Microsemi Timberwolf™ AVS Development Kit ZLK38AVS User Guide

Document# 158441 April 2017

The intent of this guide is to provide the steps to assemble and use the Microsemi Timberwolf™ AVS Development Kit (ZLK38AVS).

Contents

Revision History

Revision Number	Revision Date	Description
1	April, 17, 2017	Preliminary Release (GR)
2		First Release ( )

Overview

Microsemi's Timberwolf™ AVS development kit is engineered to help you evaluate voice-enabled front-end audio systems for your Alexa-enabled products. This kit features Microsemi's ZL38063 voice processor powered by Microsemi's proprietary AcuEdge™ technology for front-end audio clean-up and Sensory's TrulyHandsFree™ "Alexa" wake-word engine. Two separate microphone configurations allow you to test applications with 180° or 360° far-field pick-up.

This document walks you through all the steps of building an Alexa-powered prototype using Microsemi's ZLK38AVS development kit and a Raspberry Pi. It takes you from setting up the ZLK38AVS kit, integrating it with an 'Alexa' wake word engine and connecting to the Alexa Voice Services (AVS) cloud. Once completed you will have an Alexa-enabled application that will function like an Amazon Echo.

Other References

The following are documents you may want to refer to when using this guide. These documents can be found on the Microsemi Audio Processing GitHub for the ZLK38AVS:

- ZLK38AVS Quick Start Guide
- ZLK38AVS Product brief
- ZLE38AVS Hardware Guide
- ZL38063 Product brief
- ZLS38100 Microsemi VProc SDK Documentation

ZLK38AVS Development Kit Contents

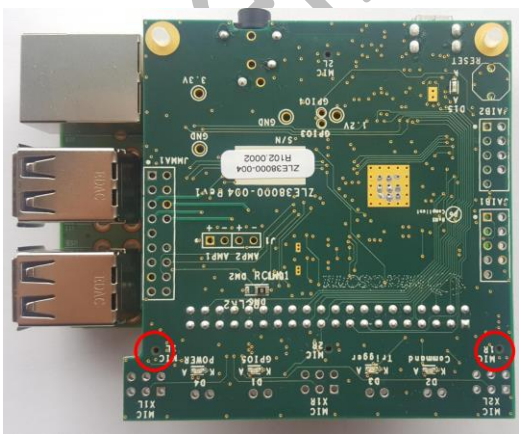
The ZLK38AVS Development Kit is shipped with some of the required hardware while other hardware must be provided by the user. All the software for the ZLK38AVS Development Kit is provided through GitHub.

Hardware Provided

The following hardware is provided in the ZLK38AVS Development Kit:

1. ZLE38AVS Board
2. Speaker and Raspberry Pi stand (plastics)
3. Plastic standoffs and screws
4. USB cable

ZLK38AVS AVS Development Kit



Raspberry Pi and ZLE38AVS with microphones for 180° or 360° far-field pick-up

Hardware Not Provided

The following hardware is needed to run the ZLK38AVS demonstration and needs to be provided by the user of the Development Kit:

1. Raspberry Pi 3
2. 2A or greater power supply for the Raspberry Pi 3 (This can be a USB3 port from your computer)
3. Micro SD card (8GB or higher)
    a. A card with a 90MB/s or great read speed is recommended
4. External Speaker
    a. https://www.amazon.com/gp/product/B00KH636V2?ref_=sr_1_7&qid=1491831969&sr=8-7&keywords=jbl%2Bclip%2Bspeaker&th=1&pldnSite=1
5. USB keyboard and mouse
6. HDMI monitor and cable
7. Ethernet Cable (or WiFi) for Internet connection

Note: The Monitor, Keyboard and Mouse can be left off if plan to use VNC (or similar) to connect to your Raspberry Pi

Software

The following software for the ZLK38AVS Development Kit is provided through GitHub:

1. A make file which installs all the required software
2. The latest Voice Processing Timberwolf device series Software Development Kit (SDK)
    a. The Voice Processing SDK is a collection of Software, tools, code examples and documents for rapid development with the Microsemi's Timberwolf device series.
3. A Firmware Loader Application
    a. This application makes use of the Voice Processing SDK functions to load the firmware into the ZL38063 device.

Note: During the ZLK38AVS installation, the software will download the following sample Application "alexa-avs-sample-app" from Amazon.

The Amazon sample application will download all necessary pre-requisites needed by the Alexa Voice service including the Sensory Library.

Hardware Assembly

To Assemble the ZLK38AVS kit the following instructions should be followed:

Plastics Assembly

1. Add stand-off screws backside of the Raspberry Pi mounting ring in the locations shown below:

2. Screw in the Raspberry PI onto the front side of the Raspberry Pi mounting ring and Add the 2nd set of set of standoffs

3. Plug in the ZLE38AVS Board

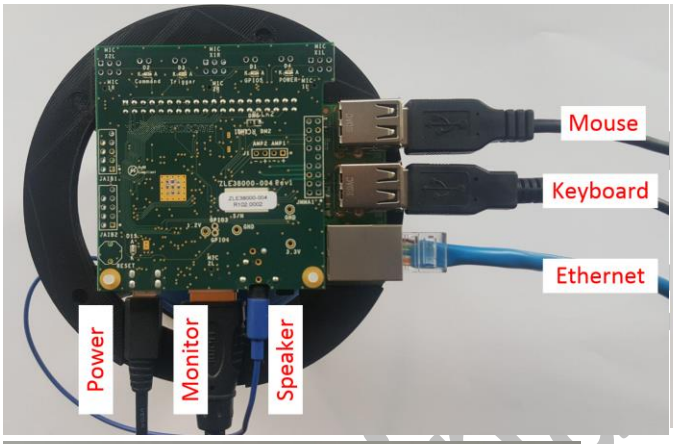
4. Place the speaker facing downwards into the lower plastics
    a. NOTE – The Shorter pin is on the right side

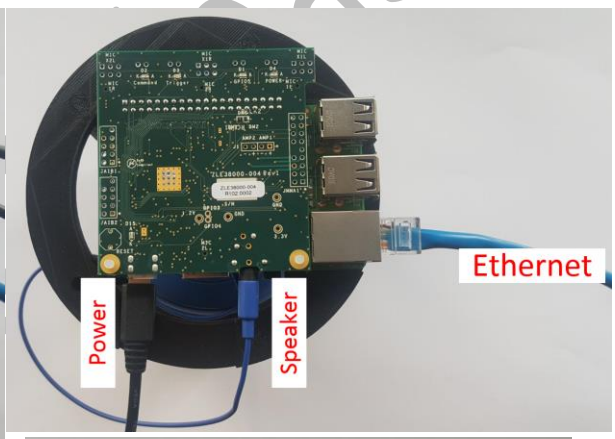
5. Now assemble the upper plastics to the lower plastics
    a. NOTE: The Shorter pin is on the right side under the Raspberry Pi USB jacks
    b. CAUTION: Be gentle as the bars on the cage could break with excess force
6. Plug in the speaker to the ZLE38AVS board

Raspberry Pi Connections

1. Connect an HDMI monitor to the Pi
2. Connect a USB mouse and keyboard to USB ports of the Pi
3. Connect the Pi to your network with an Ethernet cable (unless Wi-Fi is used)
4. Flash image onto the SD card using the Wind32Diskimager application (see Creating Raspbian Image on Page 8)
5. Insert the SD card into the SD card slot of the Pi
6. Power up the Pi using a compatible 5V supply (via the USB connection)

Note: The Monitor, Keyboard and Mouse can be left off if you are using VNC (or similar) to connect to your Raspberry Pi





ZLK38AVS with Keyboard, Mouse and Monitor

ZLK38AVS

ZLK38AVS Software Installation

Overview

There are three steps to installing the software on the Raspberry Pi:

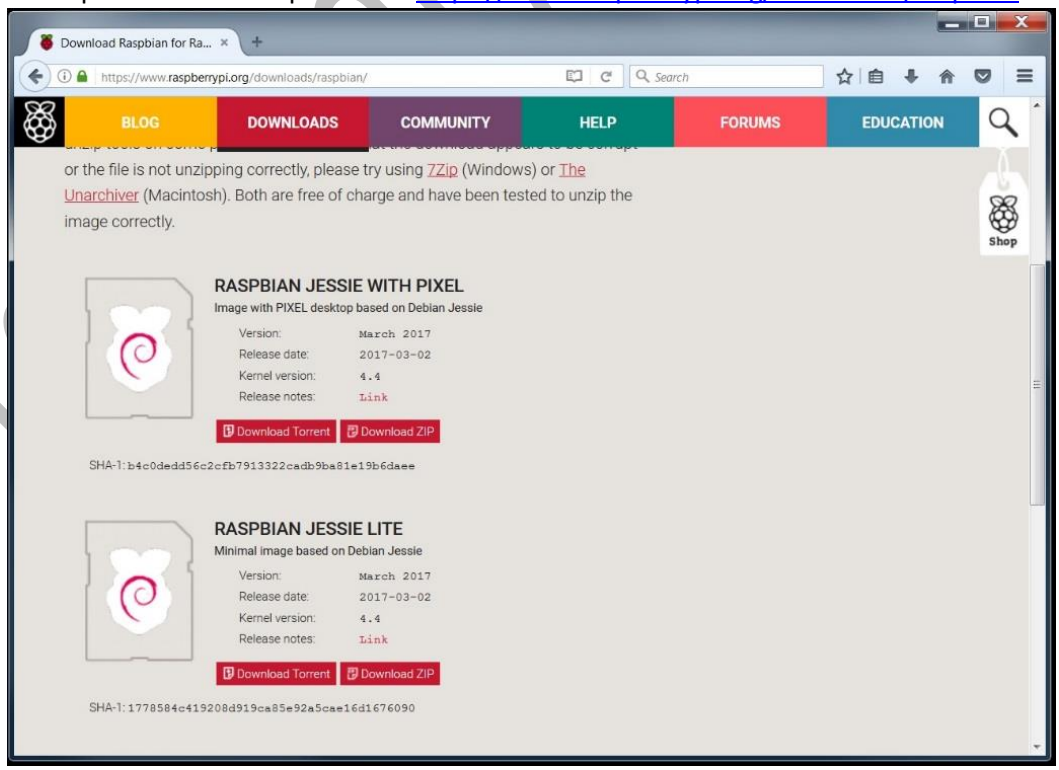
1. Creating Raspbian Image
    a. This is done on your PC
2. Installing ZLK38AVS Software
    a. This step downloads the installation scripts and Microsemi software
3. Raspberry Pi Software Installation
    a. This step downloads and installs the Amazon and Sensory software

Note: Steps 2 and 3 use a monitor, Keyboard and Mouse, these steps can also be done through VNC (or similar).

