the output will be similar to this:

Output

NAME

ubuntu

dorowu/ubuntu-desktop-lxde-vnc

rastasheep/ubuntu-sshd

consol/ubuntu-xfce-vnc

ansible/ubuntu14.04-ansible

ubuntu-upstart

neurodebian

1and1internet/ubuntu-16-nginx-php-phpmyadmin-mysql-5

ubuntu-debootstrap

nuagebec/ubuntu

tutum/ubuntu

DESCRIPTION

Ubuntu is a Debian-based Linux operating sys...

Ubuntu with openssh-server and NoVNC

Dockerized SSH service, built on top of offi...

Ubuntu container with "headless" VNC session...

Ubuntu 14.04 LTS with ansible

Upstart is an event-based replacement for th...

NeuroDebian provides neuroscience research s...

ubuntu-16-nginx-php-phpmyadmin-mysql-5

debootstrap --variant=minbase --components=m... Simple always updated Ubuntu docker images w...

Simple Ubuntu docker images with SSH access

i386/ubuntu
landlinternet/ubuntu-16-apache-php-7.0
ppc64le/ubuntu
eclipse/ubuntu_jdk8
landlinternet/ubuntu-16-nginx-php-5.6-wordpress-4
codenvy/ubuntu_jdk8
darksheer/ubuntu
pivotaldata/ubuntu
landlinternet/ubuntu-16-sshd
smartentry/ubuntu
ossobv/ubuntu
paasmule/bosh-tools-ubuntu
landlinternet/ubuntu-16-healthcheck
pivotaldata/ubuntu-gpdb-dev

Ubuntu is a Debian-based Linux operating sys...
ubuntu-16-apache-php-7.0
Ubuntu is a Debian-based Linux operating sys...
Ubuntu, JDK8, Maven 3, git, curl, nmap, mc, ...
ubuntu-16-nginx-php-5.6-wordpress-4
Ubuntu, JDK8, Maven 3, git, curl, nmap, mc, ...
Base Ubuntu Image -- Updated hourly
A quick freshening-up of the base Ubuntu doc...
ubuntu-16-sshd
ubuntu with smartentry
Custom ubuntu image from scratch (based on o...
Ubuntu based bosh-cli
ubuntu-16-healthcheck

Ubuntu images for GPDB development

In the **OFFICIAL** column, **OK** indicates an image built and supported by the company behind the project. Once you've identified the image that you would like to use, you can download it to your computer using the pull subcommand. Try this with the ubuntu image, like so:

\$ docker pull ubuntu

After an image has been downloaded, you may then run a container using the downloaded image with the run subcommand. If an image has not been downloaded when docker is executed with the run subcommand, the Docker client will first download the image, then run a container using it:

\$ docker run ubuntu

To see the images that have been downloaded to your computer, type:

\$ docker images

The output should look similar to the following:

Output

REPOSITORY TAG IMAGE ID CREATED SIZE ubuntu latest ea4c82dcd15a 16 hours ago 85.8MB hello-world latest 4ab4c602aa5e 5 weeks ago 1.84kB

As you'll see later in this tutorial, images that you use to run containers can be modified and used to generate new images, which may then be uploaded (*pushed* is the technical term) to Docker Hub or other Docker registries.

Step 5 — Running a Docker Container

The hello-world container you ran in the previous step is an example of a container that runs and exits after emitting a test message. Containers can be much more useful than that, and they can be interactive. After all, they are similar to virtual machines, only more resource-friendly.

As an example, let's run a container using the latest image of Ubuntu. The combination of the -i and -t switches gives you interactive shell access into the container:

\$ docker run -it ubuntu

Note: The default behavior for the **run** command is to start a new container. Once you run the preceding the command, you will open up the shell interface of a second **ubuntu** container.

