ZLK38AVS User Guide
Microsemi AcuEdge™ Development Kit for Amazon AVS

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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 3.0

Revision 3.0 was published in November 2017. The following is a summary of changes made in this revision.

- Software installation steps were updated. For more information, see ZLK38AVS Software Installation, page 8.
- Developer account creation was updated. For more information, see Amazon Developer Account Creation, page 11.
- A new Alexa app was added. For more information, see Demonstrating the ZLK380AVS (software), page 15.
- Installation troubleshooting details were added. For more information, see Installation Troubleshooting, page 16.
- Steps to reconfigure the software were added. For more information, see Reconfiguring the ZLK38AVS Software, page 17.

1.2 Revision 2.0

Revision 2.0 was published in May 2017. It was the first publication of this document.

1.3 Revision 1.0

Revision 1.0 was published in April 2017. It was a preliminary publication of this document.

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2 Overview

Microsemi AcuEdge™ Development Kit for Amazon AVS 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°.

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.

2.1 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 Evaluation Board Hardware Guide
- ZL38063 Product Brief
- ZLS38100 Microsemi VProc SDK Documentation

3 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.

3.1 Hardware Provided

The following hardware is provided in the ZLK38AVS Development Kit:

1. ZLE38AVS evaluation board
2. Pillar (speaker and Raspberry Pi plastic stand)
3. Plastic standoffs and screws

Figure 1 • **ZLK38AVS Development Kit Contents**

Figure 2 • **Raspberry Pi and ZLE38AVS Evaluation Board**
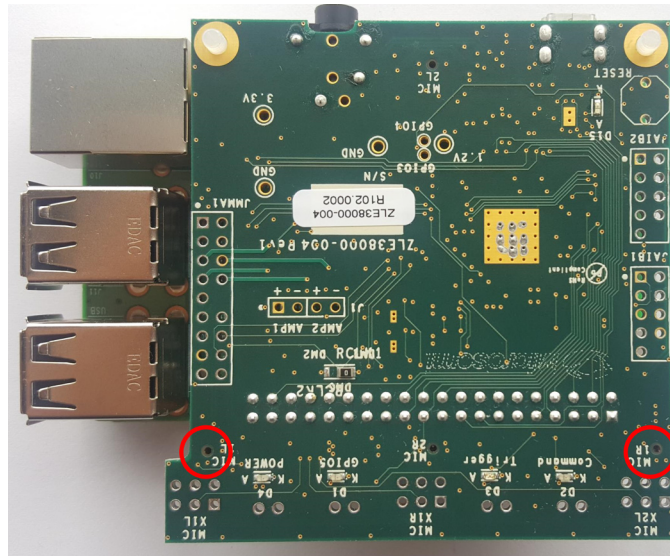
3.2 Hardware Not Provided

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. 2 A or greater power supply for the Raspberry Pi 3 (power can be provided through a USB3/Micro-USB connection from a PC).
3. Micro SD card (8 GB or higher; a card with a 90 MB/s or greater read speed is recommended)
4. External Speaker with a 3.5 mm jack (the example in Figure 6, page 6 is the JBL Clip speaker, available from Amazon at https://www.amazon.com/gp/product/B00KH636V2/)
5. USB keyboard and mouse
6. HDMI monitor and cable
7. Ethernet Cable (or WiFi) for Internet connection

Note: The monitor, keyboard, and mouse connections are optional if using VNC (or similar) to connect to the Raspberry Pi.

3.3 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 Timberwolf device series Voice Processing Software Development Kit (SDK), which 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 that 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 "avs-device-sdk" from Amazon and the "alexa-rpi" model from Sensory.

![Microsemi logo] Microsemi
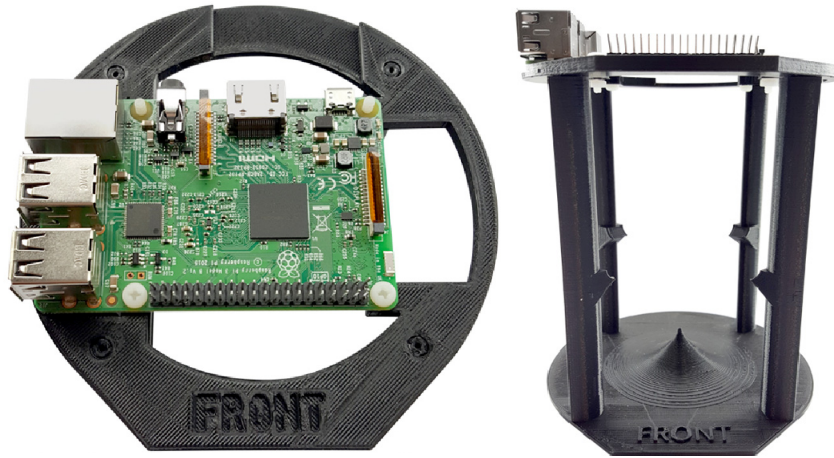Power Matters.™

