PineTime

- Tuto
  - HelloWorld!
  - Adding Images
  - Archlinux build setup
  - Install OpenOCD and remote usage with CLion
- Useful link
  - Display
  - Fonts
  - Sensor

Tuto

Tuto

HelloWorld!

based on pinetime 0.11, upgrade will come soon

Create src/displayapp/screens/HelloWorld.h:

```
#pragma once

#include <lvgl/src/lv_core/lv_obj.h>
#include <cstdint>
#include "Screen.h"

namespace Pinetime {
  namespace Applications {
    namespace Screens {
      class HelloWorld : public Screen {
        public:
          HelloWorld(DisplayApp* app);
          ~HelloWorld() override;
          bool Refresh() override;
          bool OnButtonPushed() override;
          bool OnTouchEvent(TouchEvents event) override;

        private:
          bool running = true;
          lv_obj_t * hello_world_label;
      };
    }
  }
}
```

Create src/displayapp/screens/HelloWorld.cpp:

```
#include "HelloWorld.h"
#include <lvgl/lvgl.h>

using namespace Pinetime::Applications::Screens;



HelloWorld::HelloWorld(Pinetime::Applications::DisplayApp *app) : Screen(app) {

  hello_world_label = lv_label_create(lv_scr_act(), nullptr);
  lv_label_set_text(hello_world_label, "Hello World ! ");
  lv_obj_set_auto_realign(hello_world_label, true);
  lv_obj_align(hello_world_label, nullptr, LV_ALIGN_CENTER, 0, 0);
}

HelloWorld::~HelloWorld() {
  lv_obj_clean(lv_scr_act());
}

bool HelloWorld::Refresh() {
  return running;
}

bool HelloWorld::OnButtonPushed() {
  running = false;
  return true;
}

bool HelloWorld::OnTouchEvent(Pinetime::Applications::TouchEvents event) {
  switch(event) {
    case TouchEvents::SwipeLeft:
    case TouchEvents::SwipeRight:
    default:
      return false;
```

```
  }
}
```

Edit src/displayapp/Apps.h :

Add HelloWolrd to the Enum:

```
#pragma once

namespace Pinetime {
  namespace Applications {
    enum class Apps {None, Launcher, Clock, SysInfo, Meter, Gauge, Brightness, Music,
FirmwareValidation, Paint, Paddle, Notifications, Twos, HeartRate, Navigation, HelloWorld};
  }
}
```

Edit src/displayapp/DisplayApp.cpp :

- Add

```
#include "displayapp/screens/HelloWorld.h"
```

- Add Case Apps::HelloWorld to DisplayApp::RunningState()

```

void DisplayApp::RunningState() {
//  clockScreen.SetCurrentDateTime(dateTimeController.CurrentDateTime());

  if(!currentScreen->Refresh()) {
    currentScreen.reset(nullptr);
    lvgl.SetFullRefresh(Components::LittleVgl::FullRefreshDirections::Up);
    onClockApp = false;
    switch(nextApp) {
      case Apps::None:
      case Apps::Launcher: currentScreen.reset(new Screens::ApplicationList(this));
break;
```

```
      case Apps::Clock:
        currentScreen.reset(new Screens::Clock(this, dateTimeController, batteryController,
bleController, notificationManager, heartRateController));
        onClockApp = true;
        break;
//      case Apps::Test: currentScreen.reset(new Screens::Message(this)); break;
      case Apps::SysInfo: currentScreen.reset(new Screens::SystemInfo(this,
dateTimeController, batteryController, brightnessController, bleController, watchdog));
break;
      case Apps::Meter: currentScreen.reset(new Screens::Meter(this)); break;
      case Apps::Twos: currentScreen.reset(new Screens::Twos(this)); break;
      case Apps::Gauge: currentScreen.reset(new Screens::Gauge(this)); break;
      case Apps::Paint: currentScreen.reset(new Screens::InfiniPaint(this, lvgl));
break;
      case Apps::Paddle: currentScreen.reset(new Screens::Paddle(this, lvgl)); break;
      case Apps::Brightness : currentScreen.reset(new Screens::Brightness(this,
brightnessController)); break;
      case Apps::Music : currentScreen.reset(new Screens::Music(this,
systemTask.nimble().music())); break;
      case Apps::Navigation : currentScreen.reset(new Screens::Navigation(this,
systemTask.nimble().navigation())); break;
      case Apps::FirmwareValidation: currentScreen.reset(new
Screens::FirmwareValidation(this, validator)); break;
      case Apps::Notifications: currentScreen.reset(new Screens::Notifications(this,
notificationManager, Screens::Notifications::Modes::Normal)); break;
      case Apps::HeartRate: currentScreen.reset(new Screens::HeartRate(this,
heartRateController)); break;
      case Apps::HelloWorld: currentScreen.reset(new Screens::HelloWorld(this)); break;
    }
    nextApp = Apps::None;
  }
  lv_task_handler();
}
```

