OTA Upgrading Worksheet

In this worksheet we provide a step-by-step guide to create, build and run Z3GatewayHost sample and ZigbeeMinimal applications based on EmberZNet Stack 6.6.4. If you use a later release in the future, most of the instructions should still apply, although there could be minor differences not foreseen at the time of this document.

These exercises help you get familiar with ZigBee 3.0 in the EmberZNet Stack, Simplicity Studio v4 development environment, and the Wireless Start Kit (WSTK) with EFR32MG modules. We assume that you have a WSTK and the following software requirements:
- Simplicity Studio 4
- EmberZNet 6.6.4
- GCC 7.2

1 Pre-requisites

Make sure you have installed the EmberZnet 6.6.4 SDK and GCC toolchain on your PC.

1.1 Check EmberZnet SDK

1. Launch Simplicity Studio v4.
2. "Windows"→"Preference"→"Simplicity Studio"→"SDKs", make sure "EmberZnet 6.6.4" is installed
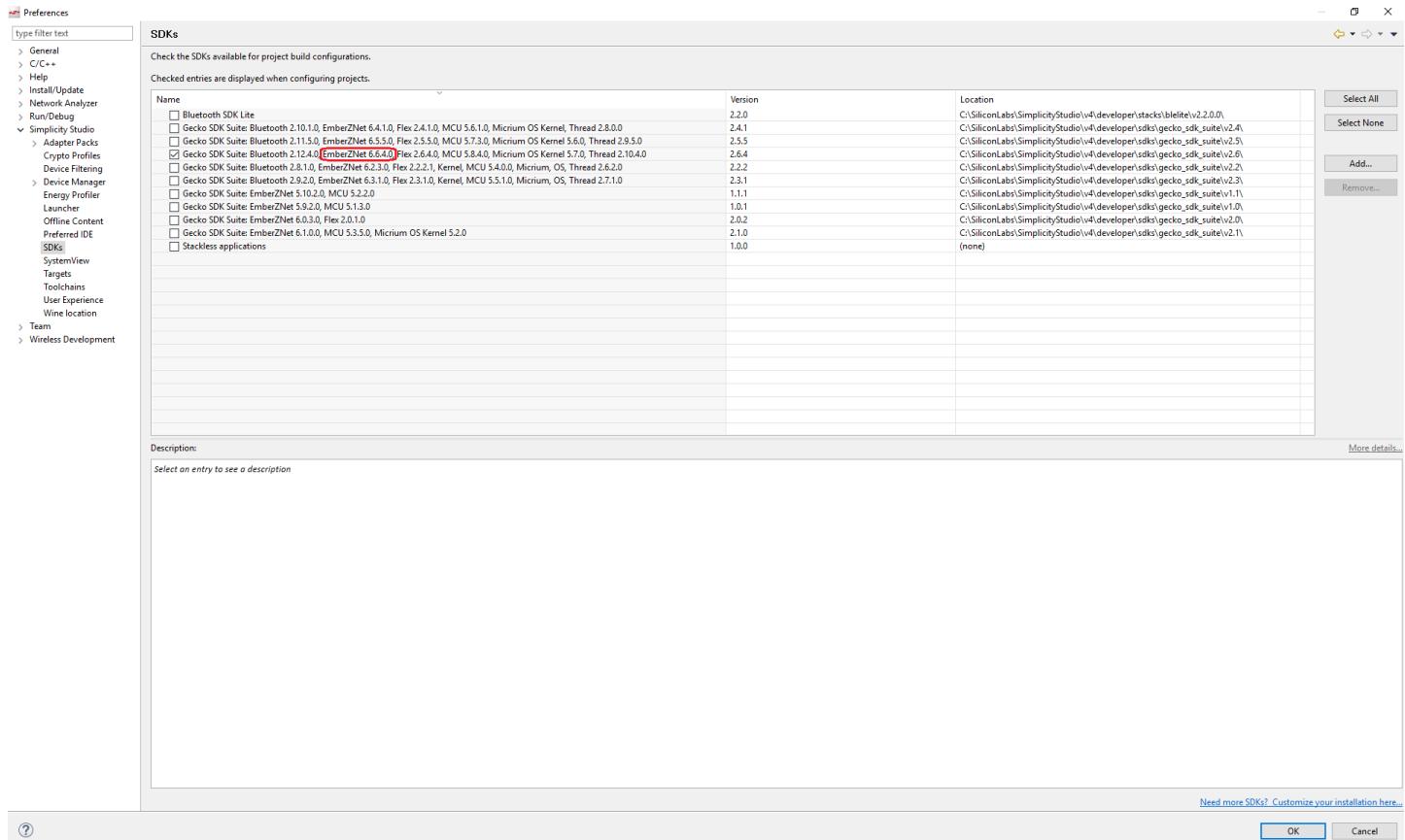

Figure 1 Check SDK in Simplicity Studio

1.2 Check Toolchains

1. Launch Simplicity Studio v4.
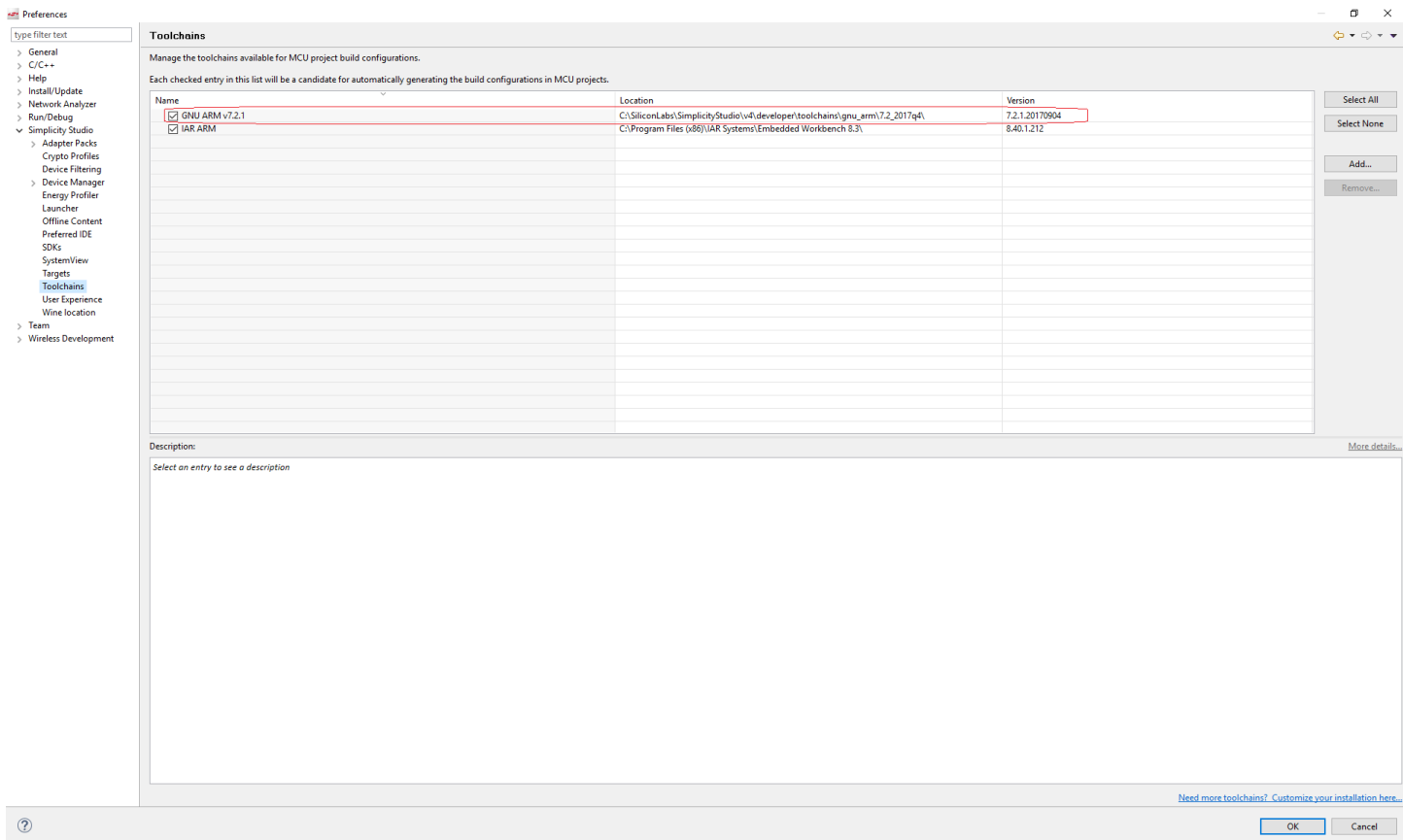2. "Windows"→"Preference"→"Simplicity Studio"→"Toolchains", make sure GCC toolchain is installed.

