

Teaching Case

Alexa, Help Me Learn About the Internet of Things!

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Abstract

The Internet of Things (IoT) is a network of objects that can exchange data with other devices also connected to the Internet. One of the most common consumer examples of IoT is home automation, as a variety of smart devices, including doorbells, lightbulbs, thermostats, and refrigerators are now available which users can control remotely using mobile apps or smart speakers. In this hands-on activity, students will apply their basic skills in accessing wireless networks and using mobile devices to connect an Amazon Echo smart speaker to a home network, configure smart plugs to communicate with the Echo, and develop routines to interact with the smart plugs, smartphones, and other smart devices.

Keywords: Internet of Things, Amazon Echo, Automation, Digital Literacy, Active Learning

1. INTRODUCTION

The Internet of Things makes it possible to connect devices in everyday objects, often equipped with software and sensors, to send and receive data over the Internet. Devices have an IP address allowing them to connect to the Internet, usually through a wireless network, enabling communication between other connected devices. A smart device is one that can connect to the Internet.

An Amazon Echo ("Echo") is a smart speaker developed by Amazon that is commonly used in homes to perform automated tasks and control smart devices. Echo devices are widely available in a variety of formats, including audio speakers (Echo Dot), video displays (Echo Show), devices to connect additional sensors (Echo Flex), and devices for use in vehicles (Echo Auto).

Echo devices use the Alexa intelligent personal assistant service to respond to a user's **voice commands**, that typically begin with the wake word, **"Alexa."** Users commonly interact with Alexa to set alarms and timers, perform Internet searches, play music, manage lists, and obtain

current news and weather information. Alexa skills are software modules that perform tasks such as playing games, setting timers and reminders, and listening to music or audio books. Alexa routines are sequences of tasks that you can configure to perform in response to a voice command.

Echo devices can connect to several smart devices to perform home automation tasks, such as turning on and off lights and adjusting thermostats.

In this lab activity, you will interact with the Internet of Things by connecting an Echo device to a wireless network. You will control smart devices using mobile apps and voice commands, and create skills and routines to automate tasks, add capabilities, and perform actions when triggered by specific events.

If you do not have access to an Echo or Alexa-enabled device, you can use the Alexa mobile app on a smartphone or tablet to complete the steps in this activity that specifically do not refer to configuring or interacting with an Echo device.

Learning Objectives

By completing this lab activity as part of your information systems / technology literacy course, you will be able to:

- Define what is meant by the Internet of Things (IoT)
- Describe how to accomplish home automation using connected devices
- Control smart plugs or devices using a smart phone and the Alexa personal assistant app on your Amazon Echo
- Identify sources of data and providers that can share data over the Internet.
- **Create routines with Amazon's Echo** to automate home tasks
- Describe the role of a home network in connecting devices
- Explain the role of APIs (application programming interfaces) in sharing data

2. THE AMAZON ECHO INTERNET OF THINGS LAB ACTIVITY

Prerequisites

While no programming knowledge is required to complete this activity, several digital literacy and information technology skills are required:

- Create, edit, and share a document on Google Drive or OneDrive
- Capture and share screenshots from a computer or mobile device
- Transfer files from a mobile device to a laptop using cloud storage
- Create a video using your computer or mobile device
- Connect a computer or mobile device to a wireless network
- **Locate a device's MAC and IP address**

Preparing For The Activity

You will work in teams of three or four to complete the activity. Each person in your team will have a different role, so decide who is going to do what. It is fine to change roles throughout the project so each person can experience more than one role.

- **Reader:** Reads the instructions aloud at each step for the group to discuss and conduct
- **Recorder:** Summarizes the group's conversation about each task or discussion question in the lab report
- **Connector:** Downloads apps to smart phone, connects and configures devices
- **Multimedia Producer:** Records video, photos, and gathers screenshots and other multimedia as required

Your group will create a shared online document or presentation to contain your screen shots and answers to several discussion questions. Your group also will create a short video and post it to Flip, a collaborative video recording and sharing platform, to demonstrate that your connected devices and routines function correctly when you speak voice commands. (Visit <http://flip.com>.)

You can work together on the project, but each student should reflect their own learning and then answer the open-ended questions individually. Also consider the technology skills you used when completing is activity.

Complete these steps before working on this activity:

- Read this description before coming to class so that you will be familiar with the steps required. Doing so will save time when you work on this in class!
- Identify three or four group members
- Create a lab report document on Google Drive or OneDrive as directed by your instructor. Share it with your instructor and the members of your group.

Equipment

Your instructor will provide the equipment as shown in Figure 1, for your use during this lab activity:

- An Echo Dot smart speaker
- A smart plug (outlet)
- A light switch socket
- A lightbulb



Figure 1. IoT Lab Equipment

You will also need a laptop and smartphone. You will need access to the network name and password on a wireless router.