Creating Raspbian Image

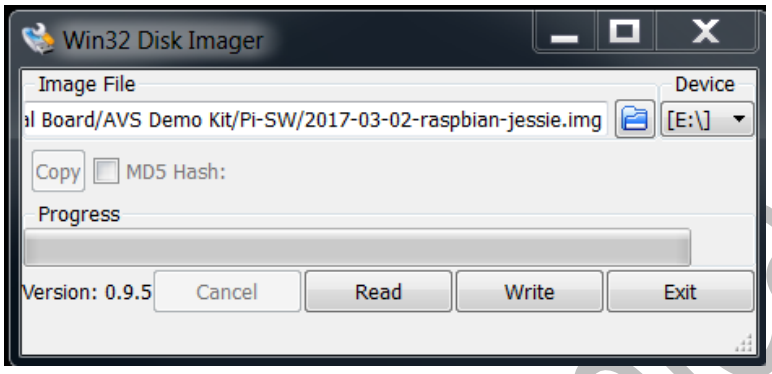
The Raspberry Pi Operating system we will install on the SD Card is the Raspbian Jessie with Pixel. On your PC follow the steps below:

1. Format your SD Card to FAT32 to ensure you are starting with an empty card
2. Download and install Win32DiskImager from https://sourceforge.net/projects/win32diskimager/
3. Download Raspbian Jessie with pixel from https://www.raspberrypi.org/downloads/raspbian



4. Unzip the downloaded image

5. Write the image to the SD card using Win32DiskImager:
    a. Select the downloaded image
    b. Select the SD card device in the Device drop down menu
        i. Ensure you select the correct device as it will overwrite all data
    c. Select write to save the image to the SD card. This process will take approximately 6 minutes



6. Once the card has been written, exit Win32 Disk Image and install the SD card into the Raspberry Pi.

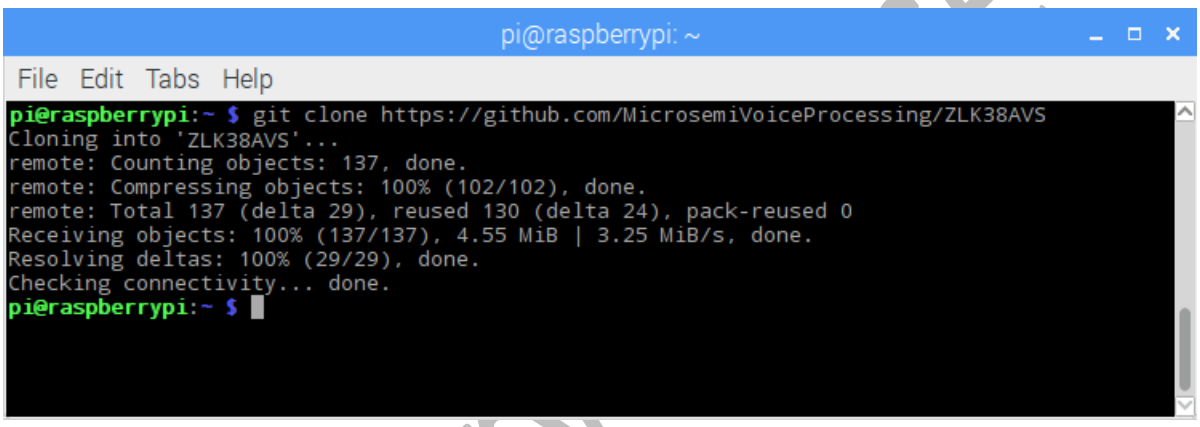
Raspberry Pi Software Installation

Once the pi is up and running make sure the Pi is connected to the Internet by opening up the web browser. Then open a terminal window and change into your desired working directory, or create one.

Downloading ZLK38AVS Software

The Microsemi software for the ZLK38AVS kit can be found on the Microsemi Voice Processing GitHub repository. To download the repository on your Raspberry Pi run the following command:

git clone https://github.com/MicrosemiVoiceProcessing/ZLK38AVS

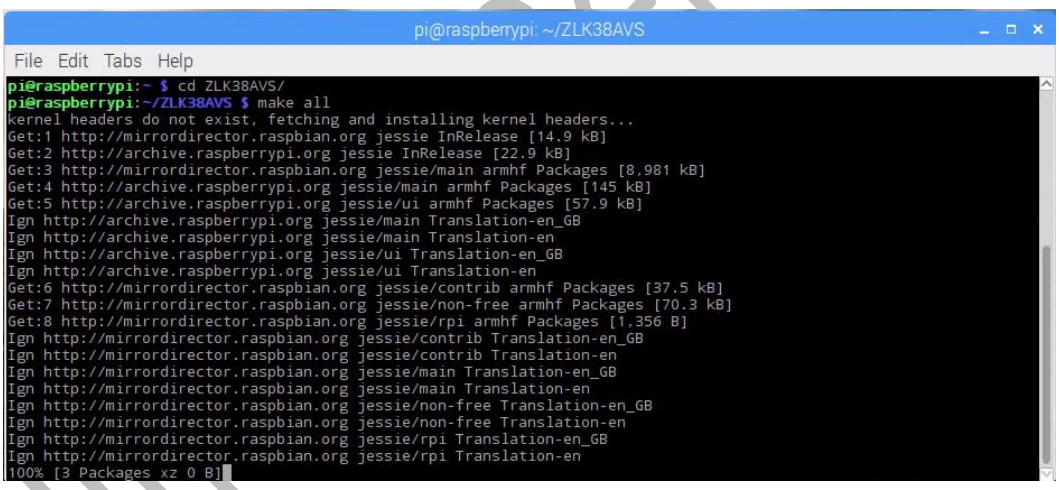


Note: *git is installed by default with the Latest Raspian Jessie, but it can also be installed using the command:*

sudo apt-get install git

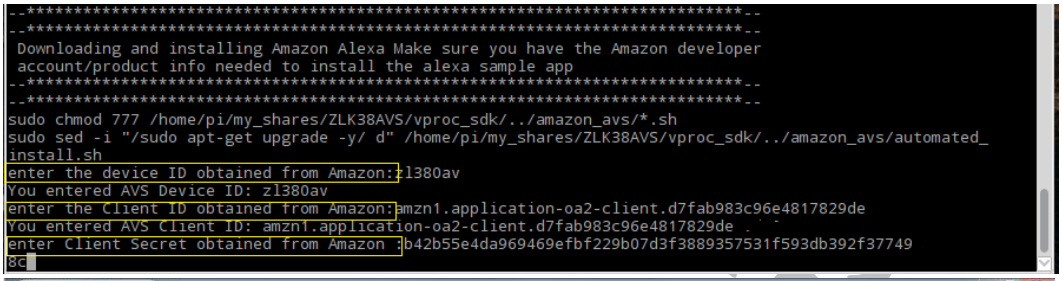
Installing ZLK38AVS Software

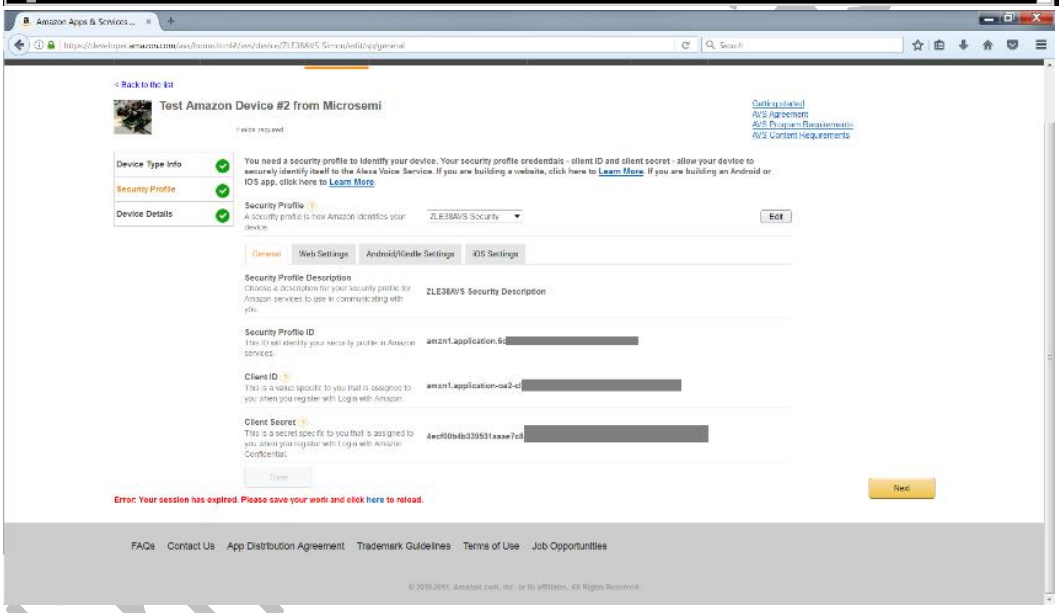
1. Cd into the location where the GitHub package was downloaded.
    a. cd ZLK38AVS/
2. Run "make all" command
    a. *During "make all" the software will download the headers for the current kernel running into the PI. This step can take as long as 30+ minutes.*
    b. *If the Pi seems to be staying on a message saying "Unpacking and installing raspberrypi-Kernel-headers …." And shows no progress for a long time (~20-30+ minutes) this does not indicate a problem with the installation or the Pi, this is the correct behavior; it is because this processing of unpacking kernel headers takes time. If there is a problem an error message will be shown*
        i. *While this is running you can create your Amazon account. You will need information from the creation of your Amazon account later in the software installation (See "*Amazon Developers Account Creation*" on Page 16)*



3. "make all" will automatically download the Amazon Alexa Sample application and install it. The installation of the Amazon sample apps requires an Alexa developer account *(See "*Amazon Developers Account Creation*" on Page 16)*

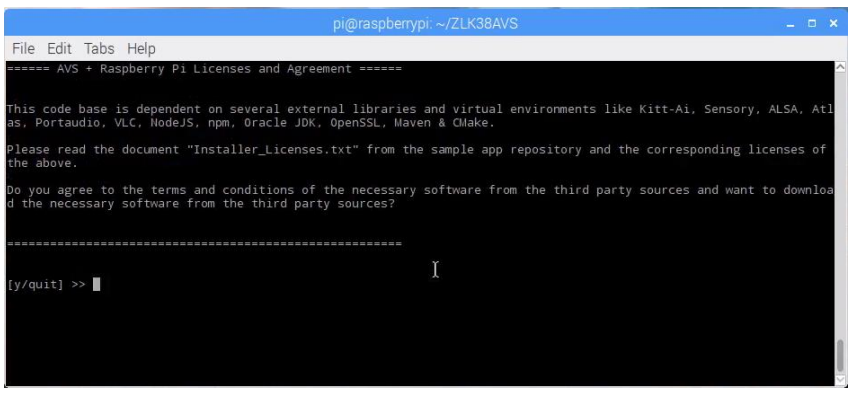
4. When prompted, enter your information from Amazon (see Amazon Developers Account Creation on Page 16):
    a. Device Type ID
    b. Client ID
    c. Client Secret



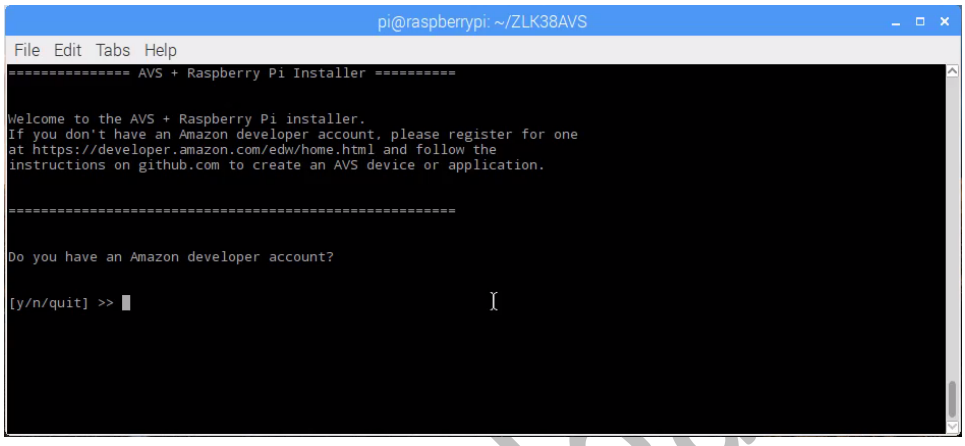


Note: The ID's shown above are only given as example and they are not valid, enter your own ids.