Figure 2 Check Toolchain in Simplicity Studio

1.3   Install the software tools:

1. Cygwin;

Extract the package cygwinx86.rar and copy it to the root directory of disk C.

You can also extract the package cygwinx86.rar to other location as long as there is only ASCII characters in the path. In this case you will need to modify the file "cygwin_here.reg" and modify the path according to your location.

```
Windows Registry Editor Version 5.00

[HKEY_CLASSES_ROOT\Folder\shell\open_cygwin]
@="Open Cygwin Here"

[HKEY_CLASSES_ROOT\Folder\shell\open_cygwin\command]
@="C:\\cygwinx86\\bin\\mintty.exe /bin/sh -lc 'cd \"`cygpath \"%V\"`\"; bash'"

[HKEY_CLASSES_ROOT\Directory\Background\shell\open_cygwin]
@="Open Cygwin Here"

[HKEY_CLASSES_ROOT\Directory\Background\shell\open_cygwin\command]
@="C:\\cygwinx86\\bin\\mintty.exe /bin/sh -lc 'cd \"`cygpath \"%V\"`\"; bash'"
```

Double click "cygwin_here.reg" then select a folder and right click, check if there is a menu to start Cygwin in this folder.
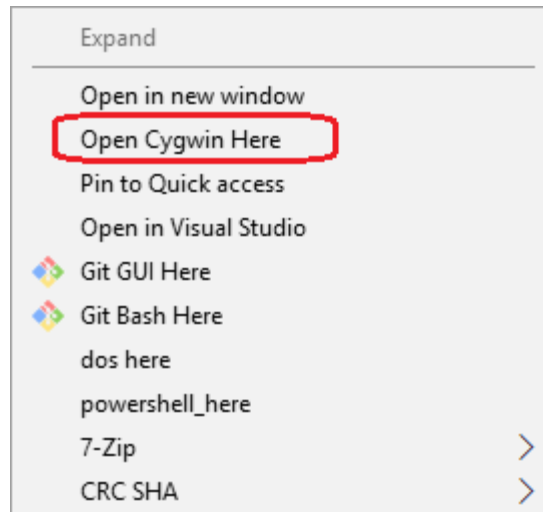
Figure 3 Right-click menu to start cygwin

1.4   How to flash the program
1. Start Simplicity Studio, then connect your device to PC;

2. In the menu bar, find the icon [icon] for "Flash Programmer", press it;
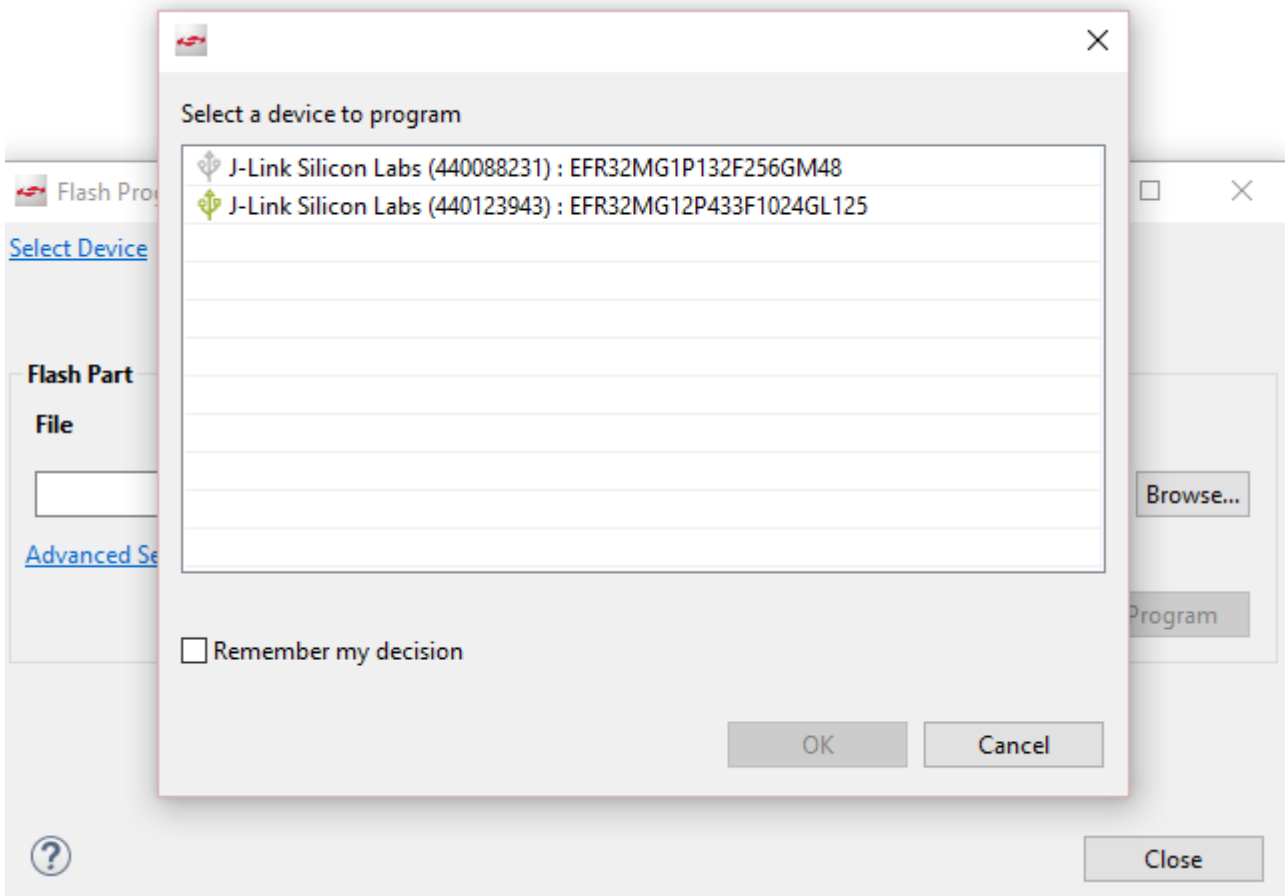3. In the popup window, select the device;