3. COMPLETE THE LAB ACTIVITY

To complete this lab activity, you will accomplish these tasks:

- Install the necessary apps on your phone
- Connect your Echo as a device on a wireless network
- Set up a smart plug with an app on your phone to turn on/off a light
- Set up Amazon Echo to turn on/off a light using a voice command
- Create a routine for Alexa to follow
- Interact with and respond to external data or events using If This Then That
- Bonus: Use Amazon Blueprints to create custom skills

Set Up Your Phone

One person in each group, the "Connector", should download and install the mobile app for the smart plug, and the Alexa app on their phone. Install the Alexa app on your phone so you can configure your Echo device. If using GoSund smart plugs, download the SmartLife App. If using Amazon brand plugs, you can use only the Alexa app. Figure 2 shows the icons for the apps to locate in your app store:

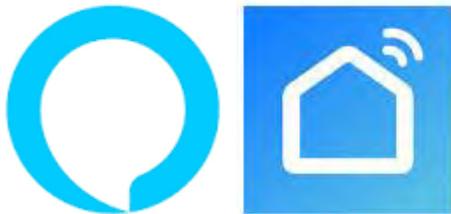


Figure 2. Alexa and SmartLife App icons.

If using other third-party smart plugs, download the app associated with those plugs.

Create an Amazon Account

If a member of your group already has an Amazon account, please feel free to sign in with your personal credentials that you use with your own Echo. After the completion of this lab activity, you will remove the Echo device used for this project from your account.

Open the Alexa app. If no one in the group has an Amazon account, create a new Amazon account for this activity (which you can delete later). You should not need to provide a credit card or phone number. Search for instructions online for how to set up an Amazon account without having to provide a credit card.

Configure the Smart Plug

These steps describe how to configure a third-party smart plug using its app installed from the Google Play or Apple App Store.

Connect your phone to the wireless network on your router. (If you are configuring the router yourself, set an SSID and password. If your instructor is providing one router for the entire class, use the SSID and password provided. Do not connect to the 5G Network.

Open the app associated with your smart plug. For GoSund plugs, open the SmartLife app. For Amazon plugs, use the Alexa app; for other third-party plugs, follow similar steps using their app,

Create a new account in the app using the same credentials as the Amazon account. In the app, allow permission for the app to access your **location, then identify the device ("socket/wifi")** you want to add to the network, as shown in Appendix I, Figure 5.

Enter the wireless network name and password to connect the device to the network. Then follow the instructions on the app to set up the plug as shown in Appendix I, Figure 6. You will need to press and hold the RESET button on the plug, watch for a blinking light, and then check the app to ensure that the plug connected to the Wi-Fi network.

Note: When doing this step in a classroom with other groups at the same time, make sure that only one **group's** plug is in set-up mode at a time (The RESET button is blinking). Otherwise, the app will connect to all plugs that are in set-up mode. If one team is setting up their plug, wait until they have finished, and then proceed with configuring yours (by pressing the RESET button for 5 seconds again).

Once connected, plug the light switch containing the lightbulb into the smart plug. Test turning on and off the light switch using the app, as shown Appendix 1, Figure 7.

To verify the plug has an IP and a MAC address, **click 'Mini Smart Plug' in the app, click the pencil icon in the top right, then click Device Settings** to see the IP and MAC address.

Set Up Amazon Echo

Install the Amazon Alexa app to your phone if you do not have it already or sign out from your personal Amazon account.

Press and hold the action button on the Echo Dot (the solid circle button) until an orange ring appears putting you in setup mode.

Follow steps in Alexa app to configure the device. **In the Devices tab, click the '+' button in the top right corner.** Click Add Device, locate Amazon Echo and your model. Select the wireless network and enter its name and password. Follow the prompts to **choose a language, set the device's location, and skip through any introductory offers or videos that appear while configuring the device.** in your home. See the screenshots in Appendix 1, Figure 8.

Set Up Echo To Work With The Smart Plug
In your smart plug's app, select the device, and look for a third-party control option. Select Alexa and sign in with your Amazon credentials to allow access.

In the Alexa app, click Devices, click the '+' button to add a device, and select the brand of your plug. Click Discover Devices, and Alexa will look for devices and connect to the plug. Note: For GoSund plugs, choose SmartLife (not GoSund).

Give the device a name (such as "Red Light"). Speak the command to ask Alexa to turn on or off the Red Light and verify that it works.

Set Up A Routine
A routine is a set of steps to perform when you **speak a trigger word, such as "good morning."** You might have Alexa perform several actions in sequence, such as turn on the light and play music, news, traffic, or weather when you say "good morning." Follow the instructions at <https://www.amazon.com/alexa-routines/> to build your own routine. Then save and test your routine.

Automation with If This Then That
If This Then That (ifttt.com) is a web-based or mobile development platform that allows you to build automation applets that connect data from different sources without writing any code. IFTTT hosts more than 700 apps and services to integrate data from social media sites, a few of which are shown in Figure 3.

You can access IFTTT in a browser or by installing **the IFTTT app from Google Play or Apple's App Store.** The free plan allows you to create up to five applets. One person from each group should install the IFTTT app on their phone and create an account.