Your command prompt should change to reflect the fact that you're now working inside the container and should take this form:

Output

root@9b0db8a30ad1:/#

Note: Remember the container id in the command prompt. In the preceding example, it is **9b0db8a30ad1**. You'll need that container ID later to identify the container when you want to remove it.

Now you can run any command inside the container. For example, let's update the package database inside the container. You don't need to prefix any command with sudo, because you're operating inside the container as the **root** user:

```
root@9b0db8a30ad1:/# apt-get update
```

Then install any application in it. Let's install Node.js:

```
root@9b0db8a30ad1:/# apt-get install -y nodejs
```

This installs Node.js in the container from the official Ubuntu repository. When the installation finishes, verify that Node.js is installed:

```
root@9b0db8a30ad1:/# node -v
```

You'll see the version number displayed in your terminal:

v8.10.0

Any changes you make inside the container only apply to that container.

To exit the container, type exit at the prompt.

Let's look at managing the containers on our system next.

Step 6 — Managing Docker Containers

After using Docker for a while, you'll have many active (running) and inactive containers on your computer. To view the **active ones**, use:

\$ docker ps

You will see output similar to the following:

Output

CONTAINER ID

IMAGE

COMMAND

CREATED

In this tutorial, you started three containers; one from the hello-world image and two from the ubuntu image. These containers are no longer running, but they still exist on your system.

To view all containers — active and inactive — run docker ps with the -a switch:

\$ docker ps -a

You'll see output similar to this:

Output

CONTAINER ID **IMAGE COMMAND CREATED STATUS** 9b0db8a30ad1 ubuntu "/bin/bash" 21 minutes ago Exited (0) About a mi d7851eb12e23 ubuntu "/bin/bash" 24 minutes ago Exited (0) 24 minutes hello-world "/hello" Exited (0) 32 minutes d54945b6510b 32 minutes ago

To view the latest container you created, pass it the -1 switch:

\$ docker ps -1

Output

CONTAINER ID IMAGE COMMAND CREATED STATUS

9b0db8a30ad1 ubuntu "/bin/bash" 22 minutes ago Exited (127) About a

To start a stopped container, use docker start, followed by the container ID or the container's name. Let's start the Ubuntu-based container with the ID of 9b0db8a30ad1:

\$ docker start 9b0db8a30ad1

The container will start, and you can use docker ps to see its status:

Output

CONTAINER ID IMAGE COMMAND CREATED STATUS

9b0db8a30ad1 ubuntu "/bin/bash" 23 minutes ago Up 11 seconds

To stop a running container, use docker stop, followed by the container ID or name. This time, we'll use the name that Docker assigned the container, which is xenodochial neumann:

\$ docker stop xenodochial neumann

Once you've decided you no longer need a container anymore, remove it with the docker rm command, again using either the container ID or the name. Use the docker ps -a command to find the container ID or name for the container associated with the hello-world image and remove it.

\$ docker rm youthful_roentgen

You can start a new container and give it a name using the --name switch. You can also use the --rm switch to create a container that removes itself when it's stopped. See the docker run help command for more information on these options and others.

Containers can be turned into images which you can use to build new containers. Let's look at how that works.

Step 7 — Committing Changes in a Container to a Docker Image

When you start up a Docker image, you can create, modify, and delete files just like you can with a virtual machine. The changes that you make will only apply to that container. You can start and stop it, but once you destroy it with the docker rm command, the changes will be lost for good.

This section shows you how to save the state of a container as a new Docker image.

After installing Node.js inside the Ubuntu container, you now have a container running off an image, but the container is different from the image you used to create it. But you might want to reuse this Node.js container as the basis for new images later.

To do this, commit the changes to a new Docker image instance using the following command structure:

\$ docker commit -m "What did you do to the image" -a "Author Name" container-id repository/new_image

The -m switch is for the commit message that helps you and others know what changes you made, while -a is used to specify the author. The container ID is the one you noted earlier in the tutorial when you started the interactive Docker session. Unless you created additional repositories on Docker Hub, the repository is usually your Docker Hub username.

