3.Deeply understand and publish images

3.1.Understanding of images

1. An image is a lightweight, executable independent software package that contains everything needed to run a certain software. We package the application and configuration into a formed, deliverable, and deployable operating environment, including code, libraries required for runtime, environment variables, and configuration files, etc. This large packaged operating environment is an image image file.
2. Docker container instances can only be generated through image files.

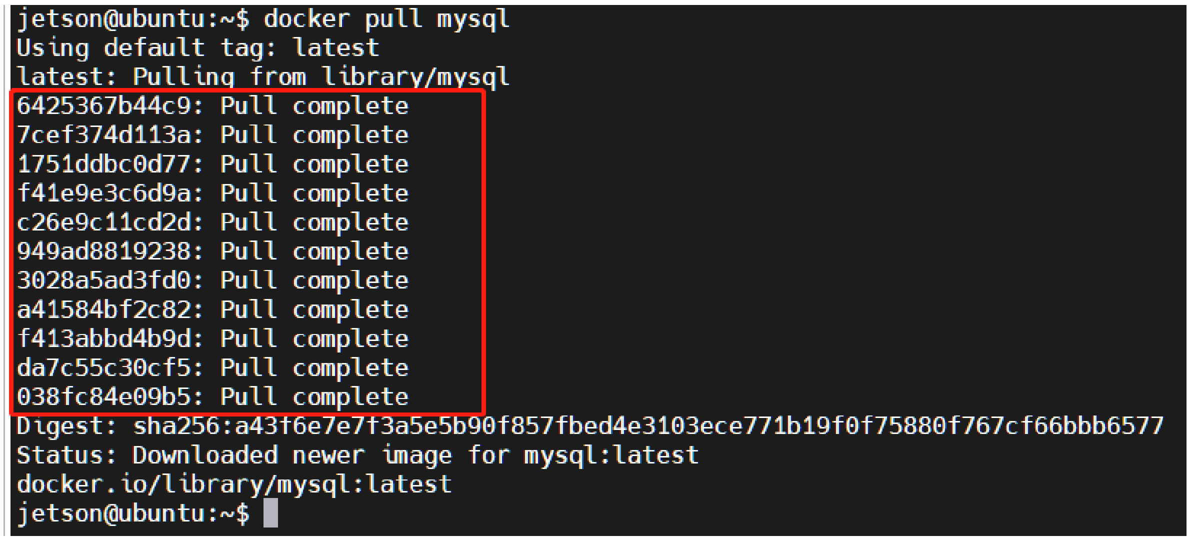
3.2.UnionFS (Union File System)

1. Union File System (UnionFS) is a layered, lightweight, high-performance file system. It is the basis of docker images and supports modifications to the file system to be superimposed layer by layer as a single submission. At the same time, different directories can be mounted under the same virtual file system.
2. Images can be inherited through layering. Based on the basic image, various specific application images can be produced.

Features of the Union file system: multiple file systems are loaded at the same time, but from the outside, only one file system can be seen;Union loading superimposes each layer of file systems so that the final file system contains files and directories from all layers.

3.3.Image layering

When downloading an image, pay attention to the download log output. You can see that it is downloading layer by layer:



```
jetson@ubuntu:~$ docker pull mysql
Using default tag: latest
latest: Pulling from library/mysql
6425367b44c9: Pull complete
7cef374d113a: Pull complete
1751ddbc0d77: Pull complete
f41e9e3c6d9a: Pull complete
c26e9c11cd2d: Pull complete
949ad8819238: Pull complete
3028a5ad3fd0: Pull complete
a41584bf2c82: Pull complete
f413abbd4b9d: Pull complete
da7c55c30cf5: Pull complete
038fc84e09b5: Pull complete
Digest: sha256:a43f6e7e7f3a5e5b90f857fbed4e3103ece771b19f0f75880f767cf66bbb6577
Status: Downloaded newer image for mysql:latest
docker.io/library/mysql:latest
jetson@ubuntu:~$
```

```
# To view the image layering method, you can use the command: docker image
inspect inspect image name
jetson@ubuntu:~$ docker image inspect mysql:latest
[
    {
        "Id":
"sha256:5371f8c3b63eec64a33b35530be5212d6148e0940111b57b689b5ba1ffe808c8",
        .........
        "RootFS": {
            "Type": "layers",
            "Layers": [

"sha256:d6d4fc6aef875958d6186f85f03d88e6bb6484ab2dd56b30a79163baceff2f6d",

"sha256:05c3b0b311a02bc56ca23105a76d16bc9b8c1d3e6eac808f4efb1a2e8350224b",

"sha256:7b80f7f05642477ebc7d93de9539af27caab7c41a768db250fe3fe2b5506ca2c",

"sha256:50e037faefab22cb1c75e60abb388b823e96a845650f3abd6d0a27e07a5a1d5e",

"sha256:66040abb3f7201d2cc64531349a8225412db1029447a9431d59d999c941d56f6",

"sha256:857162425652837a362aa5f1c3d4974cc83702728793de52ba48176d5367a89b",

"sha256:7eebed3016f6b6ab68aa8e6be35f0689a3c18d331b7b542984a0050b859eaf26",

"sha256:2fc4c142633d57d795edc0f3fd457f99a35fa611eab8b8c5d75c66e6eb729bc2",

"sha256:7fde2d12d484f0c14dabd9ca845da0bcdaf60bd773a58ca2d73687473950e7fe",

"sha256:9319848a00d38e15b754fa9dcd3b6e77ac8506850d32d8af493283131b9745a3",

"sha256:5ff94d41f068ea5b52244393771471edb6a9a10f7a4ebafda9ef6629874a899b"
            ]
        },
        "Metadata": {
            "LastTagTime": "0001-01-01T00:00:00Z"
        }
    }
]
```