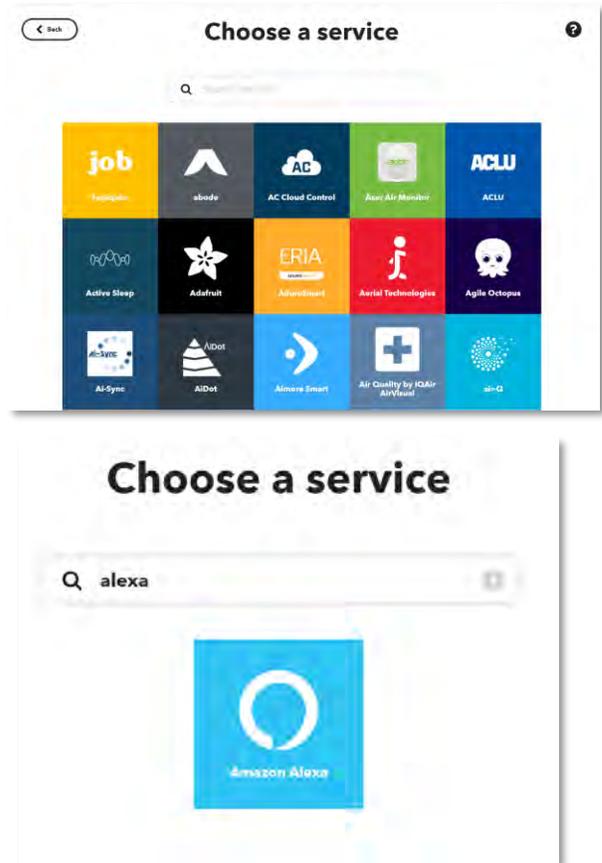


Figure 3. IFTTT Services

To create an applet, select a trigger condition ("if this") that needs to be true for the associated action to run. For example, you can check if the light connected to your smart plug is turned on.

Next, create the action ("then that") to run when the trigger condition is true. Select "Phone Call" and enter your phone number to create the action to call your phone when the trigger condition is true. IFTTT will verify your phone number by calling it and sending you a code to enter.

Test the applet by asking Alexa to turn on the light and wait momentarily for your phone to ring. Follow the steps in Appendix 1, Figure 9 to create an applet that calls your phone when the light is turned on.

Using this as an example, make your own applet using IFTTT.

You should be able to configure your Echo and smart plug and create a routine and an IfThisThenThat applet during one 60-minute class period. After completing these tasks, create a short video introducing your group members, and

demonstrating the voice commands, routines, and applets that your group created.

Create Your Own Alexa Skills With Amazon Blueprints (Extra Credit)

Alexa skills are applications that run within the Alexa app. Amazon provides an on-line tool called Amazon Blueprints to simplify the process of creating skills to leave messages for people at home, play quizzes, flashcards, and games, tell stories, create custom news briefings, and more. You can select a template for the application type you wish to create, such as a multiple-choice trivia quiz, and then add the information that you would like to use in your game. After testing your skill, you can share or publish your skill so others can use it. For an additional challenge, use Amazon Blueprints to create your own Alexa skill. Try this in class if you have time or complete it outside of class.

Visit <https://blueprints.amazon.com/>, as shown in Figure 4, to create your own Alexa skills by selecting and customizing one of the templates. As you complete your skill, consider the steps involved in creating, testing, and deploying it, and how they relate to publishing software.

Clean-Up

If you are no longer going to use the Echo and smart plug devices, remove the devices from your Amazon account. In the Alexa app, select the Echo device and deregister it from your account. Remove the smart plug from your account.

In the Smart Life app, select the plug and remove the device.

Uninstall any unwanted apps that you added to your phone for this activity.

Reset your Echo device to factory settings. For 2nd Generation Echo devices, press the microphone on/off and volume down buttons at the same time until the light ring turns orange. Steps may vary for other models of Echo devices.

In addition to the video showing that your devices worked properly, create a lab report document online and share it with your group members and your instructor. Your lab report will contain three sections: screenshots, group responses, and individual reflections.

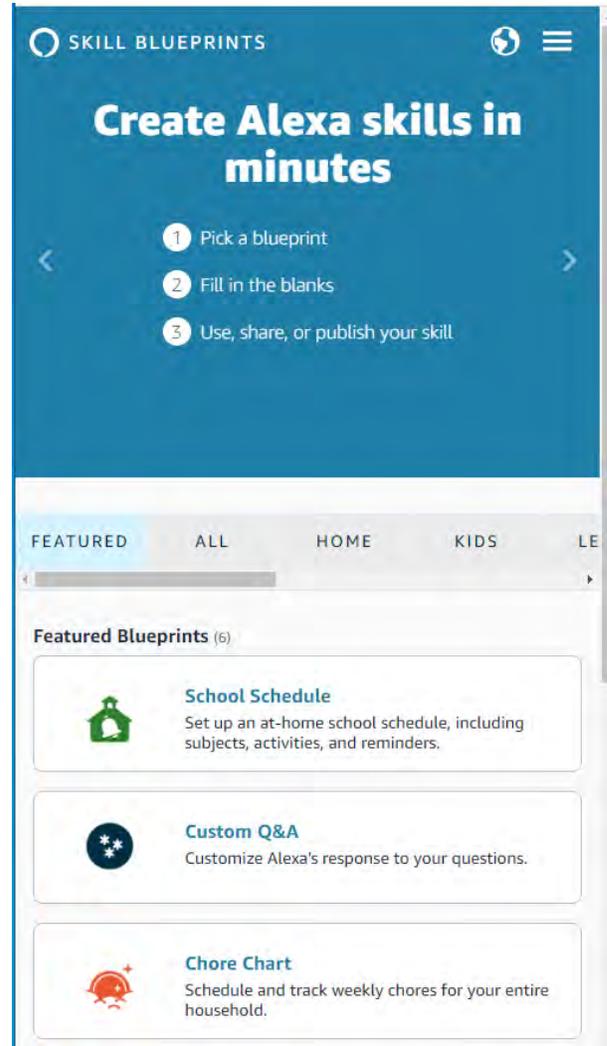


Figure 4. Amazon Blueprints

4. LAB REPORT

Screenshots

Add (at least) these screenshots to your group's lab report. Provide a caption or brief description of each.