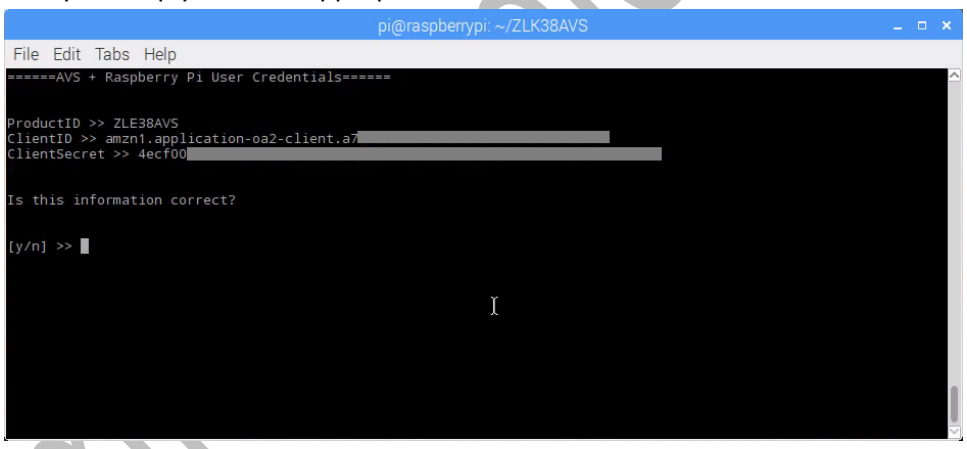
5. After entering the 3 requested IDs, the installation of the Amazon sample application will start. Further questions that require a Yes (Y or y) or No (N or n) or a digit option between 1-3 answer from the user will be asked by the Amazon installation:
    a. Continue Installation?
        i. Yes



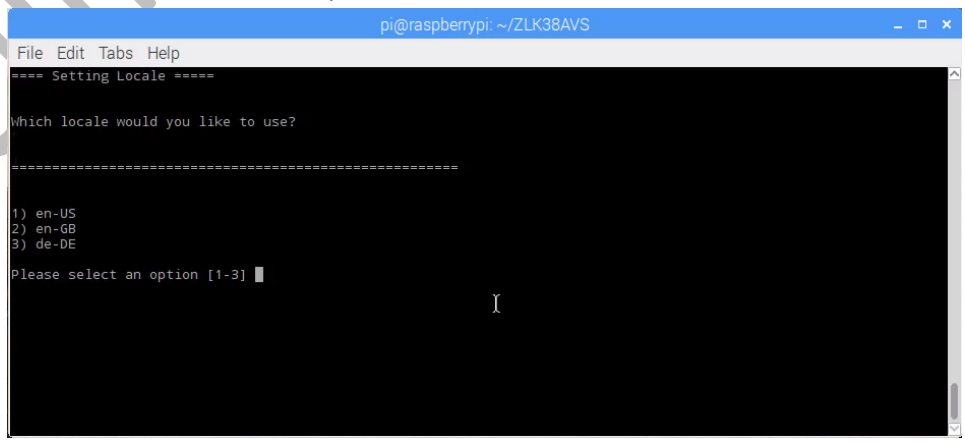
b. Do you have an Amazon developer account?
   i. Yes



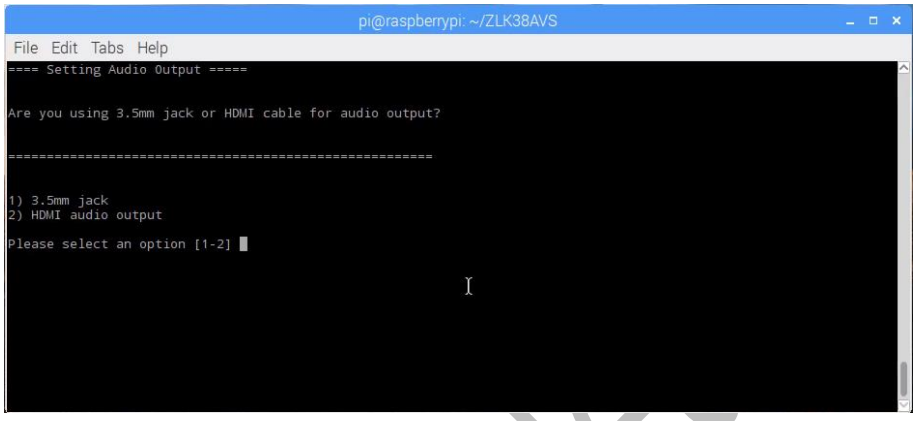
c. Is this information correct?
   i. Verify and reply with the appropriate answer



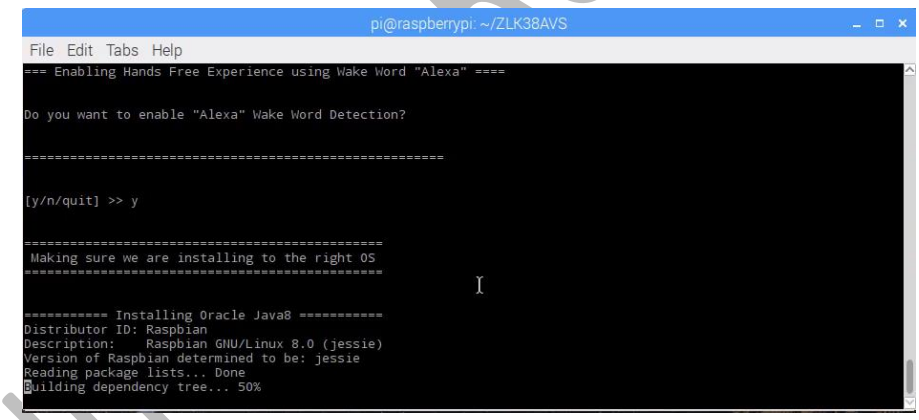
d. Which locale would you like to use?
   i. Select the correct local for you



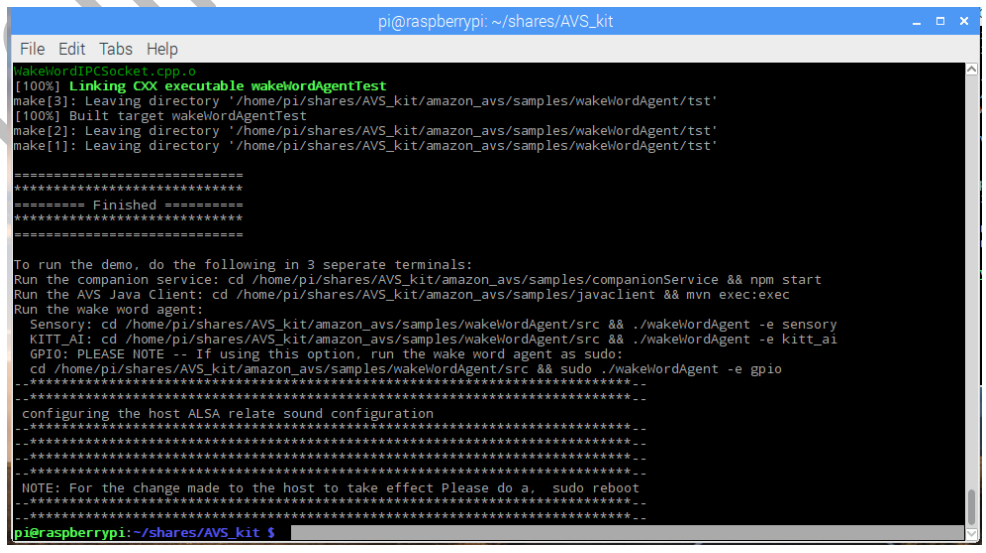
e. Are you using 3.5mm jack or HDMI cable for audio output?
   i. Since the audio will be generated and processed by the ZLK38AVS audio device either option can be selected



