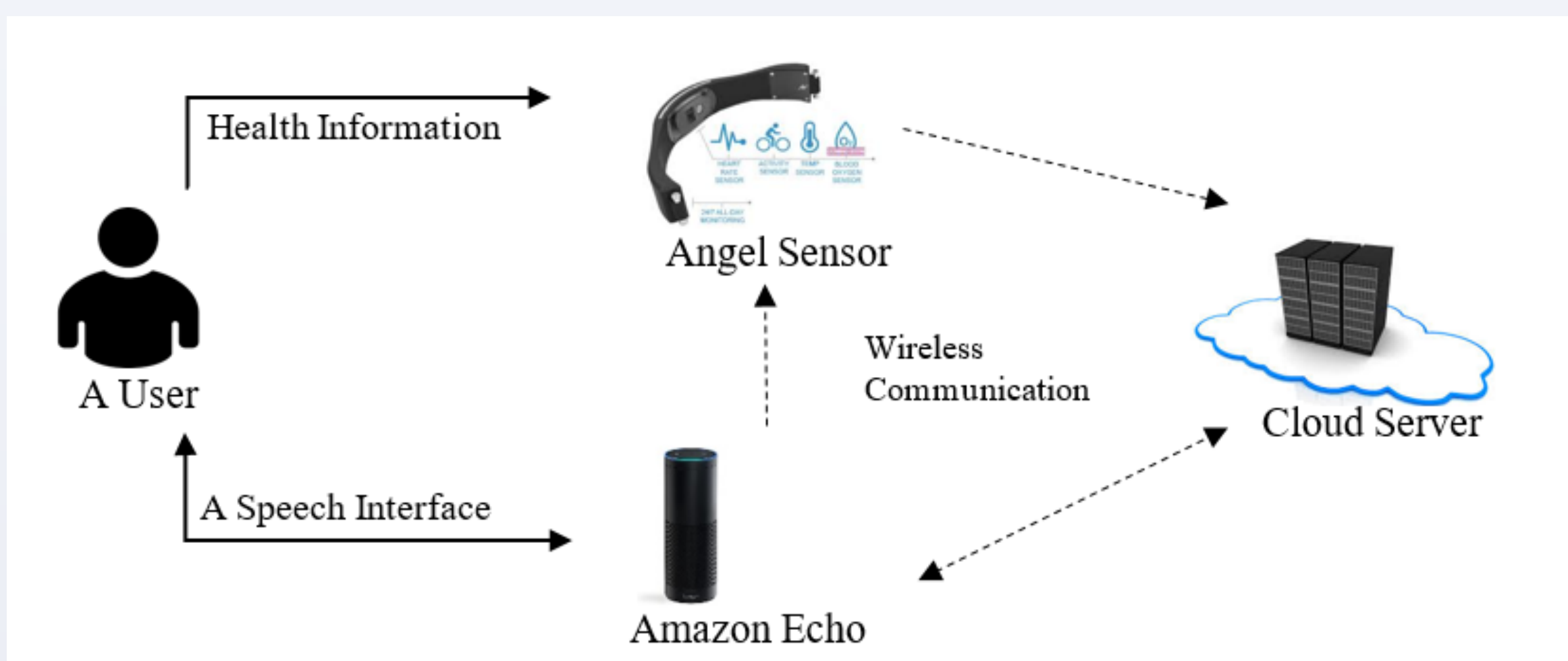# The Angel-Echo Project

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INTRODUCTION

An interactive healthcare application that utilizes the Angel Sensor and Amazon Echo

Interfacing between the elderly and technology is best when simplicity is involved. Speech recognition makes it easy for an elderly human to communicate task to an electronic device.
Our goal is to implement a smart app that monitors health status, combining the Angel Sensor for data collection and the Amazon Echo for voice access to health information and status. Knowing the limitations of the current state-of-the-art, we can develop a way for elderly patients to receive their health state without lifting a finger.

OBJECTIVES

OBJECTIVE 1:
Implement a smart application that monitors health status

OBJECTIVE 2:
Design a system to receive health status by voice command interface

OBJECTIVE 3:
Conduct experiments to analysis the speech recognition accuracy

EXPERIMENTS

Testing the voice recognition accuracy of the Amazon Echo

We conducted our experiment by gathering a group of subjects older than 65 and another group of subjects between the ages of 18-30. We then had each of these groups read out a list of phrases to the Amazon Echo, and using the pre-built "Simon says" skill in the Echo, we were able to get the Echo to repeat every sentence. We listened closely to the repeated phrase and marked off every word that had been picked up inaccurately, as well as the sentence structures that had been changed.