1. Showing the IP and MAC addresses of your smart plug
2. From the smart plug app, showing your plug is connected your wireless network
3. From the Alexa app, showing your plug is connected to your Echo.
4. From the Alexa app, showing the steps in your routine
5. From IfThisThenThat, showing the steps to configure your applet

Group Responses

With your group, discuss and write responses to these questions:

1. What is the approximate cost of a smart plug such as the one you are using? Provide a link to where you can purchase one.
2. What are the MAC and IP addresses of the smart plug?
3. Why do you have to set up the plug before connecting it to the Echo?
4. To which wireless network are you connected?
5. Why do you need to be on 2.4Ghz rather than 5 GHz?
6. How are advances in 5G technology impacting the use of IoT?
7. Describe the role of APIs (application programming interfaces) in sharing data, and the services whose APIs you used in this activity. Why would companies provide access to their data through APIs?

Individual Reflections

Each student should answer these questions individually.

1. Have you previously used a smart speaker or connected smart devices to it?
2. How might you use a smart speaker and smart devices in your room or home?
3. What other devices have you seen or used that are connected to the Internet?
4. What concerns do you have about the use of IoT related to privacy and security of your data?
5. What did you learn by completing this activity? Did anything surprise you?
6. Did you run into any technical problems while completing this activity? What happened, and what steps did you take to you troubleshoot the problems? Were you able to resolve these issues?
7. How might we improve this activity?

Discuss your responses with your group.

Appendix 1. Additional Figures

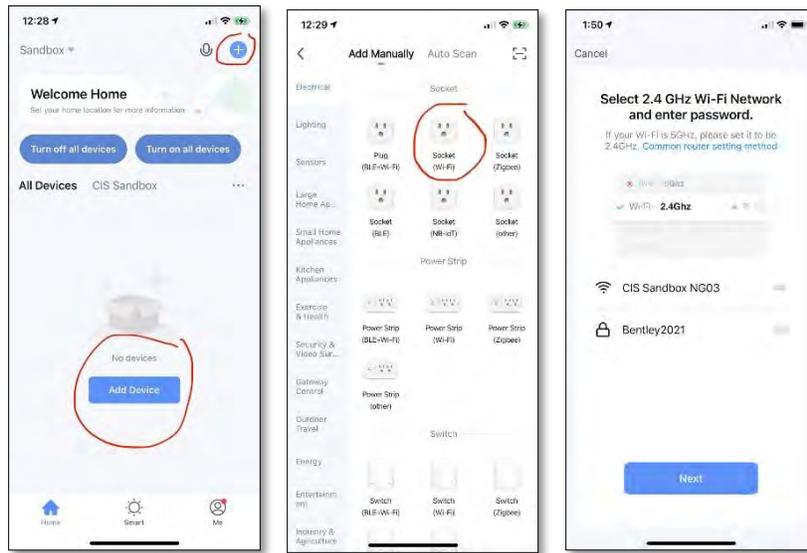


Figure 5. Steps to add a Smart Plug to a Wireless Network

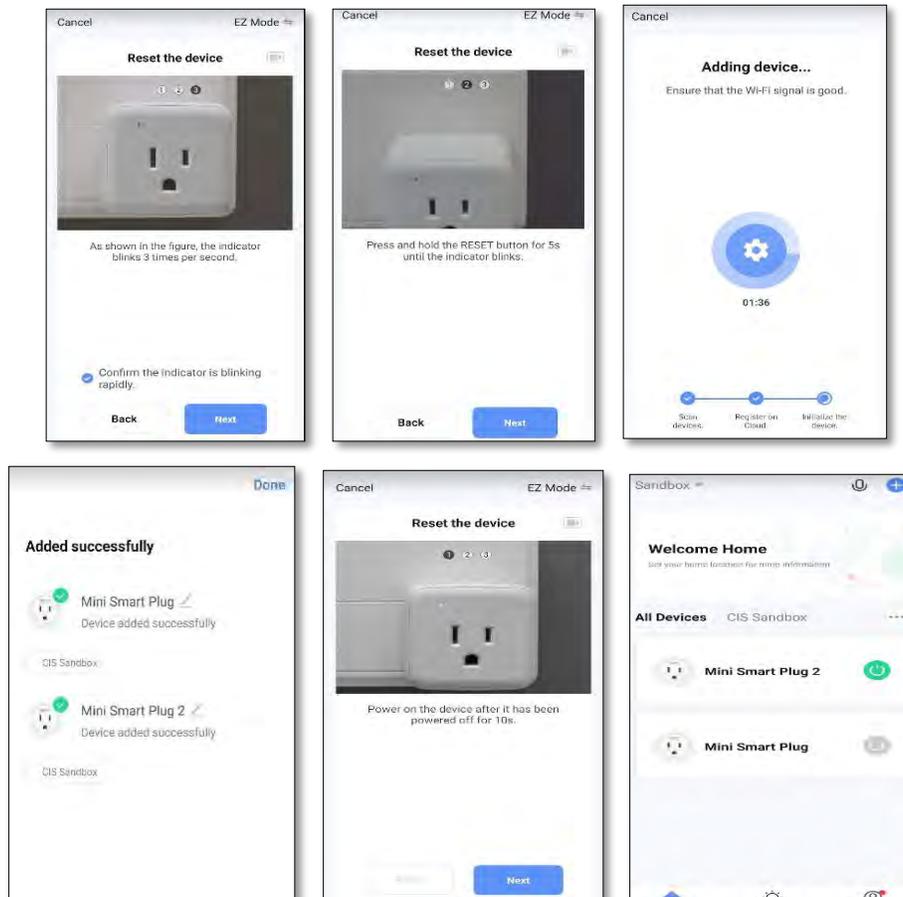


Figure 6. Steps to Configure a Smart Plug using a Mobile App.