Edit: src/displayapp/screens/ApplicationList.h:

- Increment ScreenList size

- Uncomment std::unique_ptr... CreateScreen3();

```
#pragma once

#include <memory>

#include "Screen.h"
#include "ScreenList.h"

namespace Pinetime {
  namespace Applications {
    namespace Screens {
      class ApplicationList : public Screen {
        public:
          explicit ApplicationList(DisplayApp* app);
          ~ApplicationList() override;
          bool Refresh() override;
          bool OnButtonPushed() override;
          bool OnTouchEvent(TouchEvents event) override;
        private:
          bool running = true;

          ScreenList<3> screens;
          std::unique_ptr<Screen> CreateScreen1();
          std::unique_ptr<Screen> CreateScreen2();
          std::unique_ptr<Screen> CreateScreen3();
      };
    }
  }
}
```

Edit: src/displayapp/screens/ApplicationList.cpp:

Uncomment the createScreen3

```
ApplicationList::ApplicationList(Pinetime::Applications::DisplayApp *app) :
```

```
        Screen(app),
        screens{app, {
                [this]() -> std::unique_ptr<Screen> { return CreateScreen1();
},
                [this]() -> std::unique_ptr<Screen> { return CreateScreen2();
},
                [this]() -> std::unique_ptr<Screen> { return CreateScreen3(); }
          }
        } {}
```

Edit CreateScreen3, edit Apps::HelloWorld

```
std::unique_ptr<Screen> ApplicationList::CreateScreen3() {
  std::array<Screens::Tile::Applications, 6> applications {
          {{"H", Apps::HelloWorld},
           {"B", Apps::Gauge},
           {"C", Apps::Clock},
           {"D", Apps::Music},
           {"E", Apps::SysInfo},
           {"F", Apps::Brightness}
          }
  };
```

Edit CMakeLists.txt:

- Add .cpp to list(APPEND SOURCE_FILES
- Add .h to set(INCLUDE_FILES

```
list(APPEND SOURCE_FILES
...
        displayapp/screens/HelloWorld.cpp
...

set(INCLUDE_FILES
...
        displayapp/screens/HelloWorld.h
 ...
```

Compile

```
docker run --rm -it -v $(pwd):/sources pfeerick/infinitime-build
```

DFU is then stored in `build/output`

Tuto

Adding Images

Tuto

Archlinux build setup

Main build documentation:
https://github.com/JF002/InfiniTime/blob/develop/doc/buildAndProgram.md

CLion setup : https://github.com/JF002/nrf52-baseproject/wiki/Build,-program-and-debug-NRF52-project-with-JLink,-CMake-and-CLion

Prerequisite

Install the following packets:

- aur/nrf5x-command-line-tools
- aur/nrf5-sdk
- community/arm-none-eabi-newlib
- community/arm-none-eabi-gcc

Not sure about:

- community/arm-none-eabi-binutils
- community/arm-none-eabi-gdb

CLion configuration

Base config

Then modify CMake options in CLion>Settings>Build,Execution,Deployment>CMake>CMake options

```
```

```
-DARM_NONE_EABI_TOOLCHAIN_PATH=/usr
-DNRF5_SDK_PATH=/opt/nrf5-sdk
```

JLink

If using JLink to

```
-DUSE_JLINK=1
-DNRFJPROG=/usr/bin/nrfjprog
```

Troubleshooting

The C (or C++) compiler XXXXXX is not able to compile a simple test program.