RESULTS

Percentages of Words Missed

	Older Adults (65 and older)	Younger Adults (18 - 30)
Male	10.9%	3.9%
Female	7.66%	5.58%
All	8.75%	4.6%

Some common words that were recognized as others are: "pause" for "pulse", "house" or "hills" for "health".

CONCLUSION

We have successfully created the skeleton for a personal healthcare application utilizing the Amazon Echo and Angel Sensor. From here, there are a vast number of alterations and changes that can take place to improve the reliability and usability of this application. A possible immediate next step is setting up an outside server for running the program for this app, or finding additional health information the app could provide. The results of our experiment were conclusive in the sense that they allowed for us to taper our application to better suit the needs of our target audience.

REFERENCES

S. S. Ltd, "Angel Sensor – open mobile health Wearable," 2016. [Online]. Available: http://angelsensor.com. Accessed: Jul. 1, 2016.

H. Huo, Y. Xu, H. Yan, S. Mubeen, and H. Zhang, "An Elderly Health Care System Using Wireless Sensor Networks at Home," 2009 Third International Conference on Sensor Technologies and Applications, 2009.

Amazon Services, "Amazon DynamoDB," Amazon Web Services, 2016. [Online]. Available: https://aws.amazon.com/dynamodb/. Accessed: Jul. 4, 2016.

ANGEL SENSOR

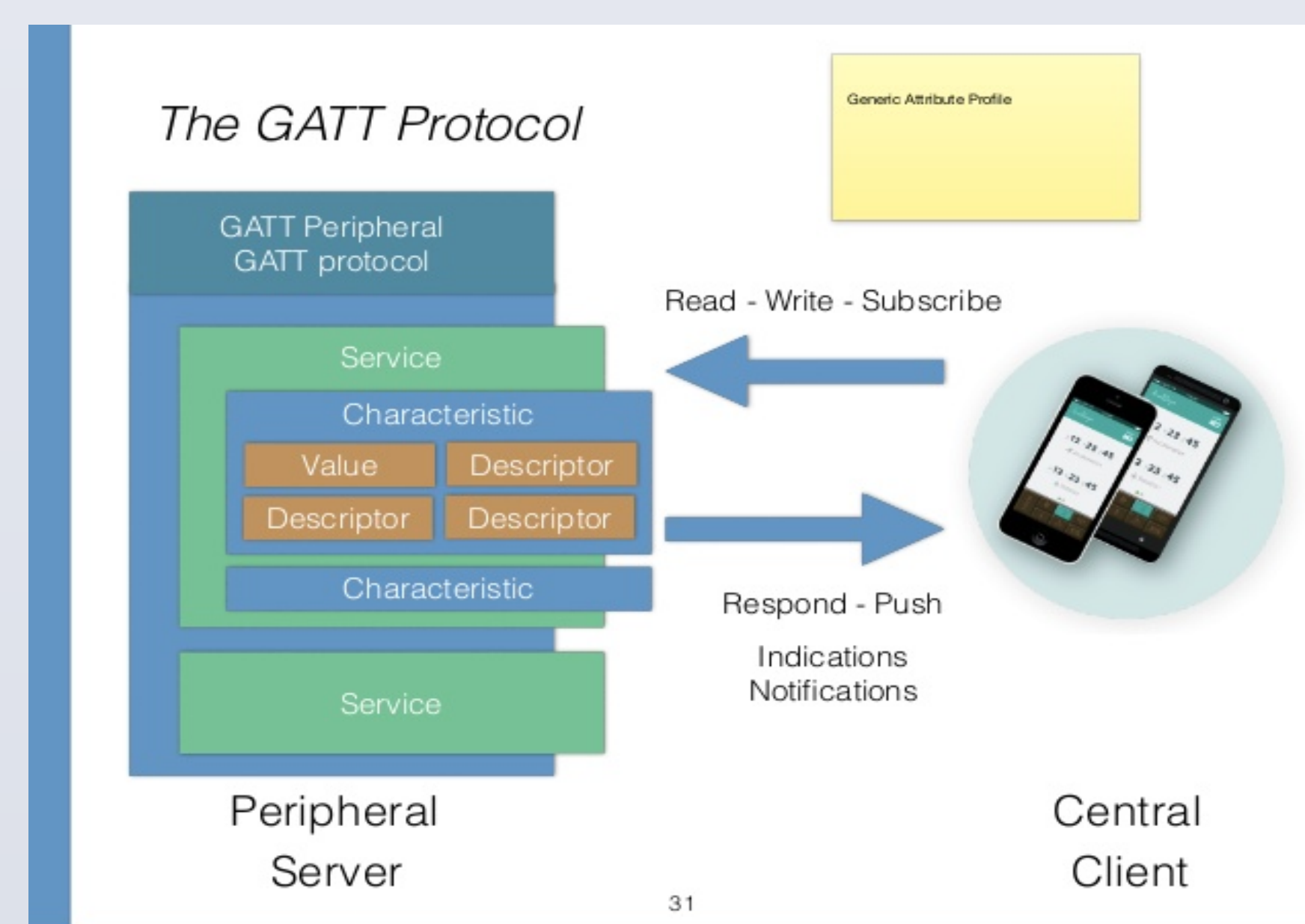Wearable sensor device that tracks health information

