MediaTek LinkIt™ Smart 7688 Duo Get Started Guide

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Specifications are subject to change without notice.

Document Revision History

Revision	Date	Description
1.0	Dec 2015	Initial Release

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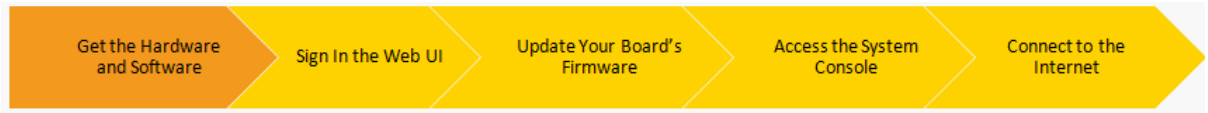
1. Get Started With the LinkIt™ Smart 7688 Duo Development Platform

Welcome to the LinkIt Smart 7688 Duo development platform quick start guide, this guide is based on using the development tools on a Windows PC with examples created in Python, however the same steps apply to Mac and Linux and for node.js — unless specifically noted otherwise.

This guide is presented in seven sections as follows:

- Get the Hardware and Software — which describes the hardware and software you need to complete this guide and where to get it.
- Sign In the Web UI – uses a web based utility to configure the development board, update firmware and more.
- Update Your Board's Firmware – describes the steps to upgrade the board's firmware using Web UI.
- Access the System Console – uses SSH (Secure Shell) to access the board for text commands and system messages.
- Connect to the Internet – explains how to connect the board to the internet.
- Install Arduino IDE and Board Support Package – a step-by-step instruction on installing the software on your PC.
- Install COM Port Driver – describes the steps to install driver that's needed for the 7688 Duo board.
- Create and Run Your First Example – illustrates a blink example code in Python.
- What's Next – describes other resources and documents you can use to create more projects with LinkIt Smart 7688 Duo.

1.1. Get the Hardware and Software



This section describes the hardware and software you need to get started. Before you start, please make sure you've the following items ready:

- A computer with Wi-Fi
- An access point that is connected to the Internet. The AP should have either open access (requires no password) or WPA/WPA2 encryption. APs that require Web-based authentication are not supported
- A micro-USB cable

To complete this section, you'll:

- Buy a LinkIt Smart 7688 Duo development board
- Install PuTTY for Microsoft Windows (For Windows only)
- Install Bonjour print service (For Windows 7 only) to use local domain `mylinkit.local`

Step 1: Get Your LinkIt Smart 7688 Duo Development Board

Purchase the LinkIt Smart7688 Duo development board from a distributor such as Seeed Studio.

Step 2: Install PuTTY (For Windows only)

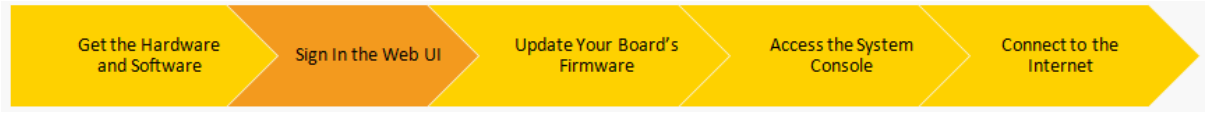
PuTTY provides you with the system console environment using Secure Socket Shell (SSH) access to the development board's operating system.

Step 3: Install Bonjour Print Service (For Windows 7 only)

The LinkIt Smart 7688 Duo development board uses `mylinkit.local` as its local domain. In Windows 7, you'll need to install the Bonjour print service because mDNS is not supported. This helps your computer discover the LinkIt Smart 7688 Duo's IP address within the local domain. For Windows 8 and later, Mac OS X and Linux, mDNS is supported and you can use `mylinkit.local` without additional software.

If you're using a virtual machine, please note that mDNS may have problems reaching the guest OS network. In this case, please use the host OS browser for the next step – sign into the board's Web UI.

1.2. Sign into the LinkIt Smart 7688 Duo Development Boards Web UI



Now power up your board, connect a USB power source or your PC to it and open the board's Web UI, which you'll use in subsequent steps to configure your board.

To complete this section you'll:

- Power up your board.
- Search for LinkIt_Smart_7688_XXXXXX AP (XXXXXX is the MAC address) and connect the board through Wi-Fi.
- Sign into the LinkIt Smart 7688 Web UI.

Step 1: Power up your board with a micro-USB cable

Plug in one end of a Micro USB cable to the power connector of the LinkIt Smart 7688 Duo and the other end of the cable to a USB power source, such as your computer as shown in Figure 1, or a USB power adaptor. Make sure you connect the cable to the Power (PWR) connector, not the USB host (HOST) connector near the MPU reset button. The Power LED (Green) will light up solid first followed by the Wi-Fi LED (orange) which will blink once. Then, after about 4~5 seconds, the Wi-Fi LED will light on solid; this indicates that the boot loader has initialized.

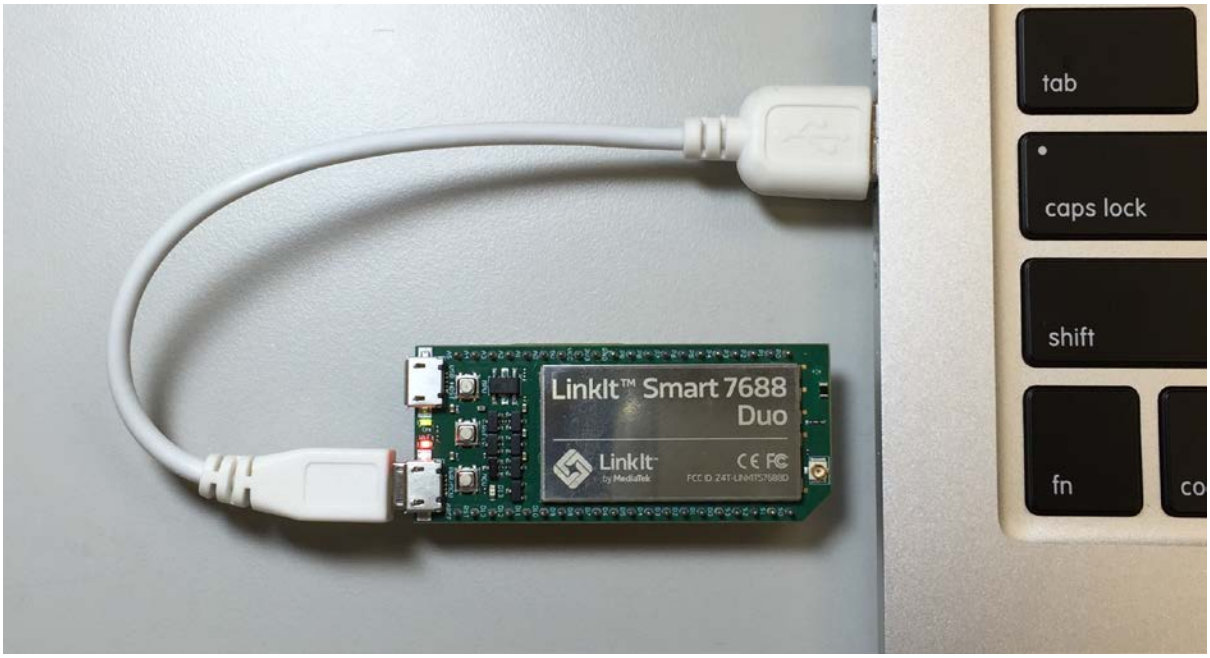


Figure 1 Providing power to the LinkIt Smart 7688 Duo board

After boot loader initialization, the boot up process begins, which takes about 30 seconds. Next, the Wi-Fi LED turns off; this means the system is ready to accept a Wi-Fi connection. Figure 2 shows how the Wi-Fi LED status matches the system state.

