4. Docker hardware interaction and data processing

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The operating environment and software and hardware reference configuration 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

4.1. Hardware mounting (port binding)

1. Create udev rules (/etc/udev/rules.d/) in the host machine, see [Six, Linux operating system ---- 6. Bind device ID] section
2. Then when opening the container, set the devices with rules through --device=/dev/myserial --device=/dev/rplidar Mount the parameters into the docker container

```
docker run -it --device=/dev/myserial --device=/dev/rplidar ubuntu:latest
/bin/bash
```

3. The device can be found in the docker container

```
jetson@ubuntu:~$ docker images
REPOSITORY                    TAG       IMAGE ID       CREATED              SIZE
ubuntu                        1.0       78ca7be949b6   About an hour ago    69.2MB
pengan88/ubuntu               1.0       78ca7be949b6   About an hour ago    69.2MB
yahboomtechnology/ros-foxy    3.4.0     49581aa78b6b   6 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
mysql                         latest    5371f8c3b63e   6 days ago           592MB
ubuntu                        latest    bab8ce5c00ca   6 weeks ago          69.2MB
hello-world                   latest    46331d942d63   13 months ago        9.14kB
```

```
jetson@ubuntu:~$ ll /dev | grep ttyUSB*
lrwxrwxrwx   1 root   root           7 Apr 23 18:07 myserial -> ttyUSB0
lrwxrwxrwx   1 root   root           7 Apr 23 18:07 rplidar -> ttyUSB1
crwxrwxrwx   1 root   dialout 188,   0 Apr 23 18:07 ttyUSB0
crwxrwxrwx   1 root   dialout 188,   1 Apr 23 18:07 ttyUSB1

jetson@ubuntu:~$ docker run -it   --device=/dev/myserial --device=/dev/rplidar
ubuntu:latest  /bin/bash
root@03522257ba30:/# ls /dev # There are already myserial and rplidar in docker
```

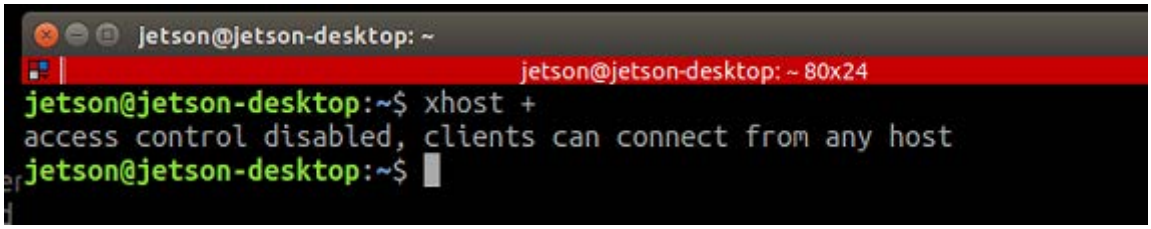
4.2. Display of GUI in docker

1. Install in the host:

```
sudo apt-get install tigervnc-standalone-server tigervnc-viewer
sudo apt-get install x11-xserver-utils
```

2. Execute in the host: xhost +

After the following figure is displayed normally, perform 3 steps:



3. Execute the command in the host to enter the container:

```
docker run -it \                                    # Interactively run docker
image
--env="DISPLAY" \                                   # Enable the display of GUI
interface
--env="QT_X11_NO_MITSHM=1" \                        # Use X11 port 1 for display
-v /tmp/.X11-unix:/tmp/.X11-unix \                  # Mapping shows the service
node directory
yahboomtechnology/ros-foxy:3.3.9                    # The image name to be
started
/bin/bash                                           # Execute the /bin/bash
command in the container
```