3.3.1.Layered understanding

- All docker images start from a basic image layer. When modifications are made or new content is added, a new image layer will be created on top of the current image layer.
- To give a simple example, if a new image is created based on Ubuntu 20.04, this is the first layer of the new image; if a python package is added to the image, a second image layer will be created on top of the basic image layer; If you continue to add a security patch, a third image layer will be created.
- Docker images are read-only, when the container starts, a new writable layer is loaded on top of the image! This layer is what we usually call the container layer, and everything below the container is called the mirror layer!

3.3.2. The benefits of using layering for docker images

Resource sharing. For example, if multiple images are built from the same Base image, the host only needs to keep a copy of the Base image on the disk.At the same time, only one base image needs to be loaded into the memory, so that it can serve all containers, and each layer of the image can be shared.

3.4. Produce and publish images

3.4.1. Create images

Method 1. Submit an image from the container:

```
# command
docker commit -m="Submission description" -a="Author" Container id Target image
name to be created: [tag name] [-m -a parameters can also be omitted]

# test
jetson@ubuntu:~$ docker ps -a
CONTAINER ID   IMAGE          COMMAND       CREATED       STATUS
  PORTS     NAMES
c54bf9efae47   ubuntu:latest   "/bin/bash"   3 hours ago   Up 24 minutes
             funny_hugle
3b9c01839579   hello-world     "/hello"      3 hours ago   Exited (0) 3 hours ago
            jovial_brown
jetson@ubuntu:~$ docker commit c54bf9efae47 ubuntu:1.0
sha256:78ca7be949b6412f74ba12e8d16bd548aaa7c3fa25134326db3a67784f848f8f
jetson@ubuntu:~$ docker images   # Generated ubuntu:1.0 image
REPOSITORY                     TAG      IMAGE ID       CREATED         SIZE
ubuntu                         1.0      78ca7be949b6   5 seconds ago   69.2MB
yahboomtechnology/ros-foxy   3.4.0    49581aa78b6b   5 hours ago     24.3GB
yahboomtechnology/ros-foxy   3.3.9    cefb5ac2ca02   4 days ago      20.5GB
yahboomtechnology/ros-foxy   3.3.8    49996806c64a   4 days ago      20.5GB
yahboomtechnology/ros-foxy   3.3.7    8989b8860d17   5 days ago      17.1GB
```

```
yahboomtechnology/ros-foxy   3.3.6     326531363d6e   5 days ago      16.1GB
ubuntu                       latest    bab8ce5c00ca   6 weeks ago     69.2MB
hello-world                  latest    46331d942d63   13 months ago   9.14kB
```

Method 2.dockerfile to create the image:

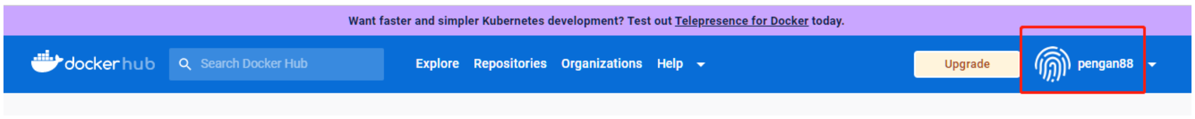
```
# command
docker build -f dockerfile File path -t new image name:TAG .  #There is a . at
the end of the docker build command indicating the current directory
# test
docker build -f dockerfile-ros2 -t yahboomtechnology/ros-foxy:1.2 .

For information on writing dockerfile, please refer to:
https://docs.docker.com/develop/develop-images/dockerfile_best-practices/
```

3.4.2. Release image

The docker repository is a centralized place for storing image files. The largest public repository is docker hub (https://hub.docker.com/), which stores a large number of images for users to download. Domestic public warehouses include Alibaba Cloud, NetEase Cloud, etc.

Steps to publish image to docker hub:

1. Address: https://hub.docker.com/, register an account first
2. Ensure that the account can be logged in normally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3. Use the tag command to modify the image name.