For example, for the user **sammy**, with the container ID of d9b100f2f636, the command would be:

\$ docker commit -m "added node.js" -a "sammy" d9b100f2f636 sammy/ubuntu-nodejs

Note: When you *commit* an image, the new image is saved locally, that is, on your computer. Later in this tutorial, you'll learn how to push an image to a Docker registry like Docker Hub so that it can be assessed and used by you and others.

After that operation is completed, listing the Docker images now on your computer should show the new image, as well as the old one that it was derived from:

\$ docker images

The output should be similar to this:

Output

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
<pre>sammy/ubuntu-nodejs</pre>	latest	6a1784a63edf	2 minutes ago	170MB
ubuntu	latest	ea4c82dcd15a	17 hours ago	85.8MB
hello-world	latest	4ab4c602aa5e	5 weeks ago	1.84kB

In the above example, **ubuntu-nodejs** is the new image, which was derived from the existing ubuntu image from Docker Hub. The size difference reflects the changes that were made. In this example, the change was that Node.js was installed. Next time you need to run a container using Ubuntu with Node.js pre-installed, you can just use the new image.

You can also build images from a Dockerfile, which lets you automate the installation of software in a new image. However, that's outside the scope of this tutorial.

Now let's share the new image with others so they can create containers from it.

Step 8 — Pushing Docker Images to a Docker Repository

The next logical step after creating a new image from an existing image is to share it with a select few of your friends, the whole world on Docker Hub, or another Docker registry that you have access to. To push an image to Docker Hub or any other Docker registry, you must have an account there.

This section shows you how to push a Docker image to Docker Hub. To learn how to create your own private Docker registry, check out How To Set Up a Private Docker Registry on Ubuntu 14.04.

To push your image, first log into Docker Hub:

\$ docker login -u docker-registry-username

You'll be prompted to authenticate using your Docker Hub password. If you specified the correct password, authentication should succeed.

Note: If your Docker registry username is different from the local username you used to create the image, you will have to tag your image with your registry username. For the example given in the last step, you would type:

\$ docker tag sammy/ubuntu-nodejs docker-registry-username/ubuntu-nodejs

Then you can push your own image using:

\$ docker push docker-registry-username/ubuntu-nodejs

To push the ubuntu-nodejs image to the sammy repository, the command would be:

\$ docker push sammy/ubuntu-nodejs

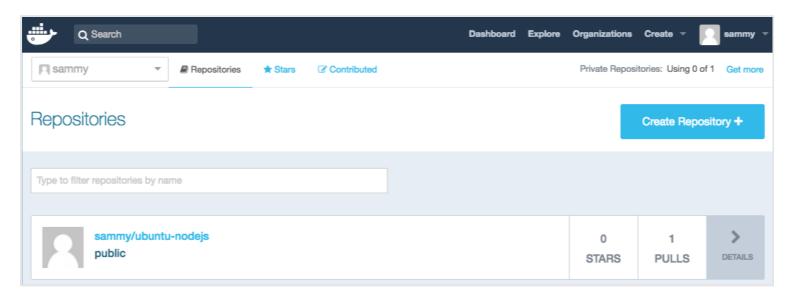
The process may take some time to complete as it uploads the images, but when completed, the output will look like this:

Output

The push refers to repository [docker.io/sammy/ubuntu-nodejs]

1aa927602b6a: Pushed 76c033092e10: Pushed 2146d867acf3: Pushed ae1f631f14b7: Pushed 102645f1cf72: Pushed latest: digest: sha256:2be90a210910f60f74f433350185feadbbdaca0d050d97181bf593dd85195f06 size: 1362

After pushing an image to a registry, it should be listed on your account's dashboard, like that shown in the image below.



