3. In-depth understanding of docker images and release of images

The operating environment and reference configuration of software and hardware are as follows:

- Reference vehicle: ROSMASTER X3PLUS
- Robot hardware configuration: Arm series master control, EAI 4ROS laser radar, AstraPro Plus depth camera
- Robot system: Ubuntu (no version requirement) + docker (20.10.21 and above)
- PC virtual machine: Ubuntu (20.04) + ROS (Noetic)
- Usage scenario: Use on a relatively clean 2D plane

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 applications and configurations into a complete, deliverable, and deployable operating environment, including code, libraries required for runtime, environment variables, and configuration files. This large packaged operating environment is the image file.
2. Only through the image file can a docker container instance be generated.

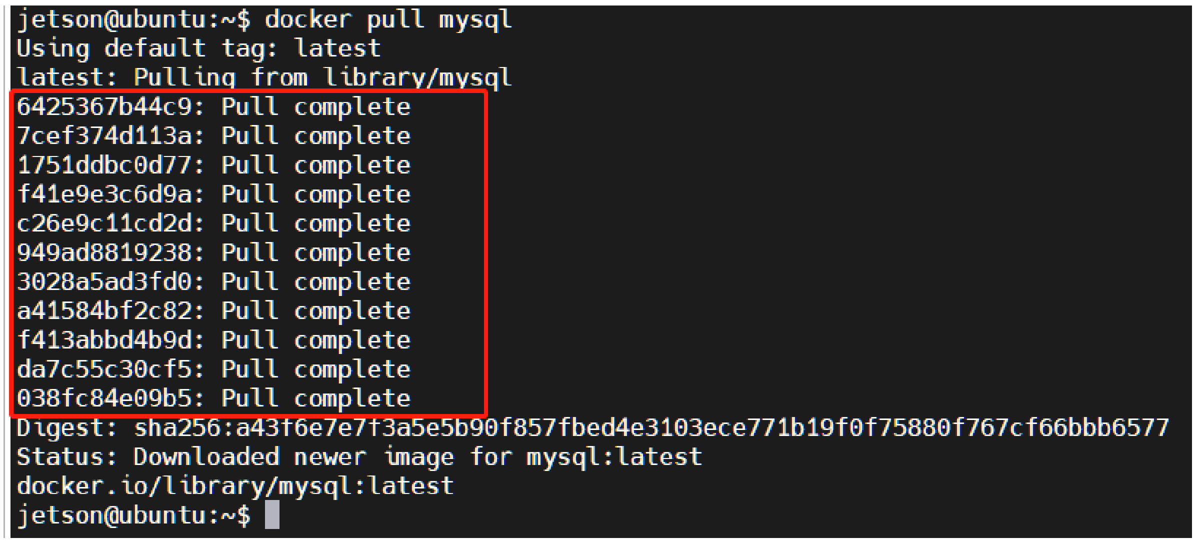
3.2, UnionFS (Union File System)

1. Union File System (UnionFS) is a layered, lightweight, high-performance file system. It is the basis of docker images and supports file system modifications as a single commit to be layered, and 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 made.

Characteristics of Union File System: Multiple file systems can be loaded at the same time, but from the outside, only one file system can be seen; joint loading will stack the file systems of each layer, so that the final file system will contain files and directories of all layers.

3.3, Image layering

When downloading an image, pay attention to the download log output, you can see that it is downloaded 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:~$
```

```
# You can view the image layering through the command: docker image 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 with a base image layer. When modifications or new content is added, a new image layer will be created on top of the current image layer.
- For example, if you create a new image based on ubuntu 20.04, this is the first layer of the new image; if you add a python package to the image, a second image layer will be created on top of the base 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 image layer!

3.3.2. The benefits of layering Docker images

Resource sharing, for example, if multiple images are built from the same base image, then the host only needs to keep a base image on the disk, and only needs to load a base image in the memory, so that it can serve all containers, and each layer of the image can be shared.

3.4, Make and publish images

3.4.1, Make images

Method 1, submit an image from the container:

```
# Command
docker commit -m="Description of submission" -a="Author" Container id Target
image name to be created: [label 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 an image:

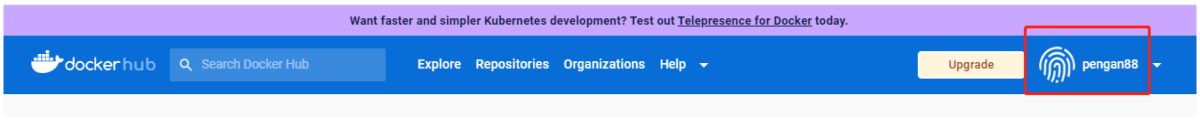
```
# Command
docker build -f dockerfile file path -t new image name: TAG . # The docker build
command ends with a . to indicate the current directory
# Test
docker build -f dockerfile-ros2 -t yahboomtechnology/ros-foxy:1.2 .

