LXLE Docker Setup Guide

This setup guide explains how to setup open-source CAD tools (ngspice, Sue2, xschem, magic & netgen) in a docker environment running lxde image.

To run this we need Docker installed in the machine.

How to Install Docker

Linux

Run below commands to install docker on ubuntu machine

- sudo apt-get update
- sudo apt-get install -y apt-transport-https ca-certificates curl gnupg lsb-release
- curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /usr/share/keyrings/docker-archive-keyring.gpg
- echo \
- "deb [arch=amd64 signed-by=/usr/share/keyrings/docker-archive-keyring.gpg] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable" | sudo tee /etc/apt/sources.list.d/docker.list > /dev/null
- sudo apt-get update
- sudo apt-get install docker-ce docker-ce-cli containerd.io

To Check the status of Docker

- sudo systemctl status docker

By default docker needs you to run docker commands with sudo, to avoid using sudo you will need to add your username to docker group.

- sudo usermod -aG docker ${USER}

If you are using different distributions like centos please use the following reference to install
Reference: https://docs.docker.com/engine/install/ubuntu/

Windows

To work with docker on windows we must enable virtualization first and then install Docker Desktop.

The following hardware prerequisites are required to successfully run WSL 2/Client Hyper-V on Windows 10:

- 64-bit processor with Second Level Address Translation (SLAT) (https://en.wikipedia.org/wiki/Second_Level_Address_Translation)
- 4GB system RAM
- BIOS-level hardware virtualization support must be enabled in the BIOS settings. For more information, see https://docs.docker.com/desktop/windows/troubleshoot/#virtualization-must-be-enabled

WSL 2 backend

Supports Windows 10 64-bit: Home or Pro 2004 (build 19041) or higher, or Enterprise or Education 1909 (build 18363) or higher.

Go to ***Turn Windows features on or off***
Enable below checkboxes

- Virtual Machine Platform
- Windows Subsystem for Linux

Once enabled restart the PC

Hyper-V backend and Windows containers

Supports Windows 10 64-bit: Pro 2004 (build 19041) or higher, or Enterprise or Education 1909 (build 18363) or higher.

Go to ***Turn Windows features on or off***
Enable below checkboxes

- Hyper-V

Once enabled restart the PC

Virtualization Reference:
https://docs.docker.com/desktop/windows/troubleshoot/#virtualization-must-be-enabled

Download and Install Docker Desktop

Installation Reference: https://docs.docker.com/desktop/windows/install/

Download the installer from
https://desktop.docker.com/win/stable/amd64/Docker%20Desktop%20Installer.exe

Once installed, add the user to the docker group otherwise you will not be able to run docker commands.
(Usually the user who installed docker would be automatically added to the docker group)

Make sure you are set to use linux containers in Docker desktop.(By default it will set to linux container if not switch to linux containers)

To check this, Right click on the Docker icon on task manager's hidden icons and check if you can see “switch to windows containers” if not click on option “switch to linux containers”.

How to Run Lxle Docker

Dockerfile

1. Create a Directory called ubuntu-desktop or of your choice
   mkdir ubuntu-desktop
2. Create a ***Dockerfile*** and paste the below code in the file.

```
FROM dorowu/ubuntu-desktop-lxde-vnc:latest

RUN apt-get update && apt-get install -y \
    git \
    vim

WORKDIR /cad
RUN  git clone https://github.com/silicon-vlsi-org/eda-ngspice.git && \
     cd /cad/eda-ngspice && git checkout v34.0 && cd /cad && \
     git clone https://github.com/silicon-vlsi-org/eda-sue2Plus.git && \
     cd /cad/eda-sue2Plus && git checkout v2.1 && cd /cad && \
     git clone https://github.com/silicon-vlsi-org/eda-xschem.git && \
     cd eda-xschem && git checkout v2.9.9.0 && cd /cad && \
     git clone https://github.com/silicon-vlsi-org/eda-magic.git && \
     cd eda-magic && git checkout v8.3.178 && cd /cad && \
     git clone https://github.com/silicon-vlsi-org/eda-netgen.git && \
     cd eda-netgen && git checkout v1.5.185 && cd /cad && \
     git clone https://github.com/silicon-vlsi-org/eda-technology.git

ARG SPICE_LIB_DIR=/cad/eda-ngspice/glnxa64/share/ngspice \
    SPICE_EXEC_DIR=/cad/eda-ngspice/glnxa64/bin \
    CPPSIMHOME=/cad/eda-sue2Plus \
    CPPSIMSHAREDHOME=/cad/eda-sue2Plus/CppSimShared \
    EDITOR=/usr/bin/vim \
    MAGIC_HOME=/cad/eda-magic/glnxa64 \
    CAD_ROOT=/cad/eda-magic/glnxa64/lib \
    NETGEN_HOME=/cad/eda-netgen

ENV SPICE_LIB_DIR=$SPICE_LIB_DIR \
    SPICE_EXEC_DIR=$SPICE_EXEC_DIR \
    CPPSIMHOME=$CPPSIMHOME \
    CPPSIMSHAREDHOME=$CPPSIMSHAREDHOME \
    EDITOR=$EDITOR \
    MAGIC_HOME=$MAGIC_HOME \
    CAD_ROOT=$CAD_ROOT

RUN echo "export PATH=${SPICE_EXEC_DIR}:${CPPSIMSHAREDHOME}/bin:/cad/eda-xschem/glnxa64/bin:${MAGIC_HOME}/bin:${NETGEN_HOME}/bin:$PATH" >> /root/.bashrc
```

Create Image

Now after creating the Docker file. Lets create a Docker image. Open your command prompt/terminal

1. Make sure you are in the directory where Dockerfile present
2. Run the following command in terminal
   docker build -t <image name>:<version> .
   Ex: docker build -t ubuntu-docker-desktop:1.0 .   (Make sure to add . after the version, (dot) here means the current directory where dockerfile is present)

Run the Image

After creating the Docker image in your machine, run the following command in terminal to launch the container which will give you the desktop.

docker run -d --name ubuntu-desktop -p 6080:80 -v /dev/shm:/dev/shm ubuntu-docker-desktop:1.0

Once the container successfully created you can access the desktop from the web browser
http://localhost:6080
The Cad tools will be available in the */cad* directory

Dockerfile Explanation

1. This Docker file uses an Ubuntu based docker image as the base image (*dorowu/ubuntu-desktop-lxde-vnc:latest*) which supports launching the desktop.
2. Updating apt-get packages and installing git and vim softwares which we need at the least.
3. WORKDIR will set /cad as the current working directory where we clone all the tools repositories.
4. Here We are cloning the repositories and checking out the tag mentioned in each documentation. We can change/checkout to different tags once we launch the container. Then moving back to the /cad directory. RUN is an utility command available in Docker to run commands/instructions provided in the Dockerfile

5. Since we need to set PATH and also access environment variables in the Dockerfile and Container. We are adding them as ARG (arguments first). If we set them as ENV variables then we can’t access them in the Dockerfile.
6. ENV enables us to make use of all environment variables in the lifespan of a container. (we can overwrite them in the container by setting them to custom values)
7. Adding the PATH variable to the .bashrc file root.

References:

1. Docker base image (https://hub.docker.com/r/dorowu/ubuntu-desktop-lxde-vnc/)
2. Windows Docker installation (https://docs.docker.com/desktop/windows/install/)