Figure 4 Select device

4. Then in the next window, click "browse" to select the generated image (.s37 or .hex) of your project, press "Program". You can also press "erase" if needed. Normally you just need to erase the device once before when you start the hands-on. The generated image is in the binary folder of your project. You can select it in "Project Explorer".
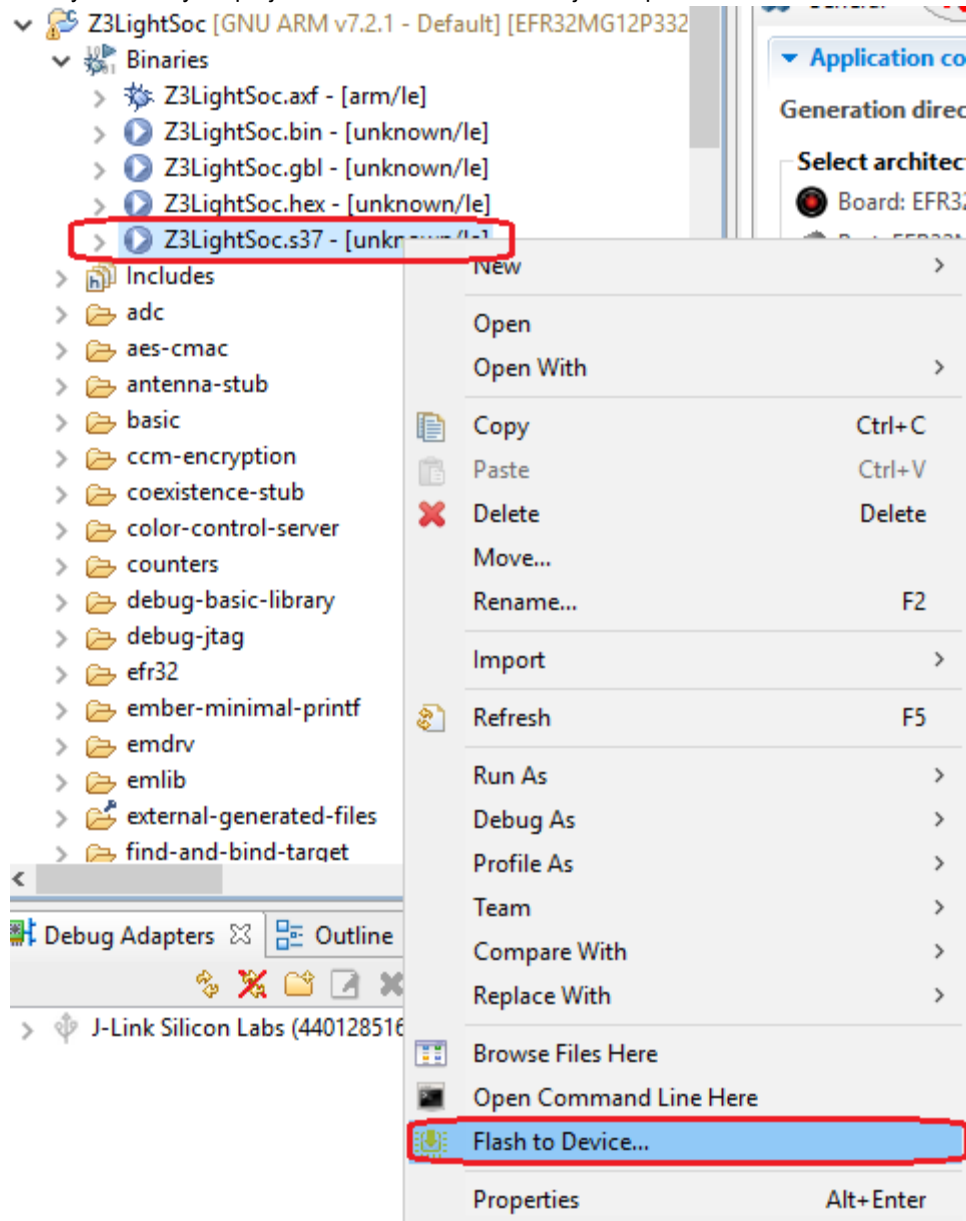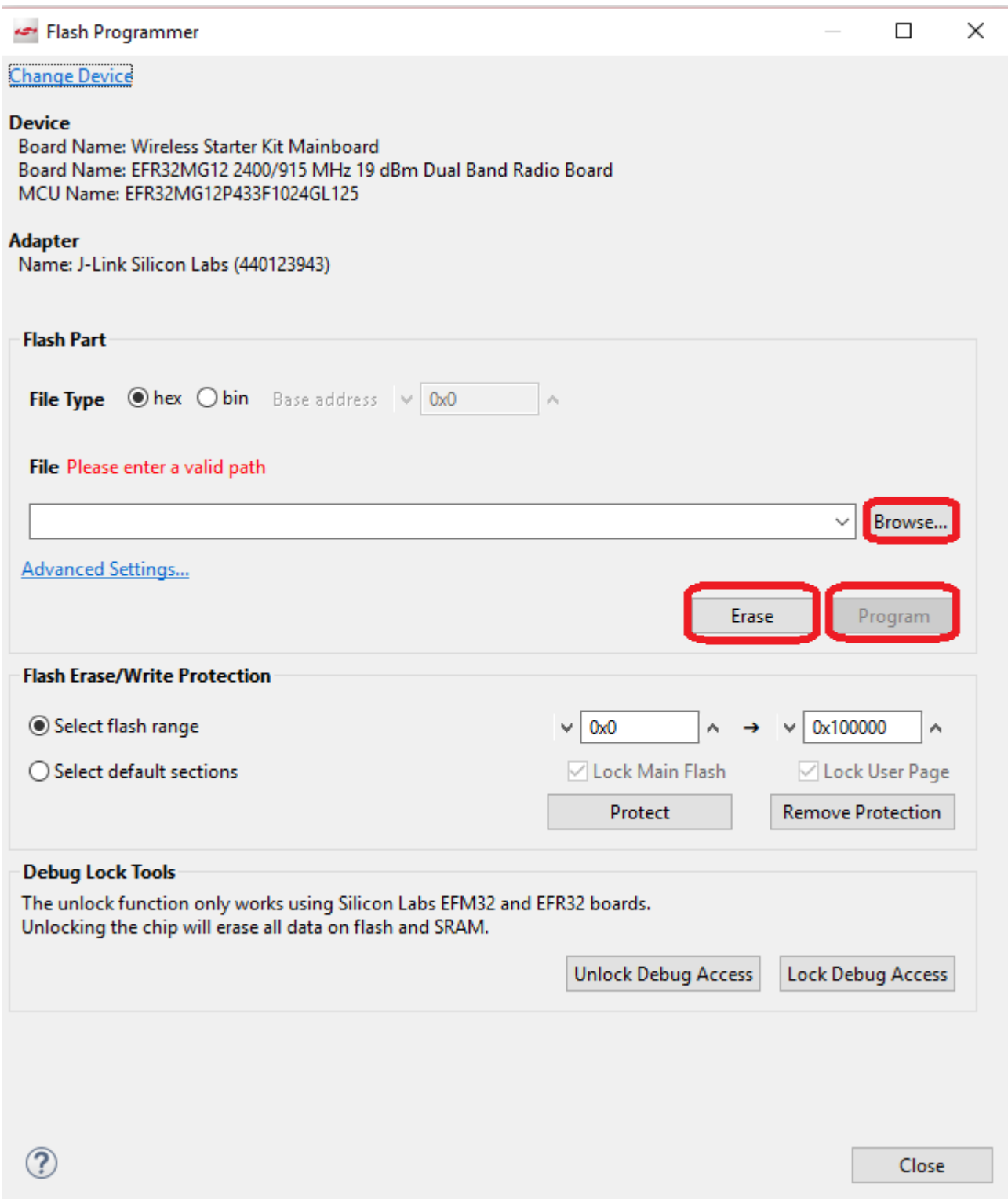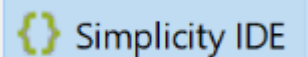

