

n-Blocks

LoRaWAN Setup

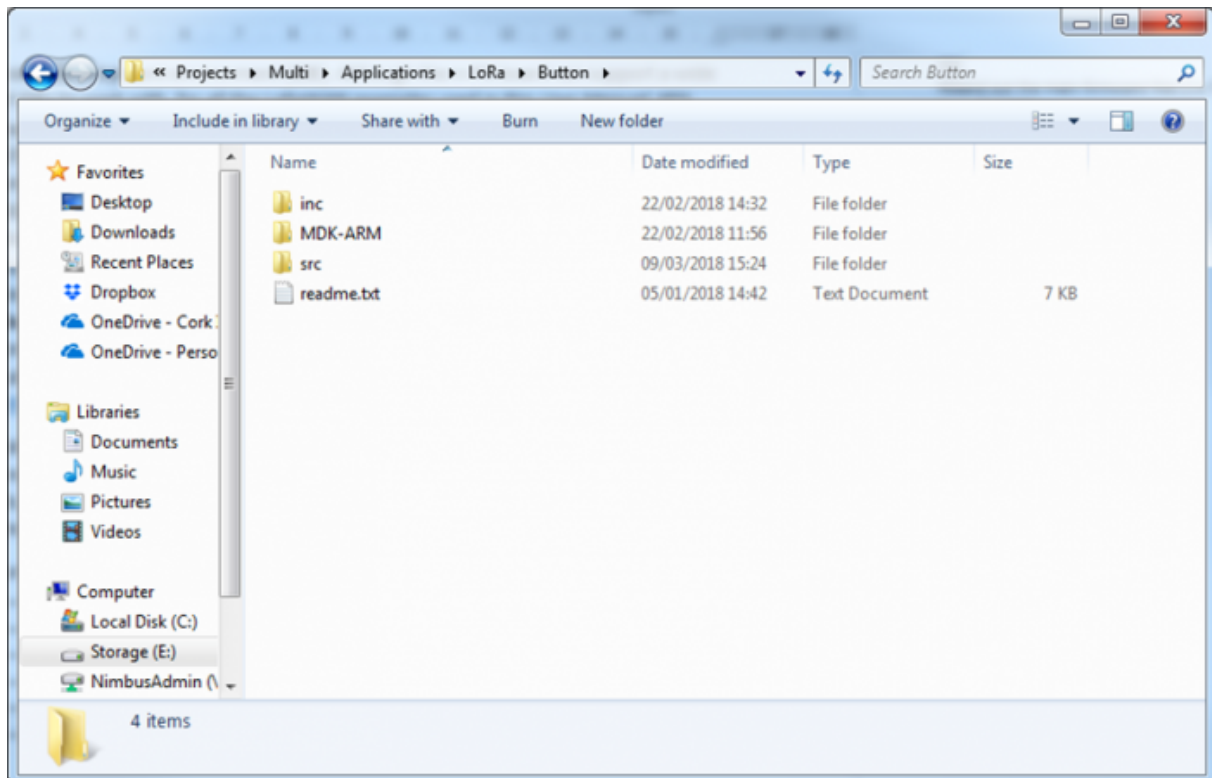
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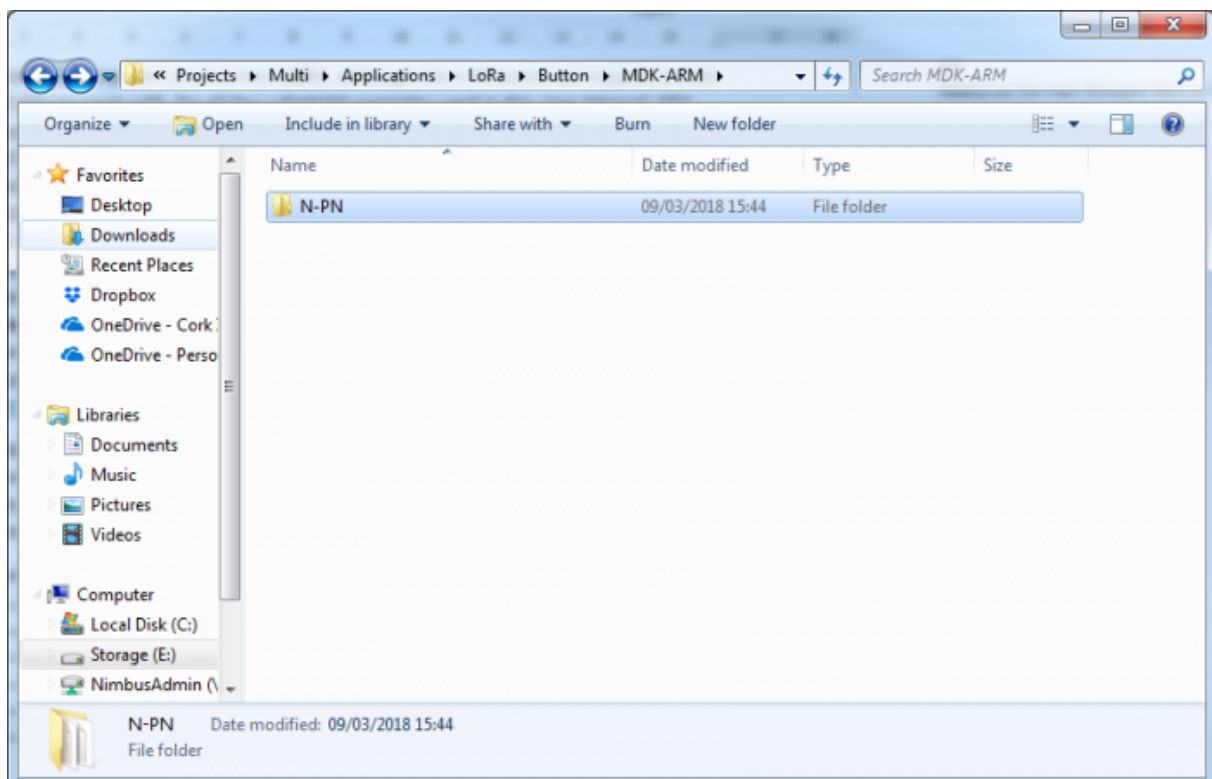
LoRaWAN Setup