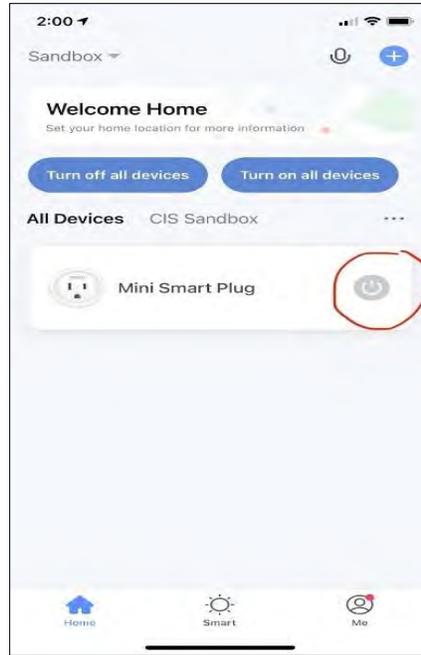


Figure 7. Turning on and off the light using the Smart Plug app.

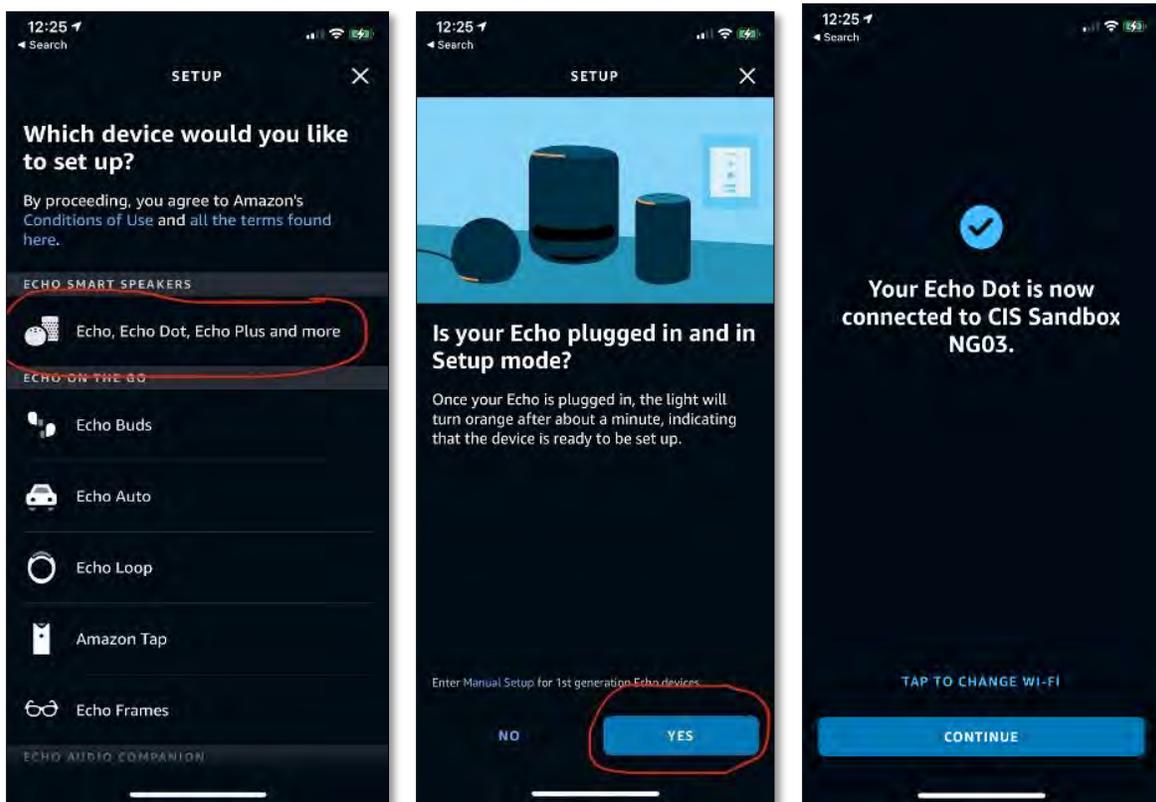


Figure 8. Steps to Connect Amazon Echo to a Wireless Network

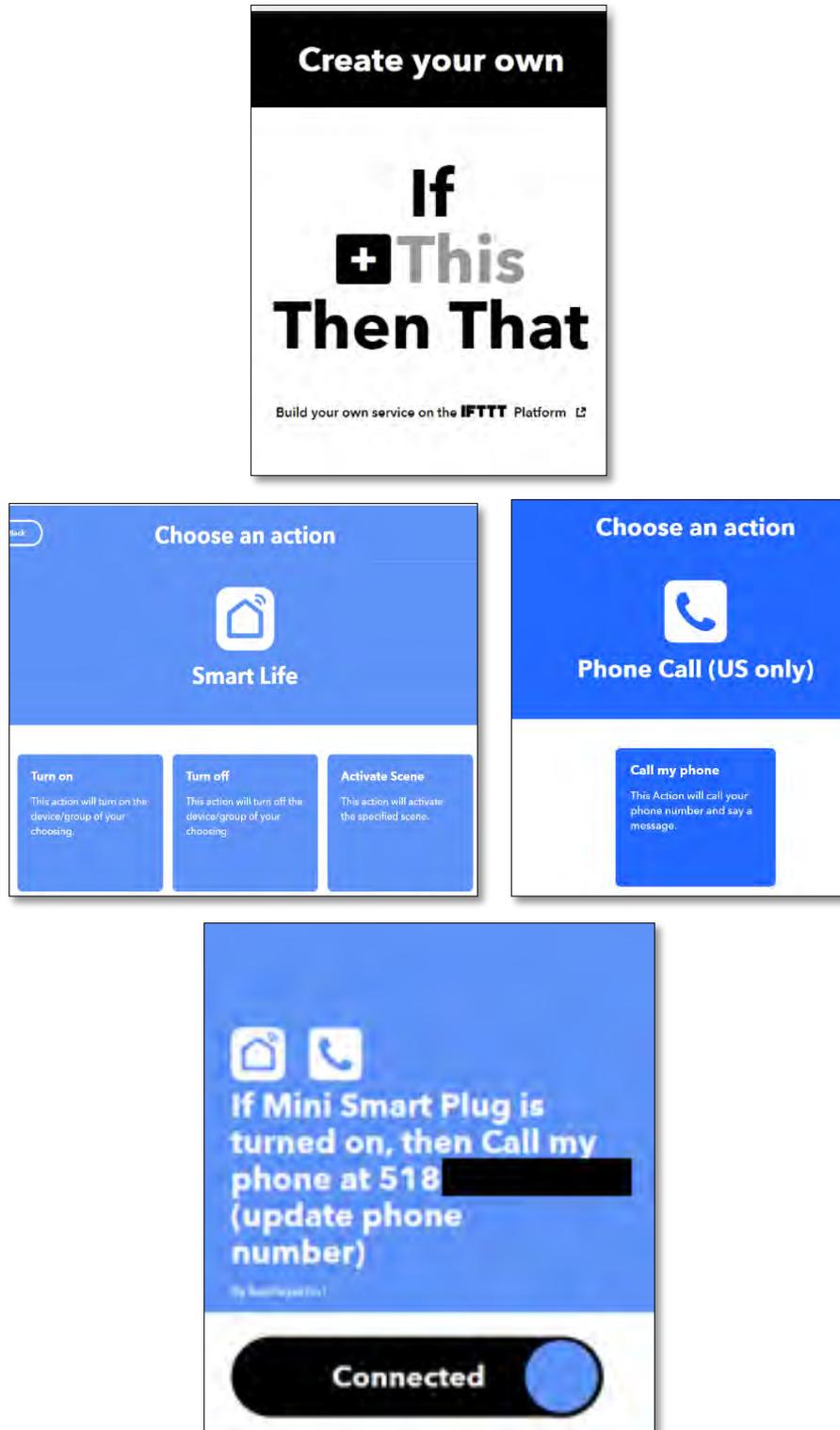


Figure 9. Steps to Create an If This Then That Applet

Appendix 2. Creating a Skill with Amazon Blueprints

This Appendix describes steps for creating a skill with Amazon Blueprints. You can