Figure 5 Select image

Figure 6 Flash application

1.5 How to open console

Simplicity Studio has integrated a console so that it's convenient to debug through console. To use the console, you need:

1. Change to "Simplicity IDE" perspective ![Simplicity IDE]:
2. Select your adapter in the "Debug Adapters" window, right click and select "connect";

3. Select your adapter in the "Debug Adapters" window, right click and select "Launch console";
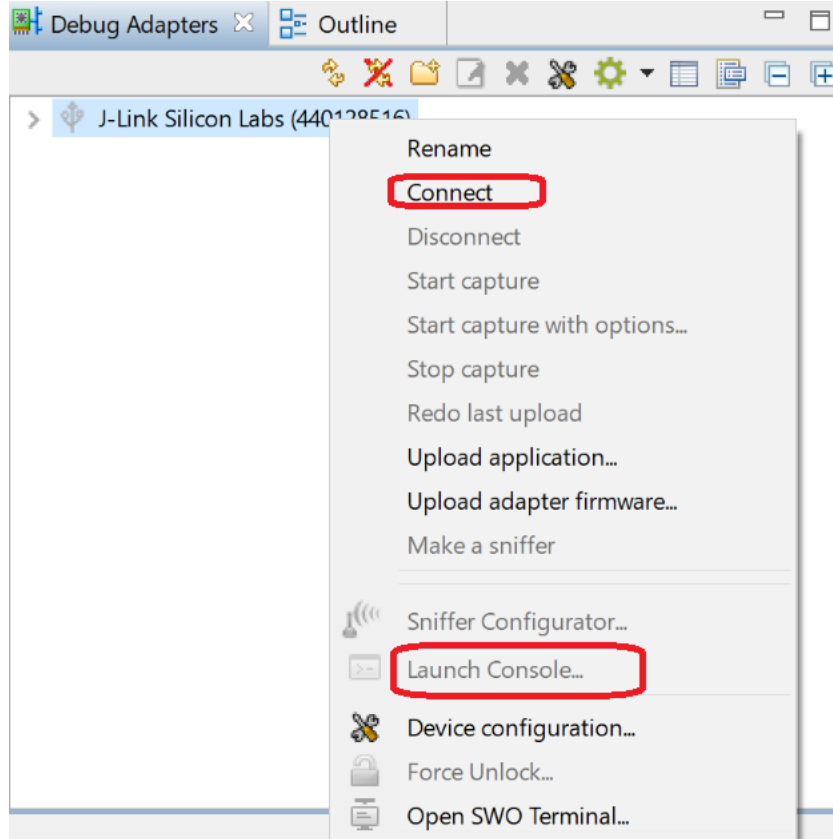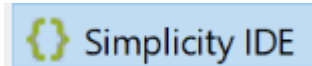

Figure 7 Launch console

1.6   How to start Capture

1. Change to "Simplicity IDE" perspective [Simplicity IDE] :
2. Select your adapter in the "Debug Adapters" window, right click and select "connect";
3. Select your adapter in the "Debug Adapters" window, right click and select "Start Capture";
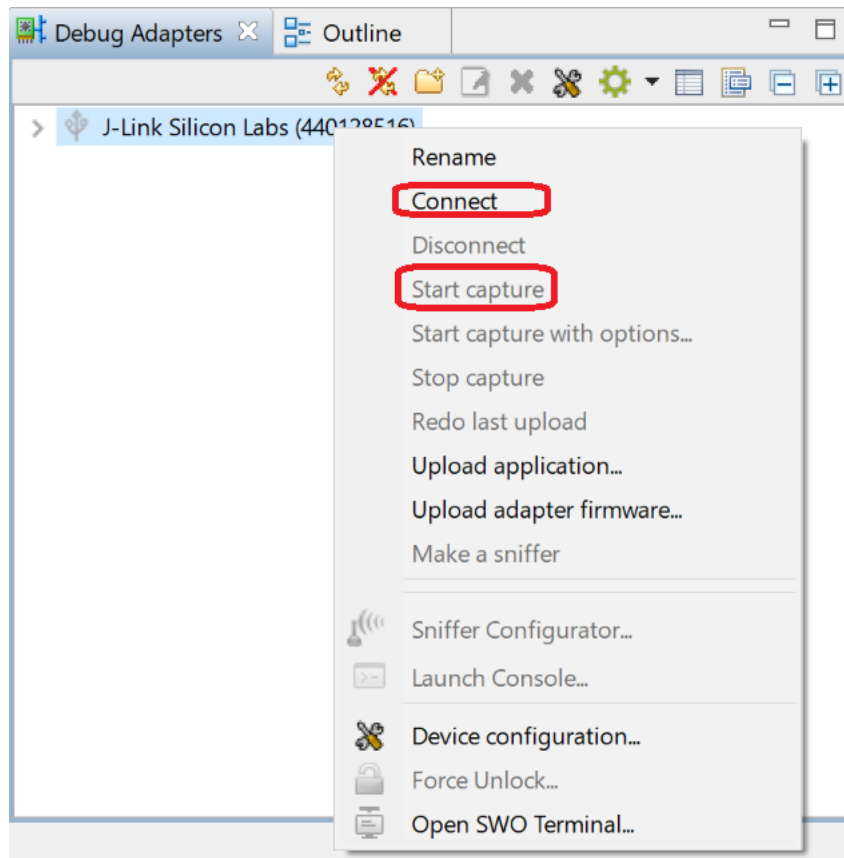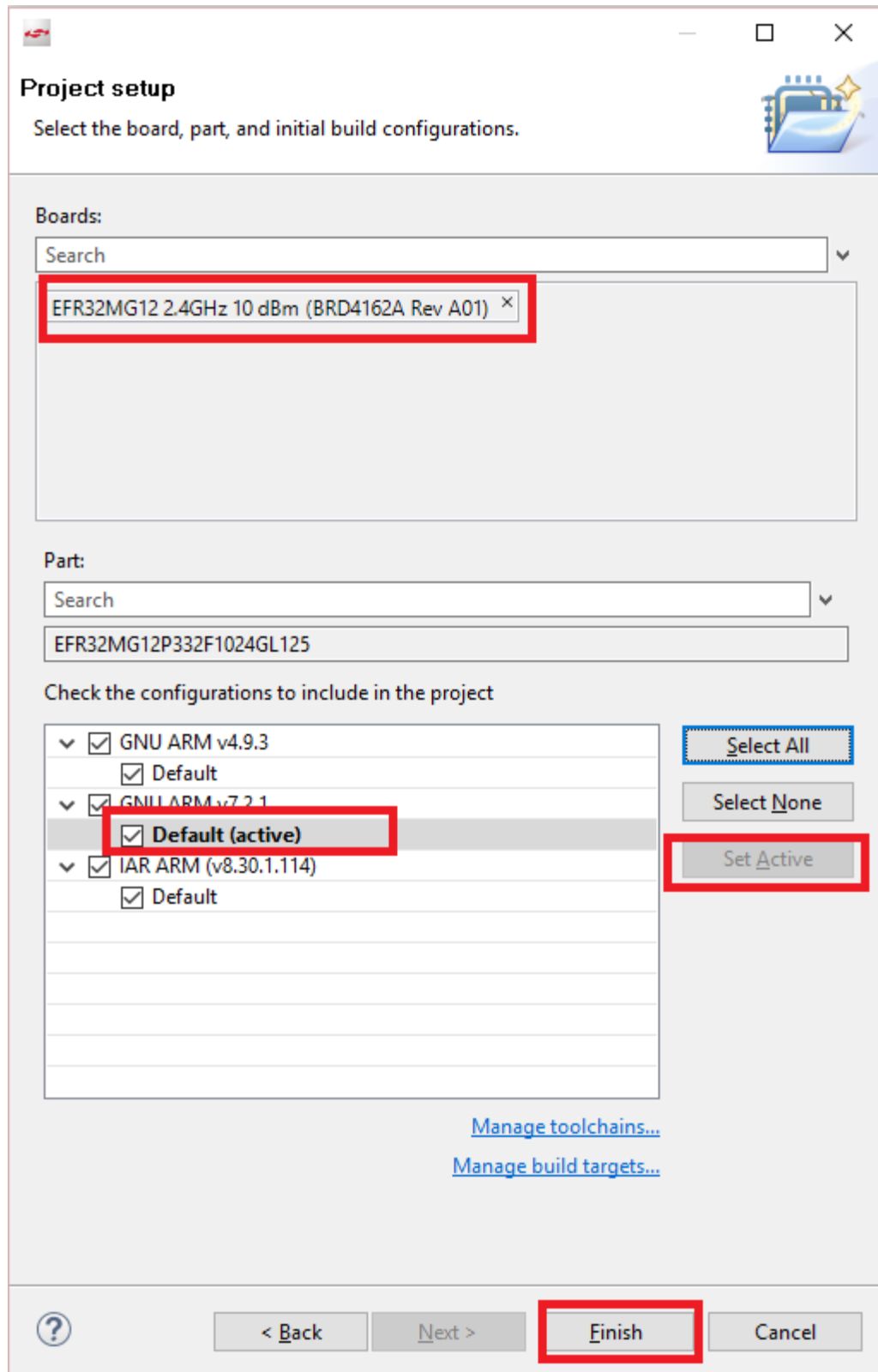
Figure 8 Start Capture