To configure all the necessary tools to start working with the n-PN board, two main elements need to be downloaded by the user.

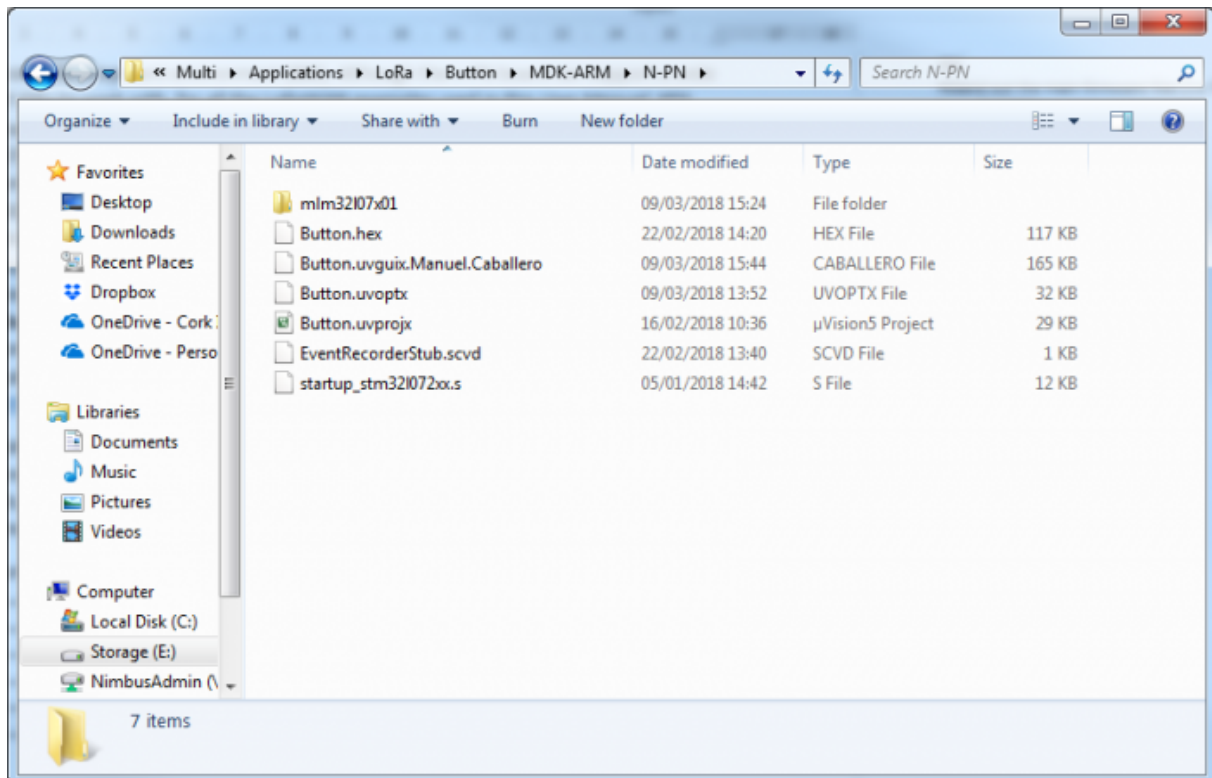
- An **Integrated development environment (IDE)**. Although the n-PN board can support a wide variety of IDEs to work with, KEIL environment can be chosen for two main reasons:
 - a. STM provides all the necessary LoRaWAN protocol drivers for the microcontroller embedded in the n-PN board for this IDE.
 - b. KEIL IDE (MDK Version 5) is free for STM32F0 and STM32L0 microcontrollers and due to the n-PN board has an STM32L0 microcontroller, we are allowed to activate the license for this software environment (follow the instructions[here](#)).
- The **Nimbus SDK** which contains the minimum files to start working with the n-PN board as well as some basic examples that the user can use as templates (Nimbus SDK is based on STM32CubeExpansion_LRWAN_V1.1.4 and can be found in the next repository: https://bitbucket.org/nimbus_it/pn_lora_node).
- After installing KEIL (MDK) IDE (and the license activated) and downloading the Nimbus SDK, there are several basic examples (using LoRaWAN technology) which the user can start working with. The examples can be found following the path: LoRaWAN_Examples / STM32CubeExpansion_LRWAN_V1.1.4 / Projects / Multi / Applications / LoRa /.
- Open Any Example folder (Button folder for this example) and open MDK-ARM folder.