If a push attempt results in the following error, it is likely that you are not logged in:

Output

The push refers to a repository [docker.io/sammy/ubuntu-nodejs]

e3fbbfb44187: Preparing 5f70bf18a086: Preparing a3b5c80a4eba: Preparing 7f18b442972b: Preparing 3ce512daaf78: Preparing 7aae4540b42d: Waiting

unauthorized: authentication required

Log in, then repeat the push attempt.

Conclusion

In this tutorial, you've learned the basics to get you started working with Docker on Ubuntu 16.04. Like most open source projects, Docker is built from a fast-developing codebase, so make a habit of visiting the project's blog page for the latest information.

For further exploration, check out the other Docker tutorials in the DigitalOcean Community.

By: finid

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39 Comments

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cetadisseny May 23, 2016 I only can say that: I get at your feet. Excellent tutorial
panousis May 29, 2016 Thank you very much for your article. It's really excellent!. Please keep going
oded June 2, 2016 4 Its probably better to use the Ubuntu APT tools to update the APT configuration. Instead of echo, use aptadd-repository to manipulate the apt sources:
sudo apt-add-repository 'deb https://apt.dockerproject.org/repo ubuntu-xenial main'
MelissaAnderson MOD November 3, 2016 Thanks for taking time to point that out. I've made the update.
iambobby January 13, 2017 If you choose to use apt-add-repository you need to make sure software-properties-common is installed
davemanginelli June 17, 2016 I had some trouble with docker failing to run after some updates to a 16.04 droplet. The solution was to install a dependency not mentioned above but recommended in Docker's instructions for 16.04: sudo apt-get install linux-image-extra-\$(uname -r) After which I was able to get Docker running again.
dekkermichelle1 June 22, 2016 Hi, I have followed the tutorial, but I get this message _dockermachine_ps1: command not found
^ tapeason July 22, 2016 O Great tutorial, easy to follow, and no problems along the way. Thank you!

^ florianfalk August 1, 2016

Well, it's not working for me. After I try running a ubuntu container, I get the following Error:

docker: failed to register layer: devmapper: Error mounting '/dev/mapper/docker-8:2-526216-d9cc121a2c92ab980cbf1218ba4f467d6cc27248993b1a79165e7602113d88b0' on '/var/lib/docker/devicemapper/mnt/d9cc121a2c92ab980cbf1218ba4f467d6cc27248993b1a79165e7602113d88k invalid argument.

Have anybody a solution?

^ florianfalk August 1, 2016

Well it doesn't work for me. It get this error when I try to run a container:

docker: failed to register layer: devmapper: Error mounting '/dev/mapper/docker-8:2-526216-d9cc121a2c92ab980cbf1218ba4f467d6cc27248993b1a79165e7602113d88b0' on '/var/lib/docker/devicemapper/mnt/d9cc121a2c92ab980cbf1218ba4f467d6cc27248993b1a79165e7602113d88k invalid argument.

Does anybody has any solution?

^ zx1986 August 24, 2016

₀ I failed on Linode ...

root@ubuntu:/var/log# service docker status

• docker.service - Docker Application Container Engine

Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)

Active: failed (Result: signal) since Wed 2016-08-24 15:09:17 UTC; 2min 11s ago

Docs: https://docs.docker.com

Main PID: 3881 (code=killed, signal=KILL)

Aug 24 13:07:30 ubuntu systemd[1]: Starting Docker Application Container Engine...

Aug 24 13:07:30 ubuntu dockerd[3881]: time="2016-08-24T13:07:30.731767656Z" level=info

msg="libcontainerd: new containerd process, pid: 3984"

Aug 24 15:07:47 ubuntu dockerd[3881]: time="2016-08-24T15:07:47.334383528Z" level=info msg="Processing signal 'terminated'"

Aug 24 15:09:17 ubuntu systemd[1]: docker.service: State 'stop-sigterm' timed out. Killing.

Aug 24 15:09:17 ubuntu systemd[1]: docker.service: Main process exited, code=killed, status=9/KILL

Aug 24 15:09:17 ubuntu systemd[1]: Stopped Docker Application Container Engine.

