Module 14:

Smart home sensors. Introduction to Amazon Alexa and Google Home

Dr. Maria Valero

KENNESAW STATE
UNIVERSITY

Agenda

- Definition. How does it work?
- History of Smart Home Technology
- Why types of technology is used in a smart home
- Examples of current products
- Amazon Alexa
- Google Home
- AI in voice assistants

Definition – Smart Home

- Smart Home technology intelligently gives you ultimate control over your home by automating the lighting system, dimming, blinds, electrical appliances, audio and security systems.

- Smart Homes connect all the devices and appliances in your home so they can communicate with each other and with you.

How does it work?

- Anything in your home that uses electricity can be put on the home network and at your command. Whether you give that command by voice, remote control or computer, the home reacts.

- Smart homes work with fairly simple systems: receivers and transmitters

- Receivers detect a certain signal from the transmitter, that issues the command

From the beginning - History

- The smart home's history can be easily traced back to the early turn of the century where electrical and telephone wiring were installed in new houses.

- Integrated smart home infrastructure was usually built by hobbyists in the 1960s, but it was until 1984 the term "smart home" was coined by the American Association of Home Builders.

- General Electric company was one of the first pioneers to develop a series of products made for smart homes in the mid 60's, these products included portable automatic dish washers and microwaves.

Smart Home Products

Different types of systems

- X-10, the oldest and most simplistic integrate home device was developed in the late 70's
- This technology involved utilizing basic household wiring in order to enable the household to become synchronized "smart"
- All the household appliances act as receivers while the transmitters issue orders in numerical code