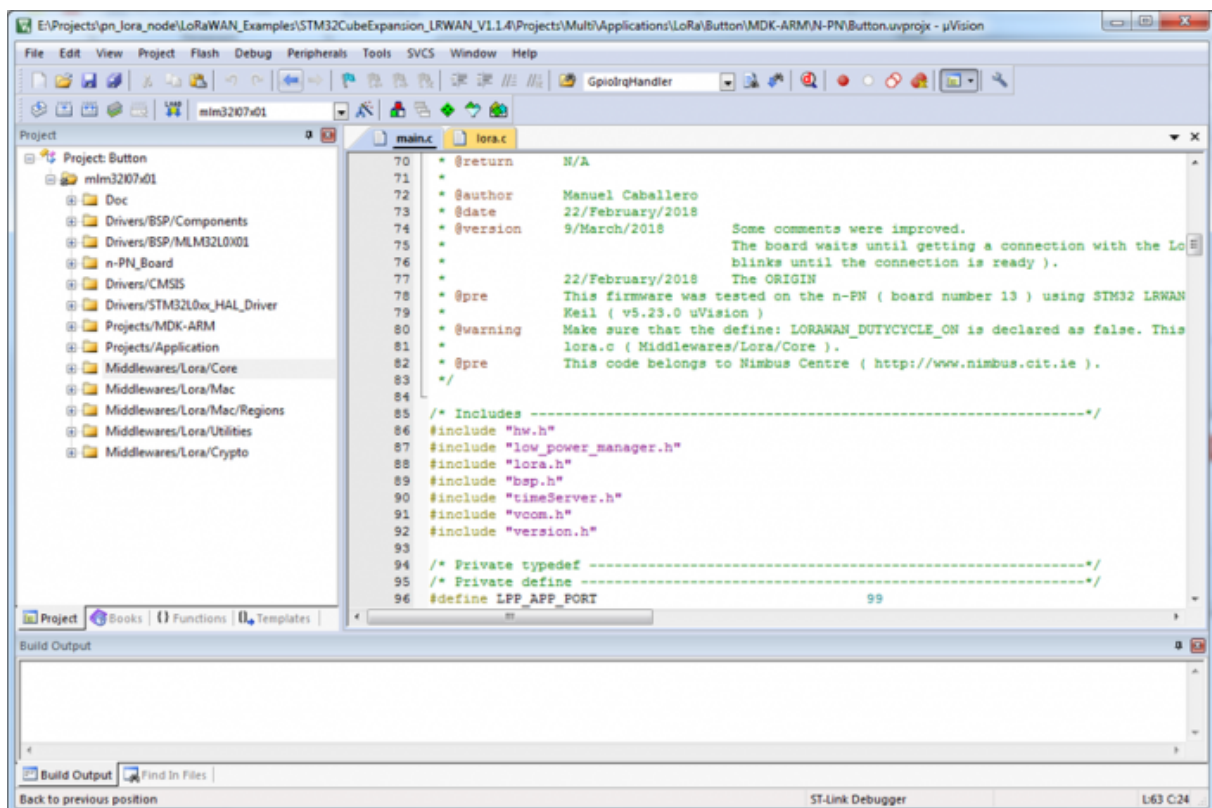
- Open N-PN folder.



- Open Button project (Double click on Button.uvprojx).



- The project is ready to be tested.