4   Hardware Assembly

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

4.1   Pillar Assembly

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

Figure 3 •   **Mounted Raspberry Pi with standoffs attached**

2. Add the standoffs to the ZLE38AVS evaluation board

Figure 4 •   **ZLE38AVS board with standoffs attached**

3. Plug in the ZLE38AVS evaluation board and add the remaining screws

Figure 5 •   **ZLE38AVS board attached to mounted Raspberry Pi**

4. Place the speaker facing downwards into the lower plastics

Figure 6 • **Pillar with speaker attached**

5. Plug in the speaker to the ZLE38AVS evaluation board

*Figure 7 •* **Speaker plugged in to ZLE38AVS board**

4.2 Raspberry Pi Connections

1. Connect an HDMI monitor to the Raspberry Pi
2. Connect a USB mouse and keyboard to USB ports of the Raspberry Pi
3. Connect the Raspberry Pi to your network with an Ethernet cable or Wi-Fi
4. Flash image onto the SD card using the Wind32Diskimager application (see Creating Raspbian Image, page 8)
5. Insert the SD card into the SD card slot of the Raspberry Pi
6. Connect a compatible 5V power supply to the Raspberry Pi's Micro-USB port in order to power up the Raspberry Pi

Note: The monitor, keyboard, and mouse connections are optional if using VNC (or similar) to connect to the Raspberry Pi

Figure 8 • **Raspberry Pi connections**
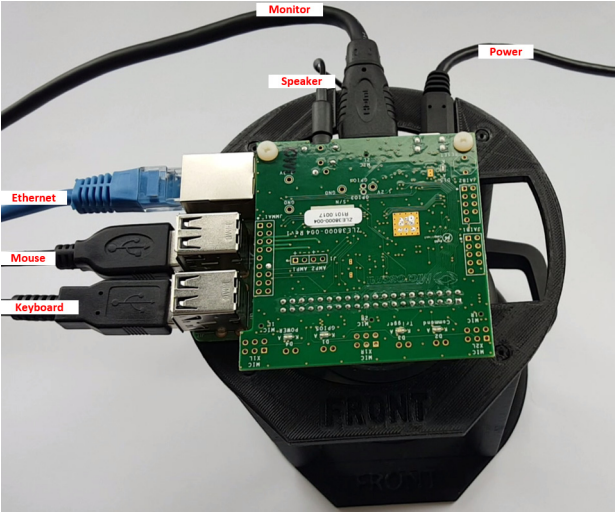
5 ZLK38AVS Software Installation

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

1. Creating Raspbian image: This step is performed on a separate PC.
2. Raspberry Pi Software Installation: This step downloads the installation scripts and installs the Microsemi, Amazon, and Sensory software onto the Raspberry Pi. This step requires a monitor, keyboard, and mouse connected to the Raspberry Pi, or a VNC (or similar) connection to the Raspberry Pi in order to control and monitor the installation process.

5.1 Creating Raspbian Image

Raspbian Stretch with Pixel is the operating system that will be installed on the SD card. On a separate PC, follow the steps below:
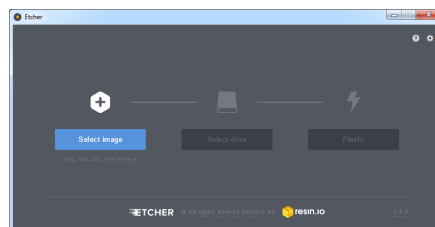
1. Format the SD card to FAT32 to ensure you are starting with an empty card.
2. Download and install Etcher from https://etcher.io/.
3. Download Raspbian Stretch with Desktop from https://www.raspberrypi.org/downloads/raspbian.