If XXXXXXX is not the arm compile : `/usr/bin/arm-none-eabi-g++` or `/usr/bin/arm-none-eabi-gcc`

If you have errors related to checking the compiler works (e.g. "-- Check for working CXX compiler: /usr/bin/arm-none-eabi-g++ - broken") add those two variables :

```
-DCMAKE_C_COMPILER_FORCED=1
-DCMAKE_CXX_COMPILER_FORCED=1
```

My (Zorvalt) issue came from CLion using "normal" `cc` instead of the arm toolchain.

Tuto

Install OpenOCD and remote usage with CLion

Introduction

OpenOCD is meant to be run locally but with a few tricks we can execute it on a raspberry pi. The idea will be to forward openocd calls through SSH and forward the port 3333 from the localhost to the raspberry pi.

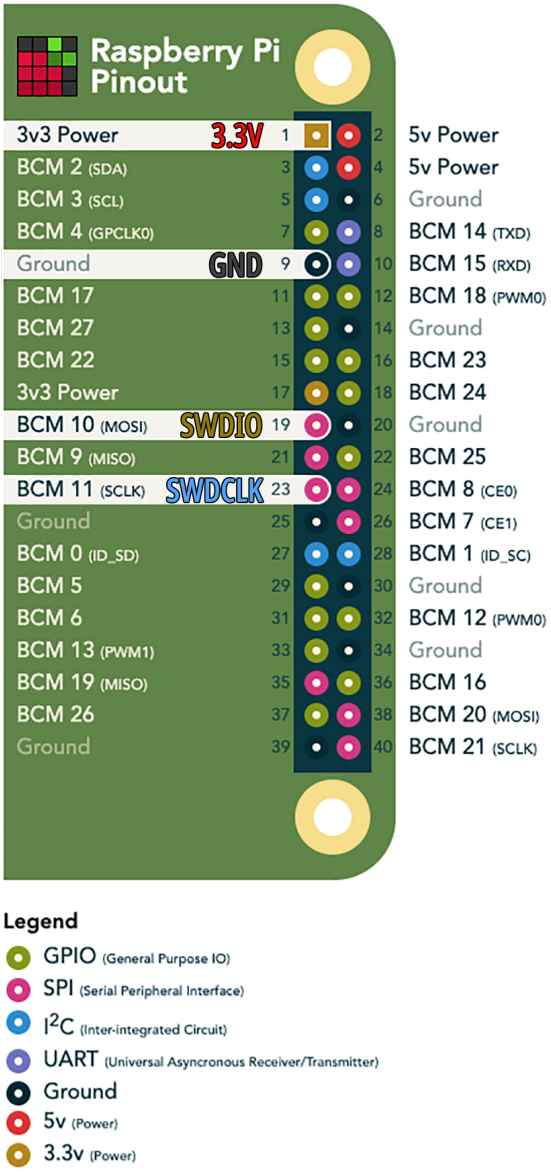
Setup

Wiring a Raspberry PI (zero, A+, B+,2,3,4)

The protocol to flash the Pinetime is SWD. In order to communicate with the Pinetime hardware, the flasher/debugger must be connected to the right pins.