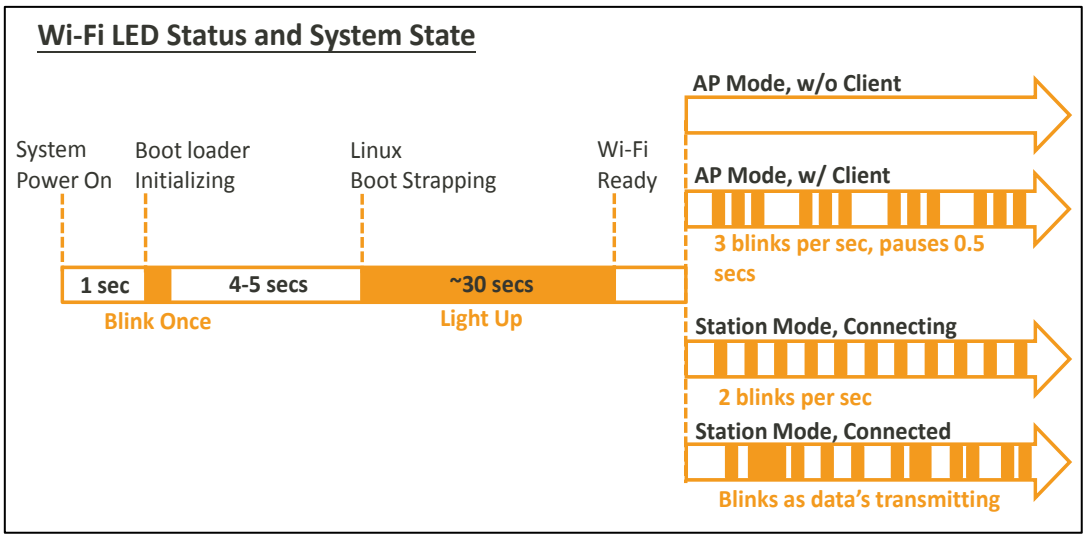


Figure 2 Wi-Fi LED Status

Step 2: Connect your PC to the LinkIt_Smart_7688_XXXXXX AP

Open the Wi-Fi connection utility on your computer and connect to the access point named LinkIt_Smart_7688_1B09F3 (1B09F3 is the MAC address and yours could be different), as shown in Figure 3.

Figure 3 Connecting to LinkIt_Smart_7688 AP

The orange LED will blink three times per second after you've connected to the LinkIt_Smart_7688_XXXXXX AP.

Keep in mind that once you've connected to LinkIt Smart 7688 Duo, your computer may no longer have access to the internet – it's now joining the Local Area Network formed by LinkIt Smart 7688 Duo, as shown in Figure 4.

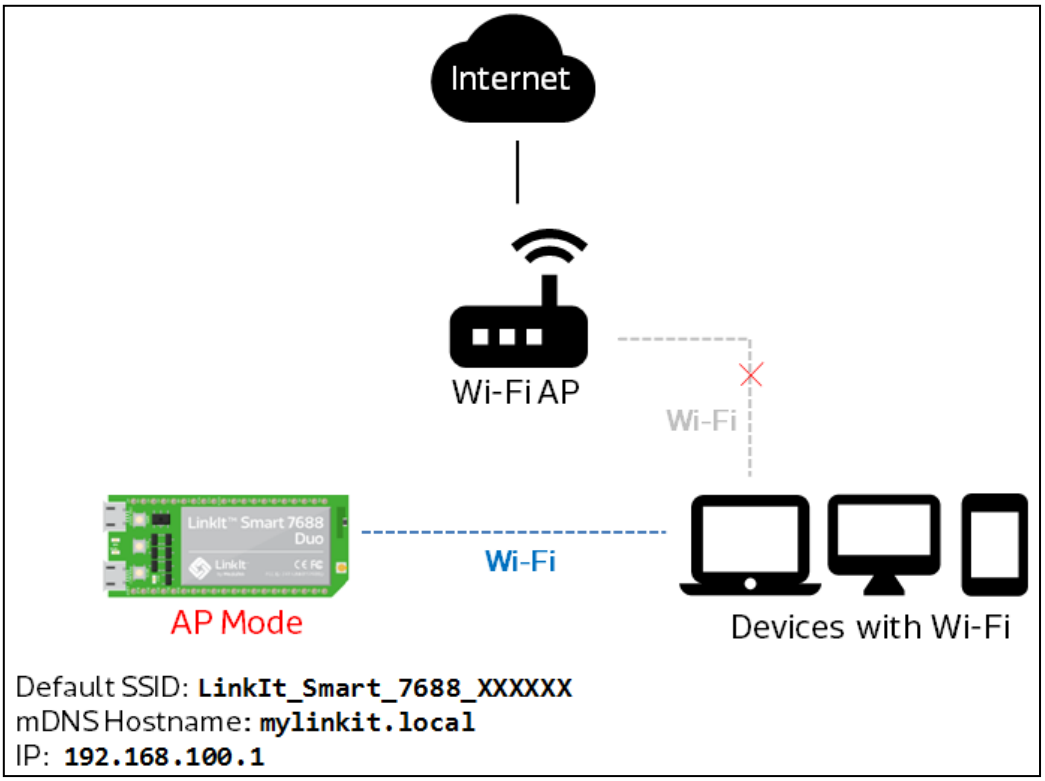


Figure 4 LinkIt Smart 7688 in AP mode

You'll learn how to connect LinkIt Smart 7688 Duo to the Internet in later steps. But first, you need to configure the board.

Step 3: Access the LinkIt Smart 7688 Duo Web UI configuration tools

You now setup the LinkIt Smart 7688 Duo Web UI, a tool for configuring the settings of you board.

1) In your web browser open `http://mylinkit.local`, as shown Figure 5.

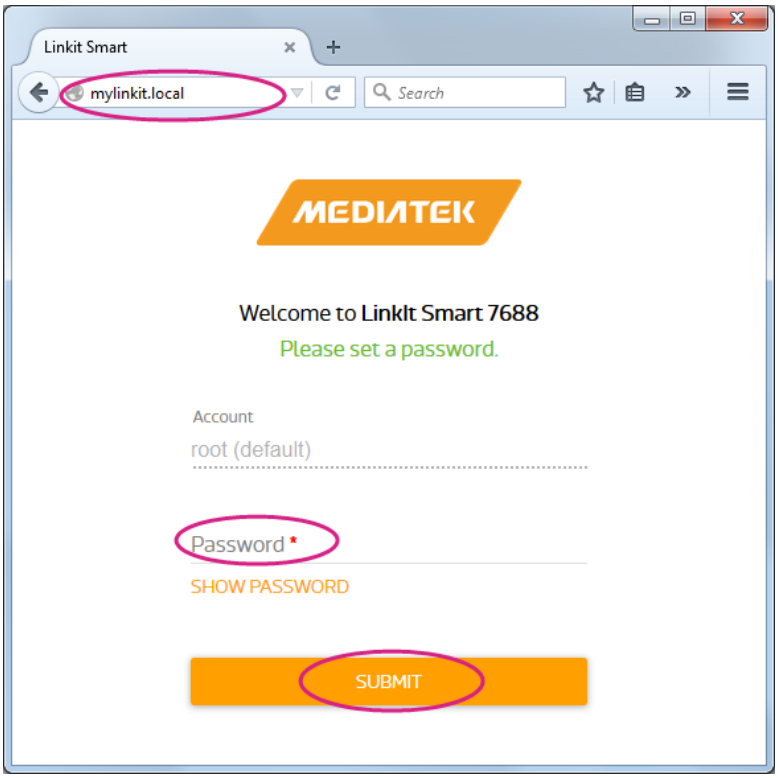
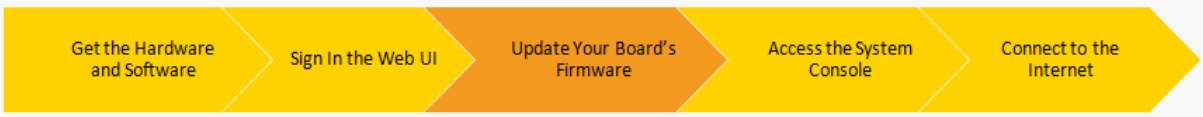


Figure 5 LinkIt Smart 7688 Duo Web UI set password

2) Set a password using at least 6 alphanumeric characters and click **SUBMIT**. Enter the password again and click **SIGN IN**.