run Amazon Echo skills using any Echo-enabled device or the Alexa app on your mobile device.

Visit <http://blueprints.amazon.com>. Select the blueprint you wish to customize. In this example, select *Flashcards* in the *Learning & Knowledge* section. Next, click *Make Your Own*. See Figure 10.

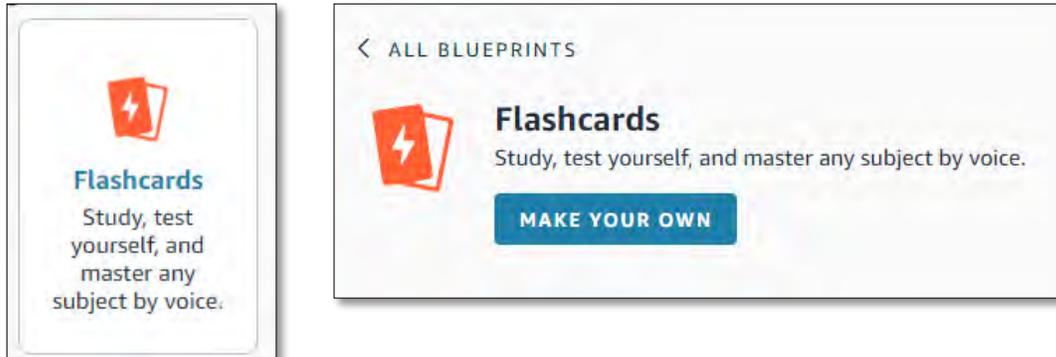


Figure 10. Create the Flashcards Skill

Add the topic and information for the flash cards. See Figure 11.