Figure 9 • **Raspbian download page**
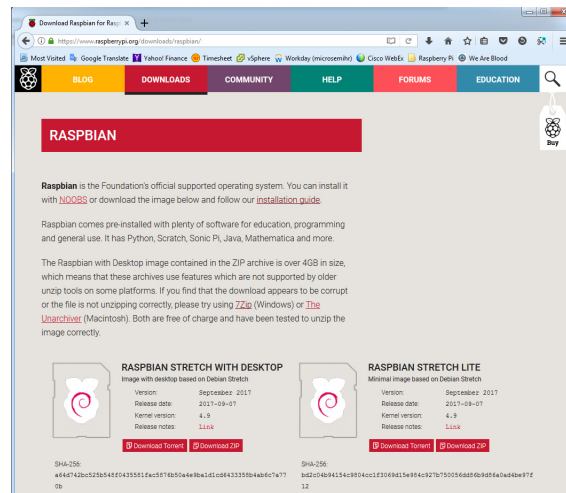
4. Write the image to the SD card using Etcher.

Figure 10 • **Etcher Disk Imager example**

5. Once the card has been written, exit Etcher and install the SD card into the Raspberry Pi.
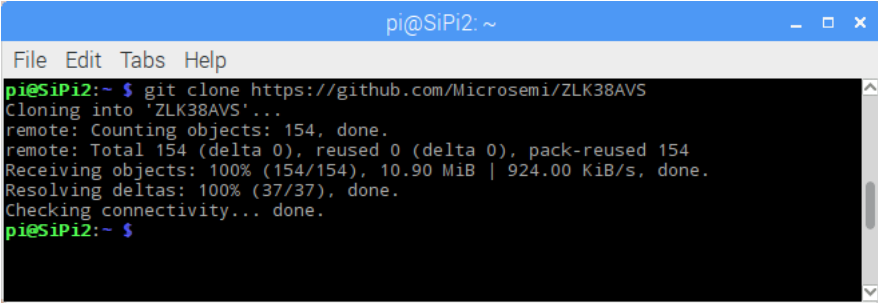
5.2 Raspberry Pi Software Installation

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

5.2.1 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/Microsemi/ZLK38AVS
```

Figure 11 • **Downloading ZLK38AVS software**

Note: git is installed by default with the Latest Raspian Stretch, but it can also be installed using the command:
```
sudo apt-get install git
```

5.2.2 Installing ZLK38AVS Software

1. cd into the location where the GitHub package was downloaded.
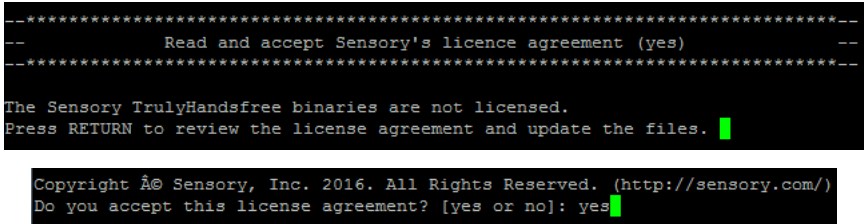   ```
   cd ZLK38AVS/
   ```
2. Run "make all" command.

**Note:** During "make all" the makefile will automatically download the all the necessary packages and dependencies (about 250 MB), expect the total installation to take 20 minutes to 30 minutes with an average connection.

While this step is running, it may be a good time to create your Amazon account. You will need information from the creation of your Amazon account later in the software installation (See Amazon Developer Account Creation, page 11).

3. When prompted, review and accept the Sensory license agreement. Press Enter and Space a few times until you reach the end of the agreement and then type "yes" and press Enter.
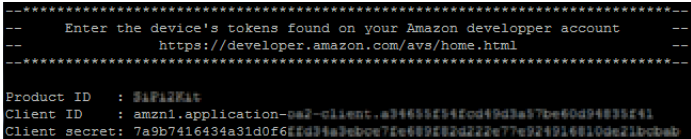
*Figure 12 •* **Sensory License Agreement**



4. When prompted, enter the Product ID, Client ID, and Client Secret from your Amazon Developer Account (see Amazon Developer Account Creation, page 11).

*Figure 13 •* **Amazon Developer Account**

5. After you enter the requested IDs, the makefile will ask you to open Chromium on the Raspberry Pi. Browse to http://localhost:3000, log in with your Amazon credentials, and follow the instructions.