2   Build the bootloader for OTA client

1. Go to File -> New -> Project. This will bring up the New Project Wizard
2. Select "Silicon Labs AppBuilder Project". Click Next.
3. Select "Gecko Bootloader". Click Next.
4. Select the latest version. (Gecko Bootloader 1.9.2). Click Next.
5. Select "SPI Flash Storage Bootloader (single image)". Click Next.
6. Name your project (Whatever name you want). Click Next.
7. Select board and compiler. Then finish.

Figure 9 Select board and compiler

8. The new project should have been created now, with the project configuration file (an .isc file) open.
9. Click "**Generate**". Notice the project files appearing in Project Explorer. A window saying Generation successful will appear. Click OK.

10. Select the project in Project Explorer window and compile your project by clicking on the Build icon 🔨 . Ensure that the build completes with 0 errors.

3   Build the old version client image

1. Go to File -> New -> Project. This will bring up the New Project Wizard
2. Select "Silicon Labs AppBuilder Project". Click Next.
3. Select "Silicon Labs Zigbee". Click Next.
4. Select our latest EmberZNet stack for Soc (in this case EmberZNet 6.6.4 GA Soc). Click Next.
5. Select "ZigbeeMinimal". Click Next.
6. Name your project, such as "Client". Click Next.
7. In next window (Project Setup), select board to BRD4162A, and compiler to "GCC v7.2" (If you don't have it, please install any other). Click Finish.
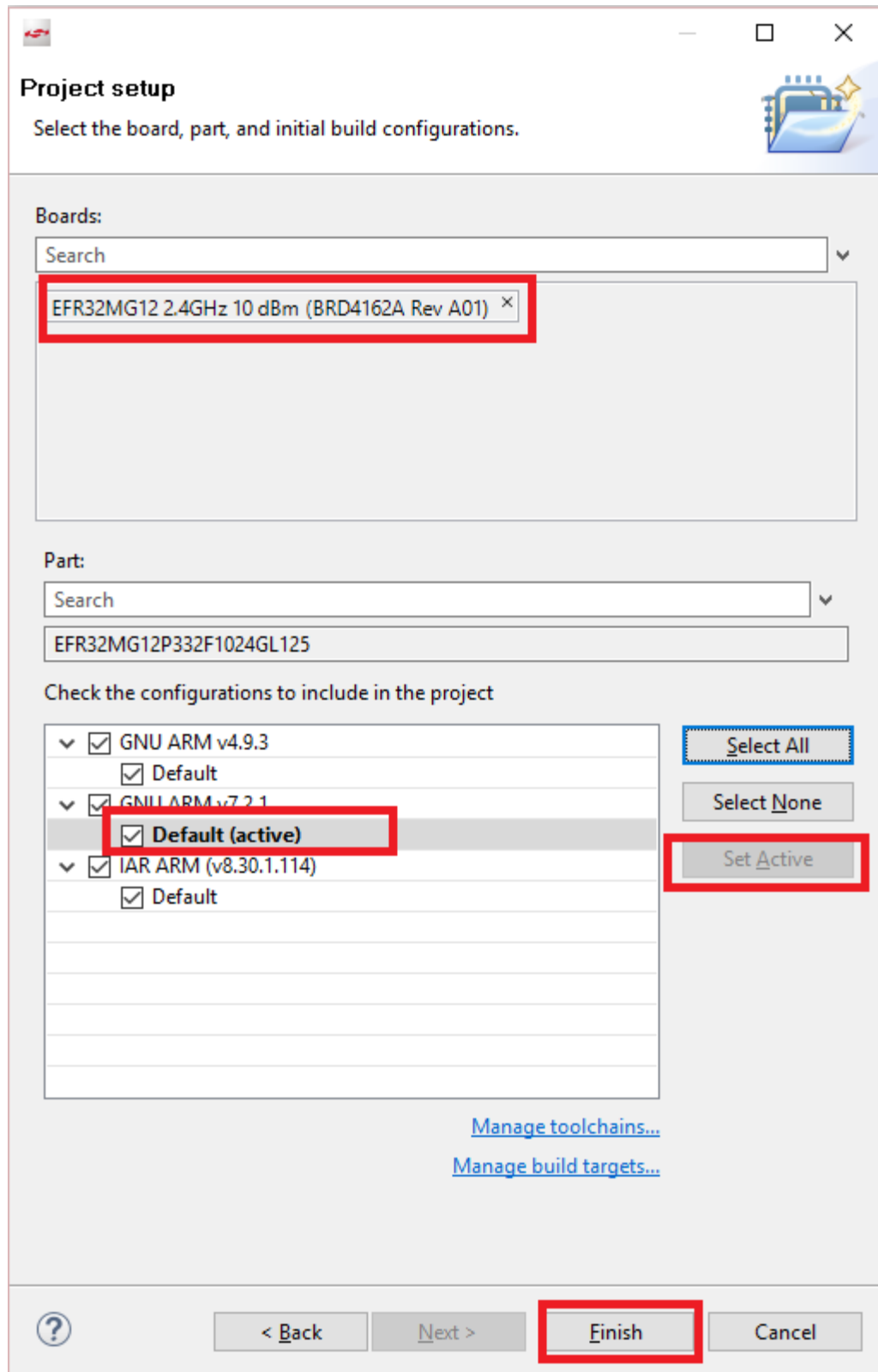
Figure 10 select board and compiler

