

10Base-T1S PHY Hands-On Training

Setup Instructions

Goal of this Hands-On Training

- Present a demonstration of an example of Single Pair Ethernet communication over 10BASE-T1S
- Use LAN8670 RMII evaluation board with SAME54 Curiosity Ultra
- Based on Application Note AN4131



AN4131

MPLAB® Harmony v3 LAN867x Driver Example

1.0 INTRODUCTION

The LAN867x is a high-performance 10BASE-T1G single-pair Ethernet PHY transceiver that is targeted for 10 Mbit/s half-duplex networking over a single pair of conductors.

This document guides you in creating a sample TCP/IP Client node (bare-metal or FreeRTOS™ based), using the LAN867x PHY. It describes how to configure the PHY in either Physical Layer Collision Avoidance (PLCA) or Carrier-Sense Multiple Access/Collision Detection (CSMA/CD) mode.

The description in this document is based on an ATSAME54P20A running on a SAM E54 Curiosity Ultra Development Board [3]. However, it can also be applied to other infrastructures; for example, to an ATSAME7DQ21B running on a SAM E70 Xplained Ultra Evaluation Kit [4].

1.1 Audience

This document is written for developers who want to create a sample TCP/IP Client node, using the LAN867x PHY. Developers should be familiar with the infrastructure of MPLAB Code Configurator (MCC) and its plug-ins [1].

1.2 References

The following sources should be referenced when using this application note.

[1] MPLAB Code Configurator

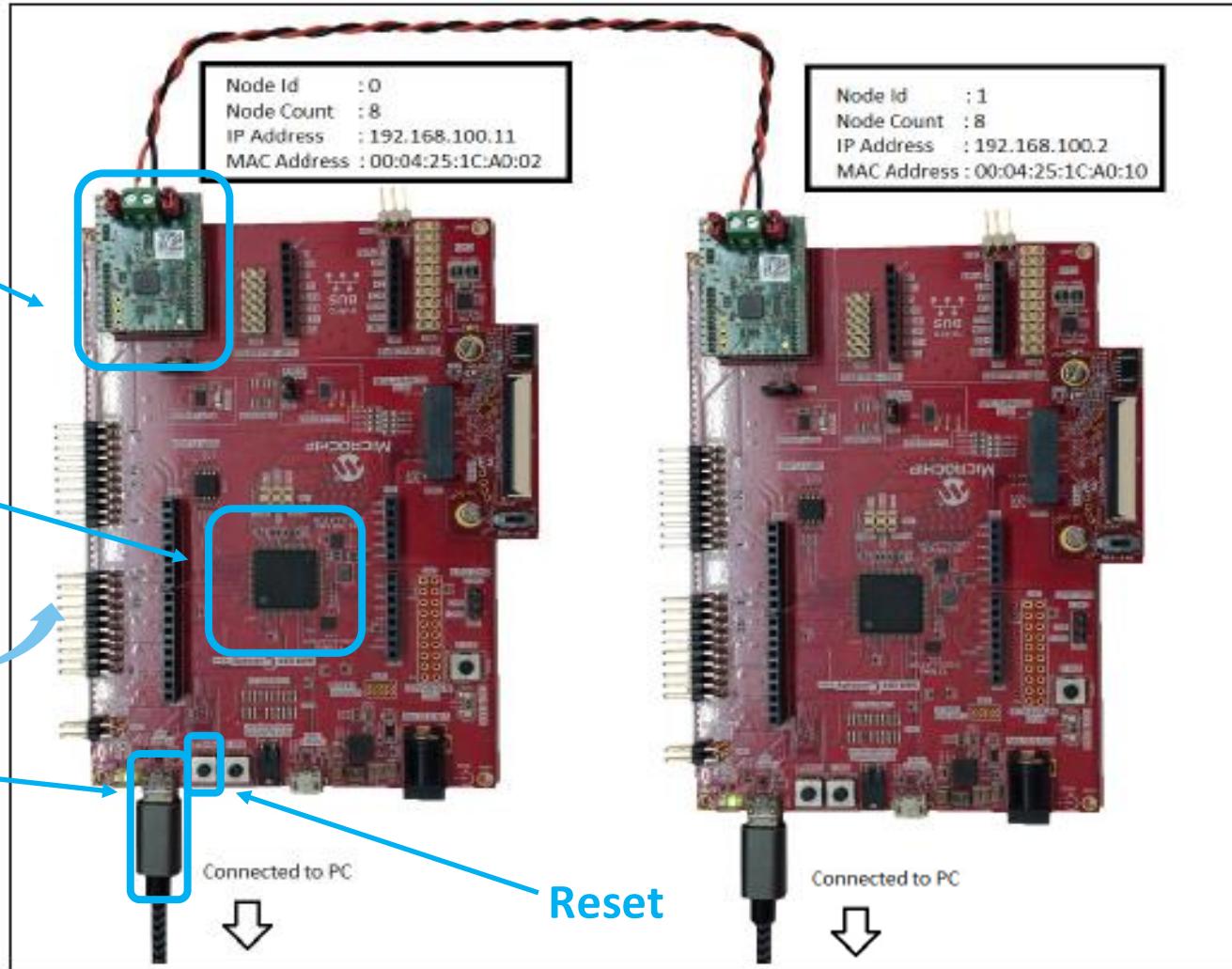
- Link to AN4131 is given [here](#) and is also available on [LAN8670 Product Page](#)

LAN8670 RMII evaluation board with SAME54 Curiosity Ultra

Ethernet Interface
with RMII mounted
with EVB-LAN8670-
RMII to 10BASE-T1S
interface card

ATSAME54P20A
On board EDBG
debugger

USB Debugger
Interface



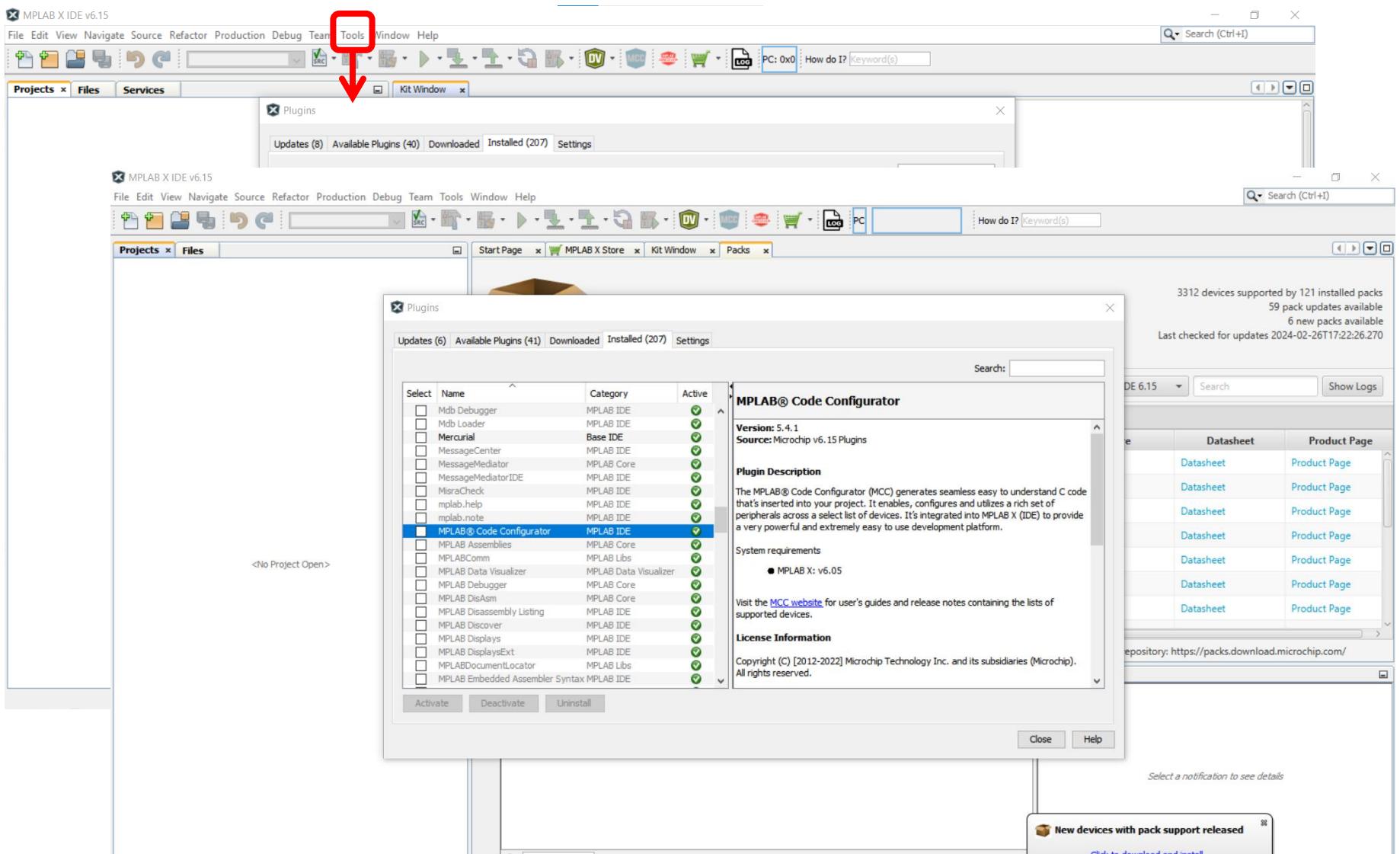
Project Setup

Step-by-Step Guide to Creating the Project

Step 1

Having opened MPLAB X IDE (See [Useful Links and References](#)) , in Tools > Plugins, check that you have MPLAB Code Configurator installed.