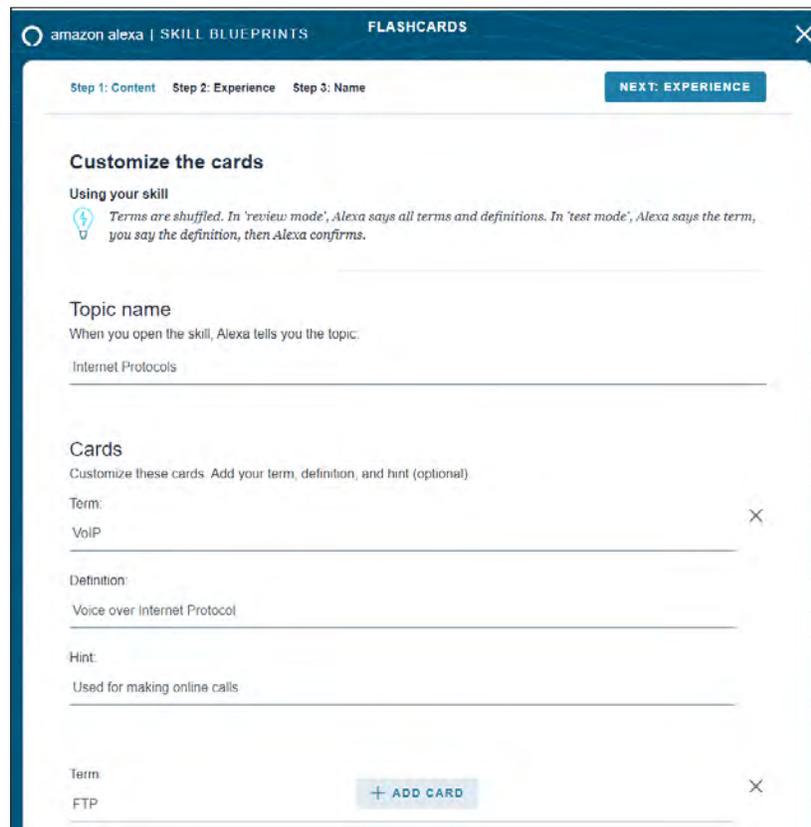


Figure 11. Add Topic and Information

Click *Experience*.

Enter information to customize the greetings, sounds, and feedback for users of this skill. See Figure 12.

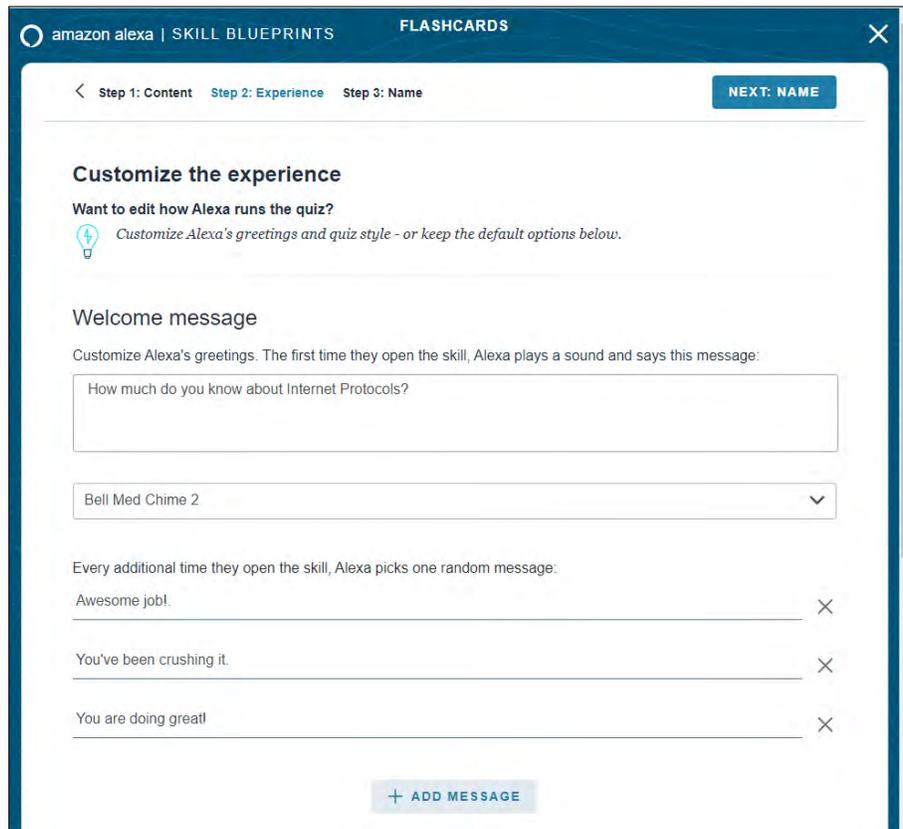


Figure 12. Add Customizations

Name your flashcard set. See Figure 13.



Figure 13. Name Your Flashcard Set

Click *Create Skill* to create the skill. This may take a few moments. See Figure 14.

