

## Setup of the necessary software on your computer

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### Install Docker

```
1 sudo apt update
2 sudo apt install -y apt-transport-https ca-certificates curl software-properties-common
3 # Add the Docker GPG key and PPA repository
4 curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
5 sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu bionic stable"
6 sudo apt update
7 # Install Docker
8 sudo apt install -y docker-ce
9 # Add your user to the docker group so you can run Docker without sudo
10 sudo usermod -aG docker ${USER}
11 # Login again so group membership is up-to-date
12 su - ${USER}
```

### Install some other tools

```
1 sudo apt install -y --no-install-recommends cmake make git
```

### Clone the RPi-Cpp-Toolchain repository

```
1 mkdir -p ~/GitHub
2 cd ~/GitHub
3 git clone --recursive https://github.com/tttapa/RPi-Cpp-Toolchain.git
4 cd RPi-Cpp-Toolchain
```

### Pull the toolchain and the cross-compiled libraries from Docker Hub

```
1 ./toolchain/toolchain.sh # List available board configurations
2 # Replace the board name with one of the options printed by the previous command
3 ./toolchain/toolchain.sh rpi3-aarch64 --pull --export
```

## Setup of the necessary software on the Raspberry Pi

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### OS installation and network configuration

If you haven't set up your Pi yet, follow the instructions on how to do so for [Ubuntu](#) or for [Raspbian \(TODO\)](#).

Make sure that you have the following set up correctly:

1. A working network connection to the same local network as your computer.
2. The hostname and DNS or mDNS configured correctly so you can find the Pi on the network as **rpi3.local**, even if its IP address changes.
3. An SSH configuration on your computer so you can SSH into the Pi using **ssh RPi3**.
4. An SSH key from your computer installed in the **authorized\_keys** of the Pi so you can SSH into it without having to enter your password each time.

### Installation of the staging area

We now have to install all libraries and tools that were cross-compiled in the previous steps to the Pi. This is as easy as just copying over the archive containing the staging area, and then extracting it to the root directory. All files in the staging area are either in **/usr/local** or in **/opt**, so it won't interfere with software you installed through the package manager.

```
1 # Copy the staging area archive to the Pi
2 # This command may take a while, depending on the speed of your SD card
3 scp ./toolchain/staging-aarch64-rpi3-linux-gnu.tar RPi3:/tmp
4 # Install everything to the root of the filesystem
5 # (will only install to /usr/local and /opt)
6 # Enter the sudo password of the Pi if necessary
7 # This command may take a while, depending on the speed of your SD card
8 ssh -t RPi3 "sudo tar xf /tmp/staging-aarch64-rpi3-linux-gnu.tar \
9 -C / --strip-components=1 --keep-directory-symlink \
10 --no-same-owner --no-same-permissions --no-overwrite-dir"
11 # Configure dynamic linker run-time bindings so newly installed libraries
12 # are found by the linker
13 # Enter the sudo password of the Pi if necessary
14 ssh -t RPi3 "sudo ldconfig"
```

To verify that the installation was successful, you can try running the newly installed Python interpreter:

```
1 # Check that Python 3.8 and OpenCV were installed correctly
2 ssh -t RPi3 "python3.8 -c 'import cv2; print(cv2.__version__)'"
```

## Try out the C++ example project

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### Configure and build the example project

```
1 cd build
2 ls ../cmake # See what toolchain files are available
3             # Use the one that matches your board
4 cmake .. \
5     -DCMAKE_TOOLCHAIN_FILE=../cmake/aarch64-rpi3-linux-gnu.cmake \
6     -DCMAKE_BUILD_TYPE=Debug
7 make -j$(nproc)
```

### Copy the tests and the Hello World program to the Pi

```
1 # Copy the cross-compiled binaries to the Pi
2 scp ./bin/* RPi3:/tmp
```

### Run the tests and the Hello World program on the Pi

```
1 # Run the tests
2 ssh -t RPi3 "/tmp/greeter.test"
3
4 # Run the Hello World program
5 ssh -t RPi3 "/tmp/hello-world"
6
7 # Alternatively, start an interactive SSH session, and run it on the Pi directly
8 ssh RPi3
```