8. In "ZCL Clusters" tab,
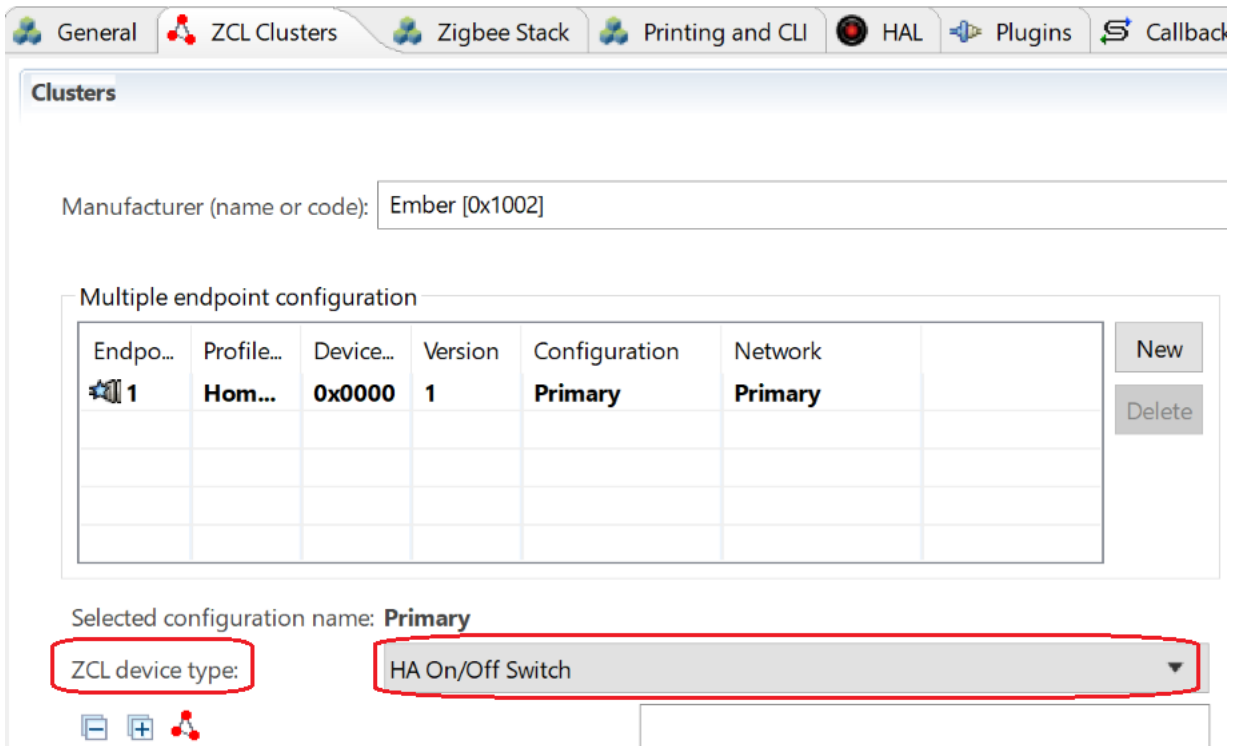   a. In "ZCL device type" field, set "ZCL device type" to "HA On/Off Switch"

Figure 11 select device type

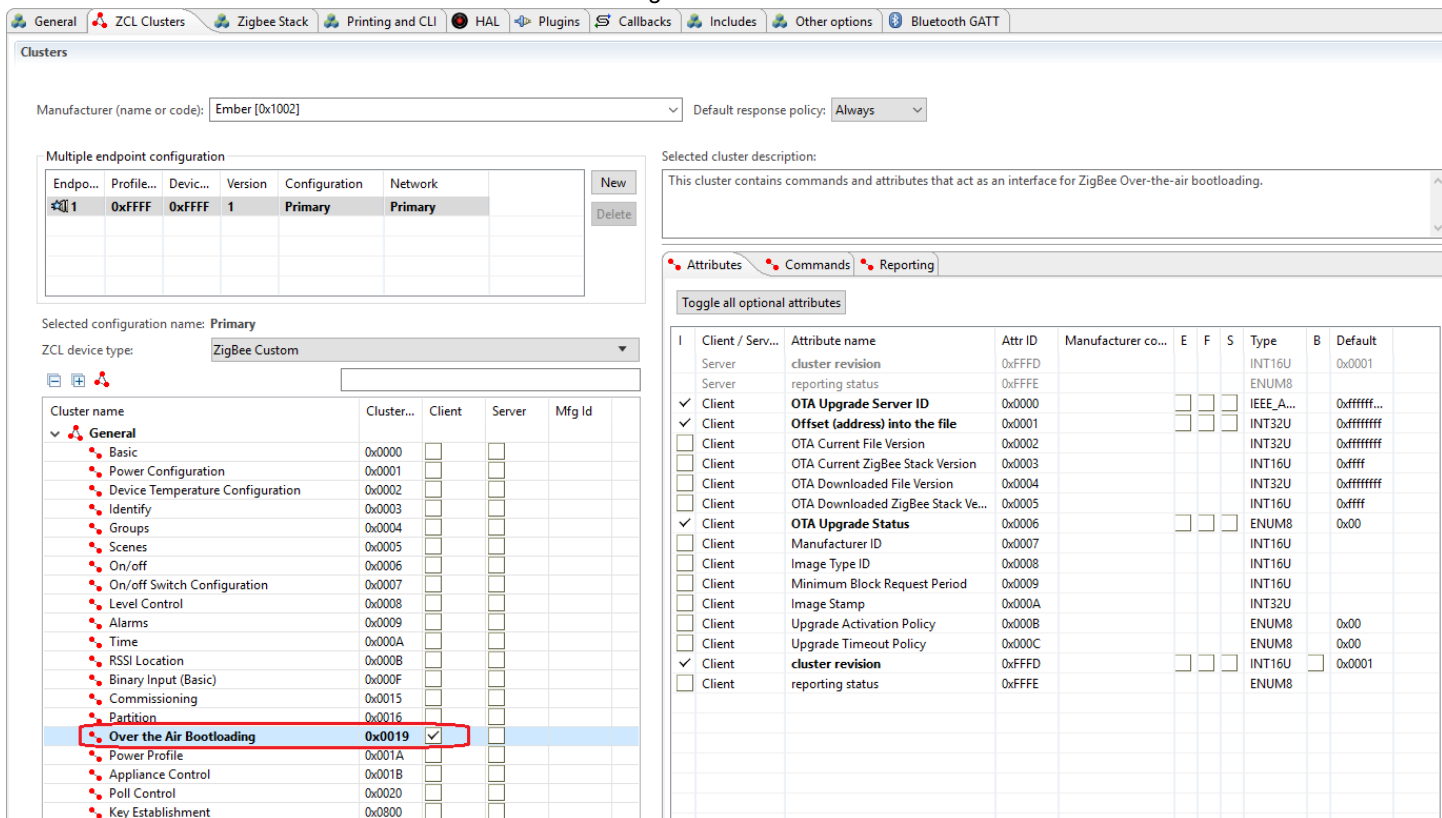b. Enable the client side of "Over the Air Bootloading"