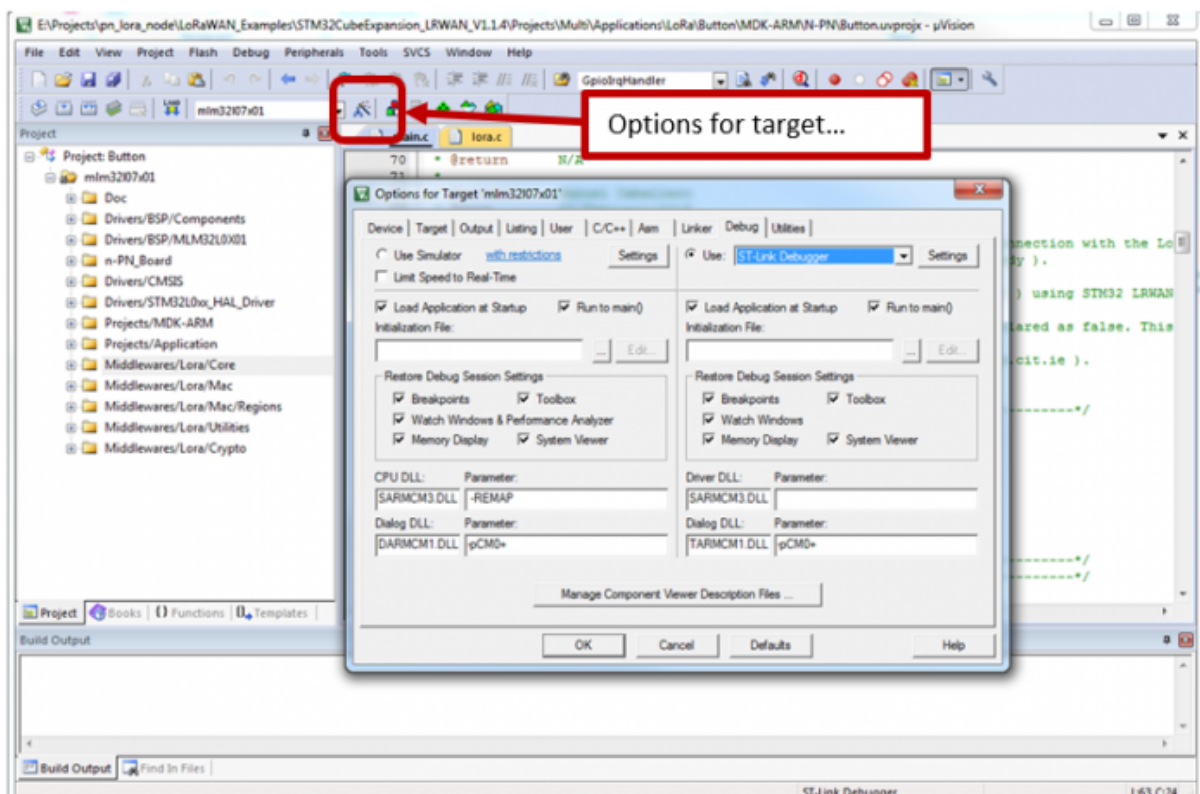
NOTES:

- KEIL IDE (MDK) may not have the libraries installed for the microcontroller embedded in the n-PN board, so a pop-up window will appear asking us to install those libraries. Just follow the instructions to install them up. You may reset your computer after the installation.
- If we double click on Button.uvprojx (a project file) and Windows does not recognise the extension file, just choose KEIL (MDK).

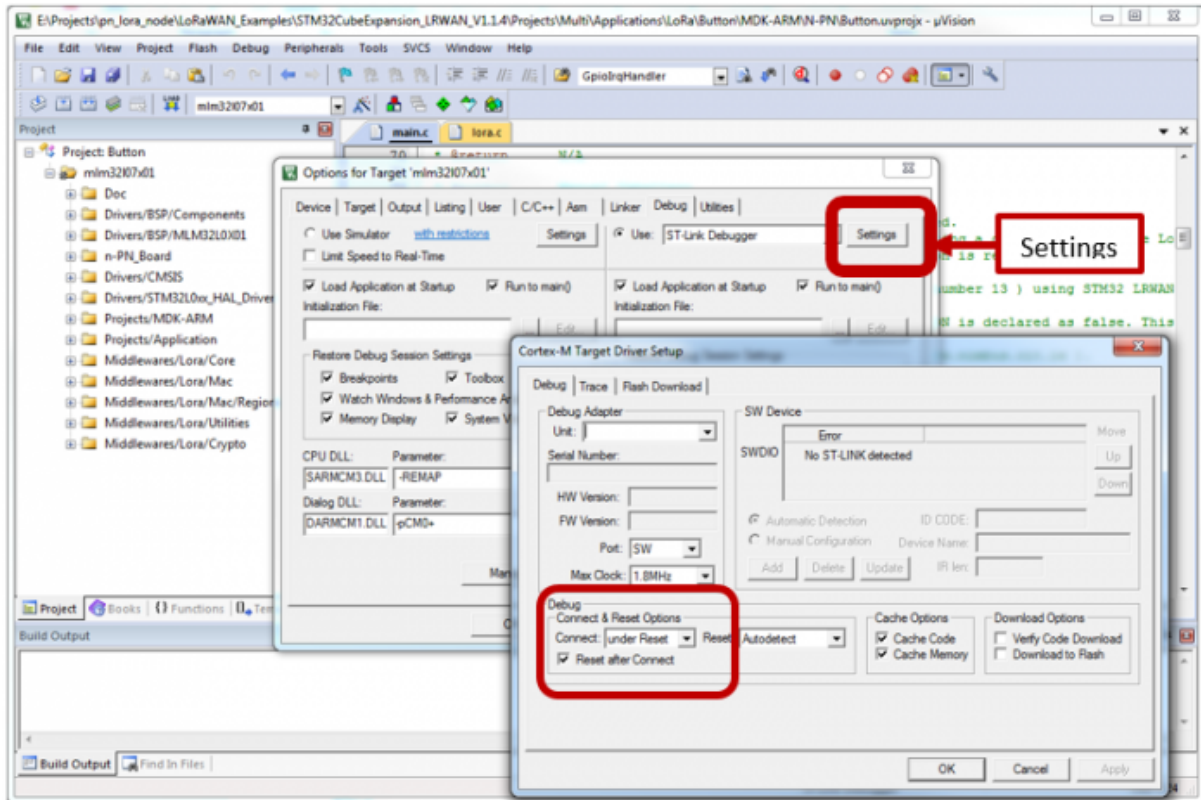
Integrated Development Environment (IDE)