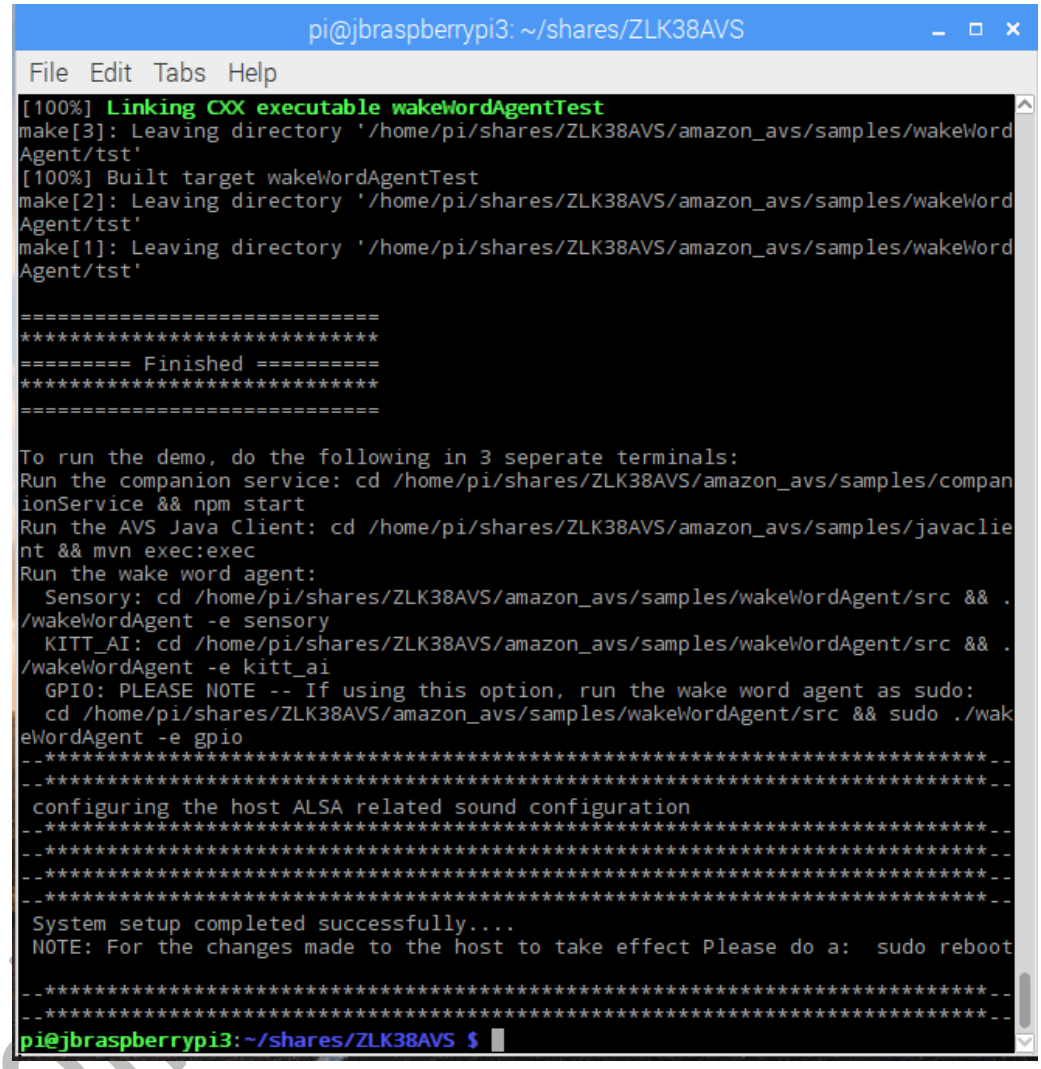
f. Do you want to enable "Alexa" Wake Word Detection?
   i. Yes
   ii. Note: installation of the Amazon Alexa application can takes as long as 45+ minutes



6. A successfully completed installation should show the message in the image below



7. Upon the completion of the ZLK38AVS kit installation, issue a reboot command to reboot the Pi
    a. sudo reboot

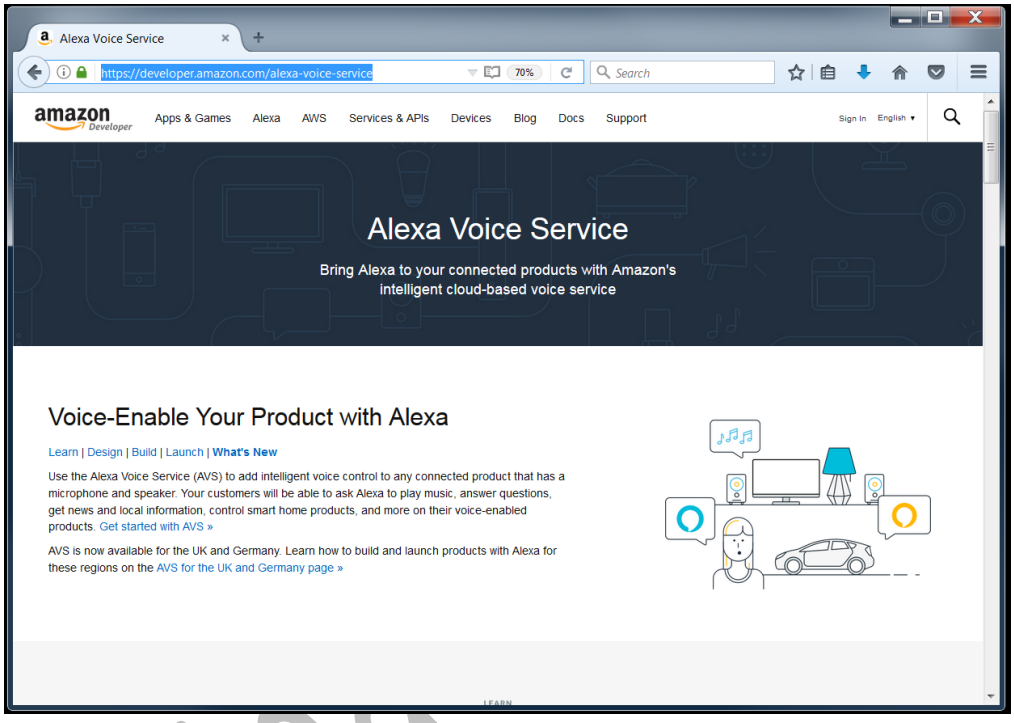


You have now completed the installing of the required software for the ZLK38AVS demonstration

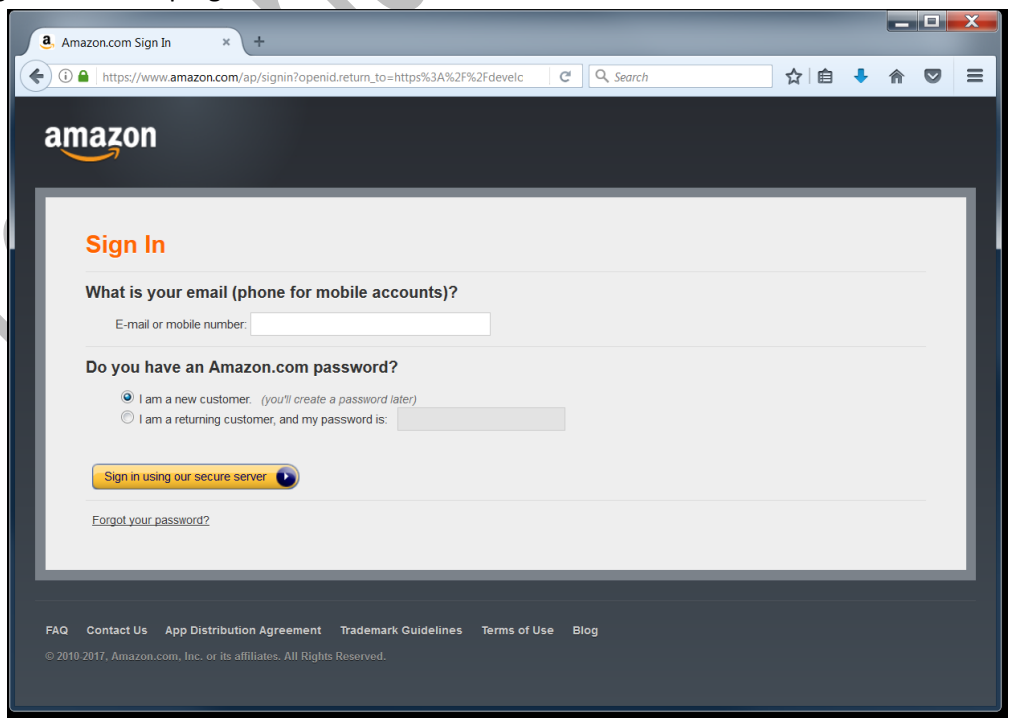
Amazon Developers Account Creation

An Amazon developers account is needed in order to run the ZLK38AVS Demonstration, the instructions below describe the steps required to create an account to use with the ZLK38AVS Demonstration kit

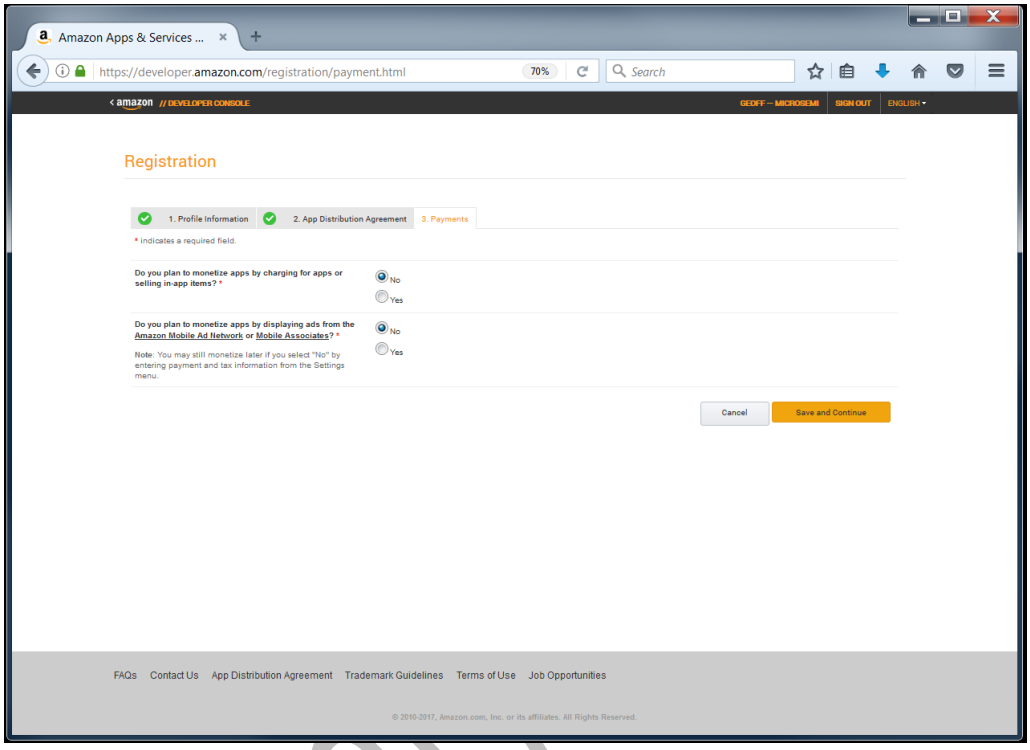
1. Go to https://developer.amazon.com/alexa-voice-service



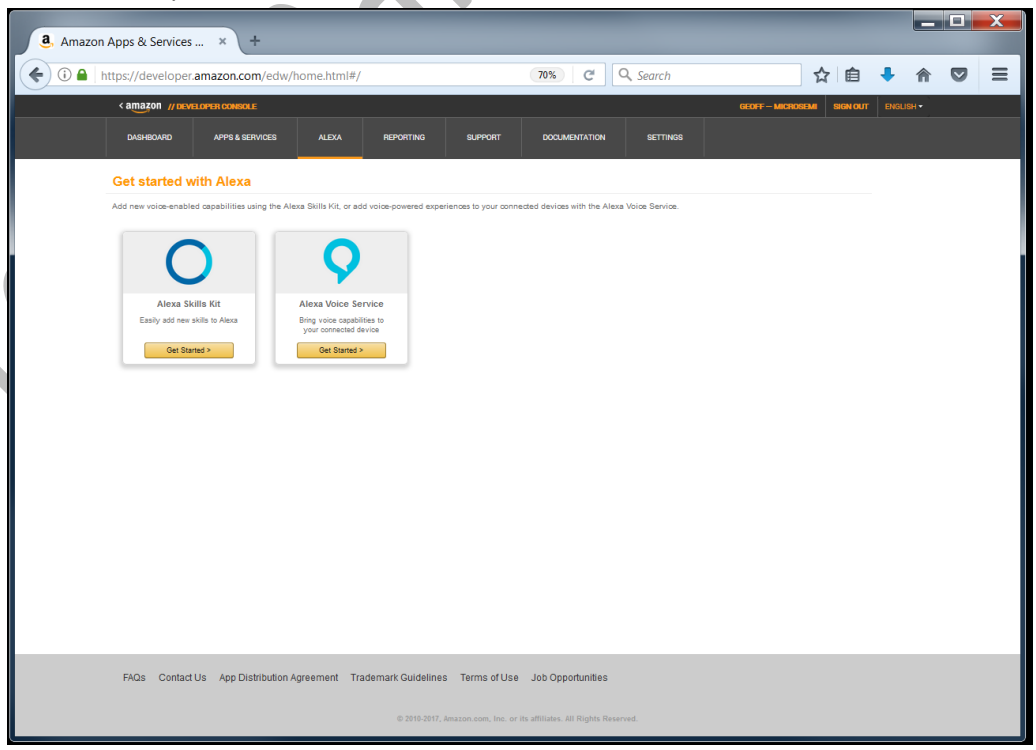
2. Click Sign-in on the top right of the screen