Figure 12 Cluster setting

9. Turn to "plugins" tab, select the following plugins:
    a. Install Code Library
    b. OTA Bootload Cluster Client

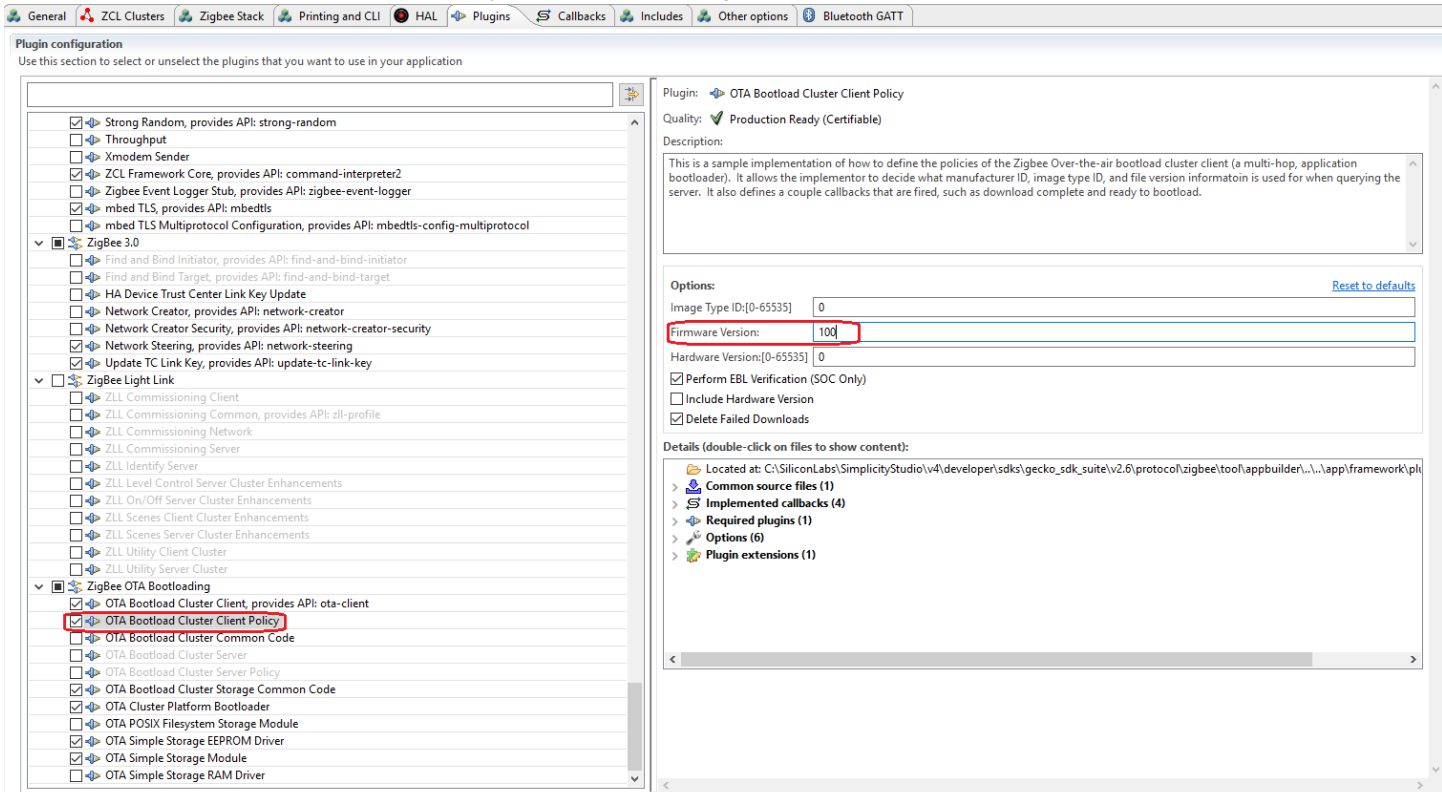c.   OTA Bootload Cluster Client Policy, in the properties page, set the firmware version to 100.

Figure 13 firmware version

d.   OTA Bootload Cluster Common Code

e.   OTA Bootload Cluster Storage Common Code

f.   OTA Cluster Platform Bootloader

g.   OTA Simple Storage Module

h.   OTA Simple Storage EEPROM Driver, in the properties, set the "read-modify-write" option to "false"
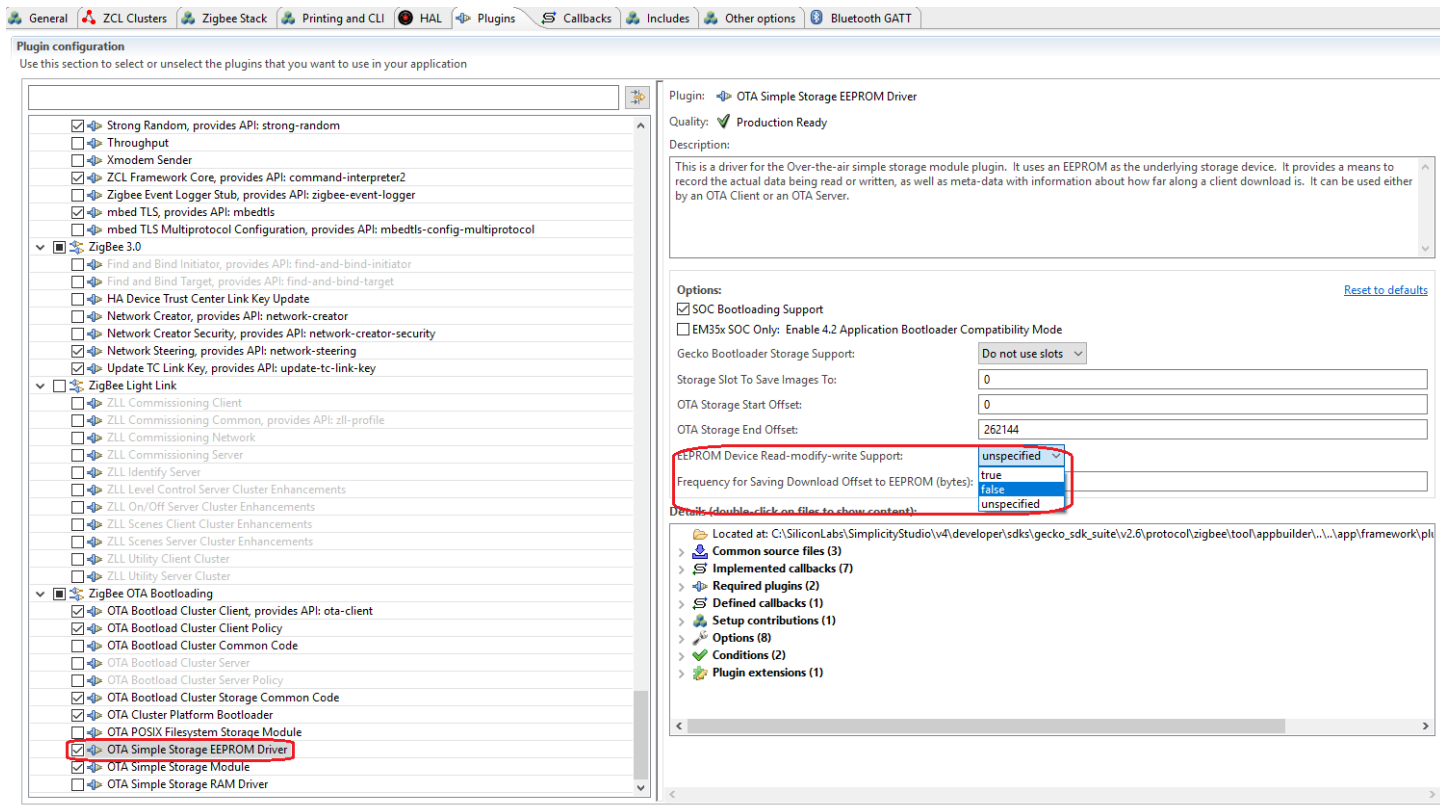
Figure 14 OTA Storage setting

10. Turn to "Printing and CLI" tab, enable the following debug options.
    a. Unfold "Individual plugin debug printing"
        i. enable "OTA Simple Storage EEPROM Driver", both "compiled in" and "Enabled at start up";
        ii. enable "OTA Bootload Cluster Storage Common Code", both "compiled in" and "Enabled at start up";
        iii. enable "OTA Cluster Platform Bootloader", both "compiled in" and "Enabled at start up";
        iv. enable "OTA Bootloader Cluster Client", both "compiled in" and "Enabled at start up";
        v. enable "OTA Bootloader Cluster Client Policy", both "compiled in" and "Enabled at start up";
        vi. enable "OTA Simple Storage Module", both "compiled in" and "Enabled at start up";
    b. Unfold "Application specific debug printing"
        i. enable "OTA Bootloader Cluster", both "compiled in" and "Enabled at start up";
11. Click "Generate". Notice the project files appearing in Project Explorer. A window saying "generating successfully" will appear. Click OK.