If the board already has a password and you don't remember it, use a USB drive to upgrade the firmware or press and hold the Wi-Fi button for at least 20 seconds and release to return the board to the factory defaults. Keep in mind if you use either of these methods, it will restore to board's default settings and all user data will be removed from the device. For more information on how to upgrade firmware using a USB drive or use the buttons please refer to LinkIt Smart 7688 Developer's Guide.

1.3. Update Your Board's Firmware



The MediaTek Labs website has the latest firmware for your LinkIt Smart 7688 Duo development board. It is recommended that you upgrade the firmware of your new board to ensure you have the latest version. This section describes how.

To complete this section, you'll:

- Install LinkIt Smart 7688 firmware
- Upgrade LinkIt Smart 7688 firmware using Web UI

Step 1: Install LinkIt Smart 7688 Firmware

1) The latest LinkIt Smart 7688 software and tools from the MediaTek Labs website includes the firmware, bootloader and toolchain you need to develop applications for LinkIt Smart 7688 Duo. Download and unzip the firmware into a permanent location on your computer, such as `D:\{firmware}`
2) Note the location of the firmware file `lks7688.img`, for example:

   `D:\{firmware}\lks7688.img`

Step 2: Run the LinkIt Smart 7688 Duo Firmware Updater Application

1) In the Web UI home page, click **UPGRADE FIRMWARE**, as shown in Figure 6.

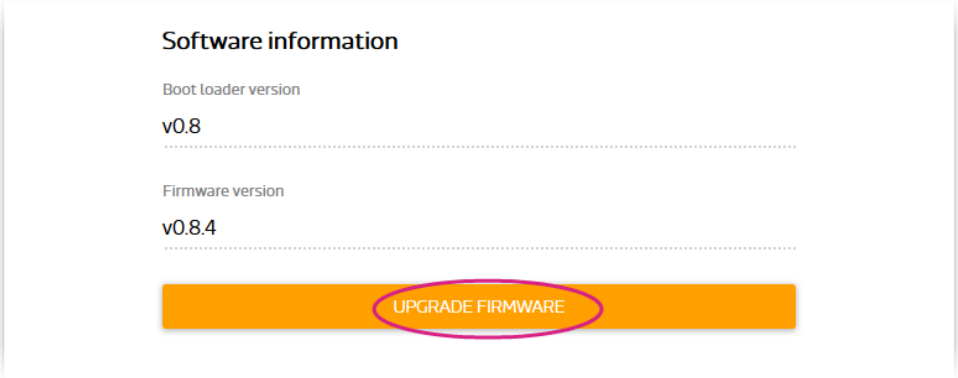


Figure 6 LinkIt Smart 7688 Duo firmware upgrade

2) Click **Choose the file** and select the `lks7688.img` file then click **UPGRADE & RESTART** as shown in Figure 7.

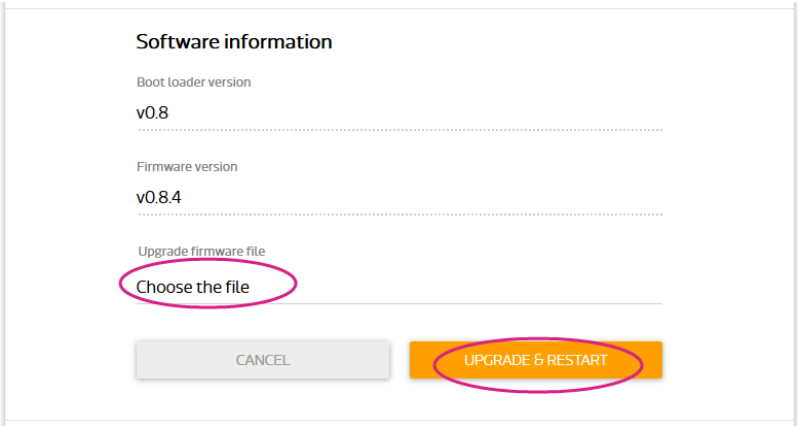


Figure 7 Selecting firmware file and start upgrade

3) The firmware uploads to your board. Please make sure the board stays connected to its power source until the firmware upgrade is completed. Notice the Wi-Fi LED blinks for about 3 minutes (firmware upgrading), then the board will restart and the LED lights on for about 30 seconds (rebooting). Finally, the board enters AP mode and is ready to be connected.

4) Find the LinkIt_Smart_7688_XXXXXX AP and connect the board through Wi-Fi. Notice the Wi-Fi LED blinks 3 times per second after the board is connected to a client device. Now, reload the `mylinkit.local` webpage, set a new password and sign in. The new firmware version details will be displayed under **Software Information**, as shown in Figure 8.

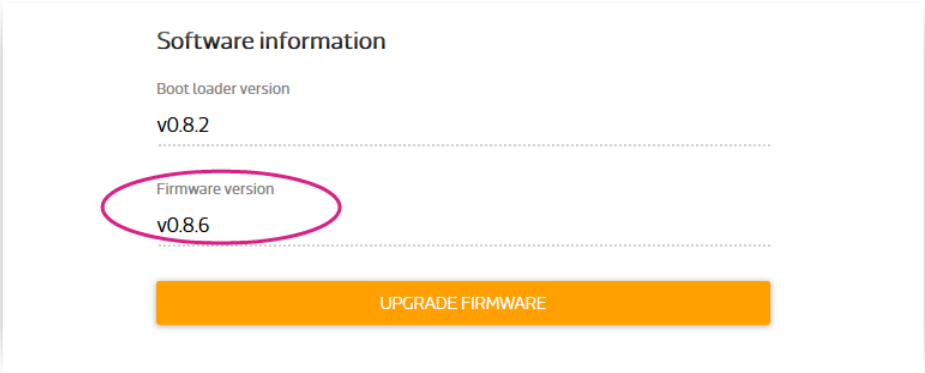


Figure 8 Firmware version

You now have the latest firmware on your LinkIt Smart 7688 development board.

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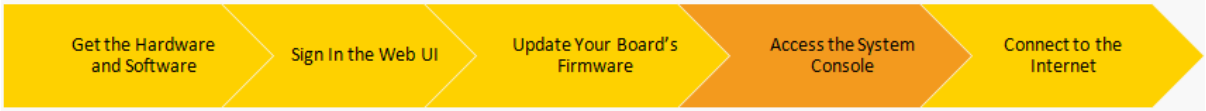
1.4. Access the LinkIt Smart 7688 Duo System Console through SSH



LinkIt Smart 7688 Duo system console enables you to enter text commands and get system administration messages.

To complete this step, you'll:

- Open your terminal emulator and sign in

Step 1: Open a Terminal Emulator and Sign in.

In Windows:

Open PuTTY and in the configuration window, type `mylinkit.local` in **`Host Name`**, click the **SSH** radio button and then **Open,** as shown in Figure 9.