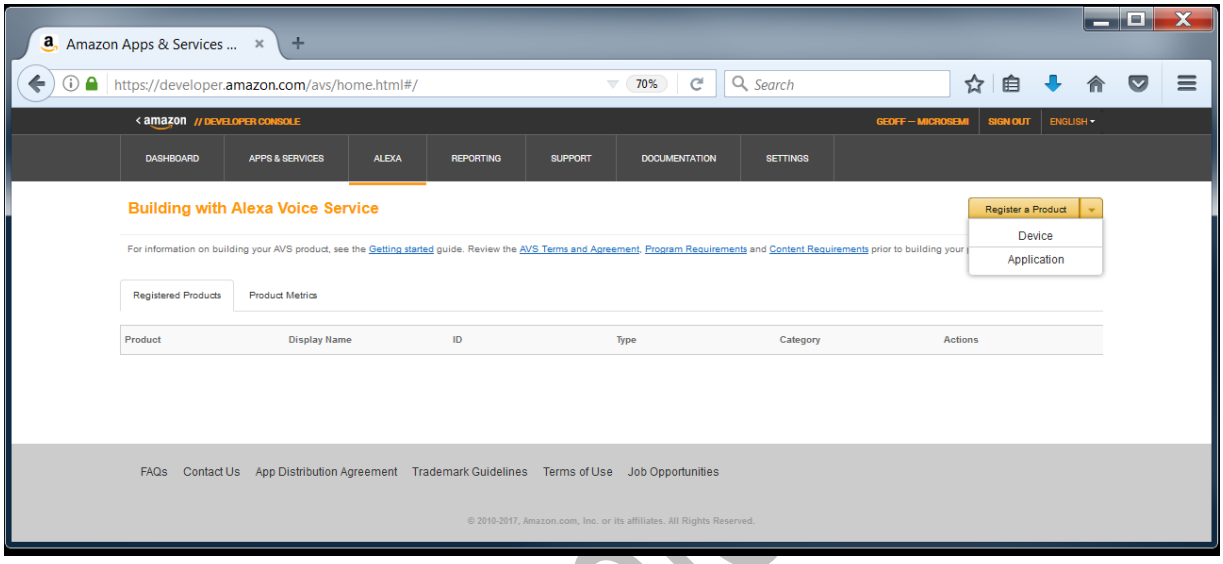
3. Either sign-in with your account, or create a new account (New Customer)
    a. Fill out the registration forms as requested by Amazon
4. When prompted for information on the Apps Distribution Agreement select No for both options:



5. Select Alexa on the top bar

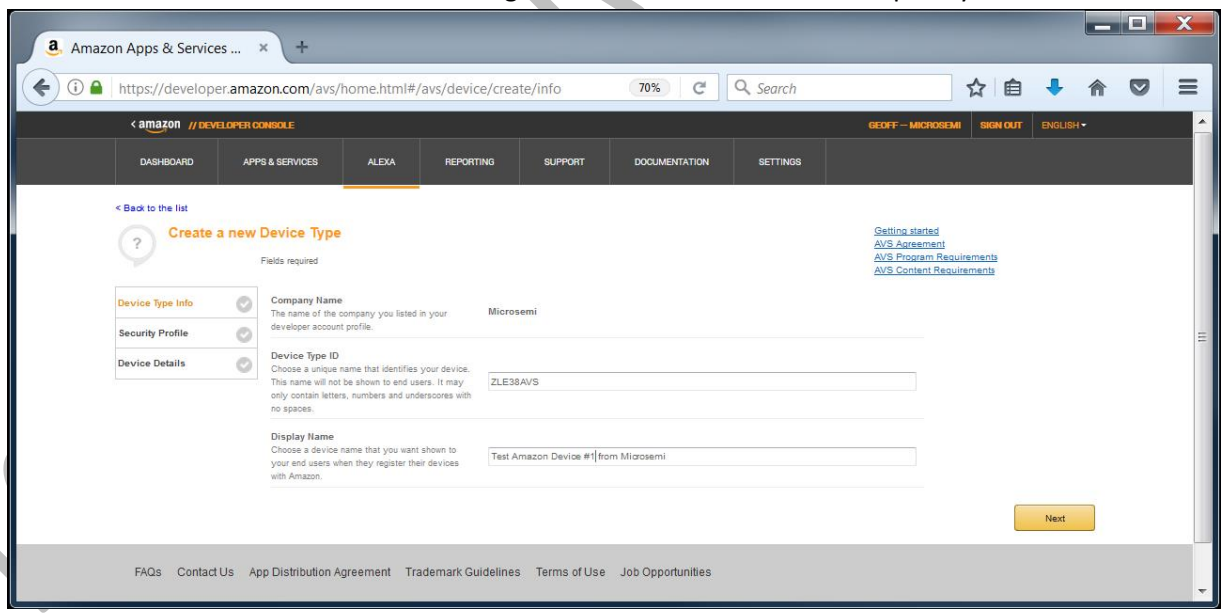


6. Select Alexa Voice Service, Get Started

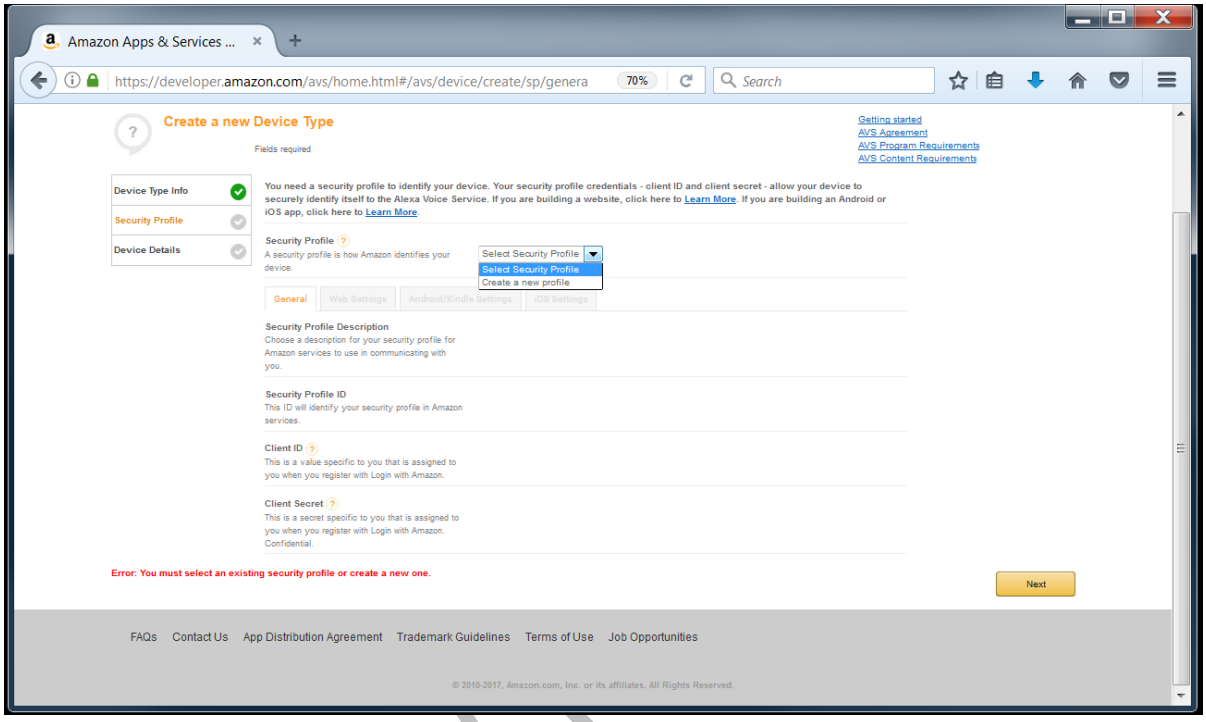


7. Select Register a Product, Device on the right side of the page
   a. Provide a name and description and click next

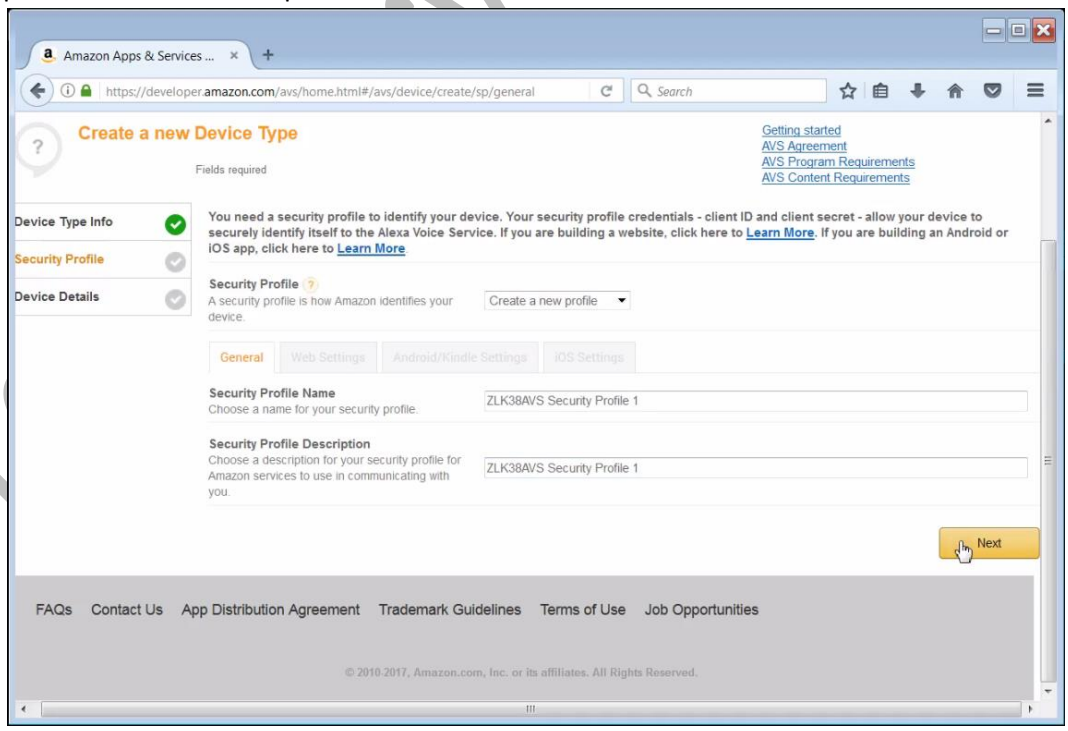
   Note: The Device ID is used when installing the Amazon Code onto the Raspberry Pi