4. Test

```
Execute in the container: rviz
```

4.3. Transfer files between docker container and host

4.3.1. Use cp naming

4.3.1.1. Copy files from the container to the host

```
# Command
docker cp container id: path in container destination host path

# Test
# Execute in the container, create a file test
jetson@ubuntu:~$ docker ps -a
CONTAINER ID   IMAGE           COMMAND       CREATED       STATUS
  PORTS     NAMES
c54bf9efae47   ubuntu:latest   "/bin/bash"   2 hours ago   Up 9 minutes
            funny_hugle
3b9c01839579   hello-world     "/hello"      3 hours ago   Exited (0) 3 hours ago
            jovial_brown
jetson@ubuntu:~$ docker attach c5
root@c54bf9efae47:/# ls
bin  boot  dev  etc  home  lib  media  mnt  opt  proc  root  run  sbin  srv  sys
tmp  usr  var
root@c54bf9efae47:/# cd
root@c54bf9efae47:~# ls
root@c54bf9efae47:~# touch test.txt
root@c54bf9efae47:~# ls
test.txt
root@c54bf9efae47:~# pwd
/root
root@c54bf9efae47:/# read escape sequence    #Press ctrl+P+Q The container does
not stop and exit

jetson@ubuntu:~$ docker cp c54bf9efae47:/root/test.txt ~/
jetson@ubuntu:~$ ls      # The test.txt file has been copied in
Desktop  Documents  Downloads  fishros  Music  openvino  Pictures  Public
rootOnNVMe  run_docker.sh  sensors  snap  temp  Templates  test.txt  Videos
```

4.3.1.2, copy files from the host to the container

```
# Command
docker cp host file path container id: path in the container

# Test
jetson@ubuntu:~$ docker ps -a
CONTAINER ID   IMAGE           COMMAND       CREATED       STATUS
  PORTS     NAMES
c54bf9efae47   ubuntu:latest   "/bin/bash"   2 hours ago   Up 5 minutes
            funny_hugle
3b9c01839579   hello-world     "/hello"      3 hours ago   Exited (0) 3 hours ago
            jovial_brown

jetson@ubuntu:~$ ls
```

```
Desktop  Documents  Downloads  fishros  Music  openvino  Pictures  Public
rootOnNVMe  run_docker.sh  sensors  snap  temp  Templates  test.txt  Videos

jetson@ubuntu:~$ touch 11.txt

jetson@ubuntu:~$ ls
11.txt  Desktop  Documents  Downloads  fishros  Music  openvino  Pictures  Public
rootOnNVMe  run_docker.sh  sensors  snap  temp  Templates  test.txt  Videos

jetson@ubuntu:~$ docker cp 11.txt c54bf9efae47:/root/

jetson@ubuntu:~$ docker attach c5
root@c54bf9efae47:/# ls
bin  boot  dev  etc  home  lib  media  mnt  opt  proc  root  run  sbin  srv  sys
tmp  usr  var
root@c54bf9efae47:/# cd /root/
root@c54bf9efae47:~# ls # 11.txt file has been copied
11.txt test.txt
```

4.3.2, Use data volume

4.3.2.1, Data volume overview

Package the application and the running environment into a container to run. The operation can be accompanied by the container, but our requirement for data is that it can be persistent! For example, if you install a mysql, and then you delete the container, it is equivalent to deleting the library and running away, which is definitely not okay! So we hope that it is possible to share data between containers. If the data generated by the docker container is not generated through docker commit, the data can beIf the data is saved as part of the image, then when the container is deleted, the data will naturally disappear! This will not work!

In order to save data in docker, we can use volumes! Let the data be mounted locally! In this way, the data will not be lost due to container deletion!

Features:

1. Data volumes can share or reuse data between containers
2. Changes in the volume can take effect directly
3. Changes in the data volume will not be included in the update of the image
4. The life cycle of the data volume lasts until no container uses it

4.3.2.2, Data volume usage

```
# Command
docker run -it -v host absolute path directory: container directory image name

# Test
docker run -it -v /home/jetson/temp:/root/temp yahboomtechnology/ros-foxy:3.4.0
/bin/bash

The /home/jetson/temp directory in the host and the /root/temp directory in the
container can share data
```