If it is not there, look in Available Plugins and install it from there.



Step 2

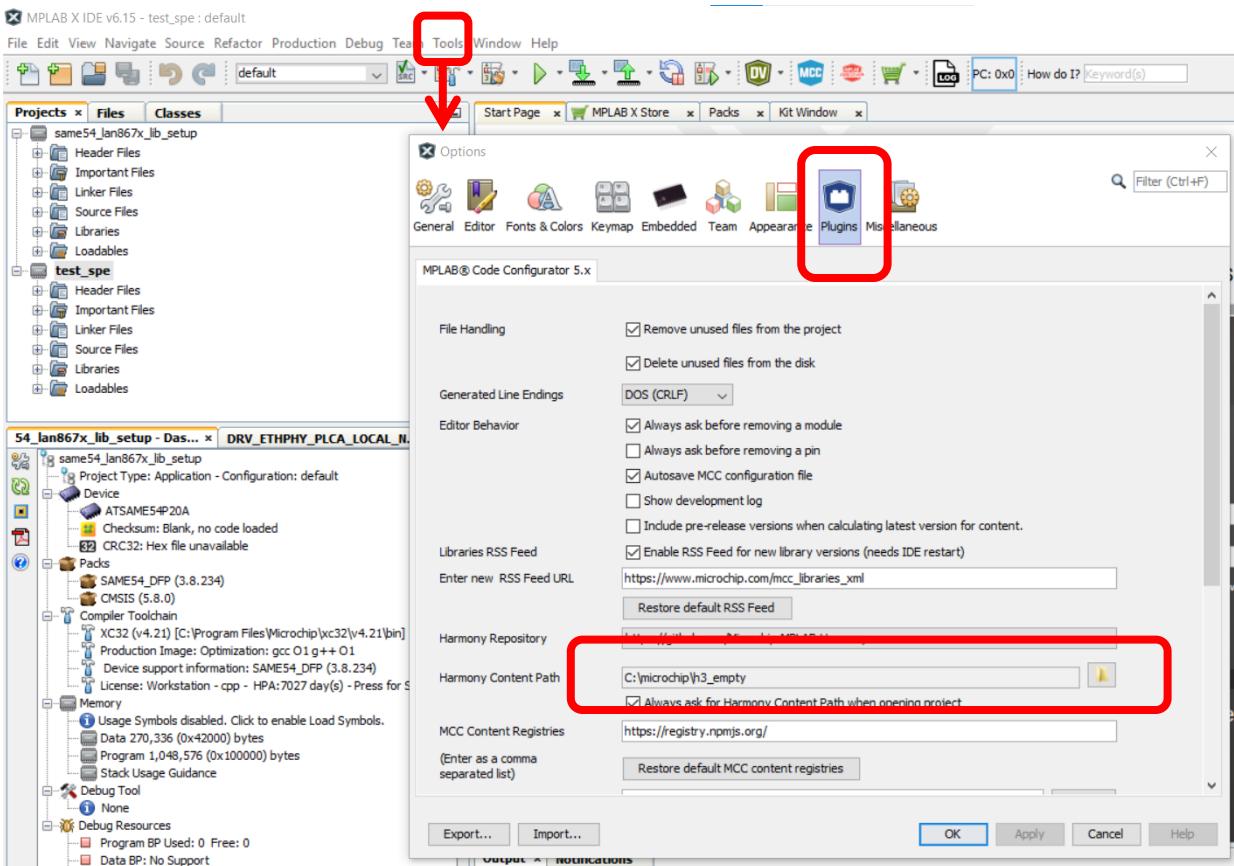
In Tools > Options, go to the Plugins tab.

If you have not used Harmony in the past:

In your Folders on your PC you need to create an empty folder where all of the harmony libraries will be downloaded to. Having created this folder, put the folder location in the **Harmony Content Path** in as shown.

If you are a Harmony user:

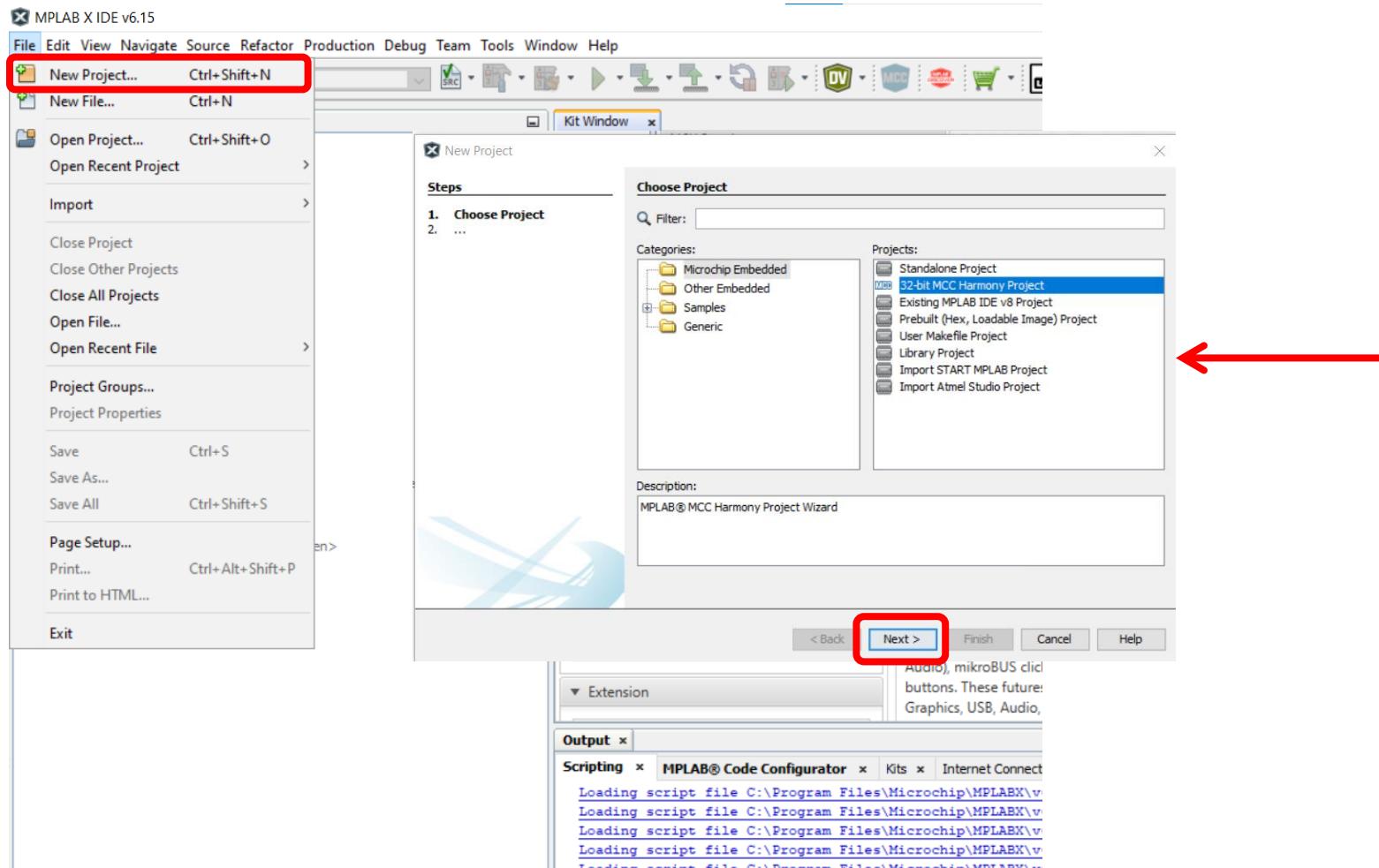
if you have used Harmony before, you will have already created a repository for all of the libraries, and you can use this same folder for the purposes of this class.