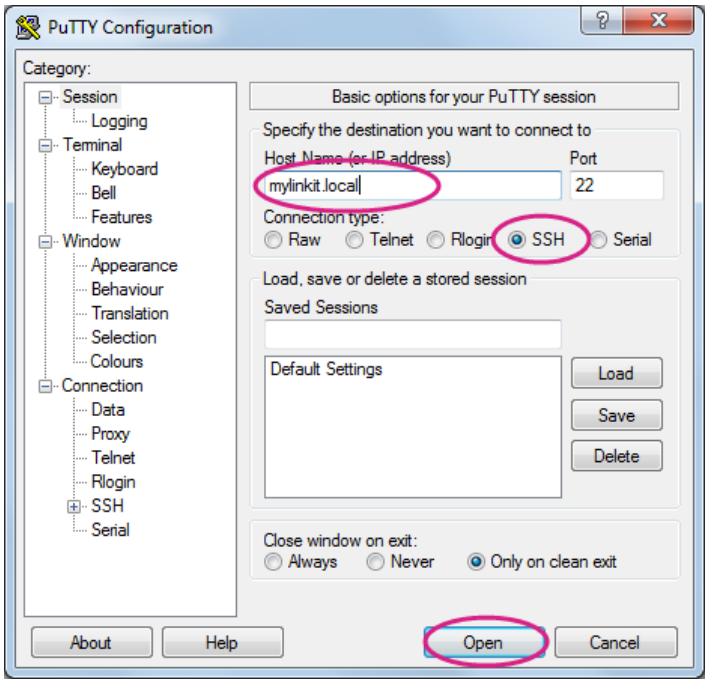


Figure 9 SSH access using Windows

5) A Security Alert window will pop up as shown below, this happens when you use PuTTY for the first time, or after upgrading firmware, or use a different board. Click **Yes.**

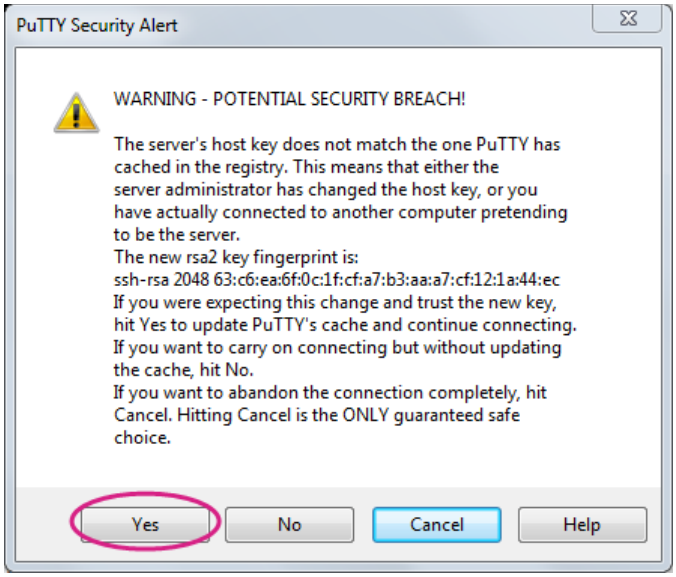


Figure 10 PuTTY security warning

6) The PuTTY terminal window displays. Log in with username **root** and the password you set previously in the Web UI, after log in you should see a screen similar to Figure 11.

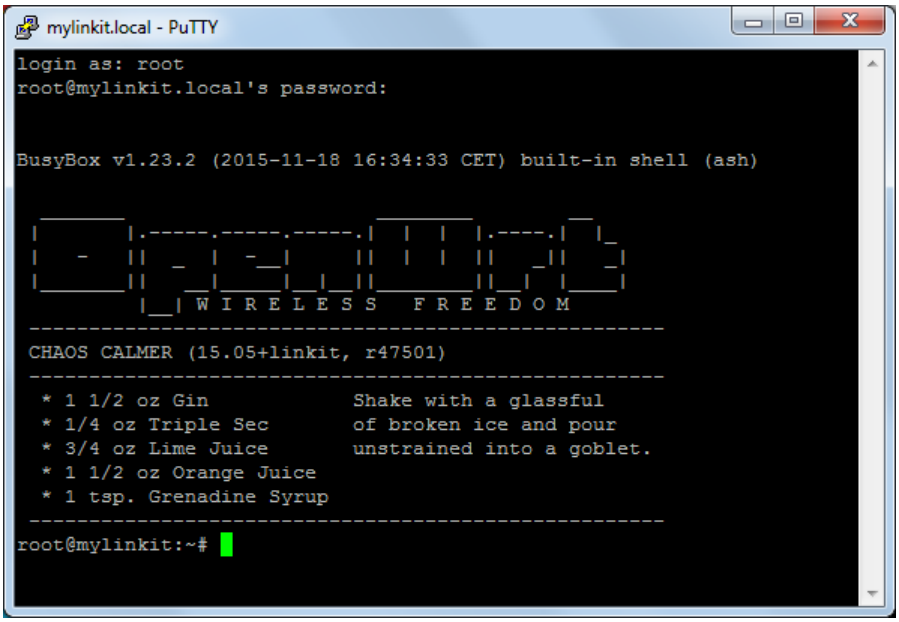


Figure 11 System console window

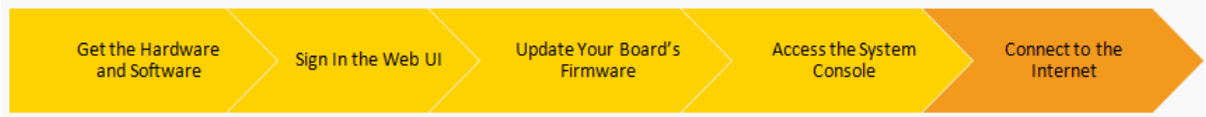
In Mac or Linux:

Open **Terminal** and at the command prompt type `ssh root@mylinkit.local`. Press return and enter the password you set previously in the Web UI.

If you see a warning error indicating host ID has changed, please check the Troubleshooting section in the MediaTek LinkIt Smart 7688 Developer's Guide.

You now have access to system console using SSH.

1.5. Connecting to the Internet



In order for the board to access the internet, it needs to join another network that has an access point connected to the internet, and to do that, the board needs to be in Station mode.

To complete this section, you'll:

- Connect LinkIt Smart 7688 to a Wi-Fi access point for internet access
- Connect the host computer to an AP that is in a Wi-Fi network
- Open Terminal emulator and sign in
- Check for internet connection

Step 1: Connecting LinkIt Smart 7688 Duo to a Wi-Fi Access Point for Internet Access

1) Open a browser with URL `mylinkit.local`, and sign-in to the Web UI with the password you have set. Click **Network** on upper right as shown in Figure 12.