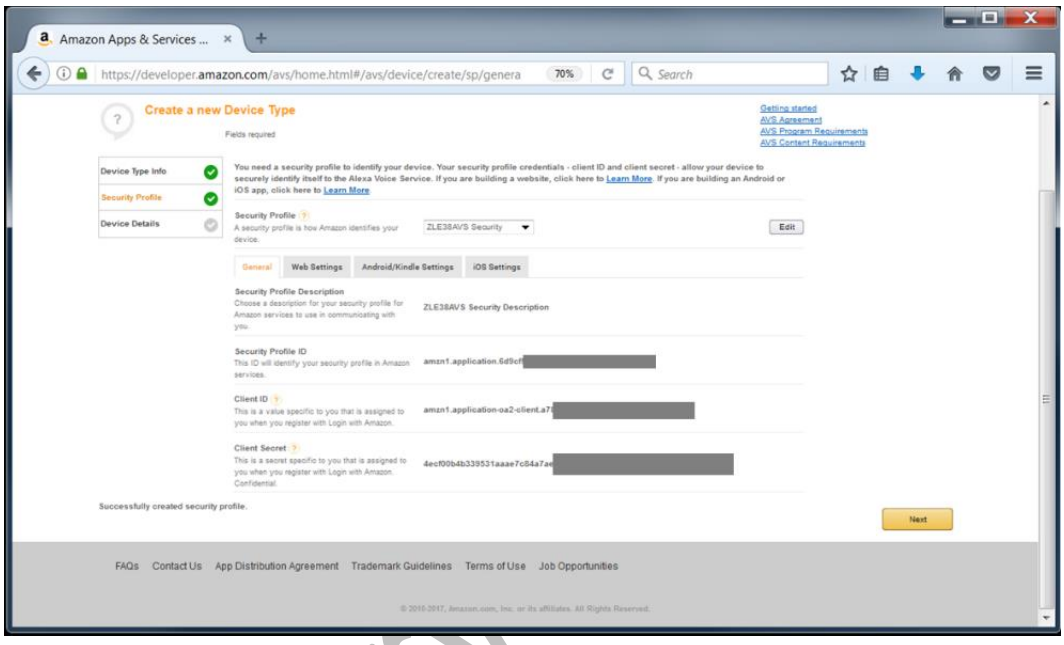
8. Select “Create a new profile” from the pull-down



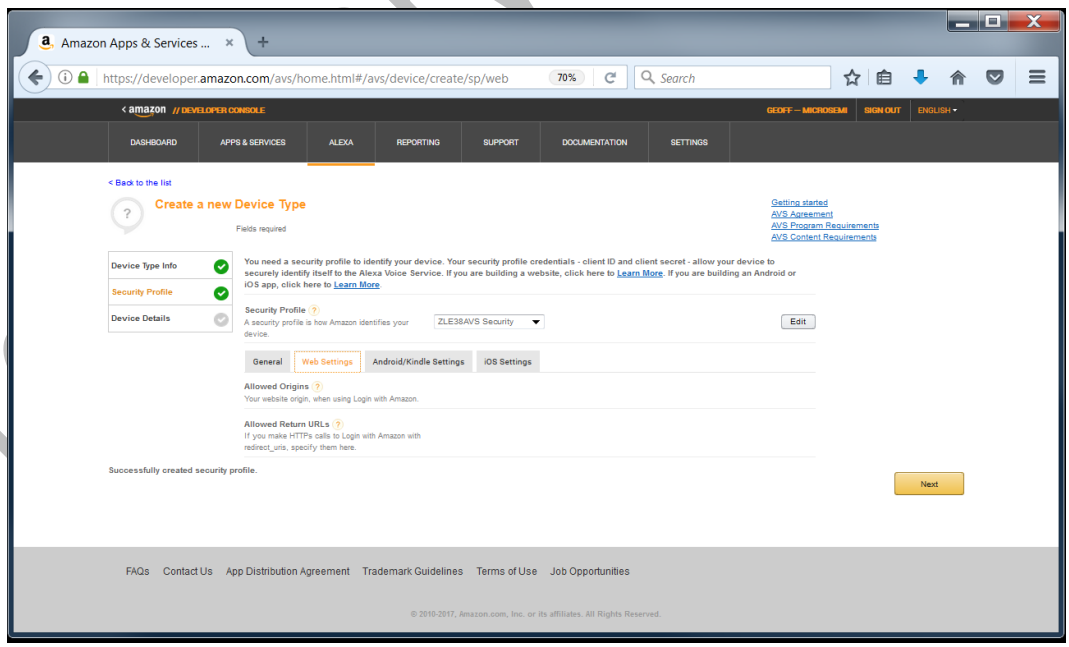
9. Enter a profile name and description and click next



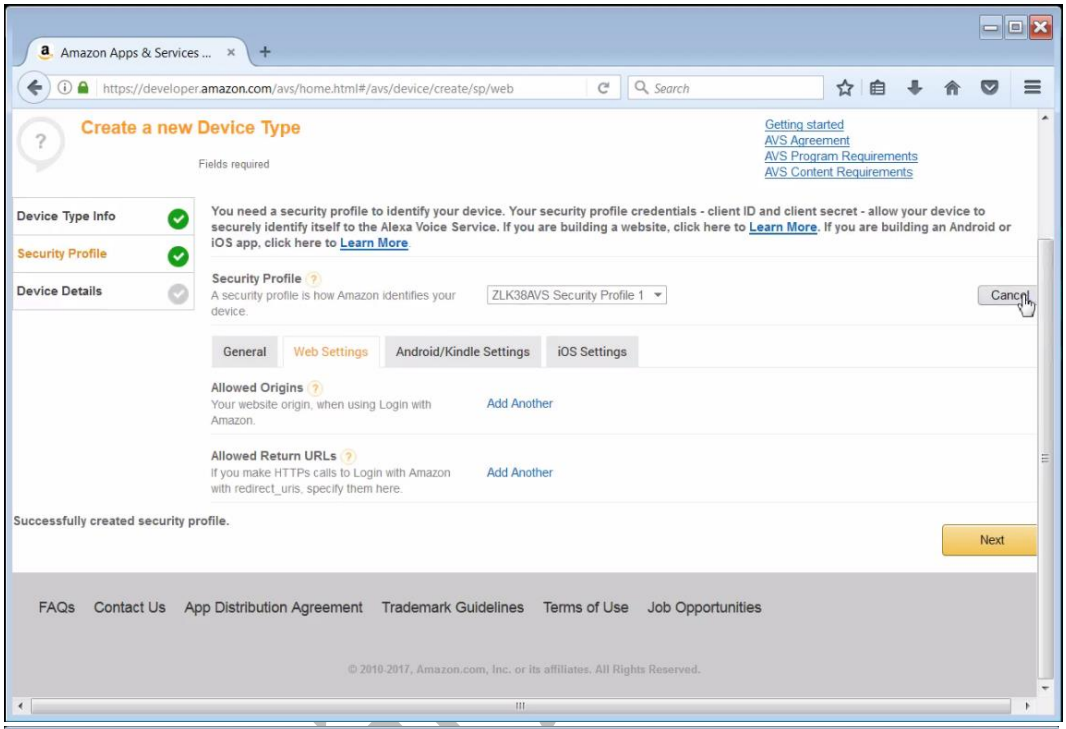
10. The Security profile will be displayed
    a. Select Web Setting
    b. Note: The Client ID and Client Secret are used when installing the Amazon Code onto the Raspberry Pi