Step 3

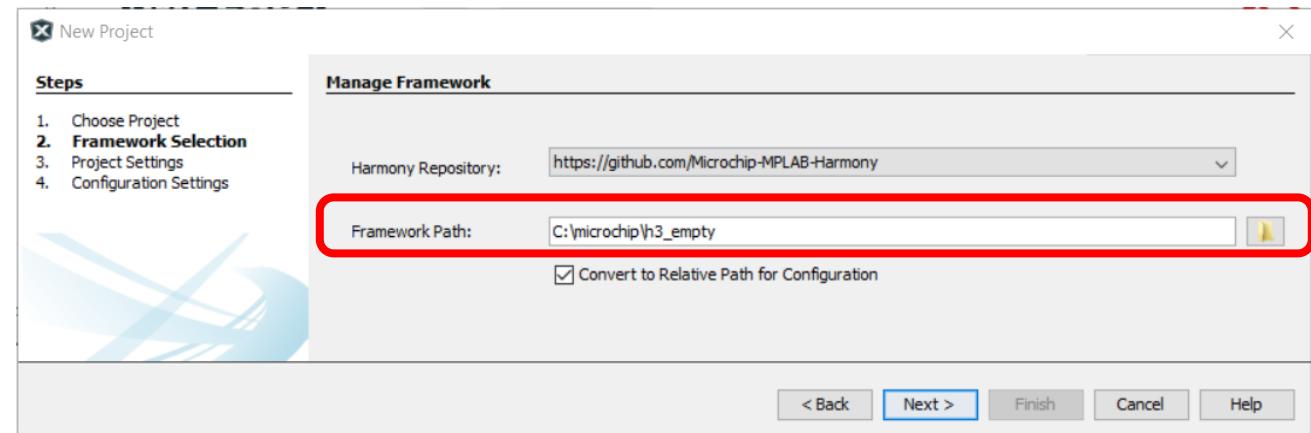
In MPLAB X, go **File > New Project...**

Select **32-bit MCC Harmony Project** and click **Next>**



Step 4

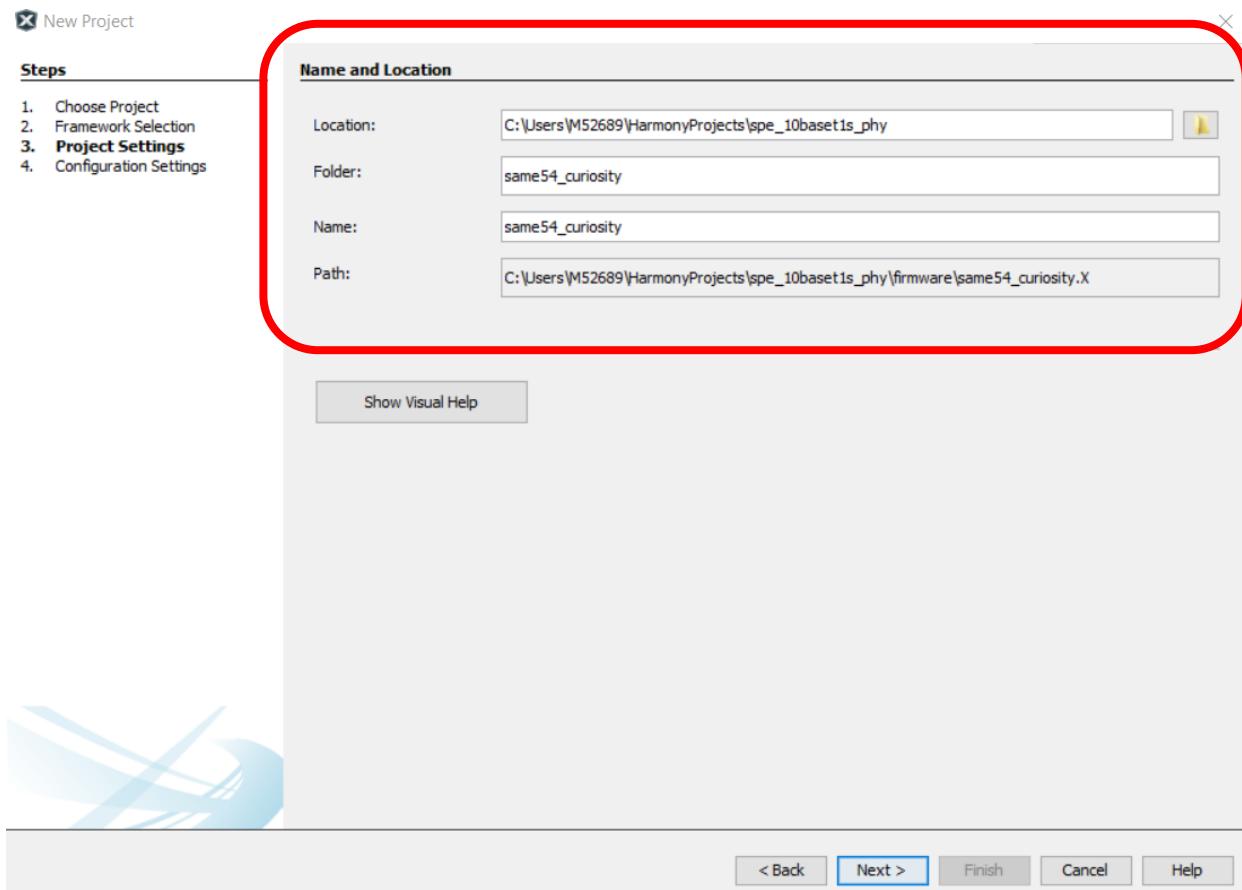
The Framework Path needs to be the same as you specified in the Tools>Options>Plugins **Harmony Content Path** in the Step 2.



Step 5

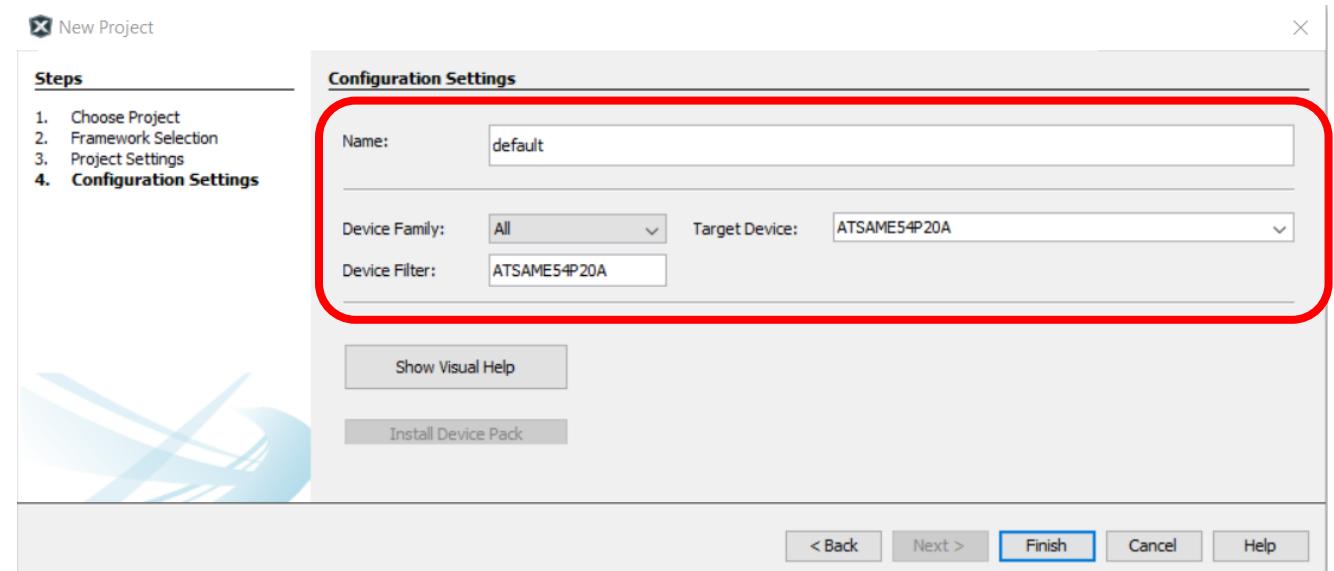
Specify the **Location**, **Folder** and **Name** of your project (Tip – Show Visual Help is useful to understand the differences between these.)

Click **Next >**.