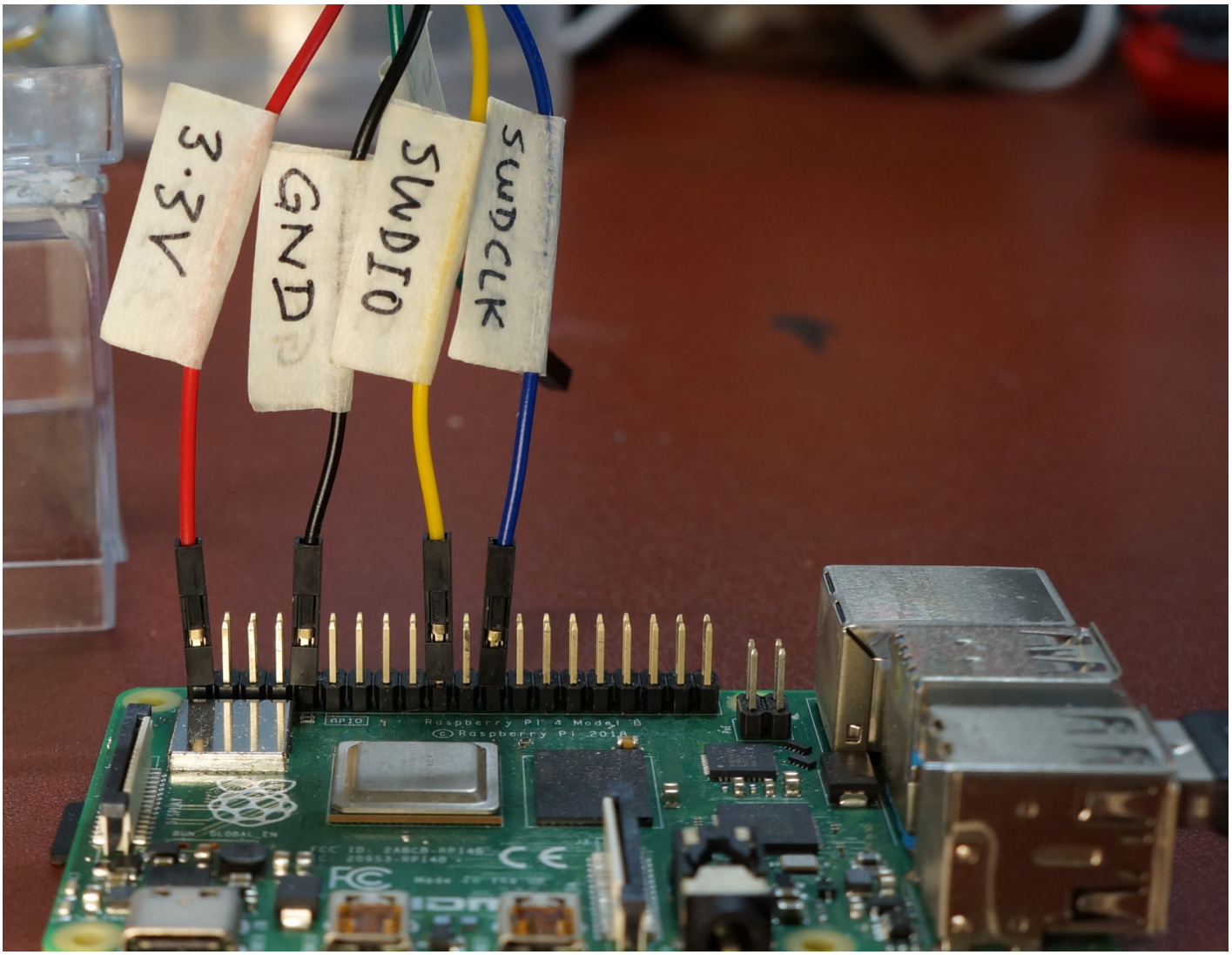


Pinetime SWD Pinout from
https://wiki.pine64.org/wiki/PineTime_Devkit_Wiring



Raspberry PI pinout from
https://github.com/lupyuen/visual-embedded-rust/blob/master/README.md#connect-pinetime-to-raspberry-pi
Valid for a Raspberry PI zero, A+, B+,2,3,4

Small trick: label your cables



Raspberry PI setup

Install raspbian

1. For simplicity, imager is a very good tool : package `rpi-imager` at least on Ubuntu and Archlinux repositories or download it from the official website https://www.raspberrypi.com/software/.
2. Flash your memory card with your favorite Raspberry PI OS (here I suppose raspbian lite)
3. Preflight configuration : mount the memory card on your dev system and
    1. Setup networking by editing /etc/wpa_supplicant/wpa_supplicant.conf and adding the following section

```
network={
```

```
ssid="YOUR_WIFI_SSID"
  psk="YOUR_WIFI_PASSWORD"
  key_mgmt=WPA-PSK
  #scan_ssid=1  # Only needed if wifi ssid is hidden
}
```