*Figure 14 •* **Chromium on Raspberry Pi**



6. When prompted, you can choose to start the Alexa sample app automatically when the Raspberry Pi boots up (no need to have a screen connected or VNC). In headless mode, the speaker plays a short alarm sound to notify the user when Alexa is ready after boot-up.

*Figure 15 •* **Sample App Autoboot Option**



7. A successfully completed installation should show the following message.

*Figure 16 •* **Completed installation**



8. Upon the completion of the ZLK38AVS kit installation, issue a reboot command to reboot the Raspberry Pi and complete the installation of the required software for the ZLK38AVS demonstration.

```
sudo reboot
```

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6   Amazon Developer Account Creation

An Amazon developer account is needed in order to run the ZLK38AVS demonstration kit. 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.

Figure 17 • **Alexa Voice Service website**
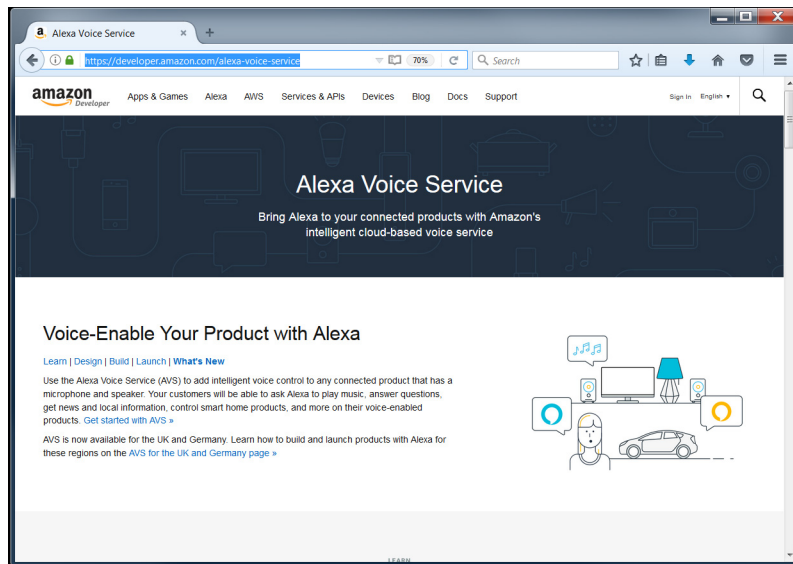
2. Click Sign-in on the top right of the screen.

Figure 18 • **Amazon sign-in**
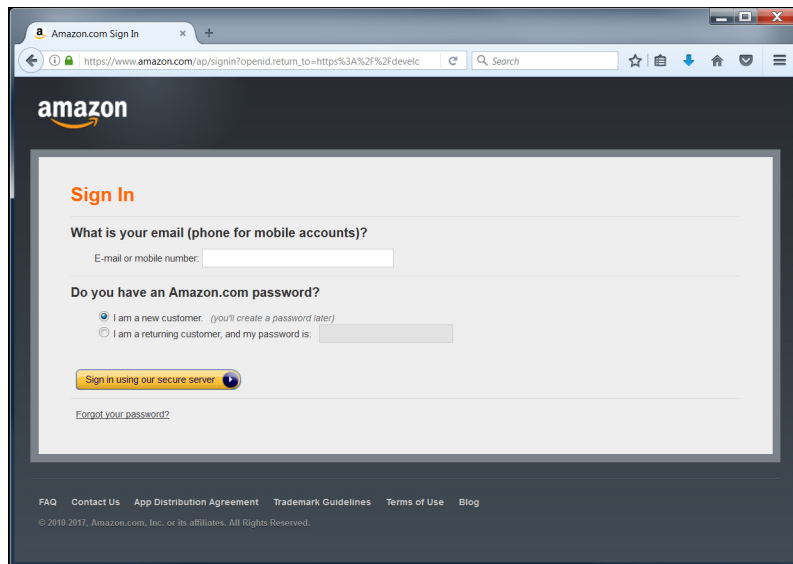
3. Either sign-in with your account, or create a new account if a new customer. Fill out the registration forms as requested by Amazon.