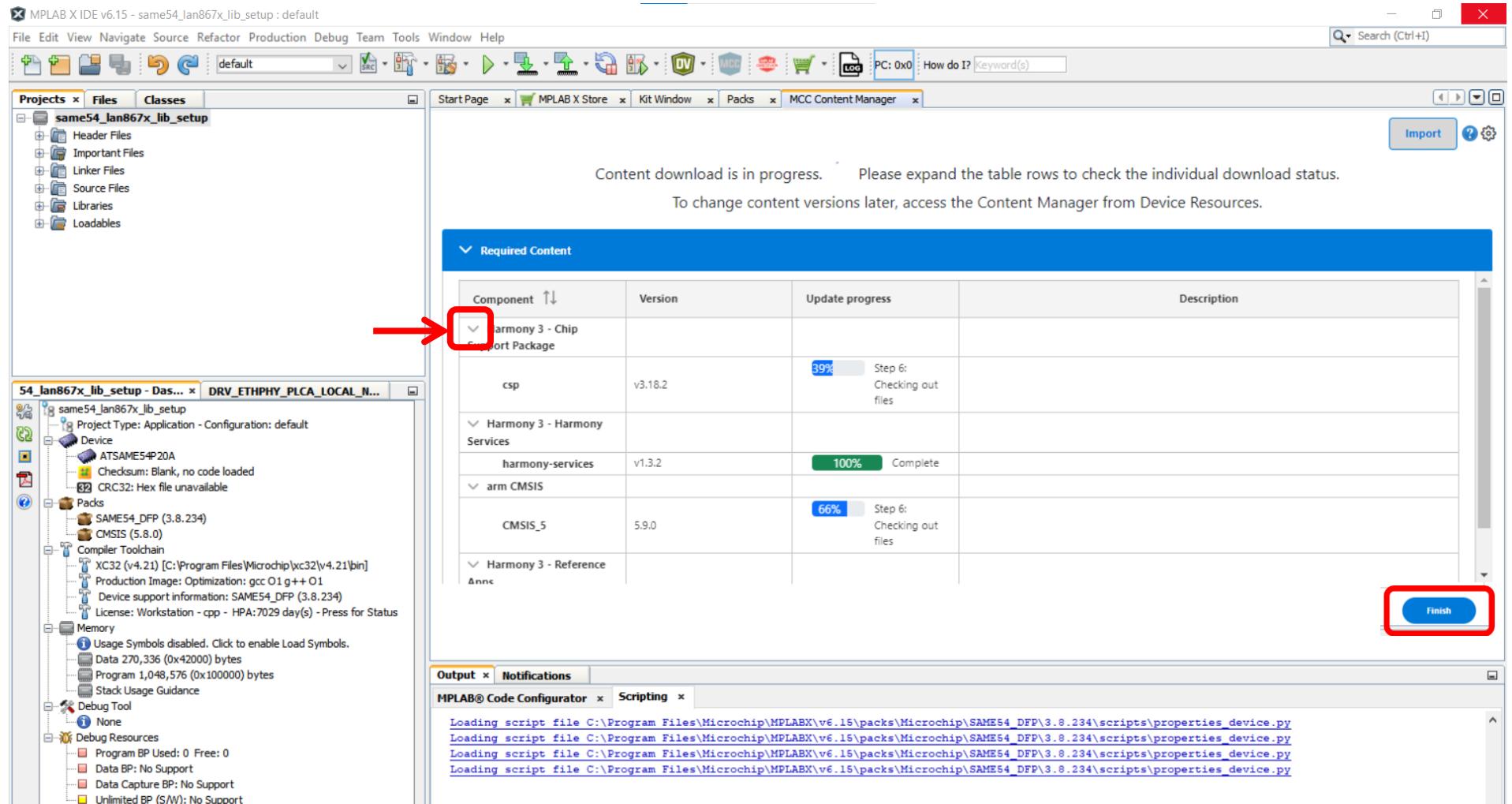
Step 6

Choose a **Configuration Name** (or leave it as **default**) and select the **Device Family** as ATSAM, and **Target Device** as ATSAME54P20A. (Tip: copy/paste ATSAME54P20A into the Device Filter and this will find the device quickly) Click **Finish**.

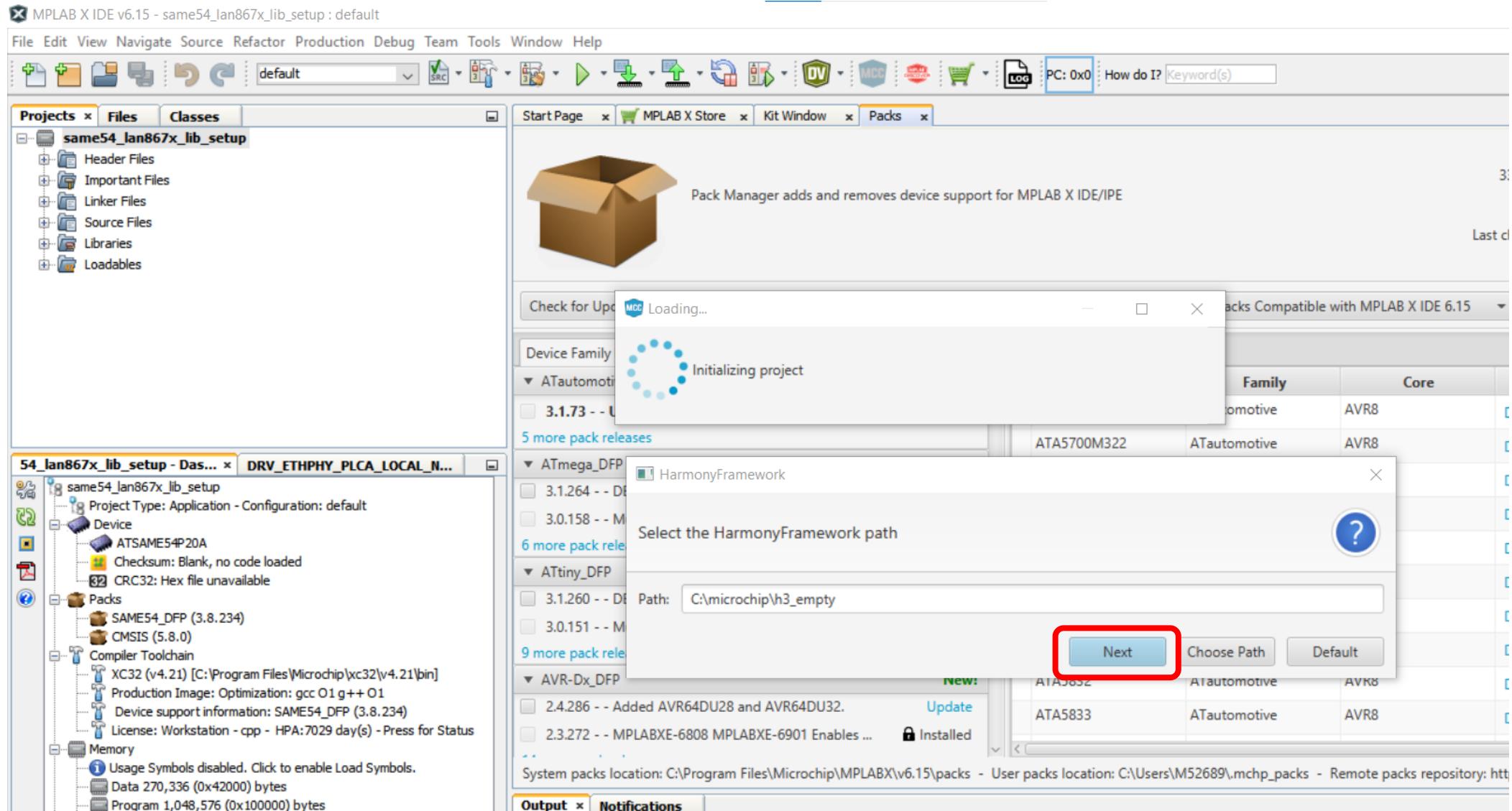


Download the Essential Libraries

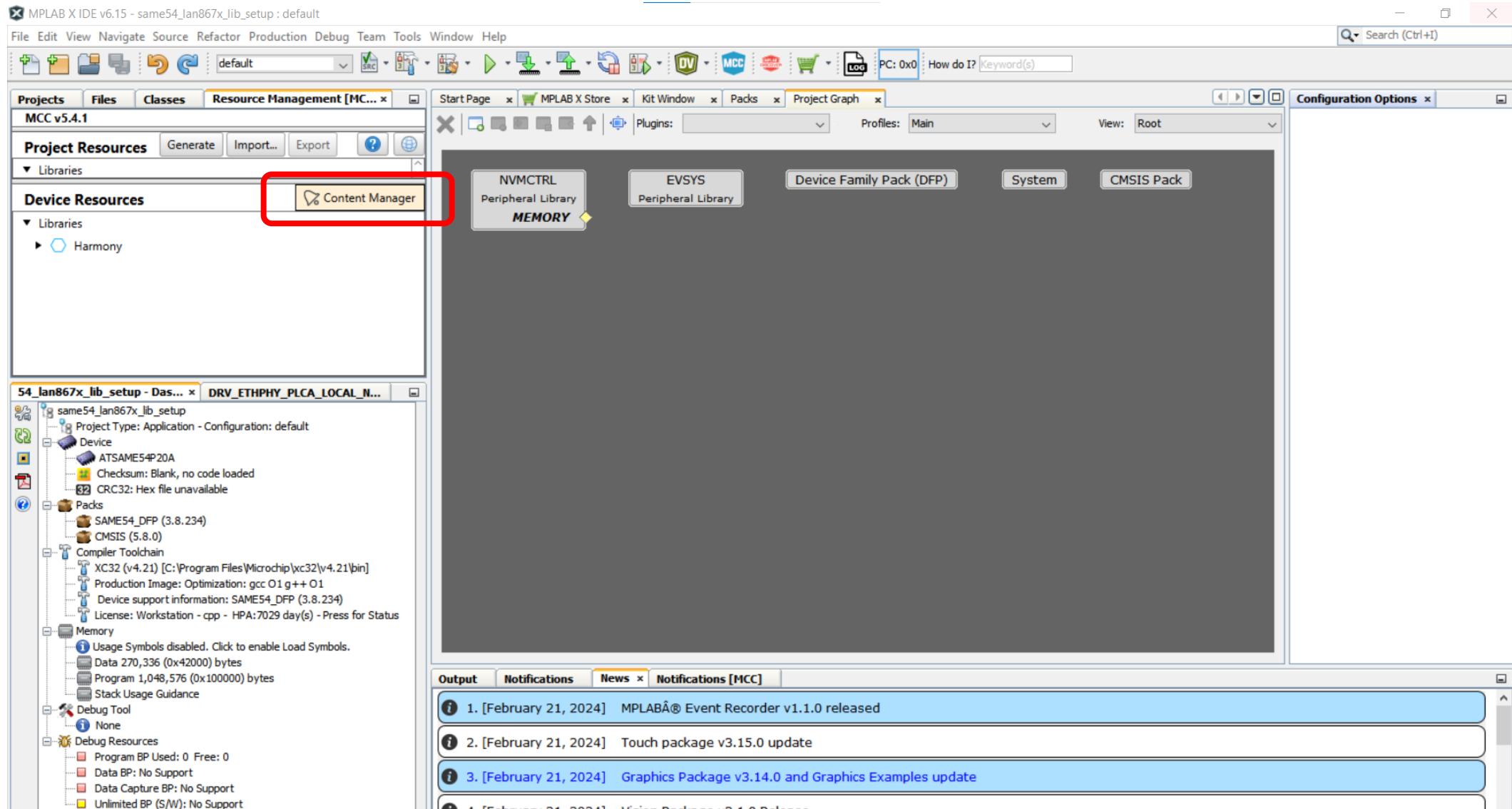
If you have not downloaded the libraries before now, you will see a window like this, and you can click **Finish** to download the essential libraries for the device you have selected to use.