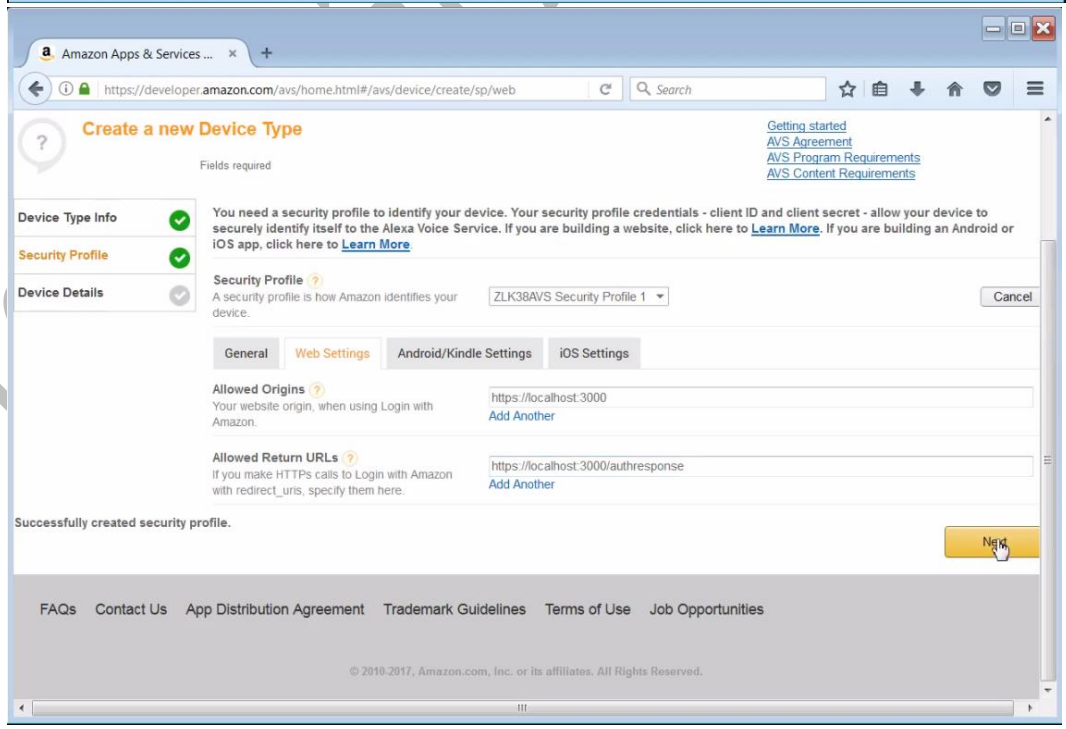


11. Select Edit

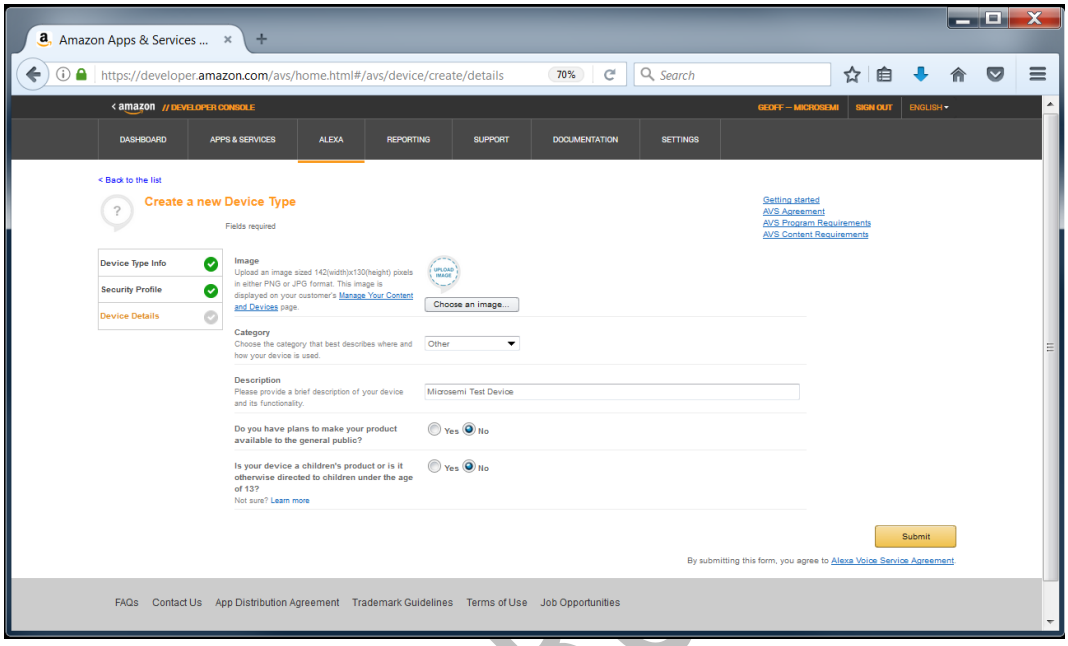


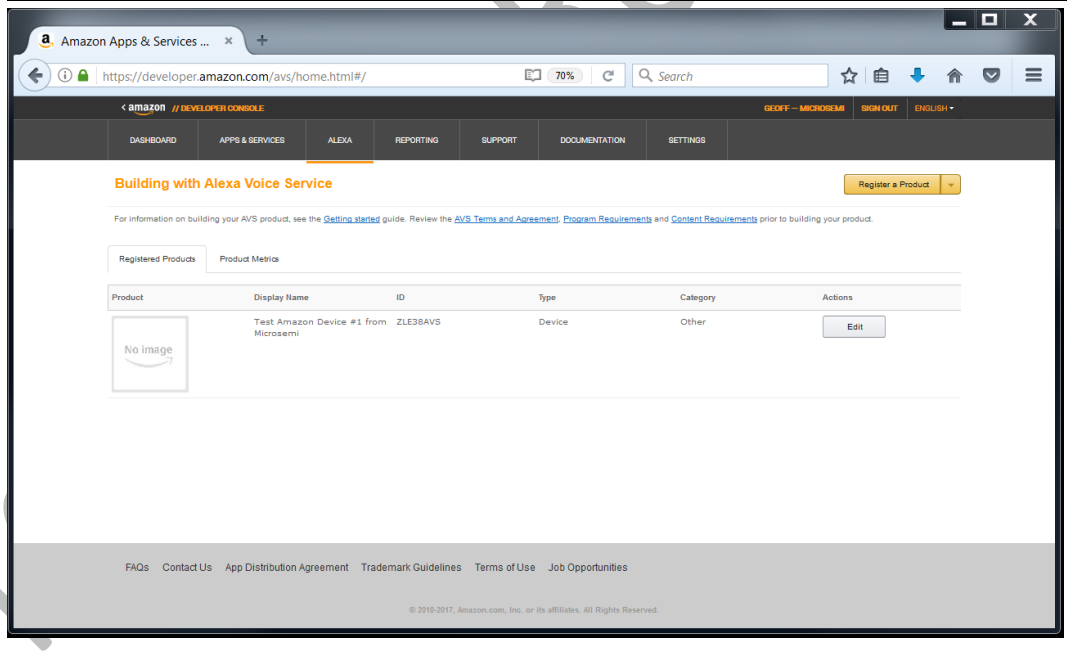
12. Enter the following (click Add Another):
    a. Allowed Origins: https://localhost:3000
    b. Allowed Return URLs: https://localhost:3000/authresponse
    c. Select Next





13. Fill out the form, click Submit





You have now created the Amazon Developer Account.

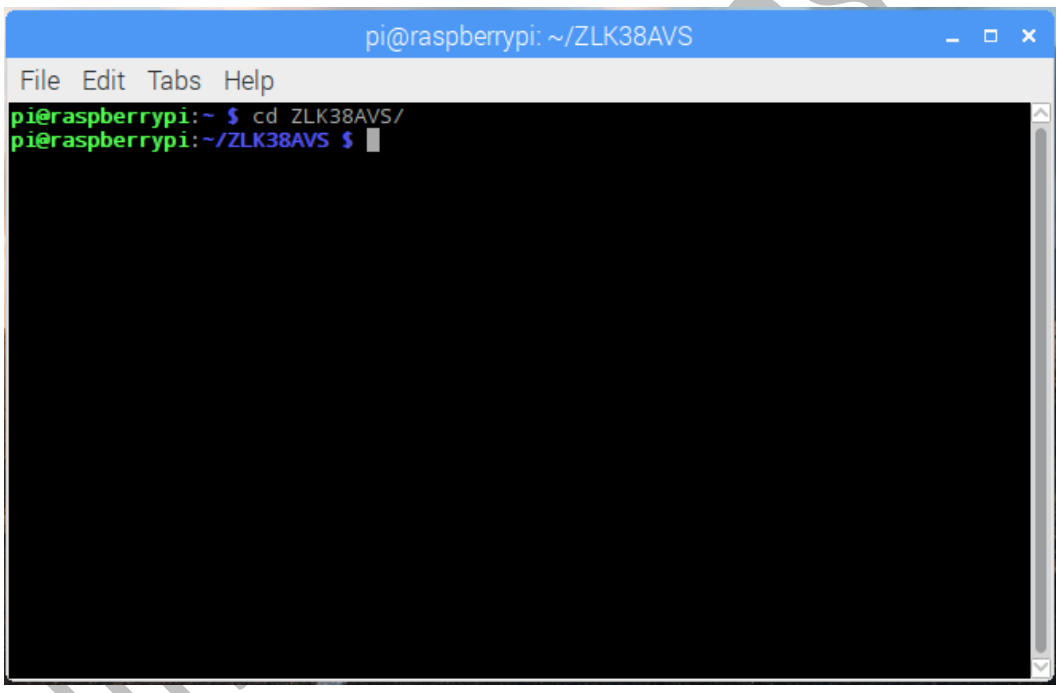
Demonstrating the ZLK380AVS (software)

After installing the software (See ZLK38AVS Software Installation on page 8) and rebooting the Pi you can now demonstrate the Alexa Voice Services.

The ZLK38AVS supports two separate microphone configurations - 180° or 360°. The ZLK38AVS default installation is to use the 180°. To change the configuration see “Changing the Microphone Configuration” on Page 27.

Starting AVS Software

1. Cd into the location where the GitHub package was downloaded.
    a. eg: cd ZLK38AVS/

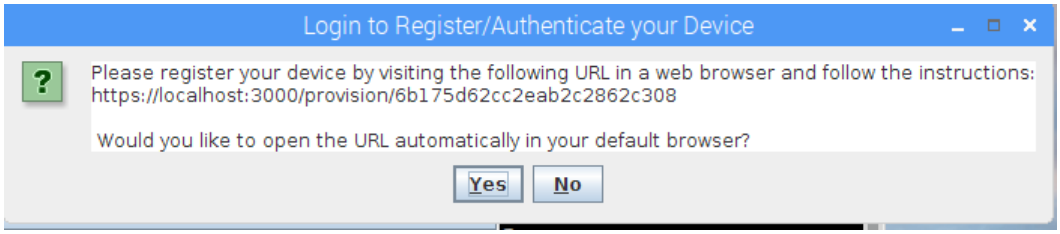


2. Issue the following make command to start the AVS software:

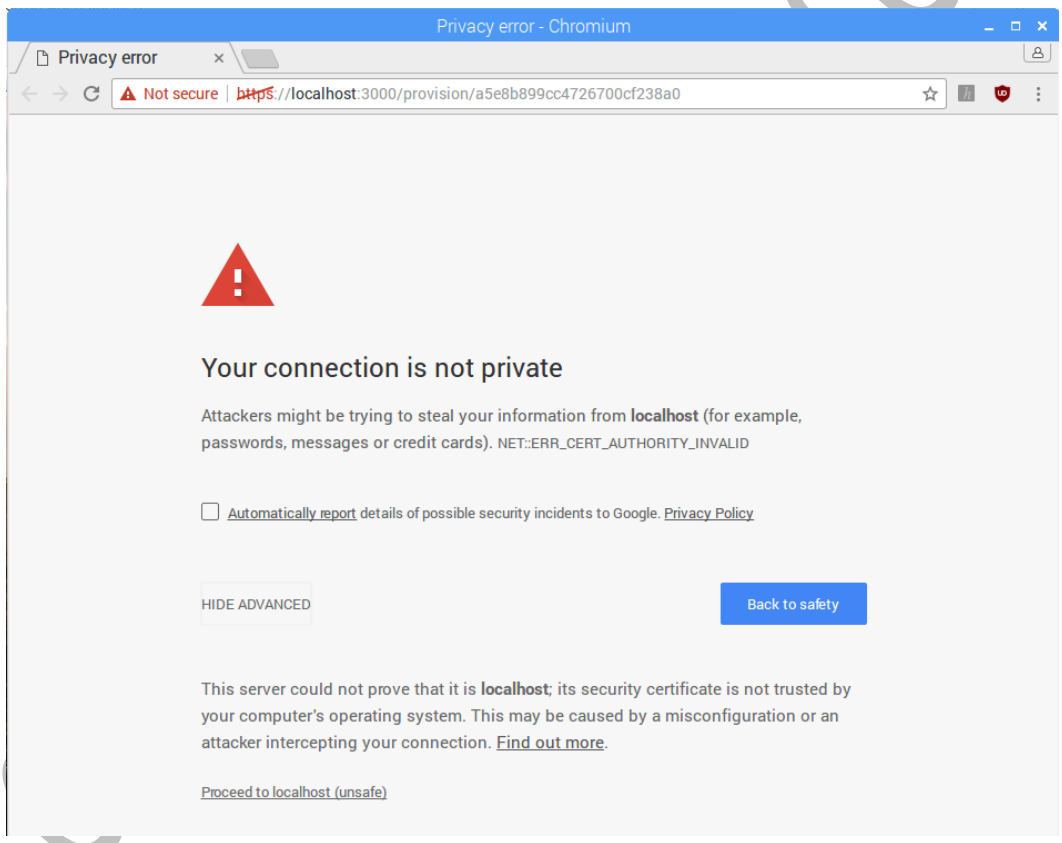
```
make start_alexa
```

    a. The command will open 3 terminals. Each of the terminal windows will start executing the appropriate command as required by the Alexa application
    Note: the error in one of the terminal screen is not an indicative that Alexa failed to start. It is due to the fact that the Internet browser is not opened yet.