   2. Enable SSH by creating a `ssh` file in `/boot`. By example, run `touch /boot/ssh`.
   3. Configure more by reading the documentation : https://www.raspberrypi.com/documentation/computers/configuration.html

4. **DO NOT CONNECT THE PINETIME IF IT IS NOT CHARGED**, it might drain to much current from the raspberry pins
5. Read the point above and then power up your raspberry PI
6. Monitor your router or DHCP server to find the PI ip address. Alternatively, you can scan your network with nmap or follow one of the other techniques documented here : https://www.raspberrypi.com/documentation/computers/remote-access.html
7. Connect to it through SSH with user `pi` and password `raspberry`. If mDNS works with your network environment, you can use `ssh pi@raspberrypi.local`.
   1. Good practice : Immediately set a new password using the `passwd` command.
   2. More security setup documented here : https://www.raspberrypi.com/documentation/computers/configuration.html#securing-your-raspberry-pi

8. Run `sudo raspi-config` to enable SPI
   1. Select Interfacing Options → SPI → Yes

Install OpenOCD-SPI

We need a patched version of OpenOCD to use SWD over SPI. Thus, the version from the official repository won't work. Instead, we'll install the `openocd-spi` fork by *lupyuen* : https://github.com/lupyuen/openocd-spi. To simplify the Pinetime debugging operations, *lupyuen* created a tool called pinetime-updater which installs openocd-spi for us.

1. Install required tools : `apt install git`

Follow the instructions from the pinetime-updater repository or trust me with this :

```
# Clone the repo using
git clone https://github.com/lupyuen/openocd-spi.git  <-- do we need this ?

git clone https://github.com/lupyuen/pinetime-updater
# Run the bash script
cd pinetime-updater
chmod +x run.sh
./run.sh
```

Compilation troubleshooting

If you have compilation errors try reverting to a previous gcc version with the following steps. At the time of writing, the gcc version was 10, so the steps show how to revert to version 9 but you can easily transpose this (dear reader of the future).

1. Download previous gcc package `sudo apt install gcc-9`
2. Setup alternatives using the following two lines (10 and 20 refers to priorities ; bigger == higher)

   ```
   # Based on a stackoverflow response from Edd Inglis
   # https://askubuntu.com/questions/26498/how-to-choose-the-default-gcc-and-g-version

   # Remove previous setup
   sudo update-alternatives --remove-all gcc

   # Add the two options with higher priority for the latest version
   sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-9 10
   sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-10 20

   # Select the version to use
   sudo update-alternatives --config gcc
   ```

3. Execute the `run.sh` script again

Create OpenOCD configuration

Create the file `/home/pi/pinetime-updater/scripts/debug.ocd` with the content:

```

```

```
# This is an OpenOCD script that connects to the nRF52 for Cortex Debug.

# Debug Level must be 2 or greater or gdb will fail.
debug_level 2

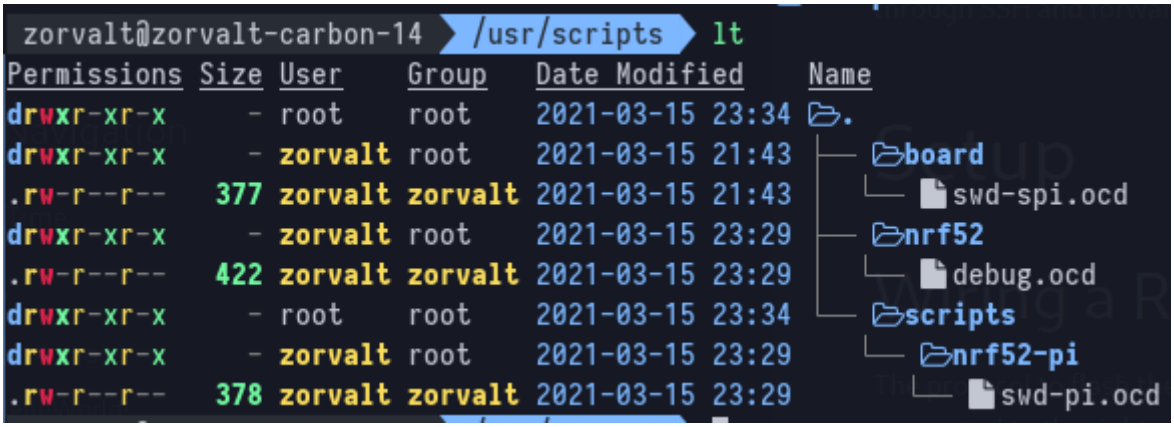
$_TARGETNAME configure -event reset-init {
    # Arm Semihosting is used to show debug console output and may only be enabled after init event.  We wait for the event and enable Arm Semihosting.
    echo "Enable ARM Semihosting to show debug output"
    arm semihosting enable
}
```