Approve the Harmony Framework Path



Open the Content Manager

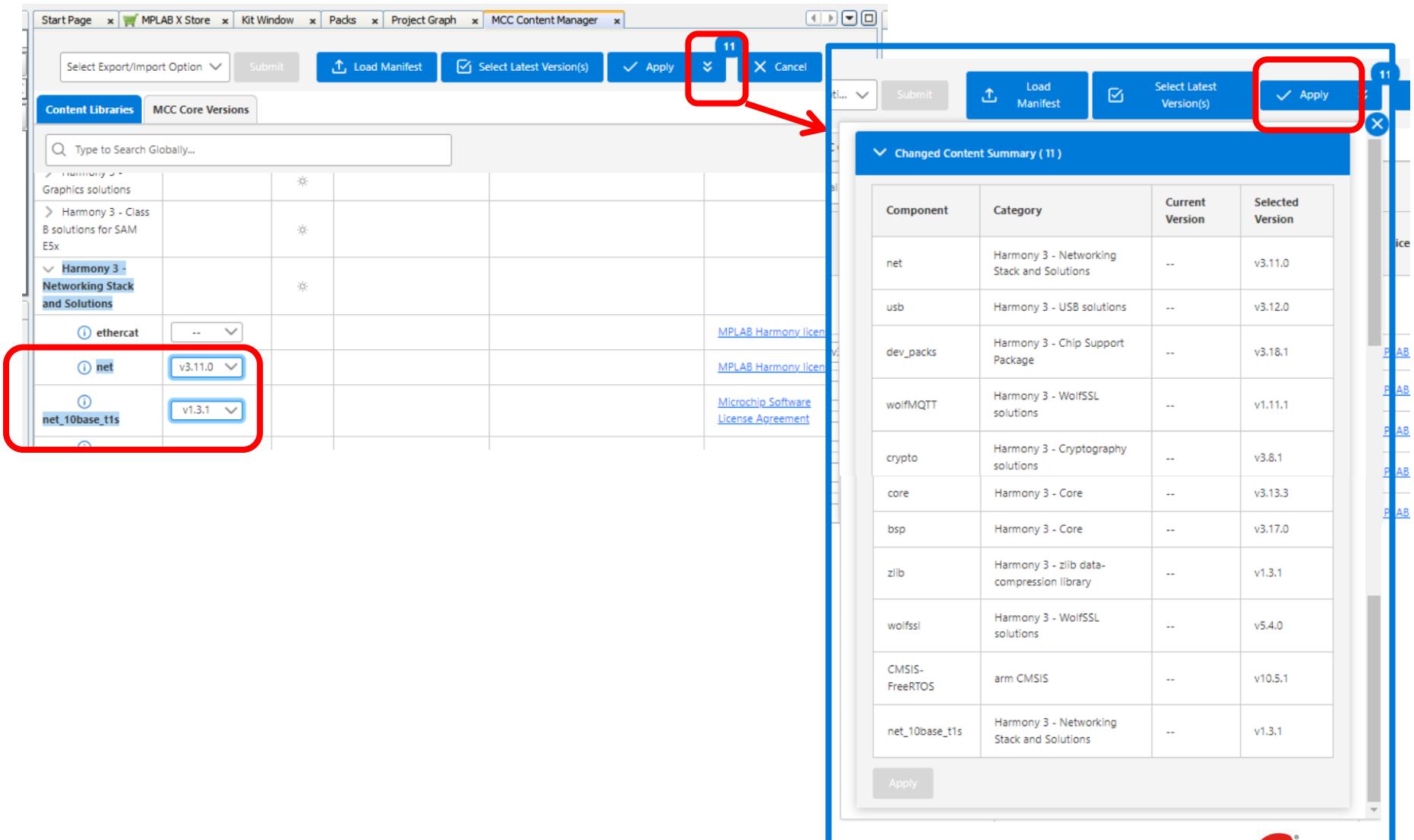


Select the Latest Versions of the Required Libraries

Select the latest versions for **net** and **net_10base_t1s** libraries.

Then you can see the libraries that these depend on – so these will be automatically included.

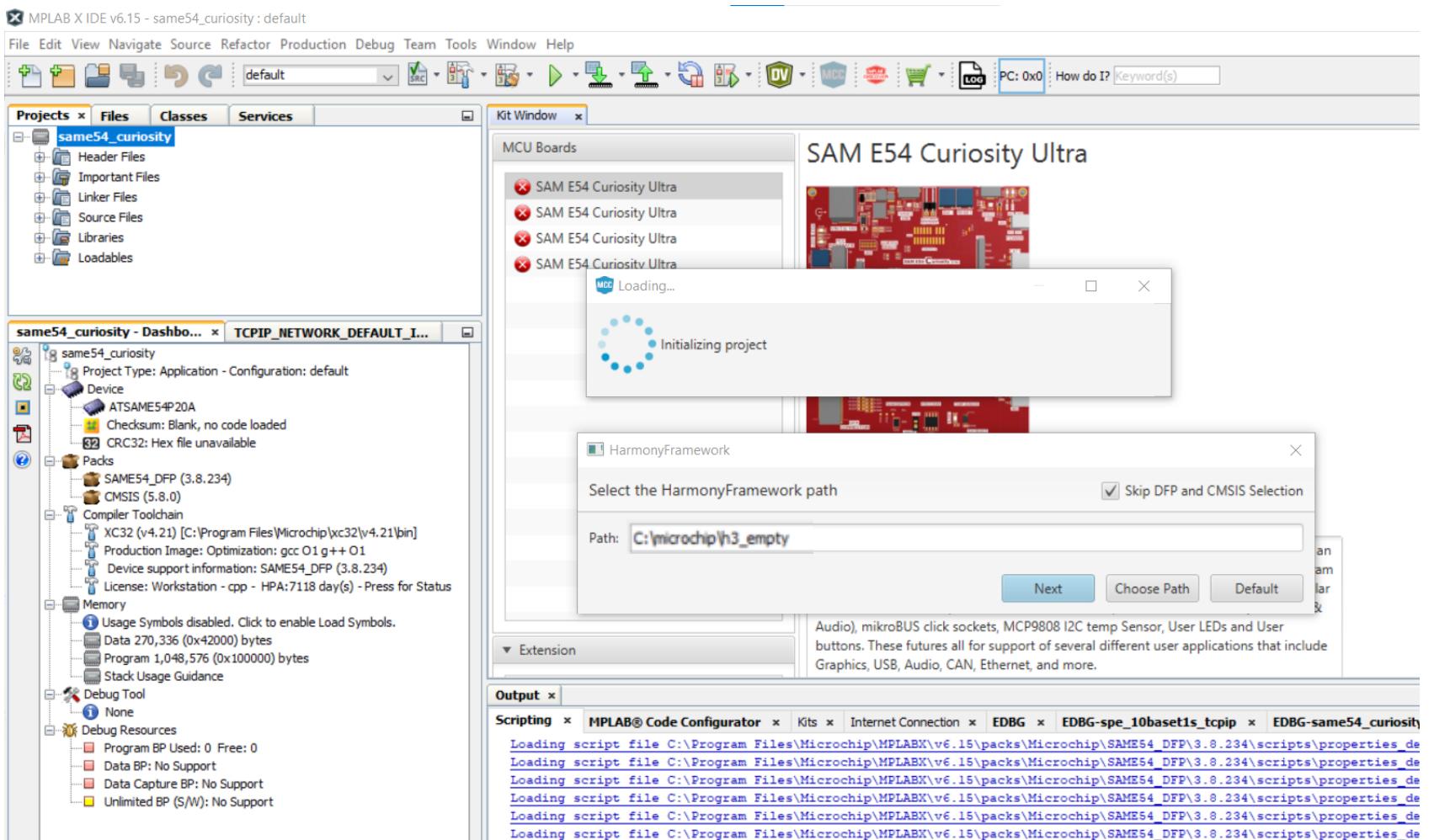
Select Apply to start the download for the libraries, this could take 30-60 minutes



Step 11

Once the libraries have downloaded, the project should open in MCC automatically. If it doesn't, then you can open MCC by clicking on the MCC button at the top of the MPLAB X window.