As stated, KEIL IDE (MDK) was chosen, this section explains the minimum configuration to improve our work flow.

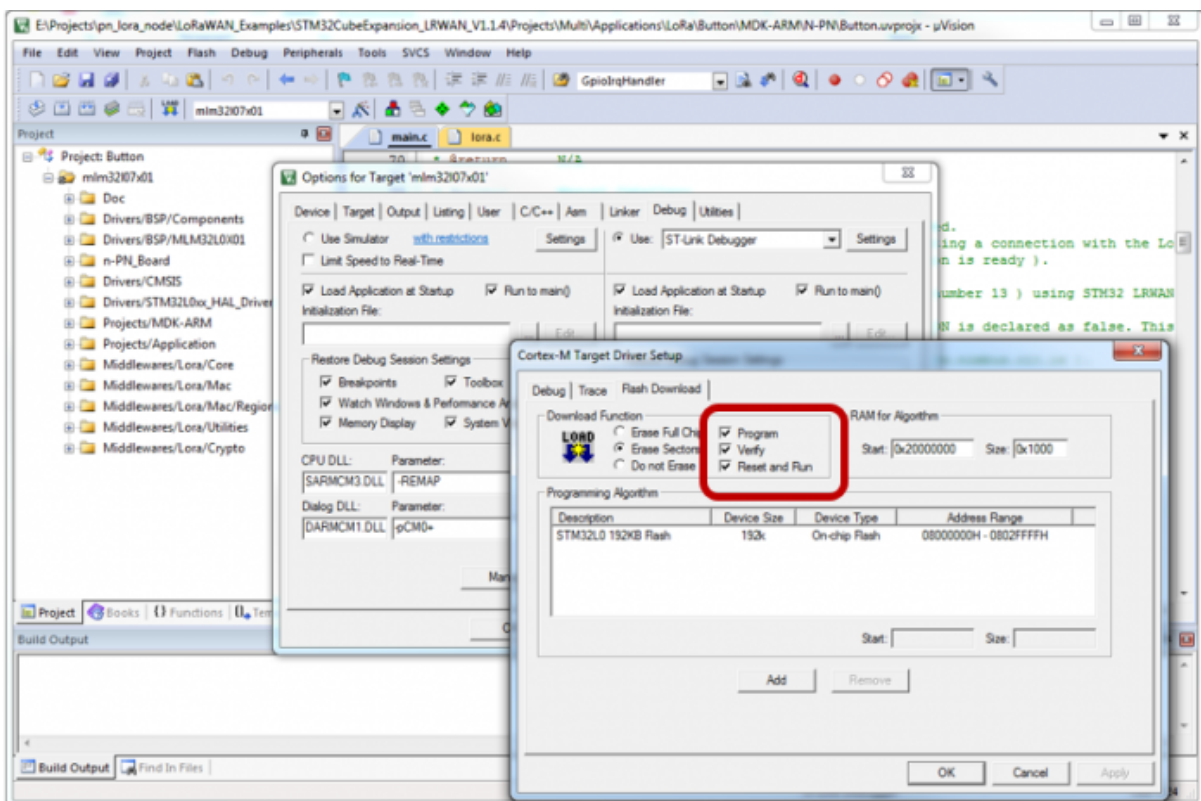
- Click on Options for Target...
- In Debug tab, make sure to use the right programmer (mostly ST-Link Debugger).