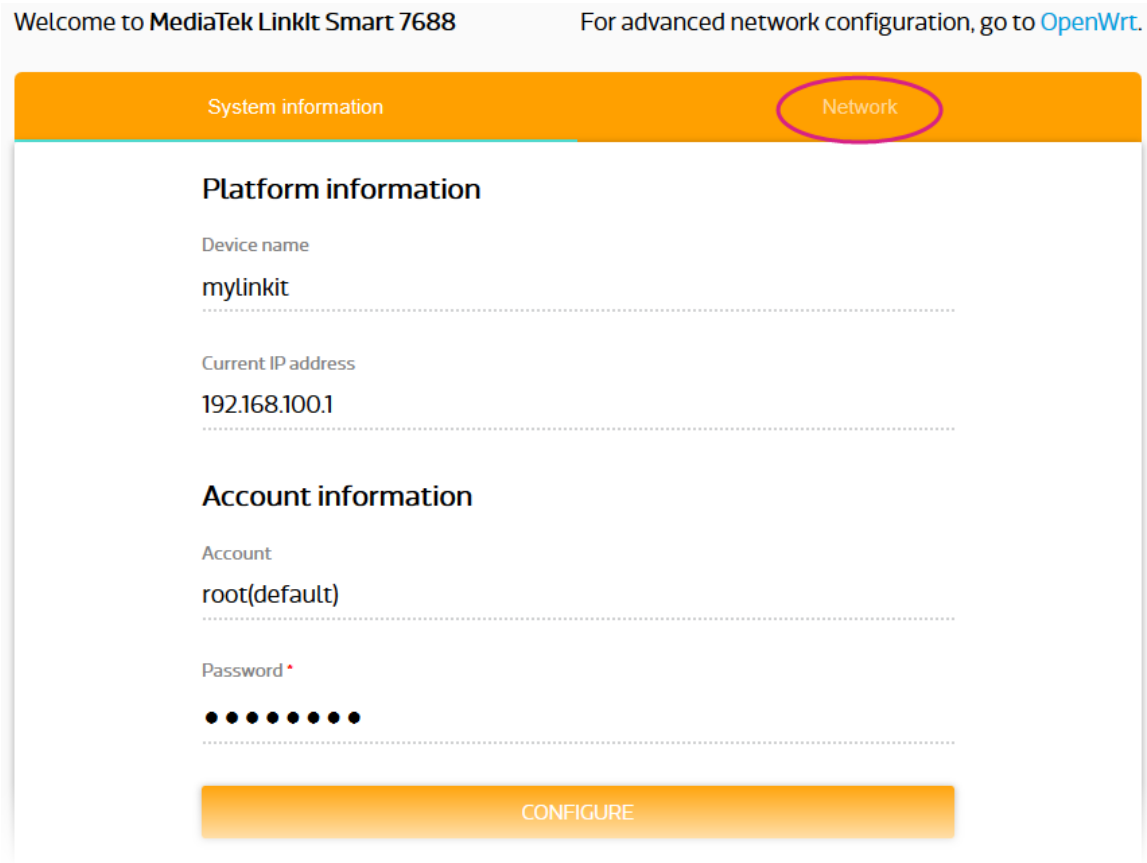


Figure 12 Change networking setting in Web UI

2) Select the **Station mode** and click **REFRESH** or **downward arrow** on the right to find the AP to connect to. After you've selected the AP, enter password if required. Click **CONFIGURE & RESTART** to finish as shown below.

Note: If you entered the AP's password incorrectly, you can reset the board to AP mode by clicking the Wi-Fi button for at least 5 seconds and release, this allows you to redo Station mode in the network settings again.

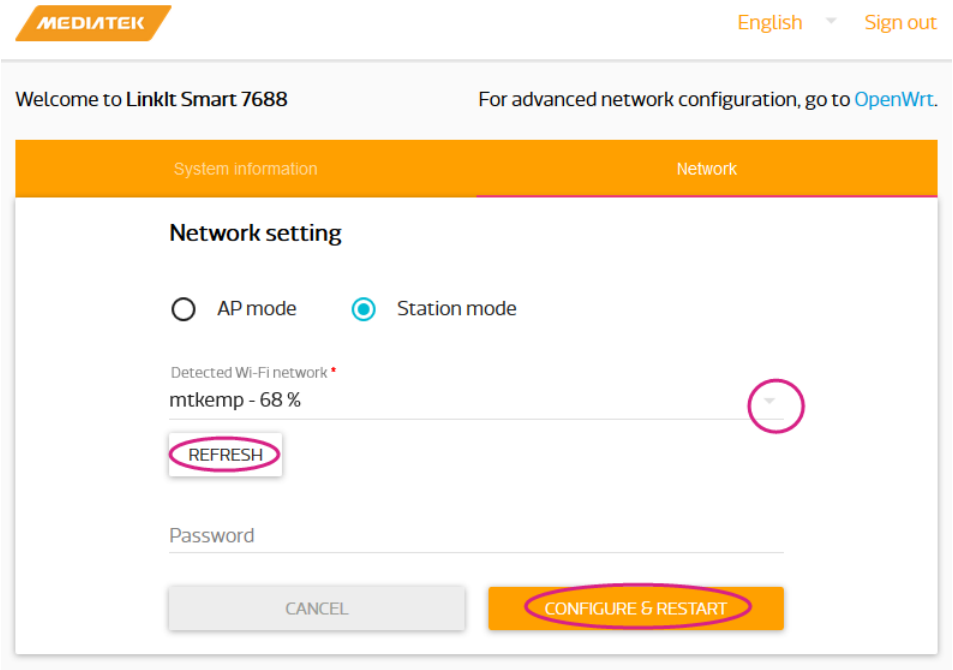


Figure 13 Changing to Station mode in Web UI

After you've switched to Station mode, the Wi-Fi LED should blink once every two seconds; this indicates LinkIt Smart 7688 Duo is in Station mode.

Since the Wi-Fi mode has changed, your host computer is now disconnected from LinkIt Smart 7688 Duo. If you try to reload the web UI, you'll see that it is not available anymore. To establish connection again, follow the next step.

Step2: Connect the host computer to an AP that is in a Wi-Fi network

Open the Wi-Fi connection utility on your computer and connect to the same access point as in Step 1. Your computer is now under the same local area network formed the by the Wi-Fi Access Point you connected to, as shown in Figure 14.

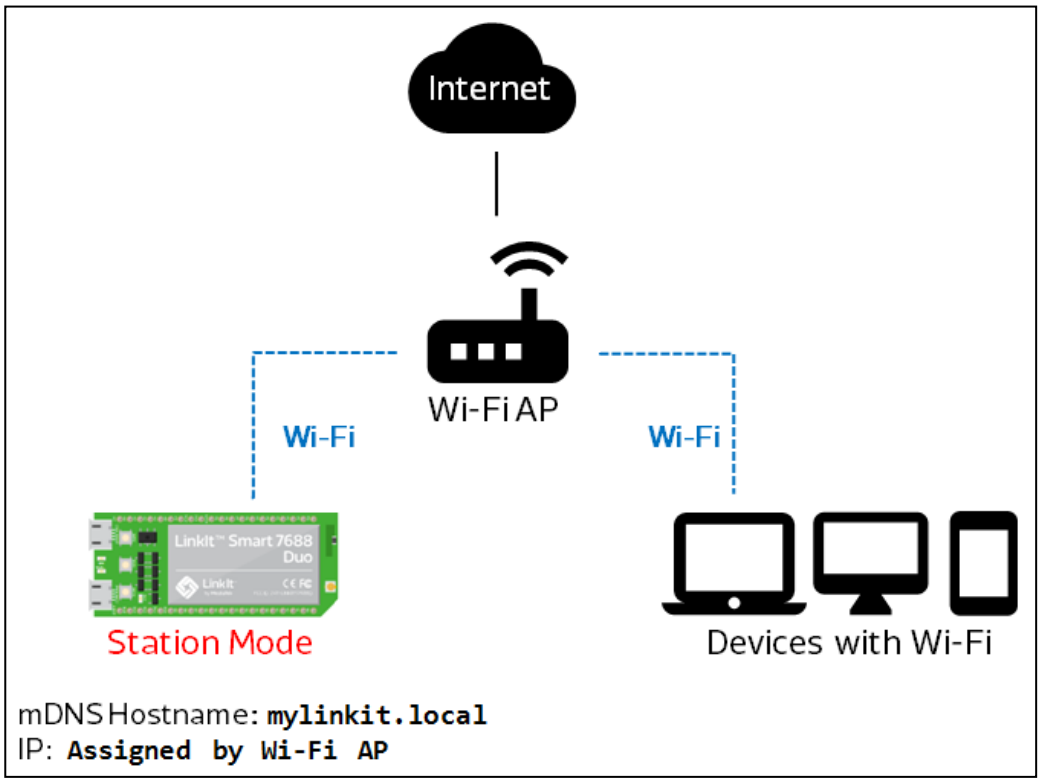


Figure 14 LinkIt Smart 7688 Duo in Station mode

Step3: Open terminal emulator and Sign in again

Once your host computer has joined the same Wi-Fi network, you can again connect to LinkIt Smart 7688 Duo with `mylinkit.local` domain again through SSH as before.

Step 4: Check for Internet connection

Now check if you've established Internet connection by typing the following command in the terminal window:

```
# ping –c 5 www.mediatek.com
```

If you see a screen that is similar to Figure 15, then you've connected to the Wi-Fi network's AP. The Wi-Fi LED will blink once every second indicating Station mode. If the ping utility reports errors such as unreachable destination, check the setting of your Wireless AP.