The Angel Sensor is a health wearable sensor that collects health information. The sensors included are a heart rate sensor, skin temperature sensor, step counter, accelerometer waveform sensor, optical waveform sensor, and much more. The Angel Sensor was created for developers and researchers because of its open source capabilities. It provides unrestricted access to health information it collects over a Bluetooth low energy connection.
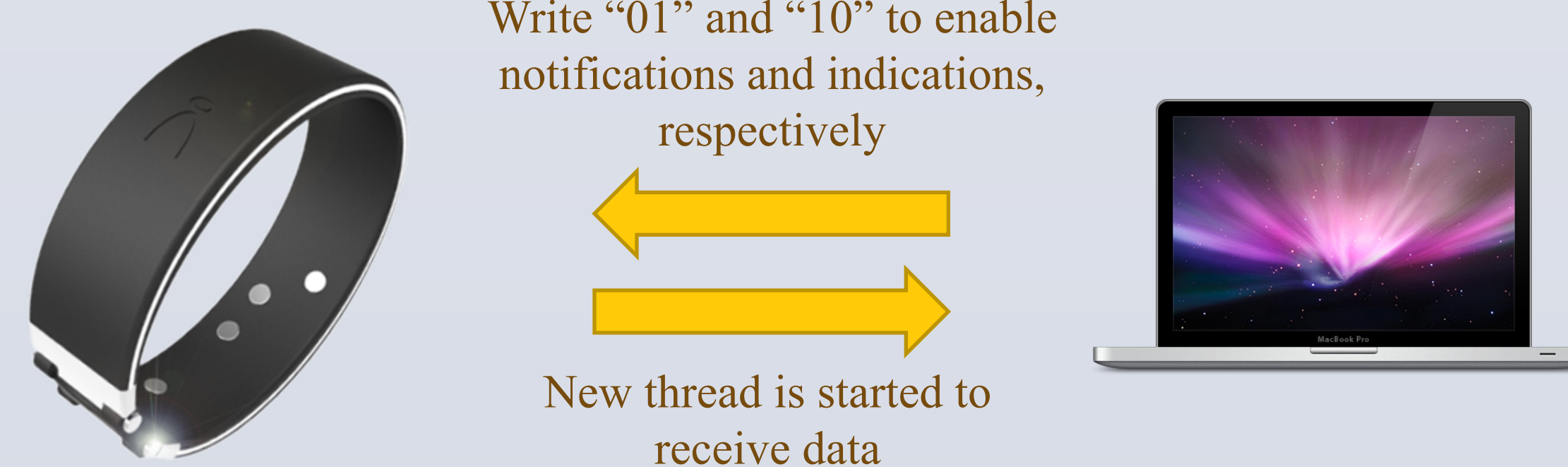
Data Flow Diagram

Angel Sensor   Client Device   Dynamo DB Database

GATT Protocol

Activating/Handling Data Retrieval

Write "01" and "10" to enable notifications and indications, respectively

New thread is started to receive data

In order to convert the data into a more readable form, it is then converted to hex bits, and the hex bits are interpreted according to the documentation given by the Bluetooth Smart website and Angel Sensor website. This data is then store into the Dynamo DB Database, provided by Amazon Web Services. This NoSQL database was chosen due to the simplicity of communication between the database and the Amazon Echo.