4. When prompted for information on the Apps Distribution Agreement select No for both options:

Figure 19 • **Apps distribution agreement**
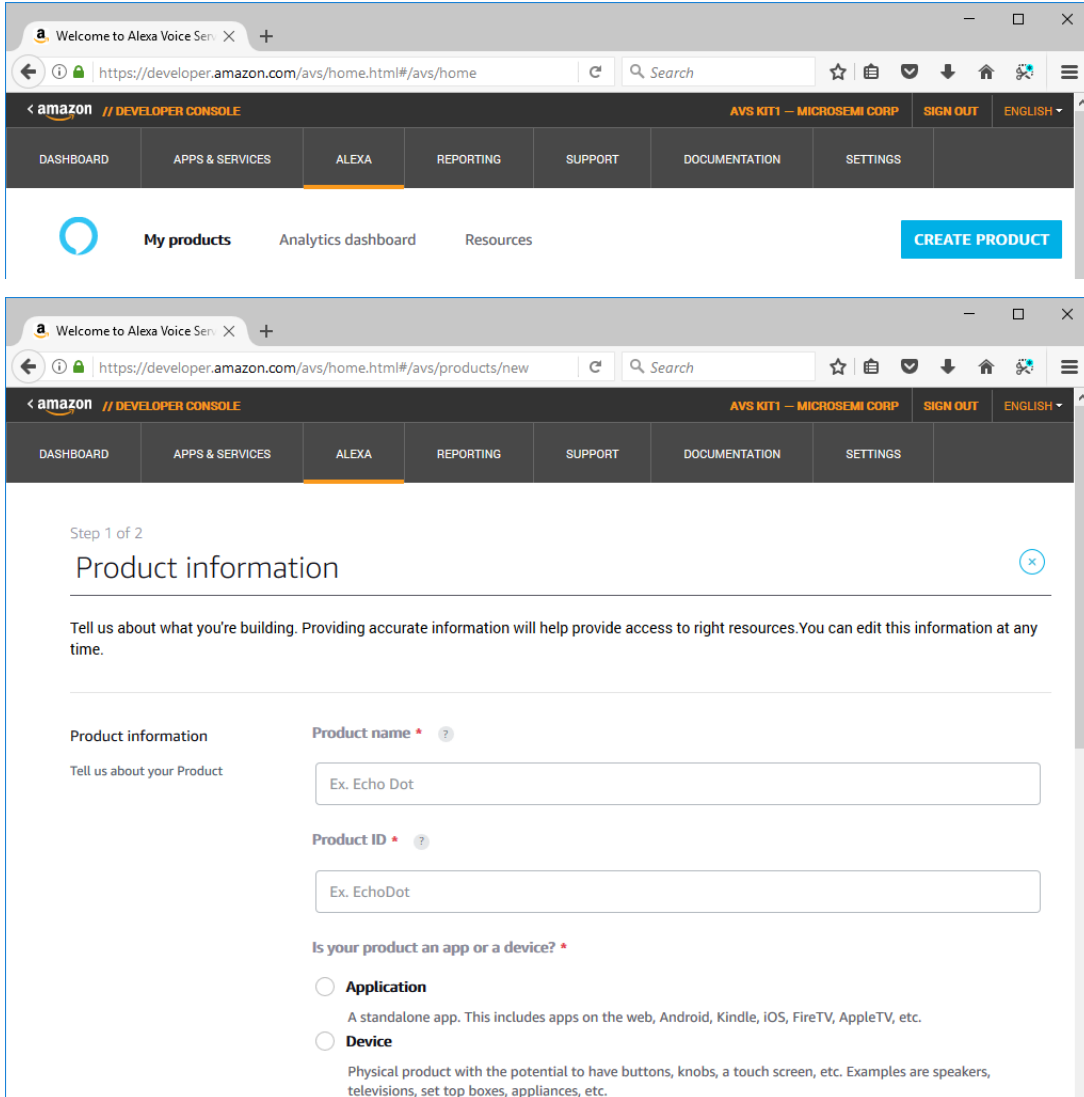
5. Select Alexa on the top navigation bar.