If the Harmony Framework path box appears, make sure that it has the same path that you specified originally for the project and for the Plugin Options in the earlier steps.

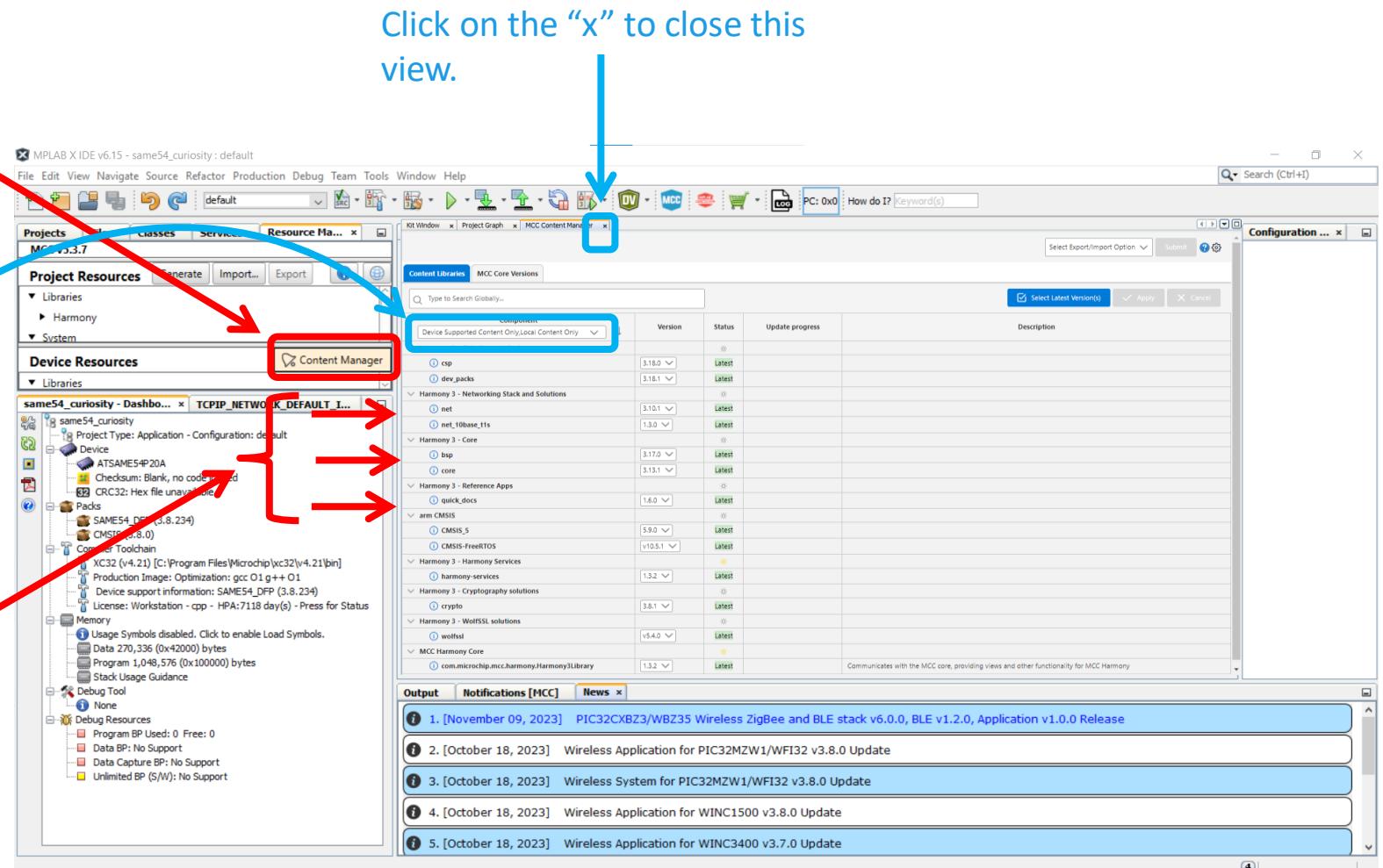


Step 12

Open the Content Manager and view the packages that have been downloaded.

Tips:

- Select **Local Content** so that you view just the libraries that you have downloaded rather than everything that was available for download
- Use the down arrows beside the package headings to view all of the packages and versions



Check the libraries that have been downloaded

The screenshot shows the MPLAB X Store interface with several panels displaying library information.

Left Panel: Shows a search bar and a table of components. A red box highlights the filter section where 'Device Supported Content Only' and 'Local Content Only' are selected. Below this, three sections are highlighted with red boxes and arrows pointing to them: 'Harmony 3 - Networking Stack and Solutions', 'Harmony 3 - USB solutions', and 'Harmony 3 - Cryptography solutions'. A tooltip 'Click To Open Release Notes' is visible over the last section.

Middle Panel: Displays a grid of Harmony 3 components. It includes:

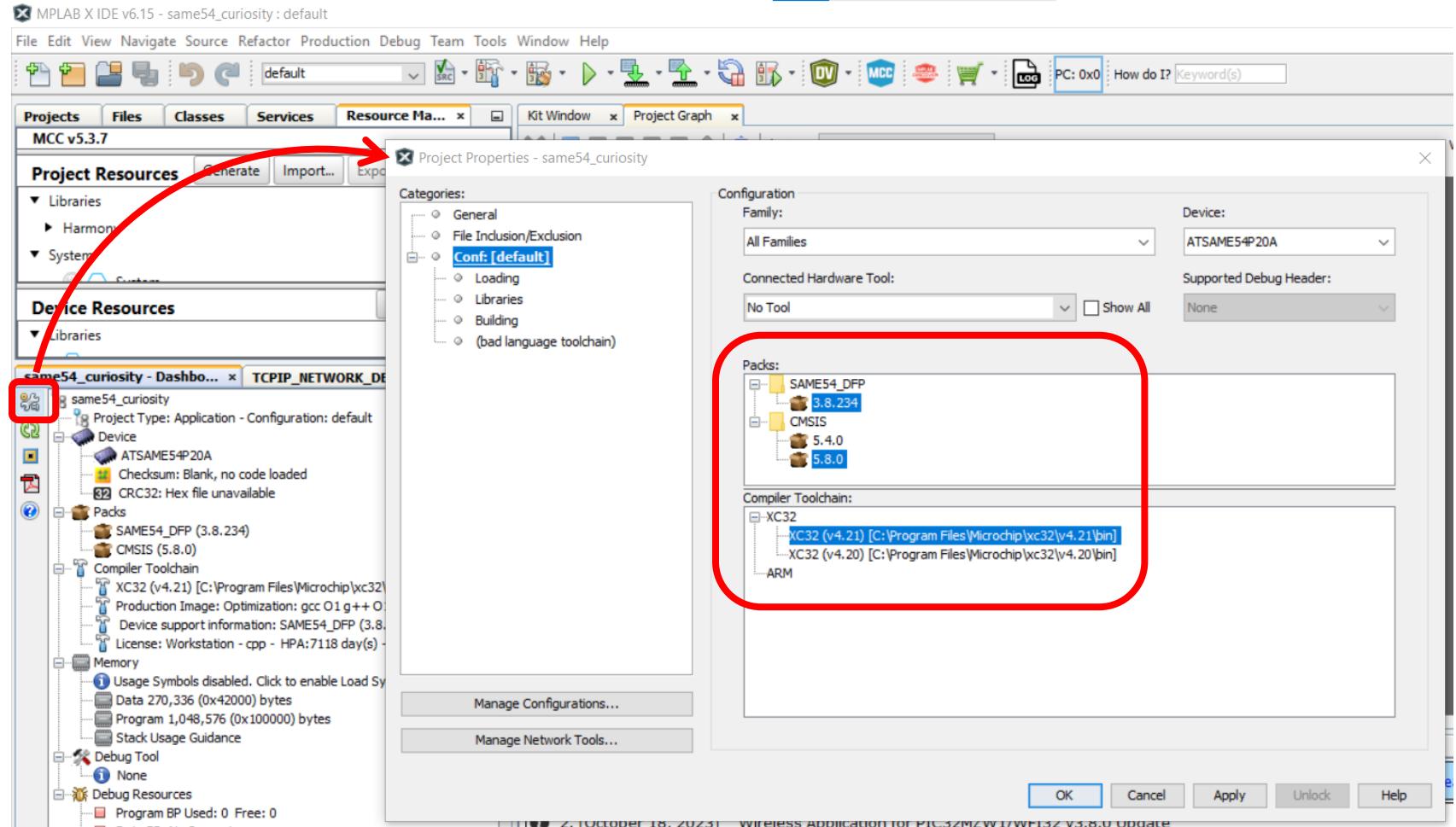
- Harmony 3 - Cryptography solutions:** crypto (v3.8.1, Latest)
- Harmony 3 - Core:** bsp (v3.17.0, Latest), core (v3.13.3, Latest)
- Harmony 3 - Reference Apps:** quick_docs (v1.6.0, Latest)
- arm CMSIS:** CMSIS_5 (5.9.0, Latest), CMSIS-FreeRTOS (v10.5.1, Latest)
- Harmony 3 - Harmony Services:** harmony-services (v1.3.2, Latest)