- In Debug tab, Click on Settings
- Make sure under Reset is chosen in Connect (Debug tab).

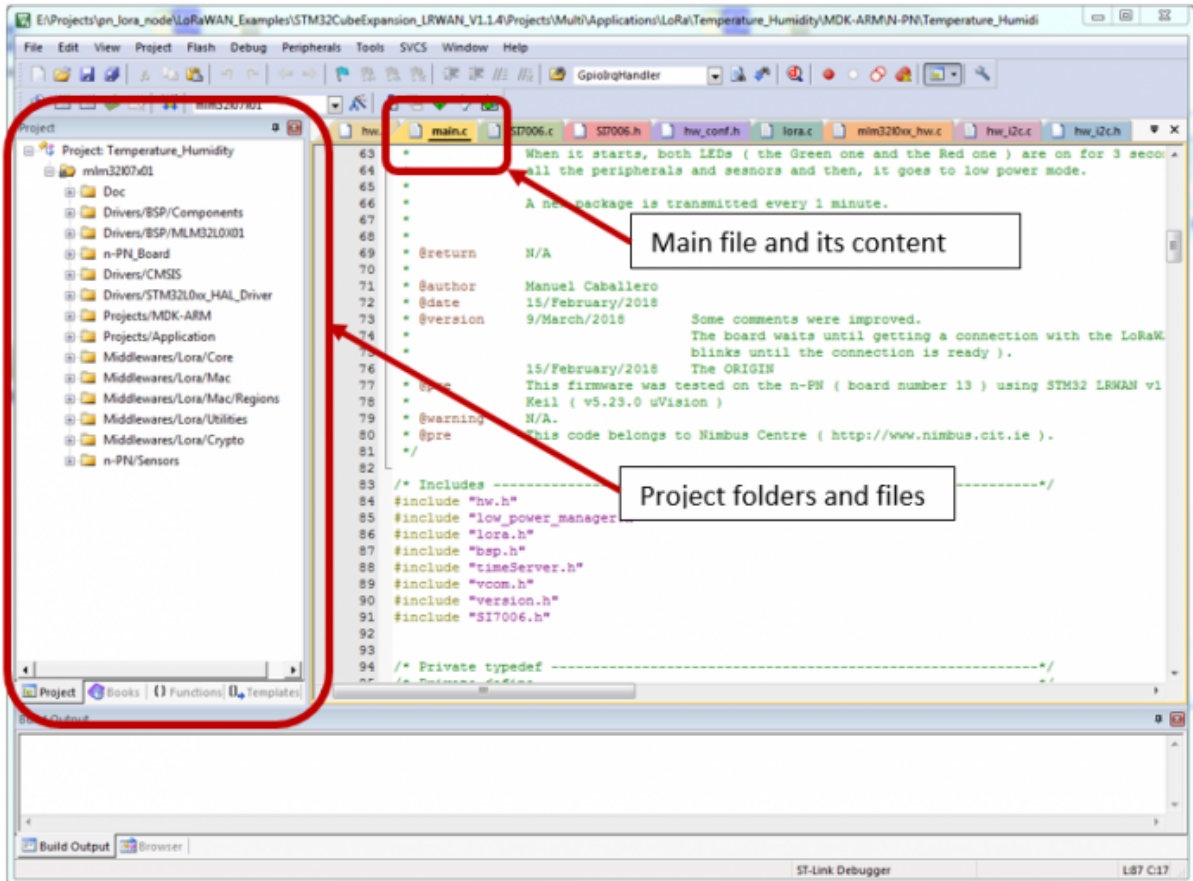


- In Flash Download tab, make sure that Program, Verify and Reset and Run are selected.