Figure 20 • **Get Started**

6. Select Alexa Voice service and Create Product using the following entry guidelines.

Figure 21 • **Alexa Voice Service Selection**

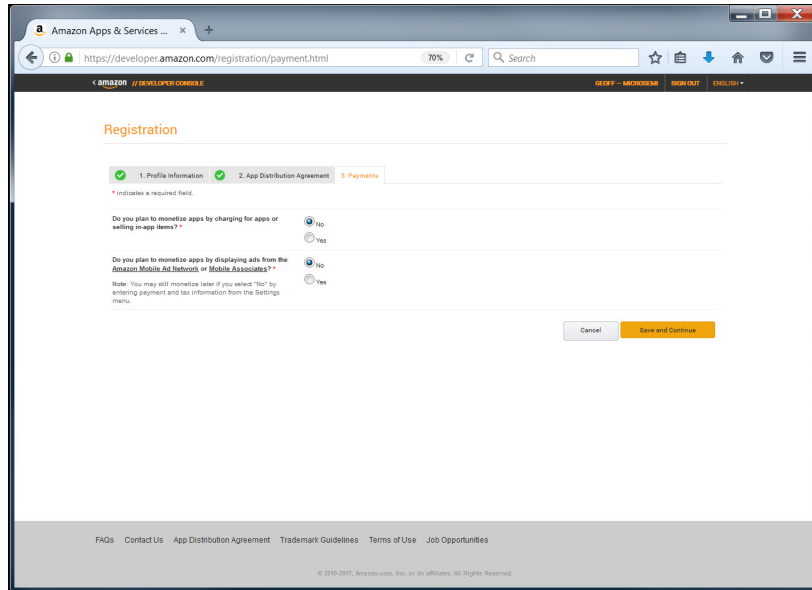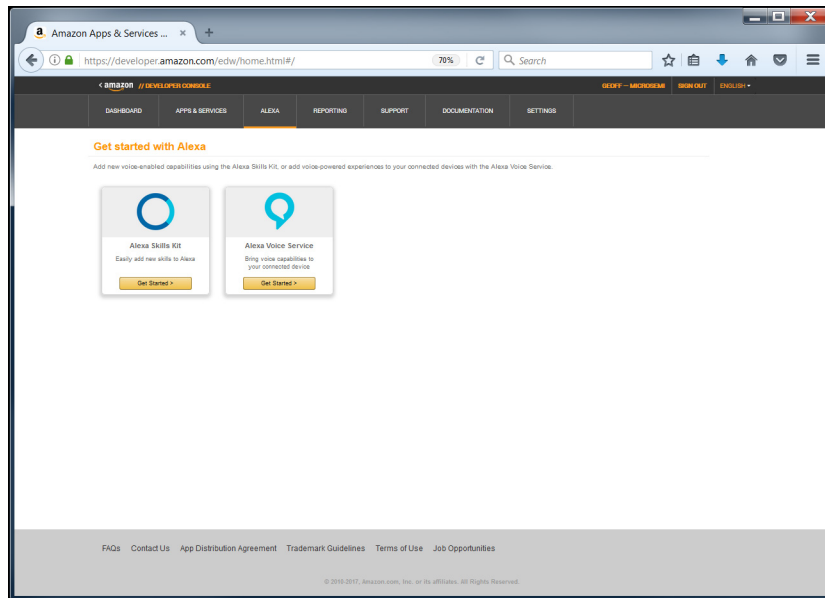a. **Product Name:** Name that will appear in your device list to describe it

b. **Product ID:** This will be the Device ID during installation (no spaces)

c. **Is your product an app or a device?** Device

d. **Will your device use a companion app?** No

e. **Product category:** wireless speakers

f. **Brief product description:** Enter description

g. **How will end users interact with your product?** Hands-free

h. **Do you intend to distribute this product commercially?** No

i. **Is this a children's product or is it otherwise directed to children younger than 13 years old?** No

j. **Next**

7.   Select Create new profile

Figure 22 •   **New Profile**
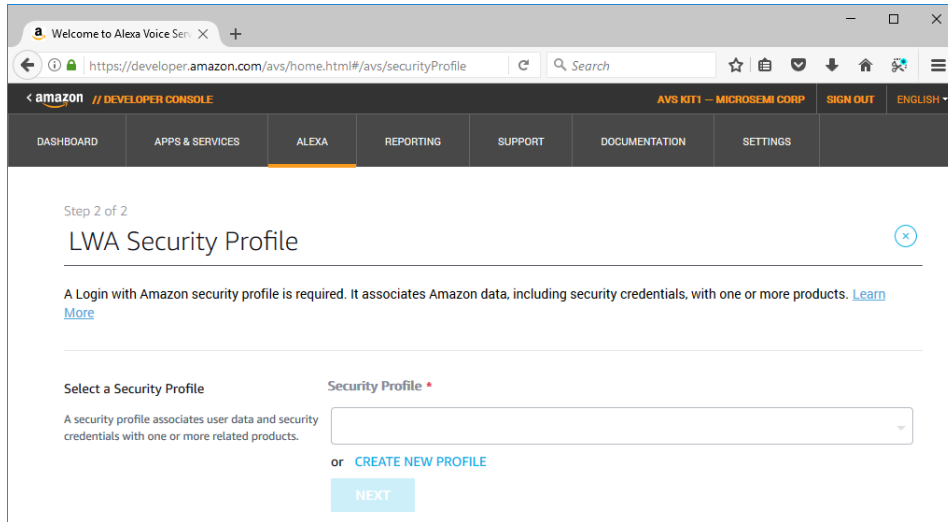
a. **Security Profile Name:** Name that refers to the device created