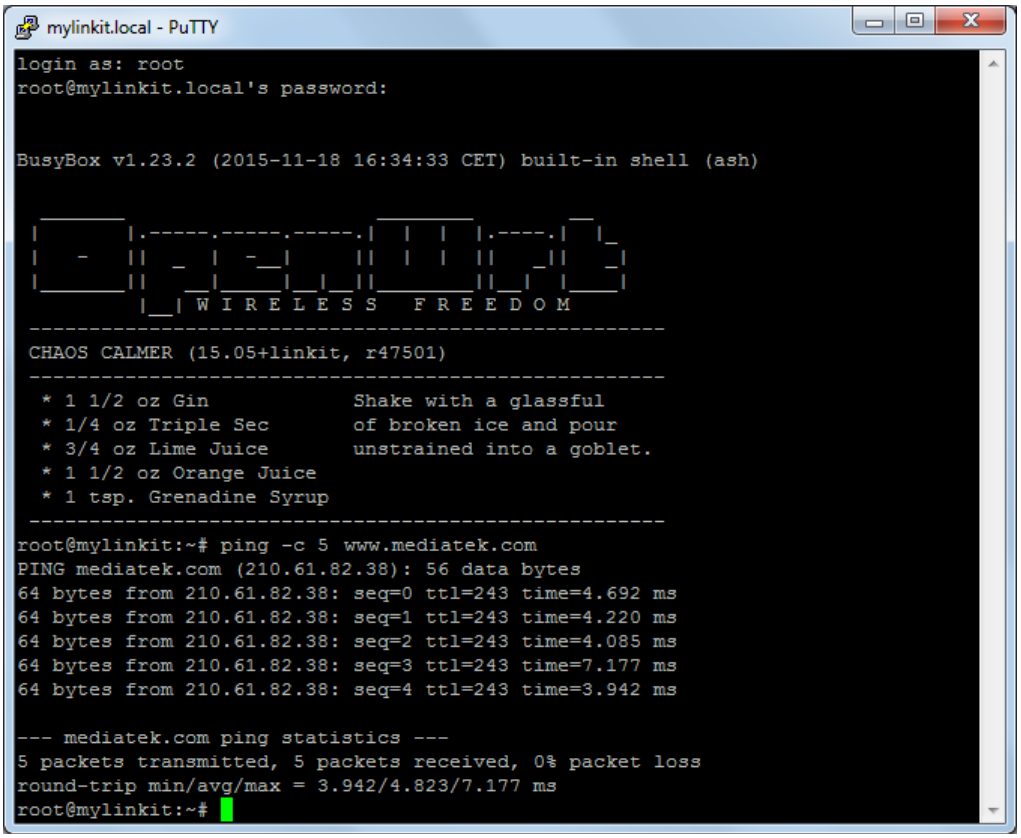


Figure 15 LinkIt Smart 7688 Duo in Station mode connected to a Wi-Fi AP

2. Install Arduino IDE with Board Support Package

LinkIt Smart 7688 Duo supports Arduino IDE with board support package. This section describes how to install the software.

To complete this section, you'll:

- Install Arduino IDE 1.6.4 or later
- Install board support package

Step 1: Install Arduino IDE

The Arduino IDE provides your coding environment and is used for monitoring the development board. LinkIt Smart 7688 Duo supports Arduino IDE version 1.6.4 or later.

Step 2: Install board support package

In order for Arduino IDE to recognize LinkIt Smart 7688 Duo development board, installing board support package is necessary.

1) To install LinkIt Smart 7688 Duo board support package, open Arduino IDE, click **File** > **Preferences** and insert the following URL to the **Additional Boards Manager URL** field as shown in Figure 16.

   `http://download.labs.mediatek.com/package_mtk_linkit_smart_7688_test_index.json`

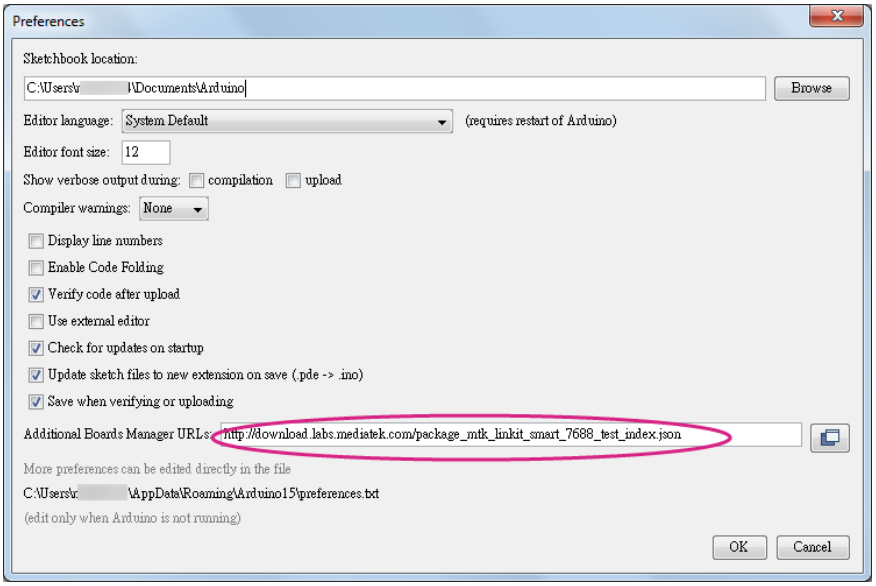


Figure 16 Board manager URL

2) Make sure your computer is connected to the Internet.

3) In the Arduino **Tools** menu point to **Board** then click **Boards Manager** as shown in Figure 17.

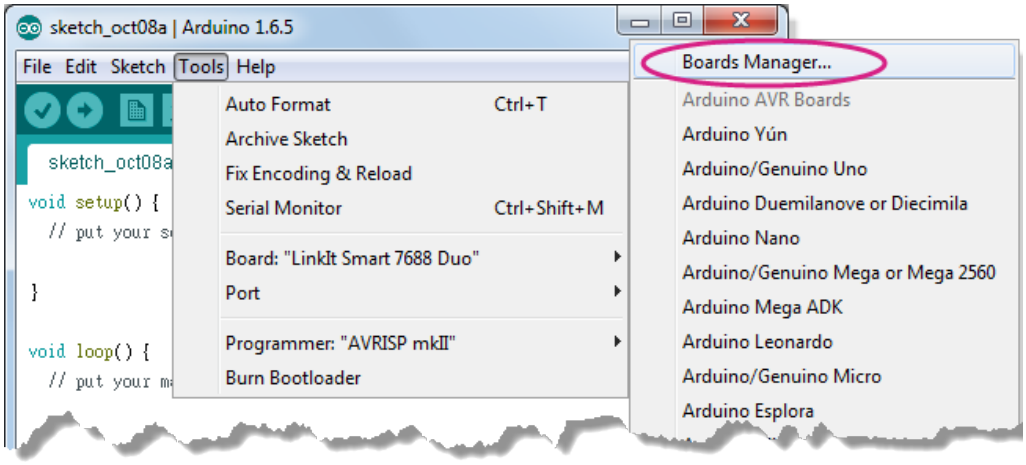


Figure 17 Board manager in Arduino IDE

LinkIt Smart 7688 board support package starts downloading automatically and it may take several seconds for the Boards Manager to download the repository.

If there is a downloading error (per Figure 18), remove the cached `.json` file. The location of the cached `.json` file is the same as the location of the `preferences.txt` file. It can be found in the Arduino IDE under the **File** menu by clicking **Preferences**.