3. Open the default browser by clicking “Yes” when you see the pop screen below:

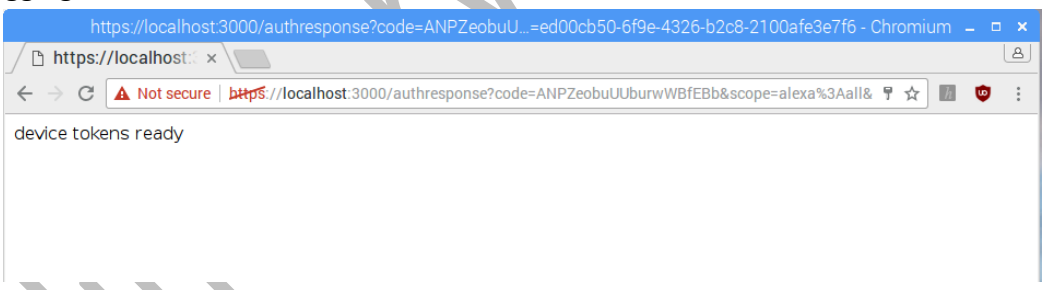


4. When the web browser opens click Show Advanced and “Proceed to localhost (unsafe)”
   a. Note: the web browser takes a minute to open

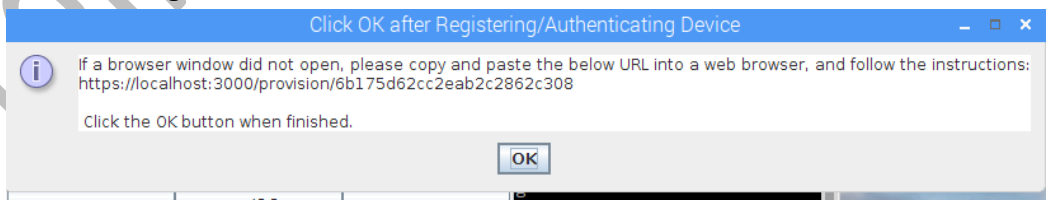


5. Login with your E-mail and password used when creating your Amazon developers account

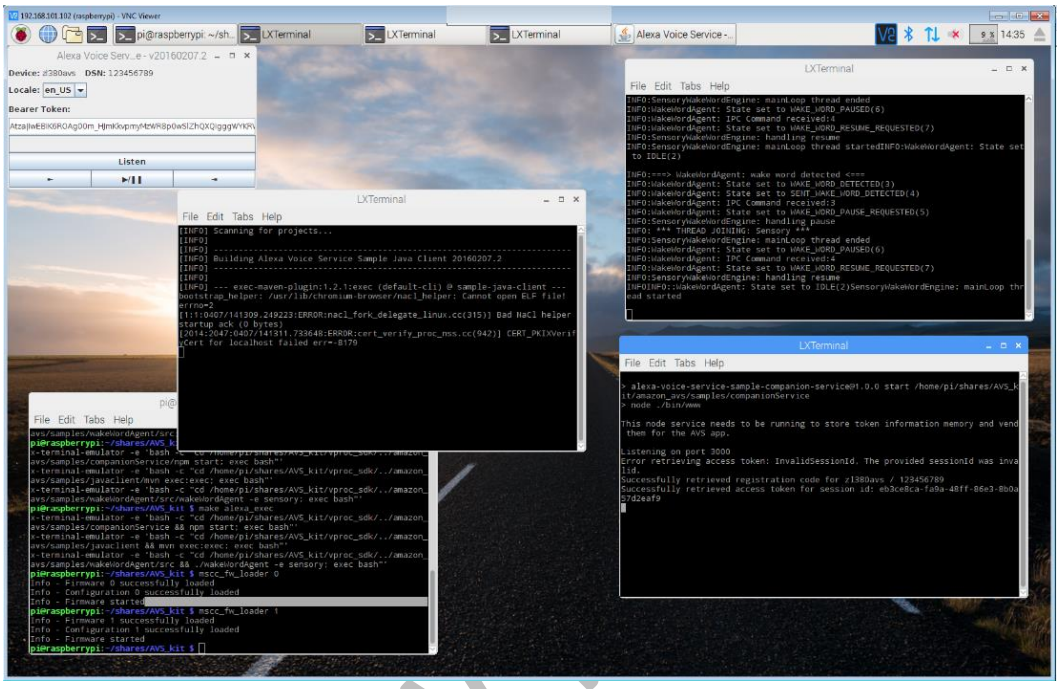
6. After logging in close the window:



7. Click OK after closing the browser window



8. Once you have confirmed your Amazon account, Amazon will generate a Bearer Token that will be displayed in the Alexa Voice Service screen as shown below.

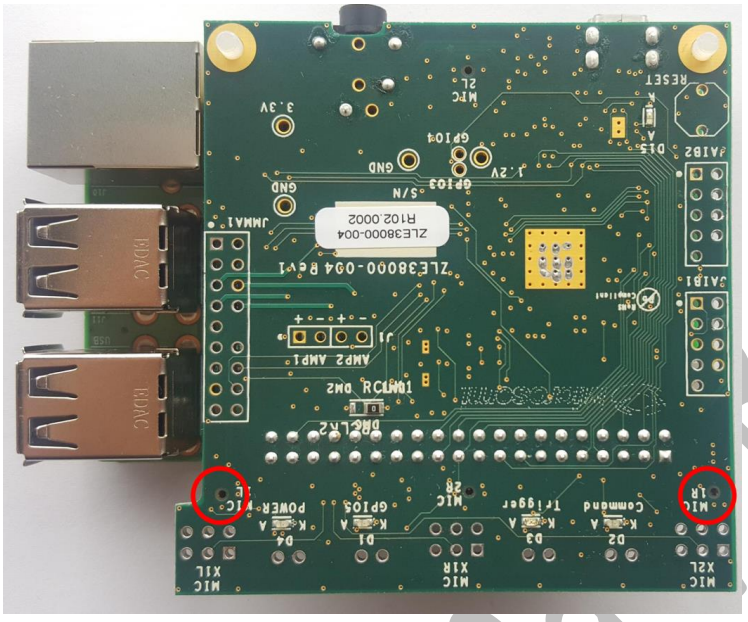


9. Turn on the speaker (using power button on the bezel) and set the volume to maximum using the + button (on the bezel).
    a. Note: The speaker has an auto-turn-off feature to save battery life, so before testing the unit, make sure turn the speaker on, if switched off
10. At this point Alexa is ready to accept commands.
    a. You can try a few quick commands like ‘Alexa, what time is it?’ or ‘Alexa, what is the capital of Peru?’ to test it.
    b. A full list of Alexa Voice commands can be found at https://www.cnet.com/how-to/the-complete-list-of-alexa-commands/
        i. Note: Some commands listed on the above website require accounts to be set-up (eg. Pandora Stations).

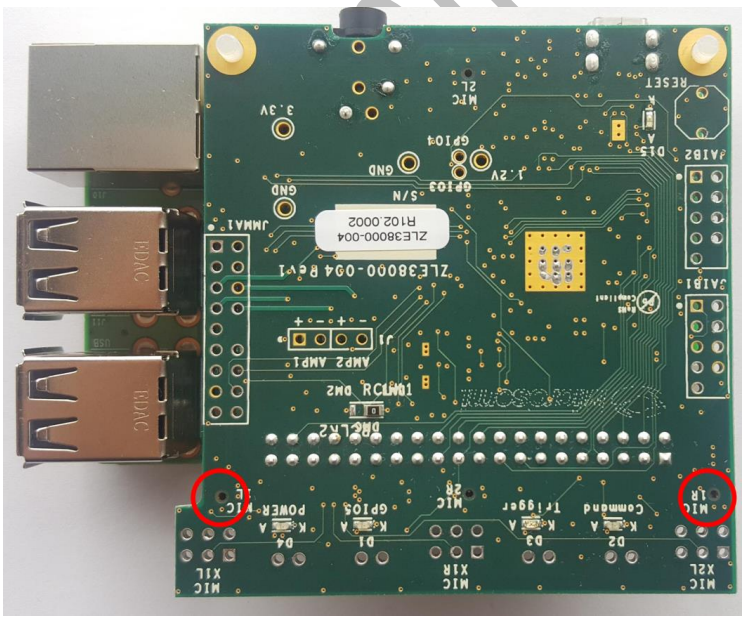
Changing the Microphone Configuration

Microphone Array Overview

This kit features Microsemi's ZL38063 voice processor powered by Microsemi's proprietary AcuEdge™ technology for front-end audio clean-up and Sensory's TrulyHandsFree™ "Alexa" wake-word engine. Two separate microphone configurations allow you to test applications with 180° or 360° far-field pick-up. The default configuration is 180° which can be changed following the steps below.



Raspberry Pi and ZLE38AVS with microphones for 180° far-field pick-up



Raspberry Pi and ZLE38AVS with microphones for 360° far-field pick-up

Changing ZL38063 Microphone Mode

The make all process (See ZLK38AVS Software Installation on page 8) installs an application required to load the ZL38063 device firmware from the Raspberry Pi.

This application can configure the ZL38063 device in one of two supported microphone modes 180° or 360° sound pick-up. The default configuration is 180° which can be changed following the steps below.

Runtime Selection

In order to change to or from 180° or 360° microphone modes the following steps should be followed:

1. Open a terminal on the Raspberry Pi
2. Issue the following command for 180° sound pick-up mode:
   mscc_fw_loader 0
3. Issue the following command for 360° sound pick-up mode:
   mscc_fw_loader 1

Boot Selection

The selection of microphone modes 180° or 360° sound pick-up is configurable prior to installing the ZLK38AVS by editing the MSCC_TW_CONFIG_SELECT variable within the /ZLK38AVS/config.mk file.

- To use the 180° mode set MSCC_TW_CONFIG_SELECT=180
- To use 360° mode set MSCC_TW_CONFIG_SELECT=360

Uninstalling the ZLK38AVS Software

The Pi can be returned back to its' state prior to the installation of the ZLK38AVS SDK install. To do this run the following command in a terminal window from the installation directory:

make cleanall

Note: this command will undo everything that was done during the make all during the ZLK38AVS Software Installation (see page 8).

To clean the ZLK38AVS installation without removing the Amazon Alexa software, run

make clean

To re-make the ZLK38AVS, without re-compiling/re-installing Amazon Alexa, run

make host