12. Select the project in Project Explorer window and compile your project by clicking on the Build icon 🔨 . Ensure that the build completes with 0 errors.

13. In the build directory, backup the following file to a new folder "V100":
    a. Client.ota
    b. Client.s37

4   Build the new version client image

1. Open the isc file of the client project, turn to "plugins" tab, select the plugins "OTA Bootload Cluster Client Policy", in the proper-ties page, set the firmware version to 200.
2. Save and generate the project, then build.
3. In the build directory, backup the following file to a new folder "V200":
    a. Client.ota
    b. Client.s37

5   Build the server

We will still use the Z3GatewayHost + NCP as the OTA server.

The OTA server is already configured. **If you have run the last hands-on successfully, then you can skip this step**.

You can check it with the following steps:

1. Open the isc file of the host project, turn to "ZCL Cluster" tab, make sure the server side of "Over the Air Bootloading" is enabled.

2. Turn to "Plugins" tab, make sure the following plugins are enabled:
   a. OTA Bootload Cluster Common Code
   b. OTA Bootload Cluster Server
   c. OTA Bootload Cluster Server Policy
   d. OTA Bootload Cluster Storage Common Code
   e. OTA POSIX Filesystem Storage Module

6 Test

1. Flash the bootloader (xxx-combined.s37) and ncp (ncp.s37) image to WSTK (NCP);
2. Flash the bootloader (bootloader-storage-spiflash-single_xxx-combined.s37) and old version image (Client.s37) to your client.
3. In the "build/exe" folder under the host project, there should be a directory named "ota-files" (If it doesn't exist, create one). Copy the **new version** of the Client.ota to this directory.
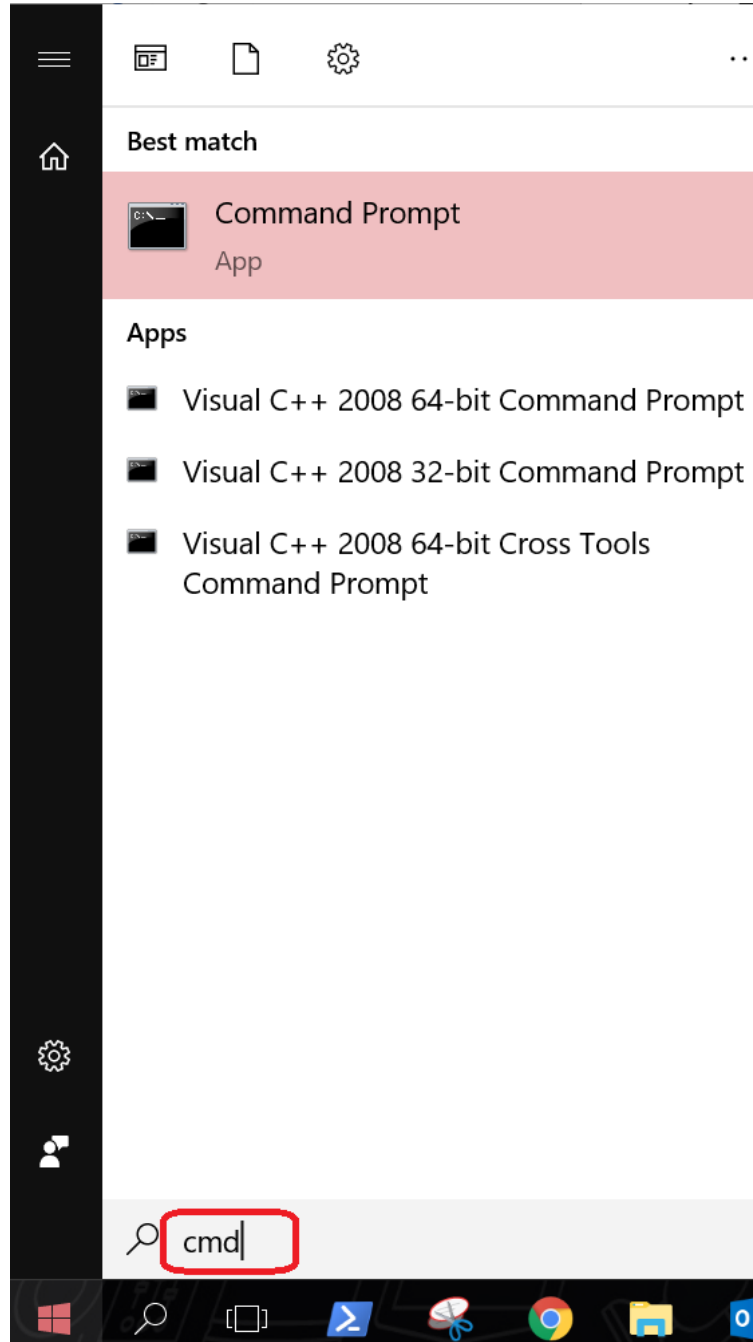4. Find the COM port number of your NCP board.
   a. Start a cmd window:

Figure 15 start cmd window

   b. Change to C:\SiliconLabs\SimplicityStudio\v4\developer\adapter_packs\serial. Then run command:

```
serial.exe –ports
```

Figure 16 get COM port of the WSTK

5. **Make sure your WSTK for NCP is disconnected in Simplicity Studio.**
6. Start Cygwin, and switch to the directory of the Z3GatewayHost project, then switch to "build/exe" directory. Run the following command to start the host:

```
//COM17 is the COM port of the NCP
./Z3GatewayHost.exe -p COM17
```


Figure 17 Start host

You should be able to see the detail info of the OTA image:

```
Found OTA file 'Z3SwitchSoc_Ota_4167A.ota'
  Manufacturer ID: 0x1002
  Image Type ID:   0x0000
  Version:         0x00000064
  Header String:   EBL Z3SwitchSoc_Ota_4167A
Found 1 files
```

7. On the console of the host, run the following command to create a network.

```
plugin network-creator start 1
```

8. Program a install code string following the steps in section 7.1 of https://github.com/MarkDing/IoT-Developer-Boot-Camp/wiki/Zigbee-Hands-on-Forming-and-Joining . After that, derive a link key from the install code with the provided tool HashingTool.exe.

Figure 18 Derive link key from install code

9. On the console of the host, use the following command to open the network for the device:

```
//000B57FFFEA8EF42 is the Eui64 of the client
//41618FC0C83B0E14A589954B16E31466 is the install code derived link key

plugin network-creator-security open-with-key {000B57FFFEA8EF42}
{41618FC0C83B0E14A589954B16E31466}
```

10. Open console of the client, then run the following command to start joining.

```
plugin network-steering start 0
```

11. Add the NWK key to Simplicity Studio, then start to capture.
12. On the console of the client, use the following command to start OTA upgrading.

```
plugin ota-client start
```

13. On the console of the client, use the following command to check the firmware version.

```
plugin ota-client info
```