b. **Security Profile Description:** Enter description

c. **Next**

8.   Update the URLs (don't forget to click ADD after each entry).

Figure 23 •   **Amazon Developer Account URLs**
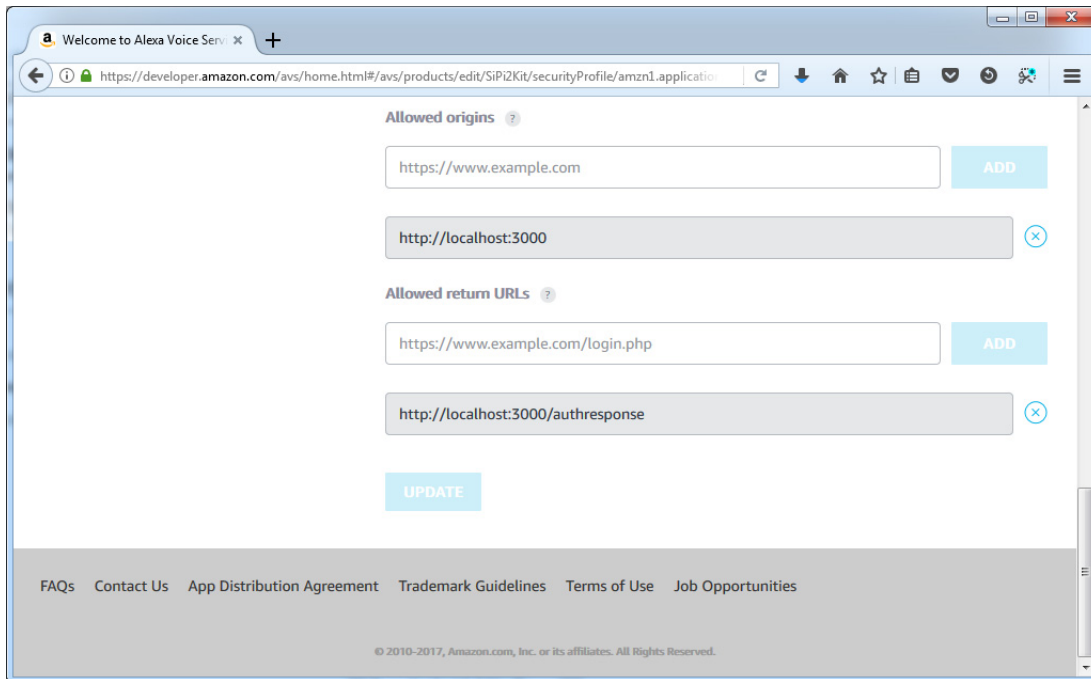
a. **Allowed origins:** http://localhost:3000

b. **Allowed return URLs:** http://localhost:3000/authresponse

c. **I agree...**

d. **Finish**

You have now created the Amazon Developer account and a device.

7   Demonstrating the ZLK380AVS (software)

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

The ZLK38AVS supports two separate microphone configurations: 180° or 360°. The ZLK38AVS default installation uses the 180° configuration. To change the configuration, see Changing ZL38063 Microphone Mode, page 19.

7.1   Starting AVS Software Demo

1. cd into the location where the GitHub package was downloaded. (eg: `cd ZLK38AVS/`)
2. Issue the following make command to start the AVS software:
    ```
    make start_alexa
    ```

Figure 24 • **Alexa Start Screen**

3. Turn on the speaker (using power button on the speaker bezel) and set the volume to maximum using the "+" button on the bezel.

Note: The speaker has an auto-turn-off feature to save battery life, so before testing the unit, make sure to turn the speaker on, if switched off.