Right Panel: Displays a grid of MCC Harmony Core components. It includes:

- Harmony 3 - WolfSSL solutions:** wolfMQTT (v1.11.1, Latest), wolfssl (v5.4.0, Latest)
- MCC Harmony Core:** com.microchip.mcc.har (1.4.1, Latest)
- Harmony 3 - zlib data-compression library:** zlib (v1.3.1, Latest)

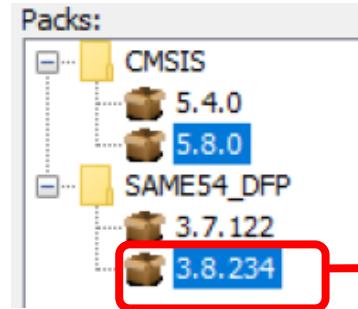
Step 13

Check that you have the most up-to-date Device Pack and that your XC32 compiler is included in the project. To do this, open the Project Properties and view the Packs and Compiler Toolchain.

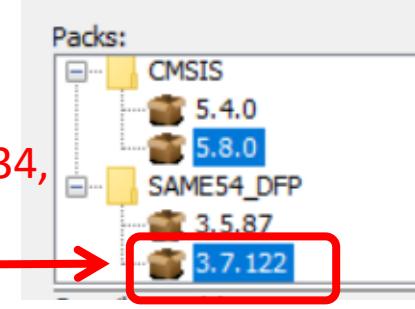


Step 13 (contd) Device Pack Update

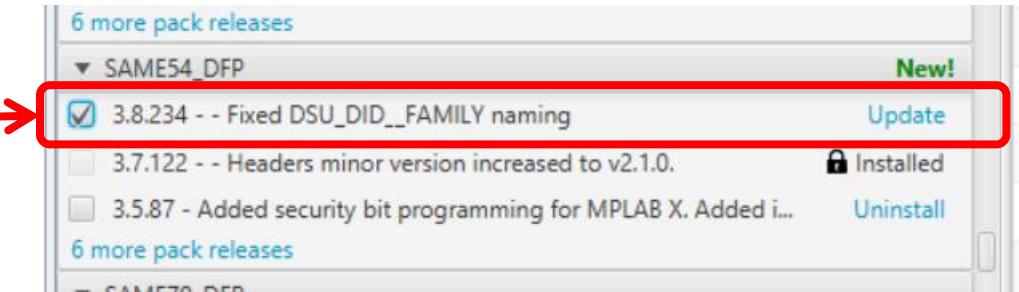
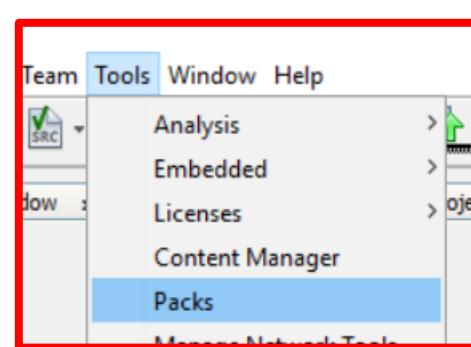
If you don't have the most up-to-date Device Pack installed, here is how to update it:



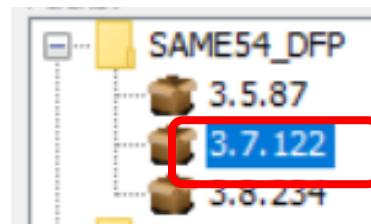
For example, if instead of 3.8.234, you have 3.7.122



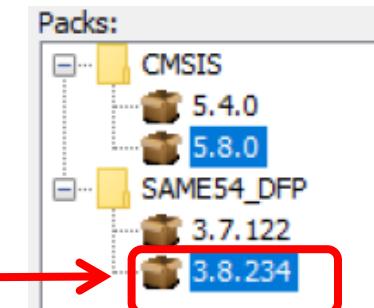
Go to Tools > Packs and search for "SAME54_DFP" and select the most recent version, and Update



Afterwards, change the version in the Project Properties



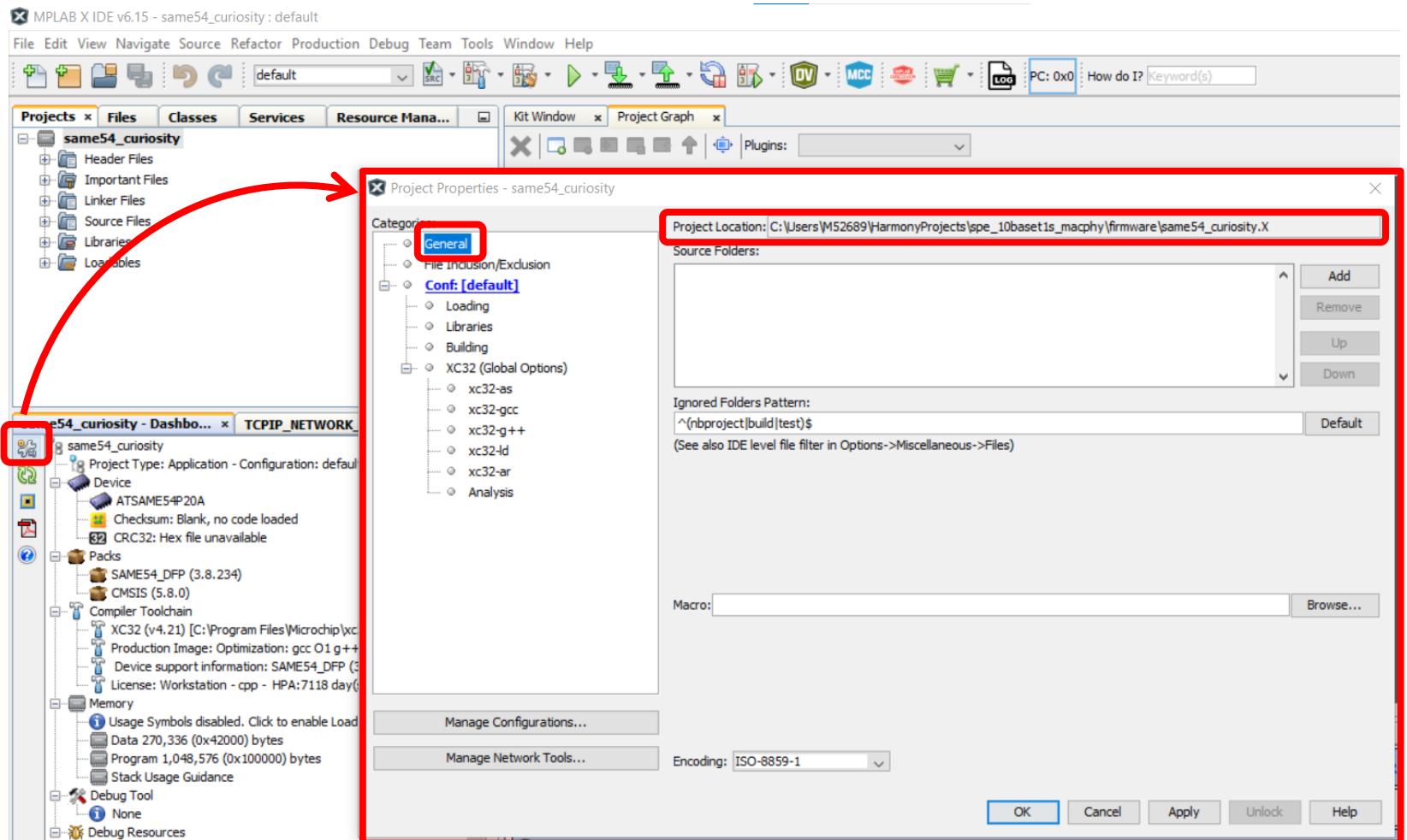
Open Project Properties to change the version