Host configuration for remote debugging

Local openocd configuration

Create the files under `/usr/scripts` with the same content as the files from `/home/pi/pinetime-updater/scripts` (same filename => same content).

You should endup with the following tree :



Forward openocd calls

Create the file /usr/bin/openocd with the following content :

```
#! /usr/bin/env bash
ssh -t -L 3333:localhost:3333 __REPLACE__THIS__ "cd pinetime-updater; openocd $@"
```

Then replace the `__REPLACE__THIS__` placeholder with your raspberry pi user and ip. Example: `pi@192.168.1.15`

.

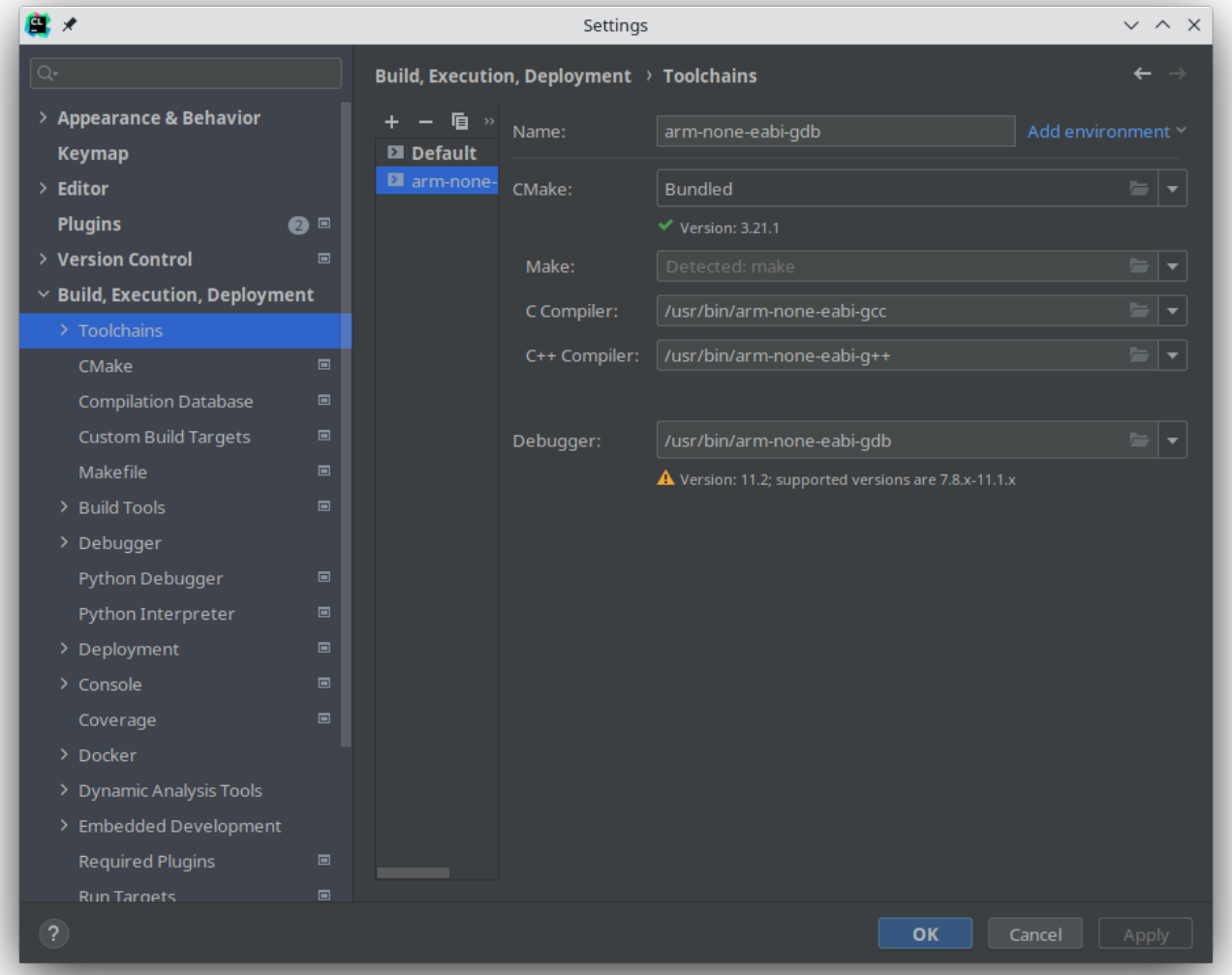
Do not forget to `chmod +x /usr/bin/openocd` when you are done.