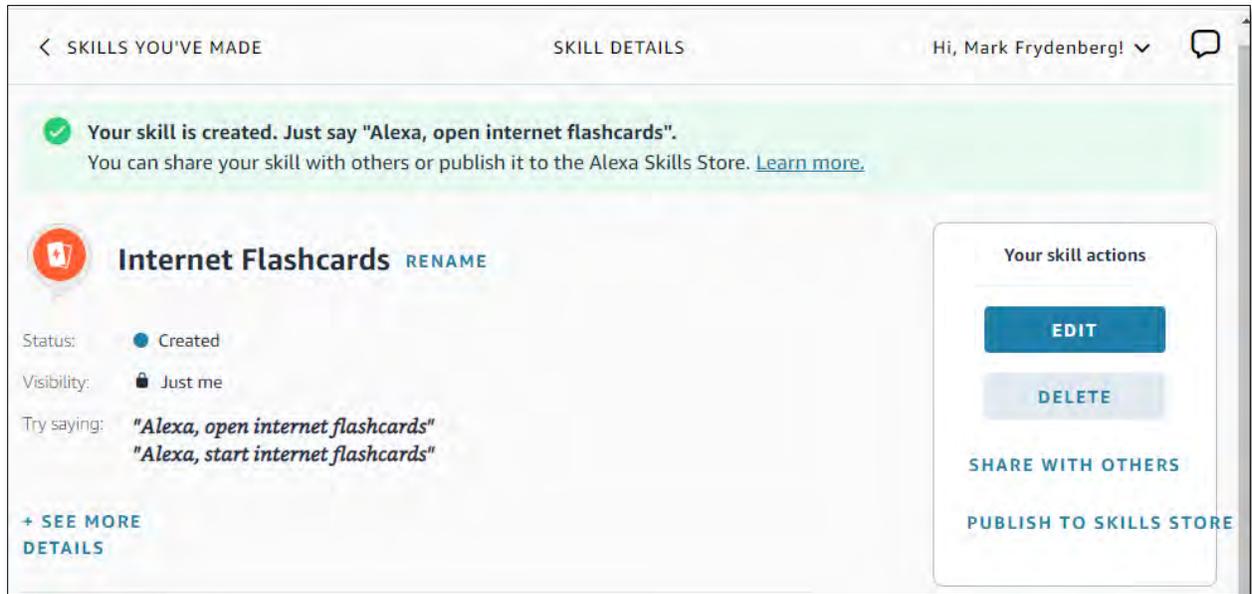


Figure 14. Create Your Skill

Say "Alexa, open internet flashcards" or "Alexa, start internet flashcards." to test your skill using your Echo device or the Alexa app on your smartphone or mobile device.

You can edit the skill at any time using Amazon Blueprints.

You can decide who has access to your skill, as shown in Figure 15.

- Keep your skill private so only the devices on your home network can access it
- Click *Share with others* to get a link to share by email or on social media sites so your friends and followers can access your skill
- Click *Publish to Skills Store* to publish your skill to the Alexa Skills Store for anyone to find, use, and review.

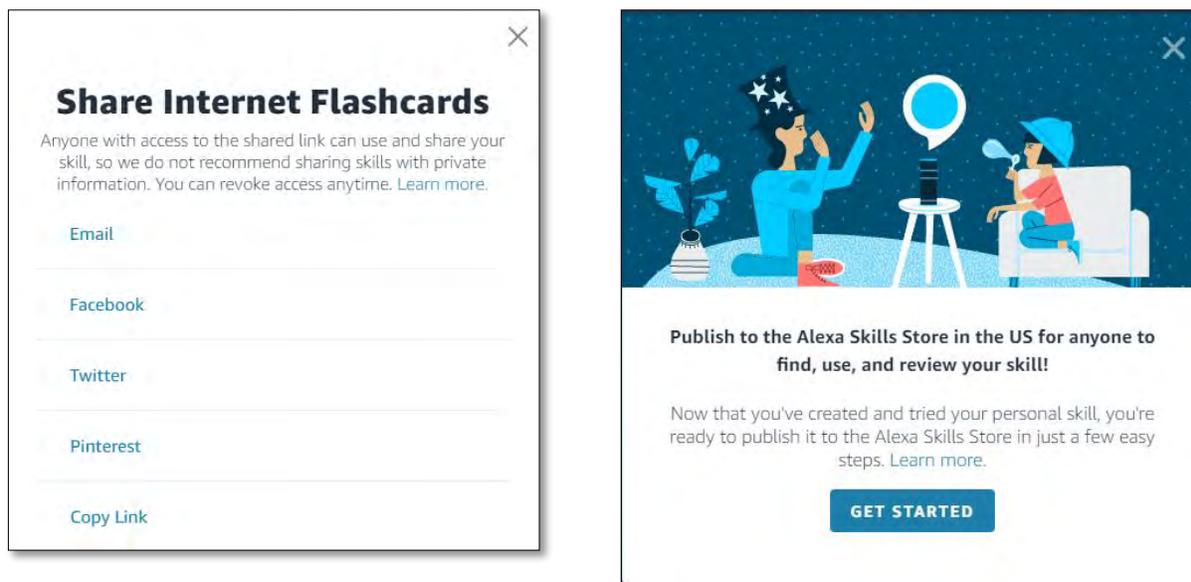


Figure 15. Share and Publish Your Skill

Appendix 3. Resources

This appendix contains information about resources described in this lab activity.

Websites

- Amazon Alexa (web interface to Alexa app with limited functionality): <http://alexa.amazon.com>
- Amazon Blueprints (for creating skills): <https://blueprints.amazon.com>
- Flip (collaborative video recording and sharing): <http://flip.com>
- If This Then That (automate apps and devices): <http://ifttt.com>

Apps

Install these apps on your mobile device. They are available from **Google Play** or **Apple's App Store**.

- Alexa
- Flip (collaborative video recording and sharing)
- If This Then That (automate apps and devices)
- SmartLife (for controlling GoSund brand smart plugs)