4. At this point Alexa is ready to accept commands. Try a few quick commands like "Alexa, what time is it?" or "Alexa, what is the capital of Peru?" to confirm the software and hardware are activated. A full list of Alexa Voice commands can be found at https://www.cnet.com/how-to/the-complete-list-of-alexa-commands/.

Note: Some commands listed on the above website require accounts on the desired services (eg. Pandora stations).
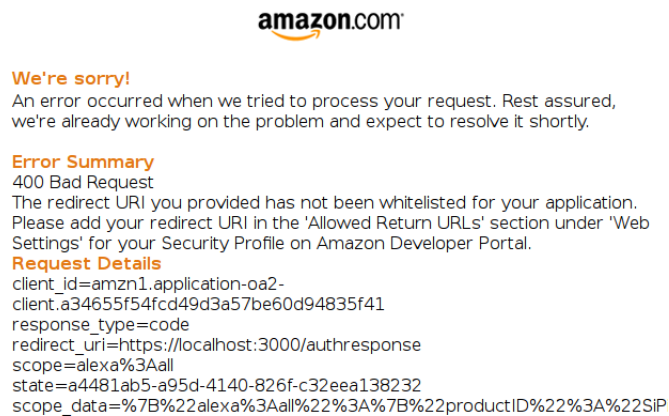
7.2 Installation Troubleshooting

This section lists the commonly encountered installation errors.

7.2.1 Credential Error

If the web page doesn't ask for your credentials, as described in step 4 in ZLK38AVS Software Installation, page 8, and displays the following error message,
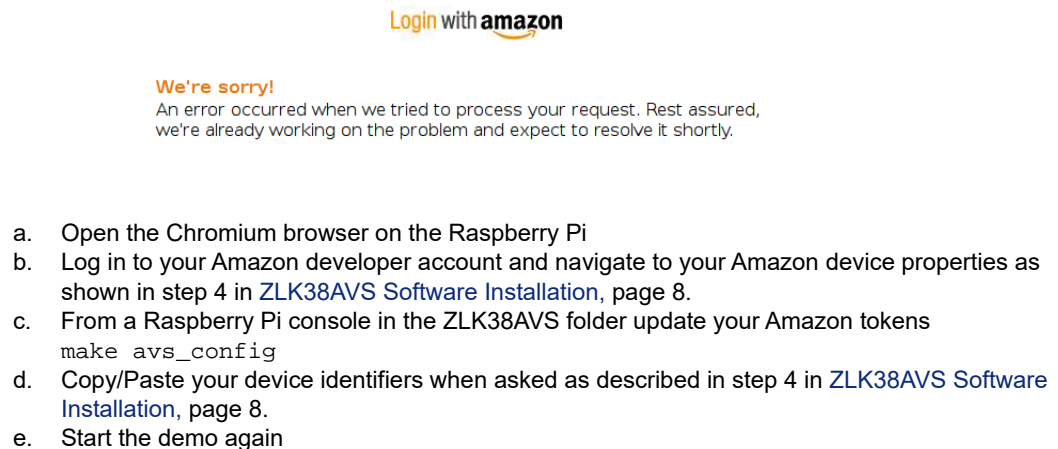
Figure 25 • **Amazon URL Error**

a. Check the URLs. For more information, see step 8 in Amazon Developer Account Creation, page 11.
b. Enter the proper **Allowed origins** and **Allowed return** URLs
c. Restart the Raspberry Pi
d. Start the demo again

7.2.2 Token Error

If the web page displays the following error message after you enter your credentials,

Figure 26 • **Amazon Identifiers Error**

a. Open the Chromium browser on the Raspberry Pi
b. Log in to your Amazon developer account and navigate to your Amazon device properties as shown in step 4 in ZLK38AVS Software Installation, page 8.
c. From a Raspberry Pi console in the ZLK38AVS folder update your Amazon tokens
   `make avs_config`
d. Copy/Paste your device identifiers when asked as described in step 4 in ZLK38AVS Software Installation, page 8.
e. Start the demo again

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8   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 ZLK38AVS Software Installation, page 8).

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

```
make clean
```

8.1   Reconfiguring the ZLK38AVS Software

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

```
make host
```

To use different Amazon identifiers or account

```
make avs_config
```

To enable/disable the headless mode

```
make avs_config
```

Note: Even if you just want to enable or disable the headless mode, you have to re-enter your Amazon tokens.

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