| Data retrieved as ascii values	→	Ascii values are converted to hex (binascii python module)	→	Hex bits are interpreted
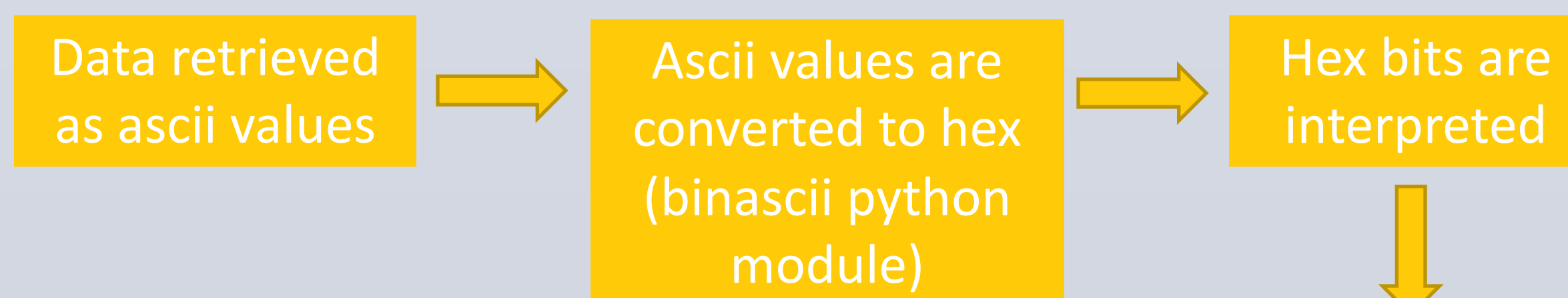
With this plan, health information from the Angel Sensor can be collected, processed, and effectively combined to analyze and determine a patient's health status without interfering with their daily life.
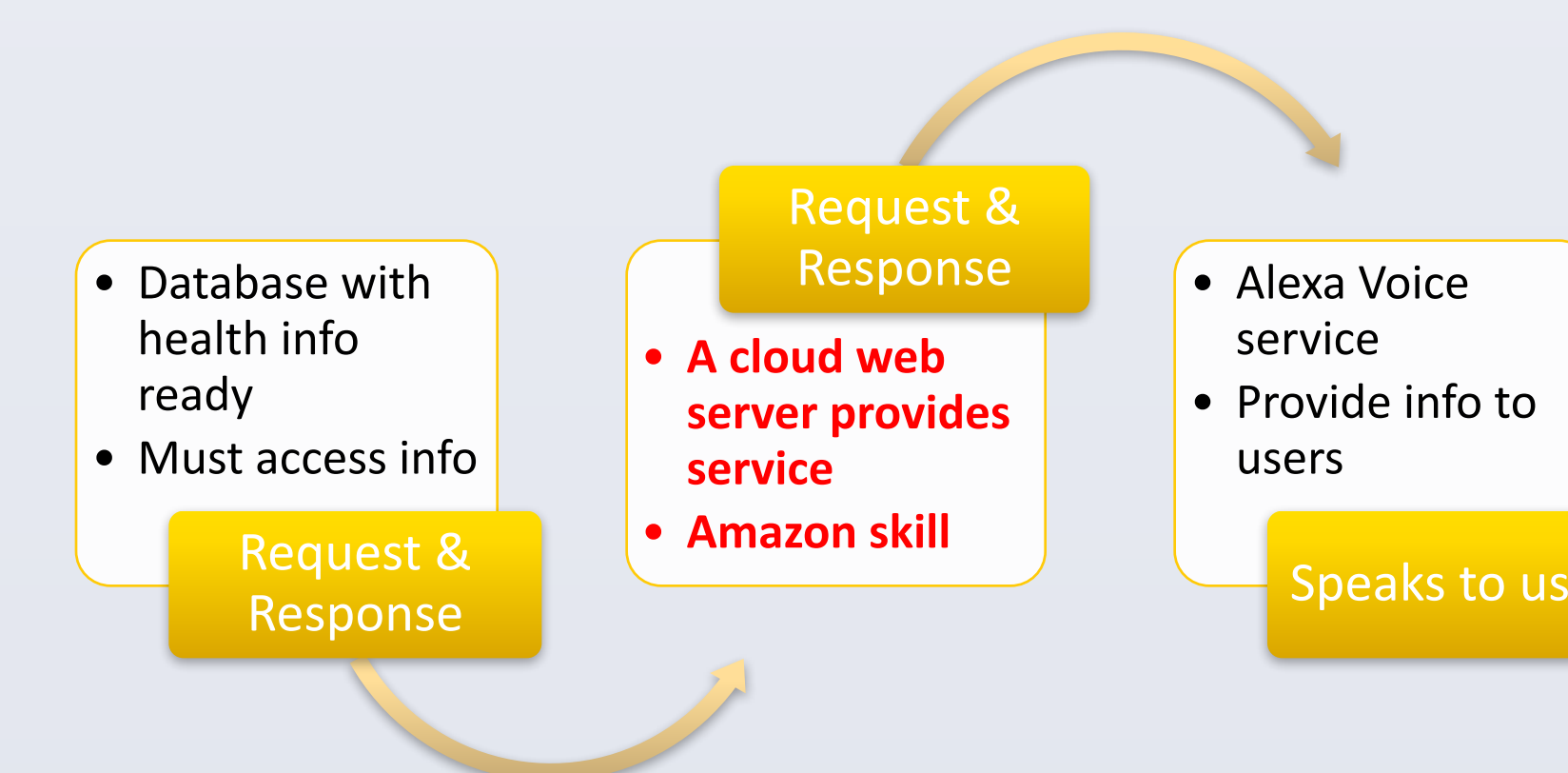