Firmware Structure

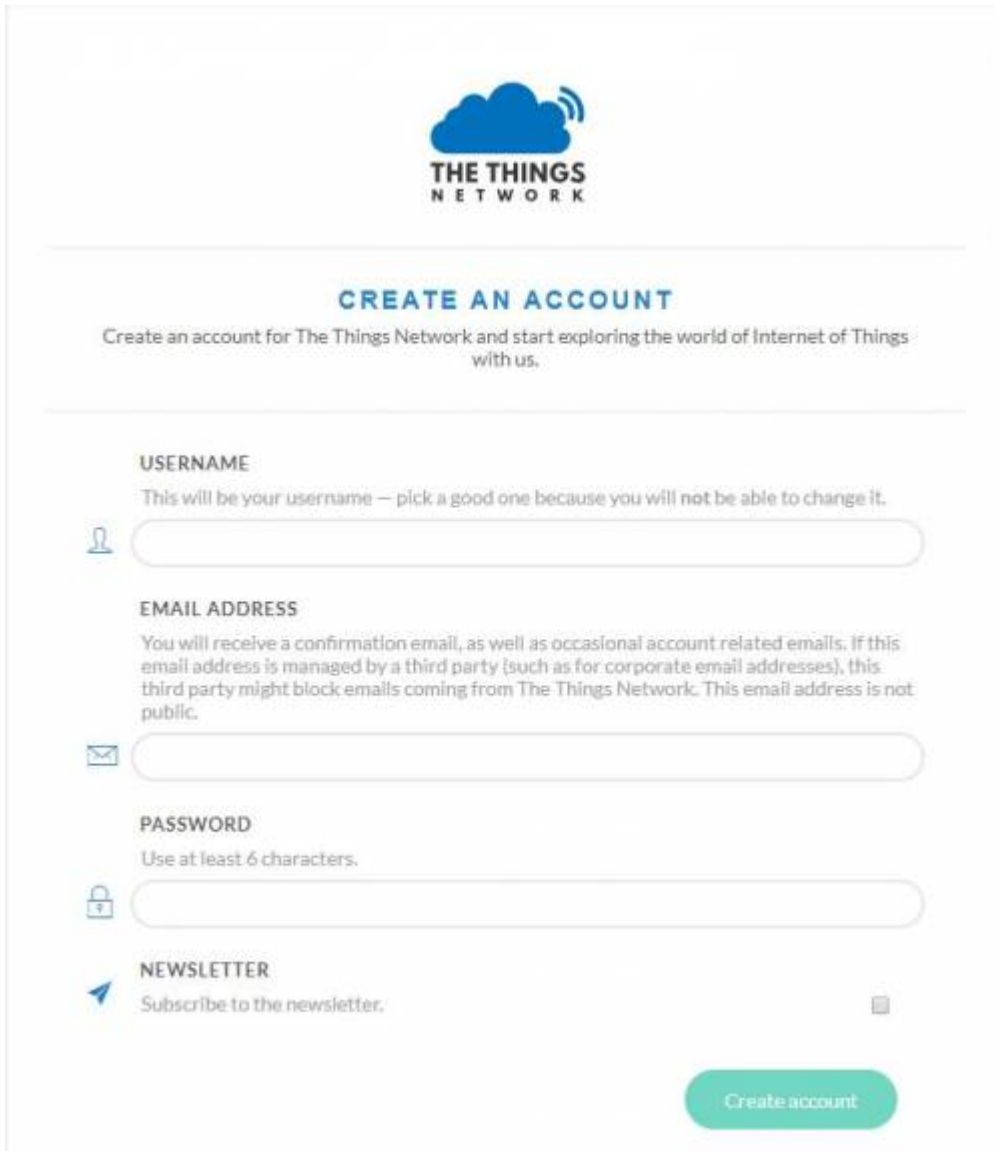
- In Keil a project is structured as shown below:



- The main folders are explained below:
 - **n-PN_Board:** The b-l072z-lrwan1.c file defines all the pinout of the n-PN board.
 - **Projects/Application:** The main.c file for the application is placed into this folder.
 - **N-PN/Sensors:** The drivers for the external sensors embedded on n-PN board are placed in this folder.
- Keil IDE does not show the header files until the project is compiled, once the project is compiled, the header files can be found under the function files (clicking on the cross sign next to the function file).
- Another important file is the header file called **Commissioning.h** which can be found under the main.c file. This header file contains the necessary parameters to configure your own LoRaWAN network: LORAWAN_DEVICE_EUI, LORAWAN_APPLICATION_EUI and LORAWAN_APPLICATION_KEY(These parameters can be obtained from The Things Network website).

The Things Network

- The user can create an account on the [THE THINGS NETWORK](#), to quickly get started.



The screenshot shows the 'CREATE AN ACCOUNT' page of The Things Network. At the top is the logo, which consists of a blue cloud with a signal icon and the text 'THE THINGS NETWORK'. Below the logo is the heading 'CREATE AN ACCOUNT' in blue, followed by the text 'Create an account for The Things Network and start exploring the world of Internet of Things with us.' The form contains four sections: 'USERNAME' with a note 'This will be your username — pick a good one because you will not be able to change it.' and a text input field; 'EMAIL ADDRESS' with a note 'You will receive a confirmation email, as well as occasional account related emails. If this email address is managed by a third party (such as for corporate email addresses), this third party might block emails coming from The Things Network. This email address is not public.' and a text input field; 'PASSWORD' with a note 'Use at least 6 characters.' and a text input field; and 'NEWSLETTER' with a note 'Subscribe to the newsletter.' and a checkbox. A green 'Create account' button is at the bottom right.

- After creating the account, the user can add Applications and Gateways in the TTN CONSOLE.