The specifications for publishing images to docker hub are:

```
docker push Register username/image name
```

For example, my registered user name here is: pengan88, then I need to change the image name first.

```
# Command:
docker tag image ID modified image name

# test
jetson@ubuntu:~$ docker images
REPOSITORY                   TAG       IMAGE ID       CREATED         SIZE
ubuntu                       1.0       78ca7be949b6   5 seconds ago   69.2MB
ubuntu                       latest    bab8ce5c00ca   6 weeks ago     69.2MB
hello-world                  latest    46331d942d63   13 months ago   9.14kB
jetson@ubuntu:~$ docker tag 78ca7be949b6 pengan88/ubuntu:1.0
jetson@ubuntu:~$ docker images
REPOSITORY                   TAG       IMAGE ID       CREATED          SIZE
```

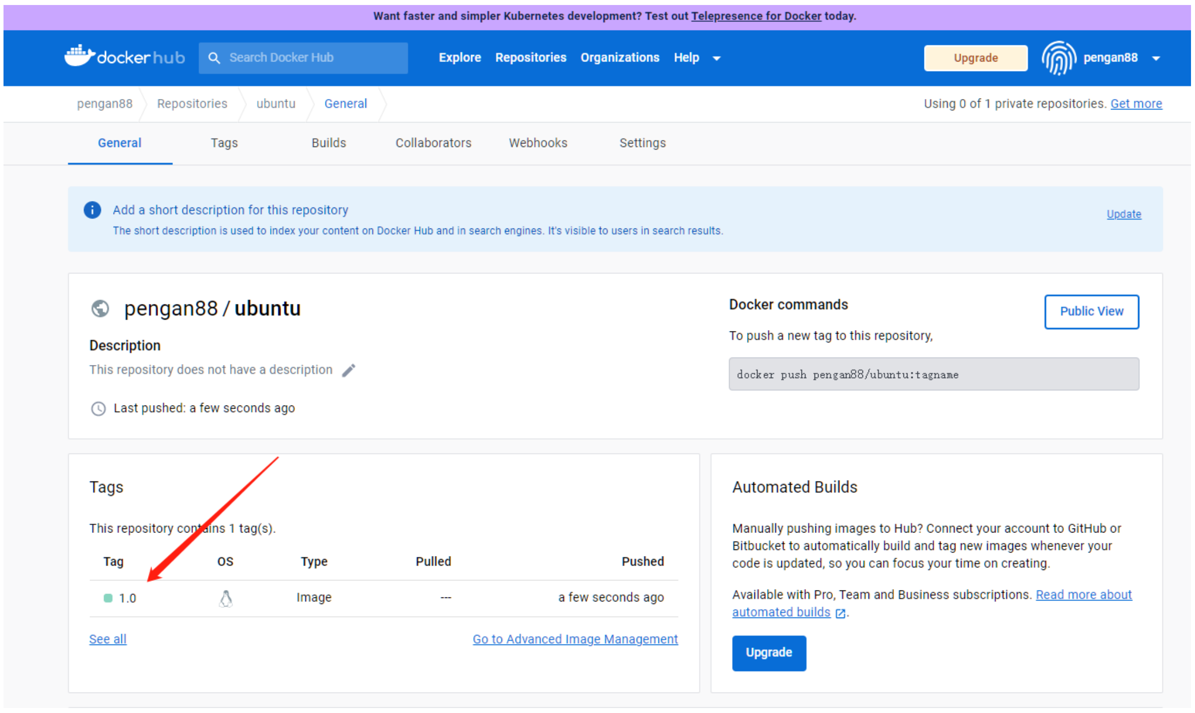
```
pengan88/ubuntu             1.0       78ca7be949b6   23 minutes ago   69.2MB
ubuntu                      1.0       78ca7be949b6   23 minutes ago   69.2MB
ubuntu                      latest    bab8ce5c00ca   6 weeks ago      69.2MB
hello-world                 latest    46331d942d63   13 months ago    9.14kB
```

4. Log in to docker hub to publish the image:

```
jetson@ubuntu:~$ docker login -u pengan88
Password:     #Enter the account and password registered by docker hub here.
WARNING! Your password will be stored unencrypted in
/home/jetson/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
jetson@ubuntu:~$ docker push pengan88/ubuntu:1.0
The push refers to repository [docker.io/pengan88/ubuntu]
ca774712d11b: Pushed
874b048c963a: Mounted from library/ubuntu
1.0: digest:
sha256:6767d7949e1c2c2adffbc5d3c232499435b95080a25884657fae366ccb71394d size:
736
```

5. Visit docker hub to see that it has been successfully published.



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pengan88 › Repositories › ubuntu › General
Using 0 of 1 private repositories. Get more
General
Tags
Builds
Collaborators
Webhooks
Settings

Add a short description for this repository

The short description is used to index your content on Docker Hub and in search results. It's visible to users in search results.

Update

pengan88 / ubuntu

Description

This repository does not have a description

Last pushed: a few seconds ago

Docker commands

Public View

To push a new tag to this repository,

```
docker push pengan88/ubuntu:tagname
```

Tags

This repository contains 1 tag(s).

Tag	OS	Type	Pulled	Pushed
1.0		Image	---	a few seconds ago

See all

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Manually pushing images to Hub? Connect your account to GitHub or Bitbucket to automatically build and tag new images whenever your code is updated, so you can focus your time on creating.

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