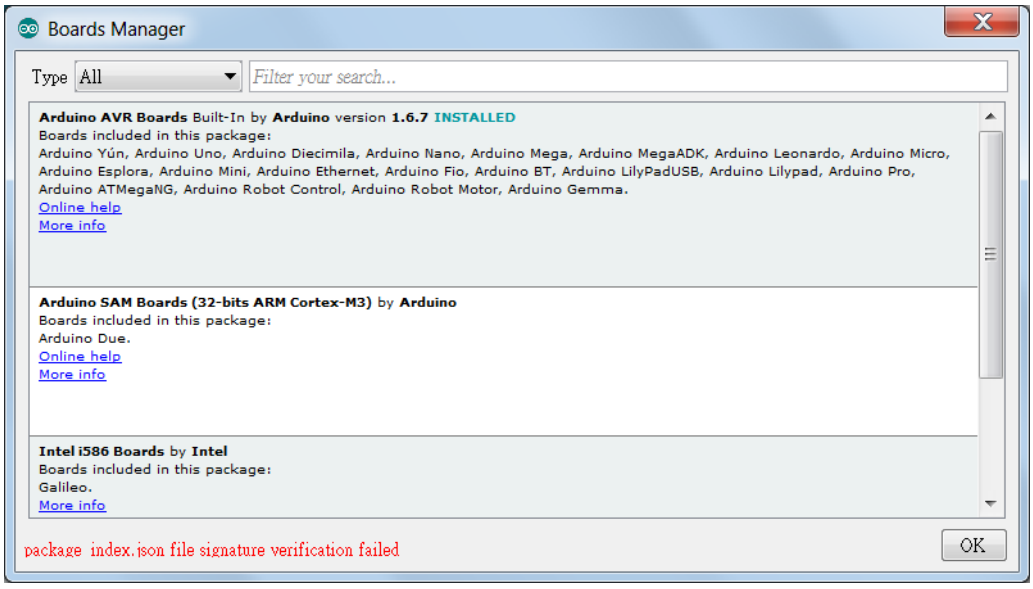


Figure 18 Error downloading the LinkIt ONE SDK package

4) There should now be a LinkIt Smart 7688 item appearing in the boards list on the Boards Manager as shown in Figure 19. Select the LinkIt Smart 7688 version and click **Install**.

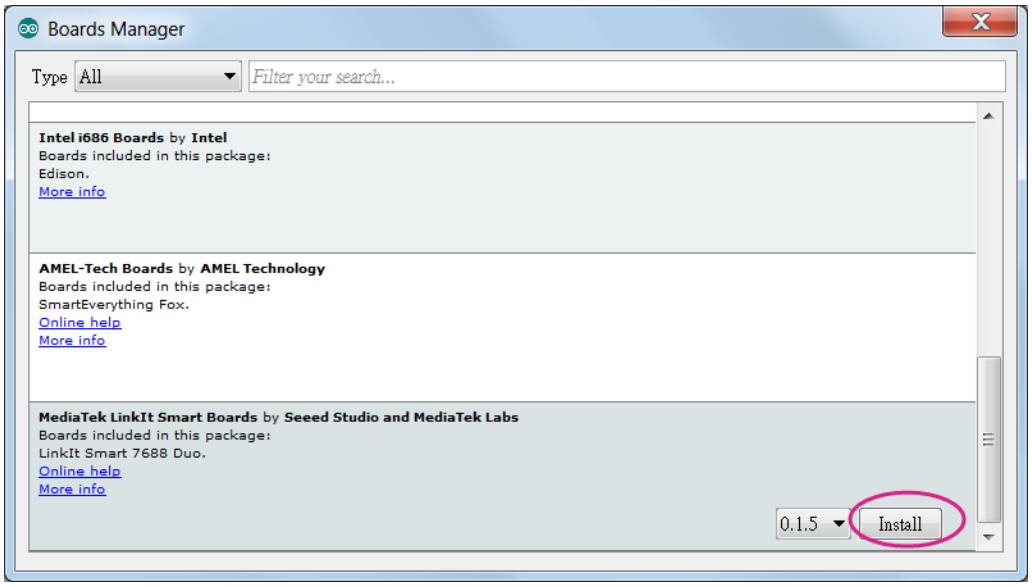


Figure 19 Installing LinkIt Smart 7688 board package

5) The installation completes, as shown in Figure 20.

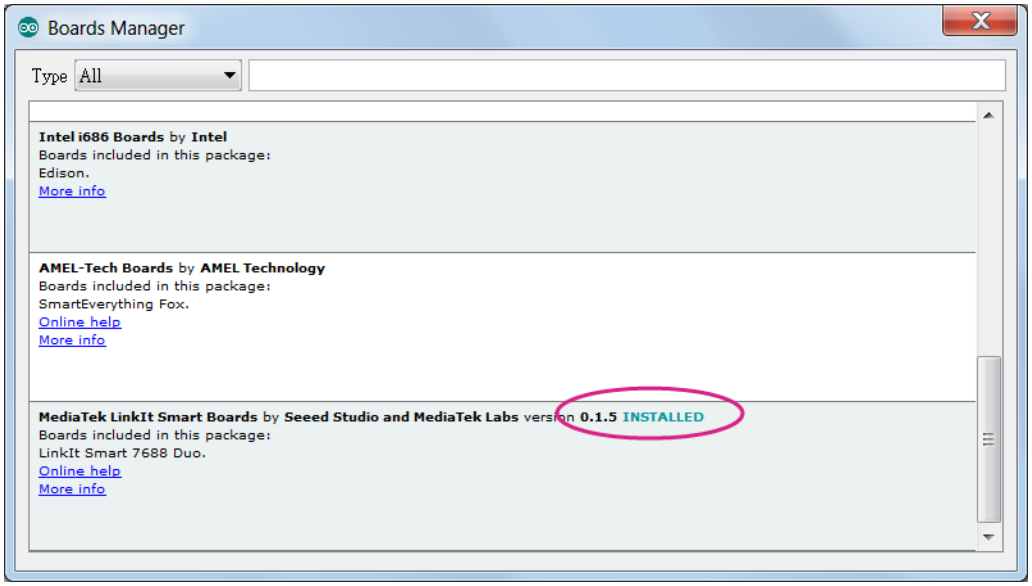


Figure 20 LinkIt Smart 7688 board package installed

6) You now have the LinkIt Smart 7688 installed on Arduino IDE as shown in Figure 21.

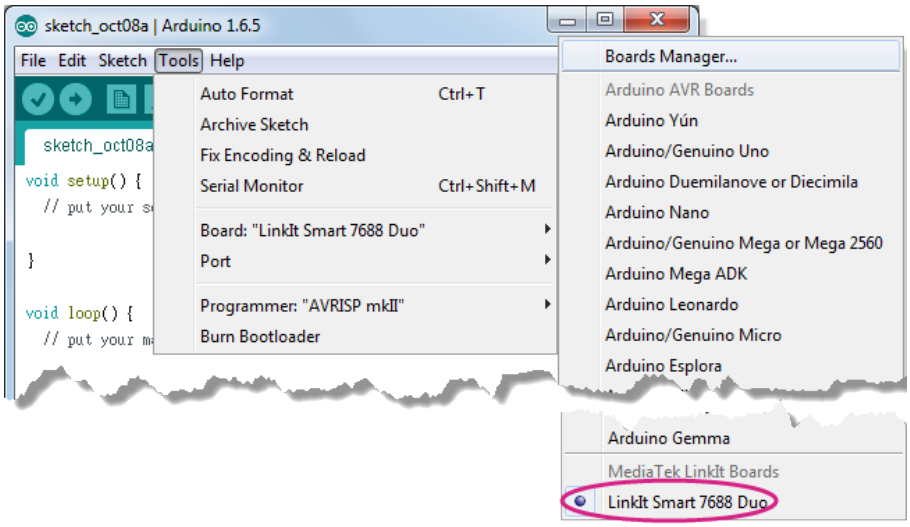


Figure 21 LinkIt Smart 7688 board in Arduino IDE

3. Install the LinkIt Smart 7688 Duo COM Port Driver

After you've installed the board package, follow the below step to install COM port driver for LinkIt Smart 7688 Duo.