The screenshot displays the 'The Things Network Console' interface. At the top, the logo 'THE THINGS NETWORK' and 'CONSOLE COMMUNITY EDITION' are visible on the left, and 'Applications' and 'Gateways' tabs are on the right. A welcome message states: 'Welcome to The Things Network Console. This is where the magic happens. Here you can work with your data. Register applications, devices and gateways, manage your integrations, collaborators and settings.' Below this, there are two main sections: 'APPLICATIONS' and 'GATEWAYS'. The 'APPLICATIONS' section shows a list of applications with columns for application ID, name, and EUI. Two applications are listed: '786 NC' and 'nimbus-internal-network'. The 'GATEWAYS' section shows a list of gateways with columns for gateway ID, name, status, and EUI. One gateway is listed: 'eui-b827ebffff5ea8' with status 'connected'.

APPLICATIONS

Application ID	Name	EUI
786 NC		70 83 D5 7E D0 01 83 78
nimbus-internal-network	Nimbus Internal Network for testing proposes	70 83 D5 7E D0 01 E8 F4

GATEWAYS

Gateway ID	Name	Status	EUI
eui-b827ebffff5ea8	Nimbus Centre TEC Cork gateway Mobile	connected	EU_863_870

- On the application page, the user can register devices under the devices section.

The screenshot shows the 'APPLICATION OVERVIEW' page in the LoRaWAN setup interface. At the top, there are tabs: Overview, Devices, Payload Formats, Integrations, Data, and Settings. The 'Overview' tab is active. Below the tabs, the page title 'APPLICATION OVERVIEW' is displayed. On the right, there is a link for 'documentation'. The main content area shows the following details:

- Application ID:** 786
- Description:** NC
- Created:** 7 months ago
- Handler:** ttn-handler-eu (current handler)

Below this section is the 'APPLICATION EUIs' section, which is currently empty. At the bottom, the 'DEVICES' section is visible, showing a 'register device' button (highlighted with a red box) and a 'manage devices' button. Below these buttons, it indicates '7 registered devices' with a device icon.

The screenshot shows the 'REGISTER DEVICE' page in the LoRaWAN setup interface. At the top, there are tabs: Overview, Devices, Payload Formats, Integrations, Data, and Settings. The 'Devices' tab is active. Below the tabs, the page title 'REGISTER DEVICE' is displayed. On the right, there is a link for 'bulk import devices'. The form contains the following fields:

- Device ID:** This is the unique identifier for the device in this app. The device ID will be immutable. The value '2272602' is entered.
- Device EUI:** The device EUI is the unique identifier for this device on the network. You can change the EUI later. The field is empty and contains the text 'this field will be generated'.
- App Key:** The App Key will be used to secure the communication between you device and the network. The field is empty and contains the text 'this field will be generated'.
- App EUI:** The value '78 83 05 7E D0 01 83 78' is entered.

At the bottom right, there are 'Cancel' and 'Register' buttons.

- All the registered devices will appear on the Devices page.

Overview		Devices	Payload Formats	Integrations	Data	Settings
DEVICES		register device				
< >		1 – 7 / 7				
000786000		00 3B 7A C1 CC 9E 4E 6A				
2272600		00 55 4C D2 0E A6 B9 26				
2272601		00 9D B7 C9 44 FD B6 83				
2272602		00 FF 14 52 A6 14 98 01				

- The following information: LORAWAN_DEVICE_EUI, LORAWAN_APPLICATION_EUI and LORAWAN_APPLICATION_KEY can be obtained from the device overview page by clicking on the selected device.

DEVICE OVERVIEW

Application ID 786

Device ID 2272602

Activation Method OTAA

Device EUI

<> 00 FF 14 52 A6 14 98 01

Application EUI

<> 70 B3 05 7E D0 01 83 78

App Key

<> { 0x85, 0x06, 0xD3, 0x00, 0x8B, 0x5A, 0x4C, 0x1C, 0x07, 0x0F, 0x29, 0x5C, 0xB6, 0x01 }

Device Address

<> multi { 0x26, 0x01, 0x2D, 0xA4 }

Network Session Key

<>

App Session Key

<>

Status

5 months ago

Frames up

1535 [reset frame counters](#)

Frames down

24

- Similarly, a gateway can be added on the gateway page.

Gateways > Register

REGISTER GATEWAY

Gateway ID

A unique, human-readable identifier for your gateway. It can be anything so be creative!

**I'm using the legacy packet forwarder**

Select this if you are using the legacy [Semtech packet forwarder](#).

Description

A human-readable description of the gateway

Frequency Plan

The [frequency plan](#) this gateway will use

Router

The router this gateway will connect to. To reduce latency, pick a router that is in a region which is close to the location of the gateway.

Location

The exact location of your gateway. This will be used if your gateway cannot determine its location by itself. Set a location by clicking on the map.

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