Step 14

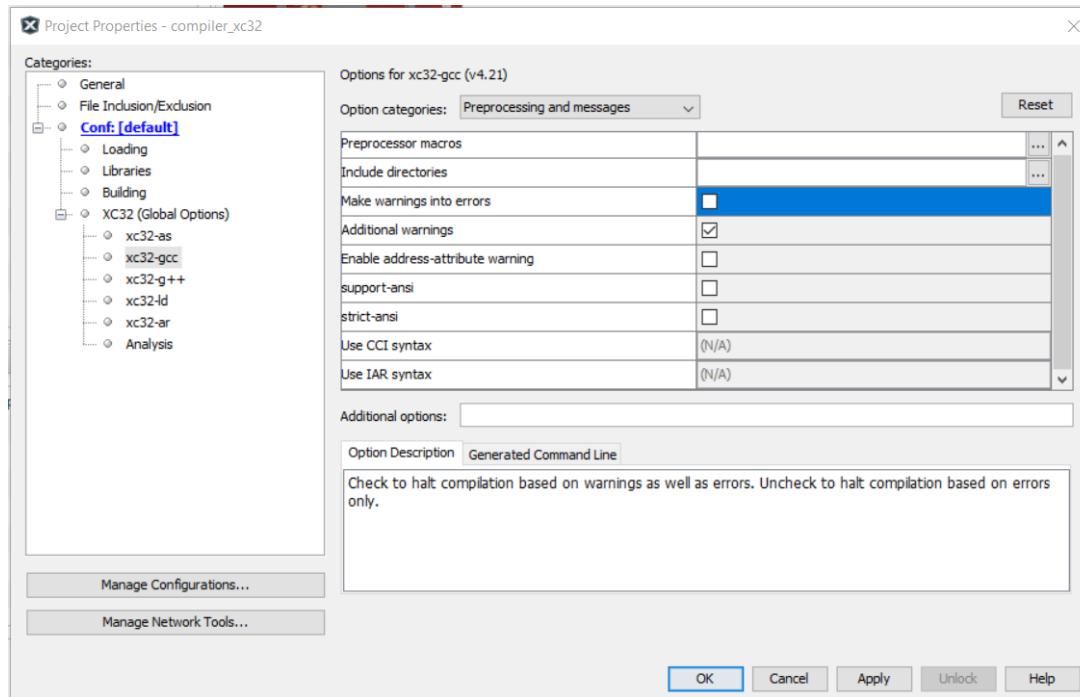
Now you are all set!
Take note of the location
of your project, you can
do this by opening the
Project Properties and
going to the General
category, and viewing
the Project Location.

You will be able to close
the project now, and re-
open when you need it.

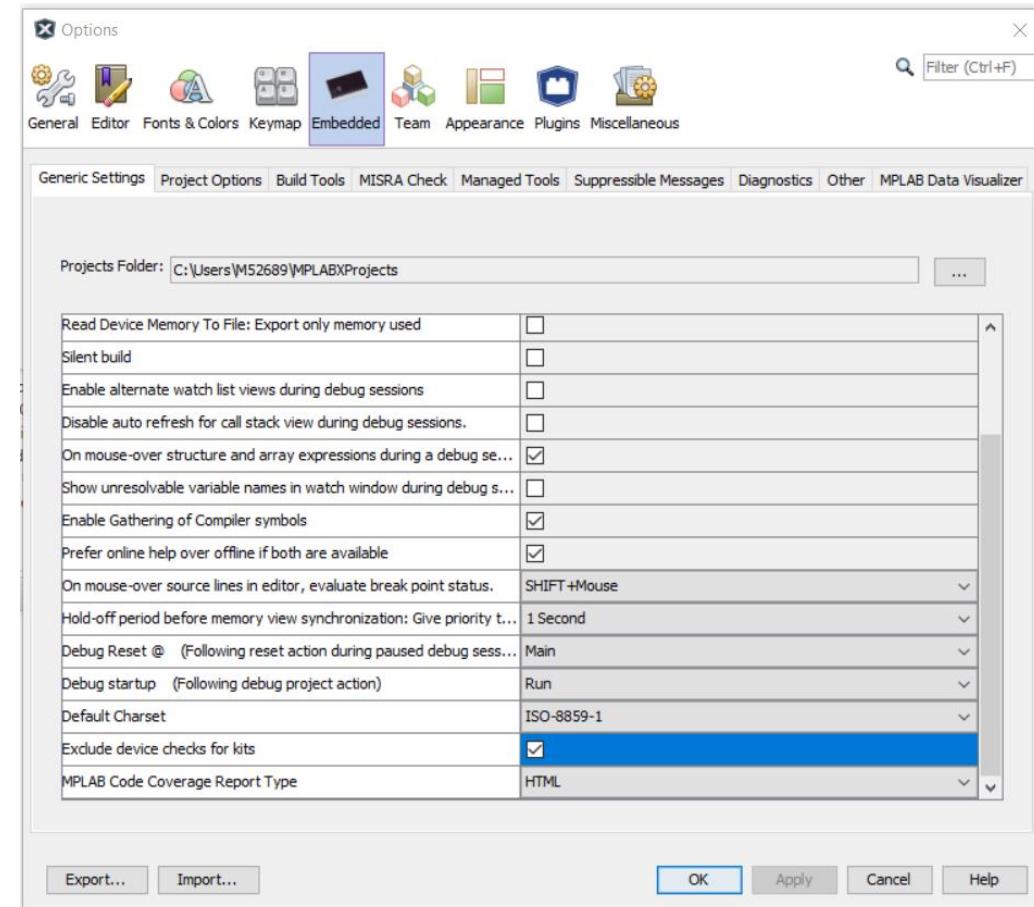


Additional settings that could cause problems!

In Project Properties, uncheck “Make warnings into errors”



In Options > Embedded, check “Exclude device checks for kits”



Useful Links and References

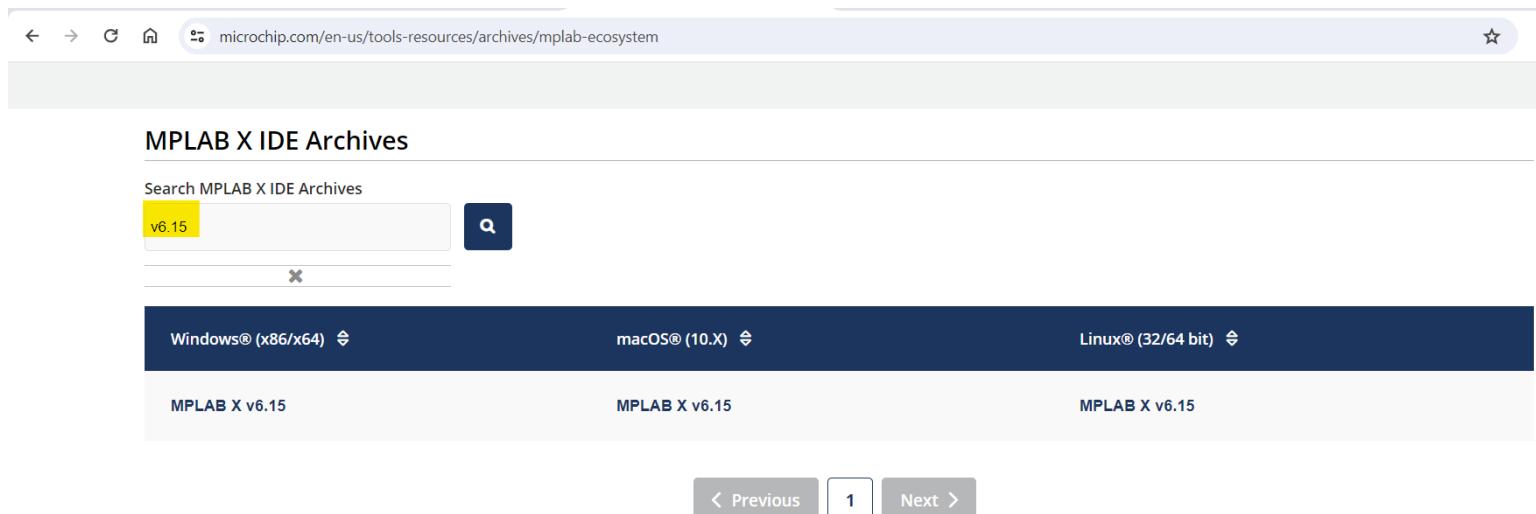
For more information...

- **For installing the necessary software, see:**

- These applications can now be downloaded from here:

<https://www.microchip.com/en-us/tools-resources/develop>

- Make sure to download XC32 Compiler version 4.21 or later (this demo uses 4.21), as well as **MPLAB X v6.15**.
- **MPLAB X v6.15** is available here: <https://www.microchip.com/en-us/tools-resources/archives/mplab-ecosystem>:



Demo Project

- There is a demo project checked into the Github Harmony repository that you will have downloaded already in the net_10base_t1s library as part of the Optional Packages list during the project setup
- Use File > Open Project and navigate to this library, and choose from the freertos or non-freertos versions
 - Note: in order to generate and compile these projects, you will still need to have downloaded the necessary packages as described in the project setup