AMAZON ECHO

A speaker device that allows for user interaction

The Amazon Echo is a voice-enabled wireless speaker. It responds to "Alexa", "Echo", or "Amazon", and is comparable to the Siri capability of the iPhone. Its many capabilities include making to-do lists, streaming podcasts, telling jokes, and accessing other real-time information. The Echo was chosen for its easy usability as well as personable communication system.
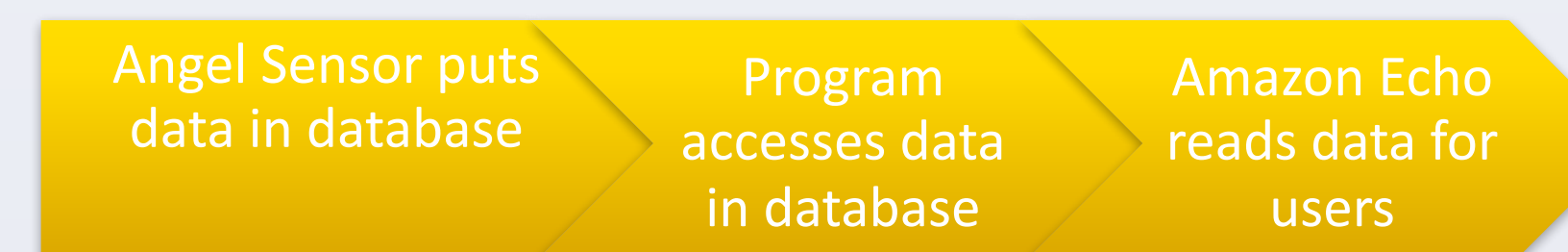
The Amazon System

Needed a web server to host and run the skill program, for usage by the application

Developing The Amazon Skill

Amazon Echo skill:
A capability that allows users to interact with the device with functionalities of Echo

Alexa Skills Kit:
A collection of self-service APIs, tools, documentation and code samples

The **Alexa Skills Kit** was used to develop an **Amazon Echo skill** that would be used to access the correct data from the Angel Sensor and correctly interact with the user

User asks:
What is my heart rate?   →   Amazon Voice Services   →   Skill on Amazon Lambda Services

Angel Sensor data in database:

timestamp	name	pulse	resident_id	skin_temp	steps
2016-06-30 11:13:06	Hubbard, Jord...	58	109238	83.12	228

EXAMPLE QUESTION: Alexa, ask Doctor "What is my heart rate?"

"Alexa" is the wake word
"Ask…Doctor" is on of the supported phrases for requesting service
"Doctor" is the invocation name that identifies the service the customer wants
"What is my heart rate?" is the specific question that elicits response
"heart rate" is the keyword invoke heart rate intent.

Setting Up A Server

At first the program for the skill was run on the AWS Lambda Services. We then tried to transition to an outside server and experienced difficulties. The first major issue was obtaining certification for our outside server, the second major issue was finding the correct remote endpoint to link the server to the Amazon skill. In the end, we decided to transition back to AWS Lambda services, but in the future we plan on successfully implementing the outside server.