Aug 24 15:09:17 ubuntu systemd[1]: docker.service: Unit entered failed state.

Aug 24 15:09:17 ubuntu systemd[1]: docker.service: Failed with result 'signal'.

^waryak September 16, 2016

o in September 2016, problems with 1st step - docker installation

^ ganeshb October 12, 2016

- The push refers to a repository [docker.io/ganesh08/grasp/ubuntu-python]
 An image does not exist locally with the tag: ganesh08/grasp/ubuntu-python
 - --- this was an error while iam pushing an image into the docker. is there any solution?

^ couchpotatoe October 23, 2016

o I run into this issue, complaining about libsystemd-journal0 being required. when I run the "sudo apt-get install -y docker-engine" step. I haven't been able to install libsystemd-journal0 with apt-get. Is there another recommended way to install this? Or did I miss a step?

amato@amato-VirtualBox:~\$ sudo apt-get install -y docker-engine Reading package lists... Done Building dependency tree

Reading state information... Done

Some packages could not be installed. This may mean that you have requested an impossible situation or if you are using the unstable distribution that some required packages have not yet been created or been moved out of Incoming.

The following information may help to resolve the situation:

The following packages have unmet dependencies:

docker-engine: Depends: libsystemd-journal0 (>= 201) but it is not installable

Recommends: aufs-tools but it is not going to be installed

Recommends: cgroupfs-mount but it is not going to be installed or

cgroup-lite but it is not going to be installed

Recommends: git

E: Unable to correct problems, you have held broken packages.

^ mleewise November 18, 2016

I created a user specifically for docker. Would someone concerned about security frown upon adding that user to the docker group to avoid having to use sudo? I already did the standard stuff for restricting ssh access (no login, ssh required). Thanks!

Squonk42 December 9, 2016

Extremely useful tutorial, thank you!

```
billyallen January 6, 2017
continuous excellent
```

Allwo March 5, 2017

O Thank you very much for this tutorial!

However, I get an error that is, after of a couple of attemps, is really frustrating me. I have been installing docker a lot of times already, also on this OS, but this never happened.

I am stuck at the end of Step 1, when docker-engine cannot be installed:

```
~# systemctl status docker.service
• docker.service - Docker Application Container Engine
   Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
   Active: failed (Result: exit-code) since So 2017-03-05 17:47:20 CET; 32s ago
     Docs: https://docs.docker.com
 Main PID: 18194 (code=exited, status=1/FAILURE)
dockerd[18194]: time="2017-03-05T17:47:20.567753592+01:00" level=error msg="'overlay' not fo
dockerd[18194]: time="2017-03-05T17:47:20.569299675+01:00" level=error msg="'overlay' not fo
dockerd[18194]: time="2017-03-05T17:47:20.591796895+01:00" level=info msg="Graph migration t
dockerd[18194]: time="2017-03-05T17:47:20.592394882+01:00" level=warning msg="Your kernel do
dockerd[18194]: time="2017-03-05T17:47:20.592410368+01:00" level=warning msg="Your kernel do
dockerd[18194]: time="2017-03-05T17:47:20.592421460+01:00" level=warning msg="Your kernel do
dockerd[18194]: time="2017-03-05T17:47:20.592427398+01:00" level=warning msg="Unable to find
dockerd[18194]: time="2017-03-05T17:47:20.592458649+01:00" level=warning msg="Unable to find
dockerd[18194]: time="2017-03-05T17:47:20.592490516+01:00" level=warning msg="mountpoint for
dockerd[18194]: Error starting daemon: Devices cgroup isn't mounted
```

I added root to the group, also I found the advice to add GRUB_CMDLINE_LINUX="cgroup_enable=memory swapaccount=1" to the file /etc/default/grub, but that file does not exist!

Thank you for your help!

p80.pool.sks-keyservers.net does not resolve, so you can't get keys this way anymore.



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