To complete this section, you'll:

- Connect LinkIt Smart 7688 Duo to a computer
- Install drivers

Step 1: Connect LinkIt Smart 7688 Duo development board to a computer

Plug in one end of the micro USB cable to the Power/MCU connector of the LinkIt Smart 7688 Duo and the other end of the cable to a computer.

Step 2: Install drivers

You'll need to install drivers depending on your operating system.

- For Windows

  Install a Serial COM port INF driver from here or the following link:

  `{ARDUINO_IDE_PREFERENCE_LOCATION}/packages/LinkIt/hardware/avr/0.1.5/driver/linkit_smart_7688.inf`

  You can find the Arduino preference location at `File > Preferences,` see the `preference.txt` path, as shown in Figure 22.

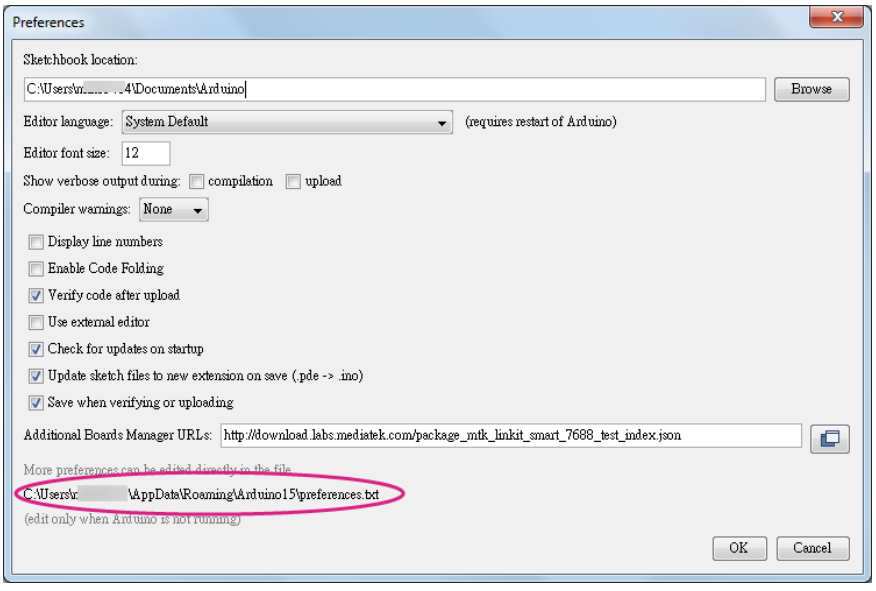


Figure 22 Arduino preference location

Right click on the linkit_smart_7688.inf and select **install.** A security windows will open, as shown in Figure 23, click **Install this driver software anyway**. This completes the driver installation.

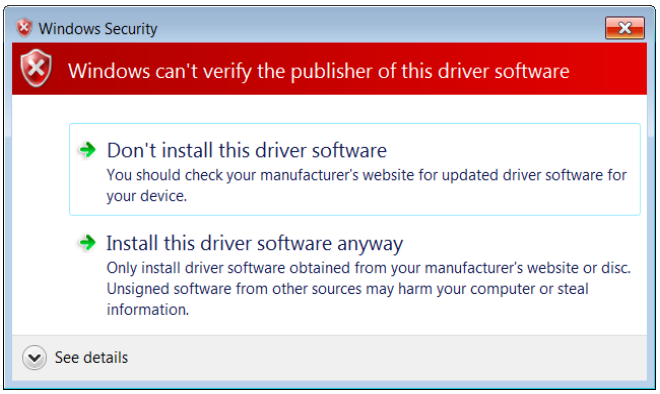


Figure 23 Driver installation security warning

- For Linux

  It should work without having to install a driver. LinkIt Smart 7688 should be in `/dev` folder and mounted as `ttyUSB0.`

- For OS X

  It's also not required to install a driver, LinkIt Smart 7688 Duo is mounted as a serial device under`/dev/tty.usbmodem1413`. The number `1413` may be different on each OS X machine.

4. Run a Blink Example on LinkIt Smart 7688 Duo in Python

This example uploads an Arduino sketch to LinkIt Smart 7688 Duo and listens for commands in `Serial1` port of the sketch. The commands are issued from the Linux side using a Python program. Once the `Serial1` port receives a command from the Python program, it will change the status of the D13 LED on the board.

To complete this section, you'll:

- Upload an Arduino sketch to LinkIt Smart 7688 Duo
- Create a Python program and run it
- Watch the D13 LED blink

Step 1: Upload an Arduino sketch to LinkIt Smart 7688 Duo

1) Open Arduino IDE and click **File > New**, copy and paste the following example code. **Upload** the sketch when you're done.

```
void setup() {
    Serial.begin(115200);  // open serial connection to USB Serial
                           //port (connected to your computer)
    Serial1.begin(57600);  // open internal serial connection to
                           //MT7688

    pinMode(13, OUTPUT); // in MT7688, this maps to device
}
void loop() {
      int c = Serial1.read();      // read from MT7688
      if (c != -1) {

            switch(c) {
                  case '0':               // turn off D13 when
                                            receiving "0"
                  digitalWrite(13, 0);
                  break;
                  case '1':               // turn on D13 when
receiving                                         "1"
                  digitalWrite(13, 1);
                 break;
            }
      }
}
```

You won't see the LED blink at this point yet because it's waiting for commands on Serial1 from a program, which you'll create next.

Step 2: Create a Python program to send commands to the sketch

This program sends the 0 and 1 commands to the ttys0 device periodically. The commands maps to the Serial1 in the Arduino sketch.

1) Create a file `blink_on_duo.py` in the system console by typing below command. After the text editor opens, press the **i** key and go to next step.

```
# vim blink_on_duo.py
```

2) Copy the below example to the editor of `blink_on_duo.py`.

```
import serial
import time

s = None

def setup():
    global s
    # open serial COM port to /dev/ttyS0, which maps to UART0(D0/D1)
    # the baudrate is set to 57600 and should be the same as the one
    # specified in the Arduino sketch uploaded to ATMega32U4.
    s = serial.Serial("/dev/ttyS0", 57600)
def loop():
    # send "1" to the Arduino sketch on ATMega32U4.
    # the sketch will turn on the LED attached to D13 on the board
    s.write("1")
    time.sleep(1)
    # send "0" to the sketch to turn off the LED
    s.write("0")
    time.sleep(1)
if __name__ == '__main__':
      setup()
while True:
      loop()
```

3) Save the file and exit the editor by typing **Esc** key followed by **:wq!**

4) Run the Python program by typing the below command in the system console.

```
# python ./blink_on_duo.py
```

Step 3: Watch the D13 LED on LinkIt Smart 7688 Duo blink

After you've executed the Python program and see the D13 LED on LinkIt Smart 7688 Duo blink every second, you've successfully completed the example.

5. What's Next?

You've set up the development environment for LinkIt Smart 7688 Duo and ran examples using Python. Please check out more tutorials, resources and inspiration related to LinkIt Smart 7688 Duo from the following links:

5.1. LinkIt Smart 7688 Developer's Guide

This document provides you with detailed information on the LinkIt Smart 7688 development board, SDK tools, introduction to OpenWrt and programming guide. You can download it from here.

5.2. LinkIt Smart 7688 Tutorials

The following tutorials are available:

- LinkIt Smart 7688 and MediaTek Cloud Sandbox Python
- LinkIt Smart 7688 and MediaTek Cloud Sandbox Node.js

5.3. Seeed Studio Starter Tutorial

Create projects using LinkIt Smart 7688 HDK and get inspired, check out www.seeed.cc/7688.

5.4. Hackster.io

See what other developers have created with LinkIt Smart 7688 and get inspired

- LinkIt Smart 7688/ONE Sensor Project
- Who's Home
- Zoned Climate Control