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

3.4.2, Release the image

A docker repository is a place where image files are stored centrally. The largest public repository is docker hub (https://hub.docker.com/), which stores a large number of images for users to download. Domestic public repositories include Alibaba Cloud, NetEase Cloud, etc.

Steps to publish an image to docker hub:

1. Address: https://hub.docker.com/, register an account first
2. Make sure the account can log in normally


Want faster and simpler Kubernetes development? Test out Telepresence for Docker today.
docker hub
Search Docker Hub
Explore
Repositories
Organizations
Help
Upgrade
pengan88

3. Use the tag command to modify the image name

The specification for publishing an image to docker hub is:

```
docker push registered username/image name
```

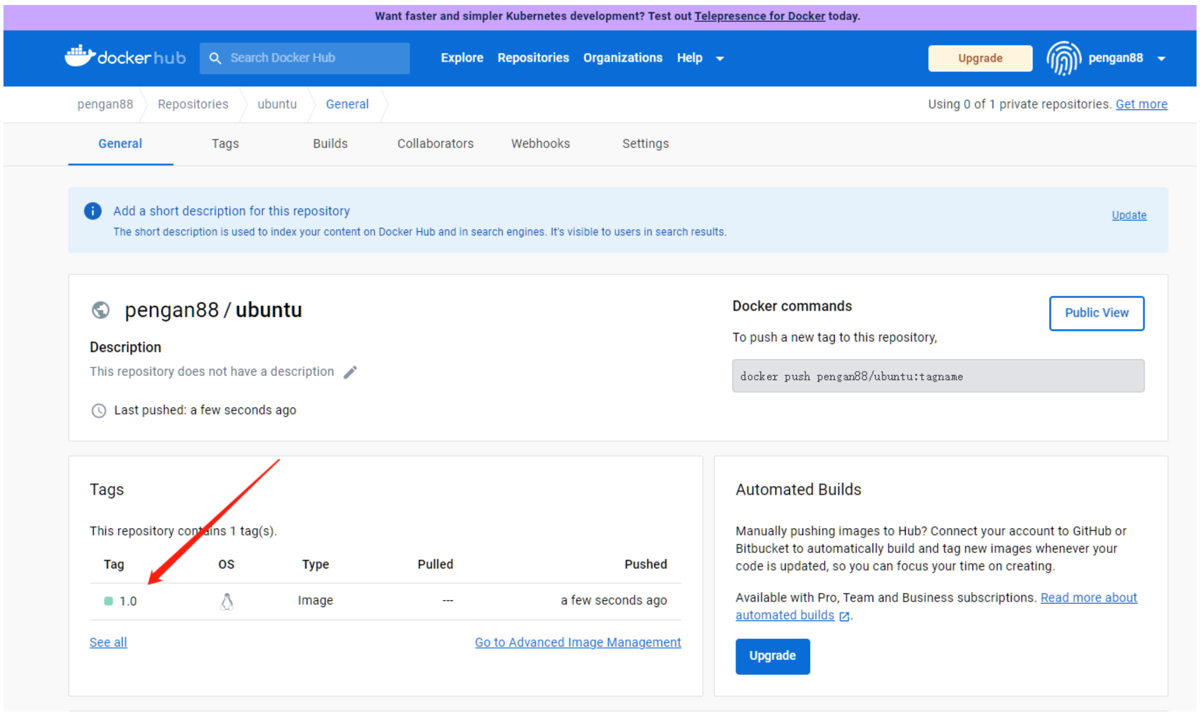
For example, my registered username here is: pengan88, then I have to modify the image name first

```
# 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 with 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 released



Want faster and simpler Kubernetes development? Test out Telepresence for Docker today.

Using 0 of 1 private repositories. Get more

Add a short description for this repository

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

pengan88 / **ubuntu**

Description

This repository does not have a description

Last pushed: a few seconds ago

Docker commands

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

Automated Builds

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.

Available with Pro, Team and Business subscriptions. Read more about automated builds.