Getting a Docker container that does everything we need is not trivial. The following steps is what I was able to get working for my NVIDIA Jetson Orin Nano. If you already have a docker image saved as a .tar.gz file, please look at the end for instructions.

1. Follow system setup (through at least the “Relocating Docker Data Root” step) from <https://github.com/dusty-nv/jetson-containers/blob/master/docs/setup.md>

If you have NVME storage to add, I found this tutorial helpful: <https://www.digitalocean.com/community/tutorials/how-to-partition-and-format-storage-devices-in-linux>

Also, be sure to add the following line to etc/docker/daemon.json:

"data-root": "/mnt/data"

Note: /data should be whatever your mount folder name is…

1. Choose a base container. I like l4t-ml since it contains cuda enabled pytorch, cuda enabled tensorflow2, and cuda enabled opencv. The full list of containers can be found <https://github.com/dusty-nv/jetson-containers/tree/master>

Now, run the container, e.g.:

jetson-containers run $(autotag l4t-ml)

1. Now we can install ROS. For example, for ROS Noetic, follow the instructions here: <https://wiki.ros.org/noetic/Installation/Ubuntu>

IMPORTANT: Install the **ROS-Base** version. The other version will attempt to modify the opencv, which we cannot do! Thus, install the bare bones version and the selectively install additional packages we may need.

The following is also useful to put in your ~/.bashrc file

source /workspace/catkin\_ws/devel/setup.bash

export ROS\_IP=192.168.xx.xx

export ROS\_MASTER\_URI=http://$ROS\_IP:11311

export ROBOT\_ID=x

1. Install any additional ros packages you need, e.g.

sudo apt install ros-noetic-PACKAGE

I installed the following:

* tf2-msgs
* tf
* gmapping
* diagnostic-updater

For the camera to work, I find it necessary to first run:

apt-get purge -y '\*opencv\*'

Then, follow instructions at <https://github.com/satomm1/ros_astra_camera>, with the following exception: run these lines outside of the docker container

./scripts/create\_udev\_rules

sudo udevadm control --reload && sudo udevadm trigger

1. Install other python packages you need.

IMPORTANT: Any package which has an opencv-python dependency must be sure not to modify the opencv-python package already installed from the original container. Updating will break the package!

Some packages I install include:

* spidev
* confluent-kafka
* rospy-message-converter
* pyignite
* matplotlib
* scipy
* ultralytics\*\*\*\*be careful with opencv-python here!

1. Install Cyclone DDS and it’s python binding.

Follow the directions of <https://github.com/eclipse-cyclonedds/cyclonedds> to first install cycloneDDS. Be careful! Check what the latest version of the cyclonedds python binding is and match this version! The install directory should be /path/to/cyclonedds/install. Next:

export CYCLONEDDS\_HOME="$(pwd)/install"

Even better, put this in the ~/.bashrc file since we need this anytime we use the python binding. Last, we install the python binding via:

pip3 install cyclonedds --no-binary cyclonedds

1. Commit the docker container so you can use it later, e.g.:

docker commit c3f279d17e0a ml\_ros:latest

1. Now, to run the container, we can use the command:

jetson-containers run $(autotag ml\_ros:latest)

You can include any of the usual docker commands with this. For example, my full command is:

jetson-containers run -v ~/workspaces/catkin\_ws:/workspace/catkin\_ws -v /dev/bus/usb:/dev/bus/usb -i --device=/dev/ttyUSB0 --device=/dev/spidev0.0 --rm --privileged --name ros\_noetic $(autotag ml\_ros:latest)

1. To save the image (for easy loading on a new machine), use the following command:

docker save myimage:latest | gzip > myimage\_latest.tar.gz

If everything has gone according to plan, you should now have a docker container which has ROS, cuda enabled pytorch/tensorflow, and everything else you might need!

**What if I already have a docker image saved as a \*.tar.gz file?**

In this case, just set docker up and the call:

docker load < your\_image.tar.gz

You should source ROS via:

source /opt/ros/noetic/setup.bash