Configure CLion

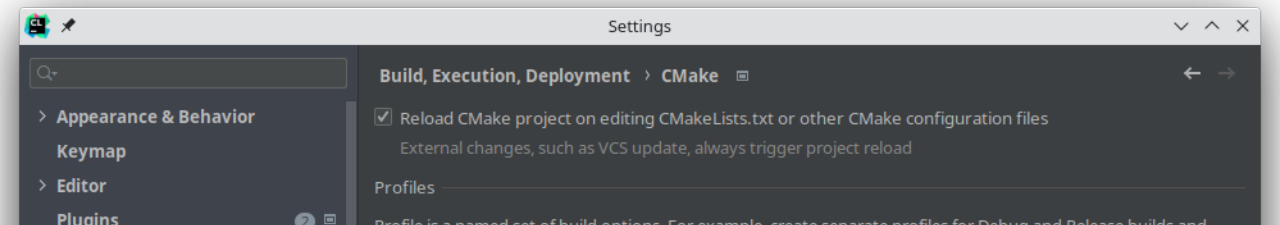
Toolchain

sudo apt-get install gcc-arm-none-eabi gdb-multiarch

sudo ln -s /usr/bin/gdb-multiarch /usr/bin/arm-none-eabi-gdb



CMake

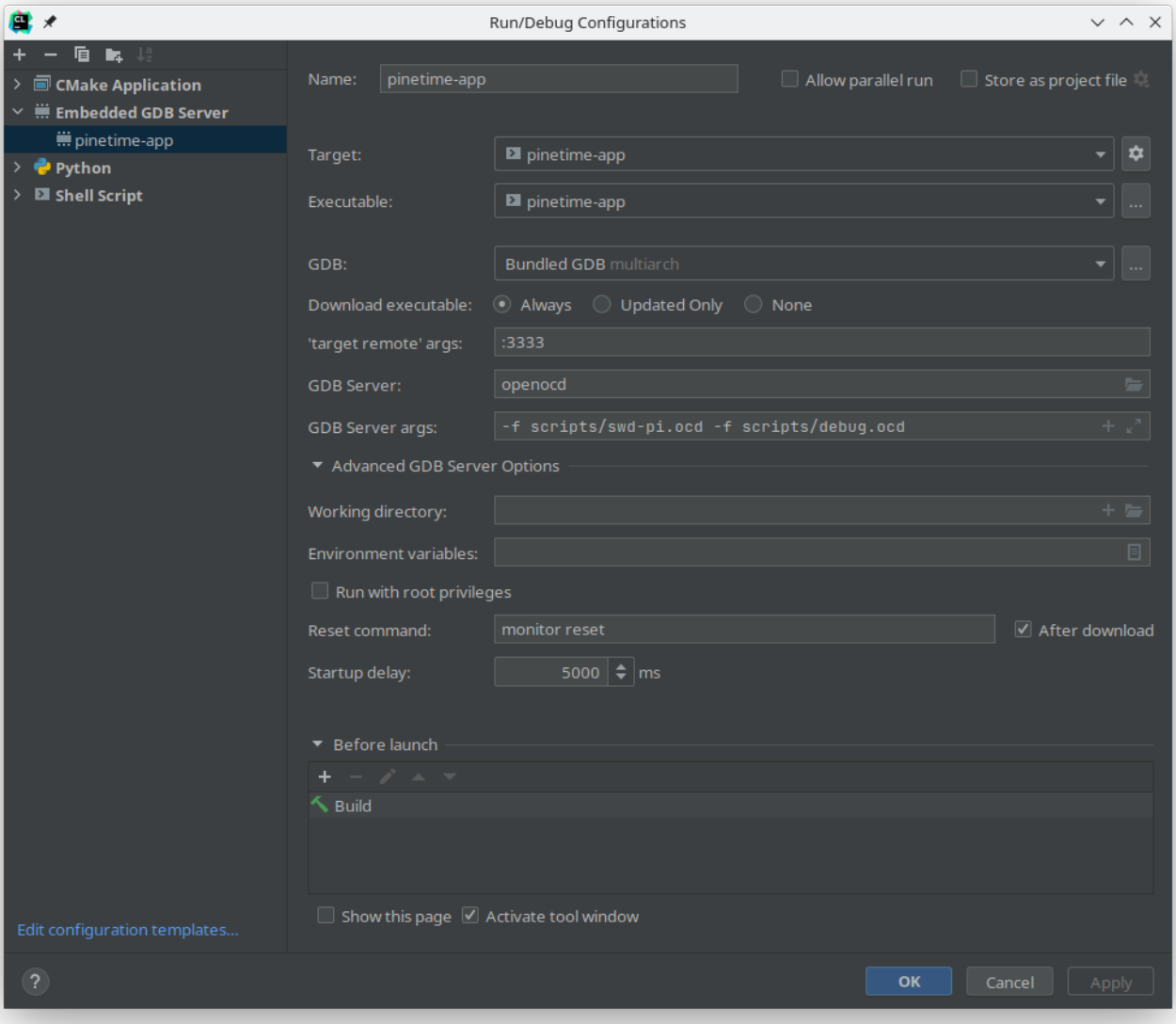


With `CMake options` field content :

```
-DCMAKE_C_COMPILER_FORCED=1
-DCMAKE_CXX_COMPILER_FORCED=1
-DARM_NONE_EABI_TOOLCHAIN_PATH="/usr"
-DNRF5_SDK_PATH="/opt/nrf5-sdk"
-DNRFJPROG="/usr/bin/nrfjprog"
-DUSE_OPENOCD=1
```

Run/Debug configuration

Pay attention to the `Startup delay` field. As the openocd command must first connect through SSH before starting a GDB server, you might experience some lag, especially on a Raspberry PI zero. Tune its value to your needs.


Run/Debug Configurations
CMake Application
Embedded GDB Server
pinetime-app
Python
Shell Script
Edit configuration templates...
Name: pinetime-app
Allow parallel run
Store as project file
Target: pinetime-app
Executable: pinetime-app
GDB: Bundled GDB multiarch
Download executable: Always Updated Only None
'target remote' args: :3333
GDB Server: openocd
GDB Server args: -f scripts/swd-pi.ocd -f scripts/debug.ocd
Advanced GDB Server Options
Working directory:
Environment variables:
Run with root privileges
Reset command: monitor reset
After download
Startup delay: 5000 ms
Before launch
Build
Show this page
Activate tool window
OK
Cancel
Apply

Useful link

Useful link

Display

littlevgl

Version used : LVGL 7.11.0

Official website: https://lvgl.io/

Doc: https://docs.lvgl.io/latest/en/html/

Image to .cpp convertor: https://lvgl.io/tools/imageconverter use indexed 2 color

Useful link

Fonts

FontAwesome5

From lvgl: https://lvgl.io/assets/others/FontAwesome5-Solid+Brands+Regular.woff

From here: FontAwesome5-Solid+Brands+Regular.woff

JetBrainsMono-Bold

The latest Jetbrain mono Bold file is in woff2 and then, not supported by LGLV font converter

A woff version is disponible the jetbrains mono github tag V2.002 or here JetBrainsMono-Bold.woff

Useful link

Sensor

https://github.com/daniel-thompson/bma42x-upy