Web Client

Mobile Client

Server
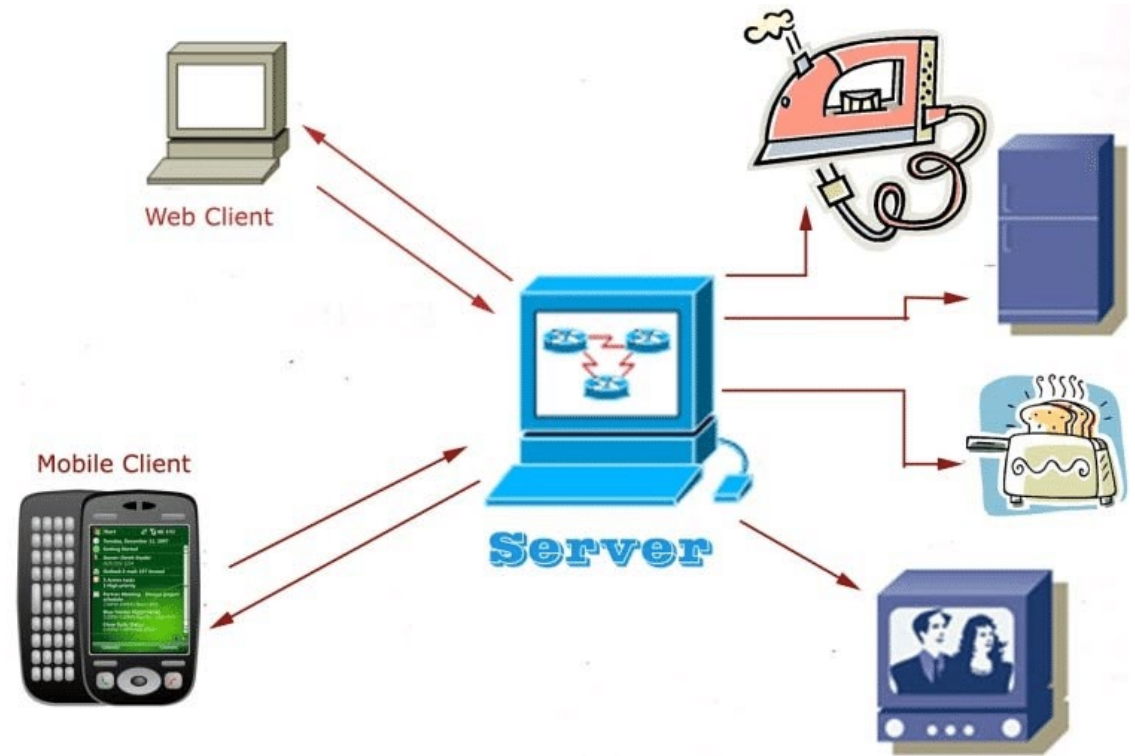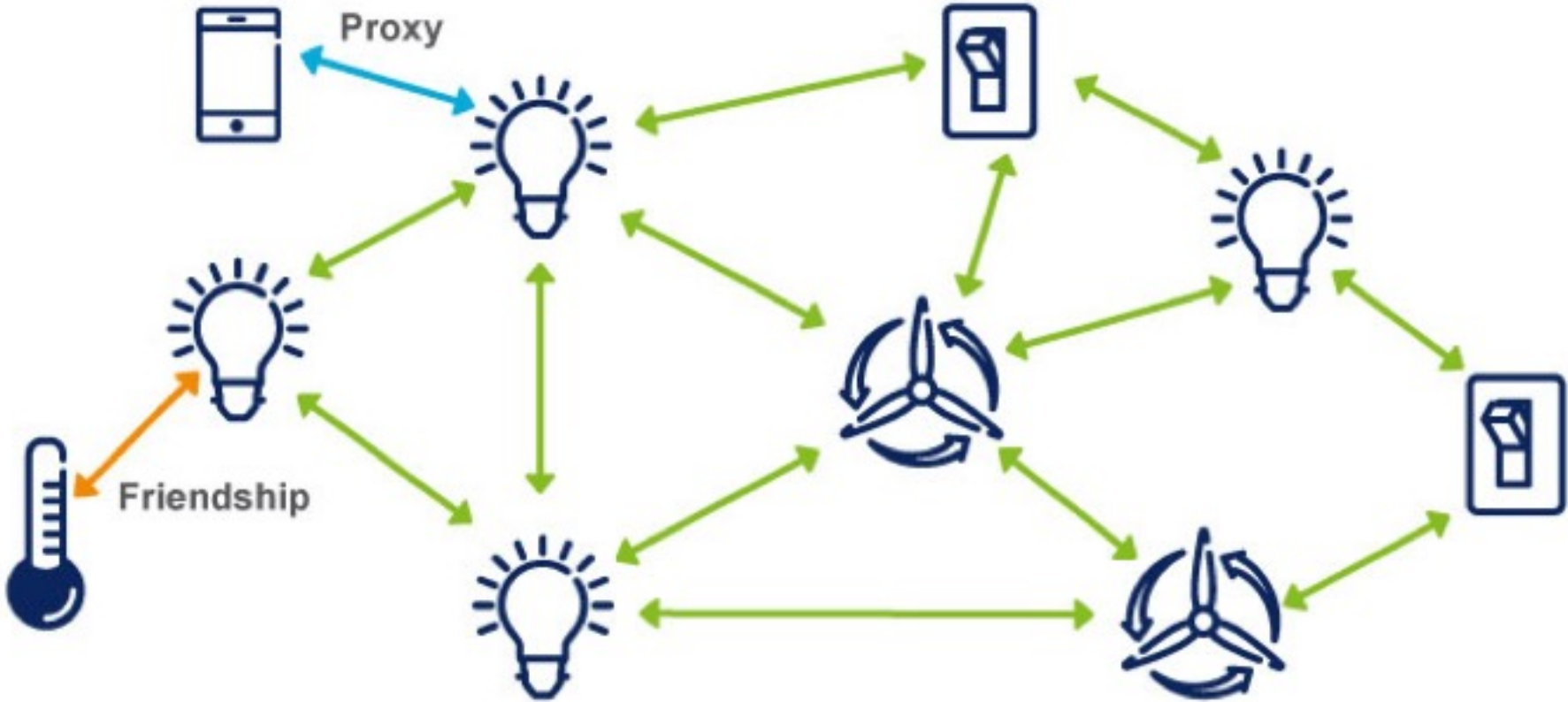
Mesh Networks (1)

Mesh Networks (2)

- A mesh network is a network in which devices -- or nodes -- are linked together, branching off other devices or nodes. These networks are set up to efficiently route data between devices and clients. They help smart homes provide a consistent connection throughout a physical space.

- This approach increases the resilience of the network in case of a node or connection failure. Larger mesh networks may include multiple routers, switches and other devices, which operate as nodes.
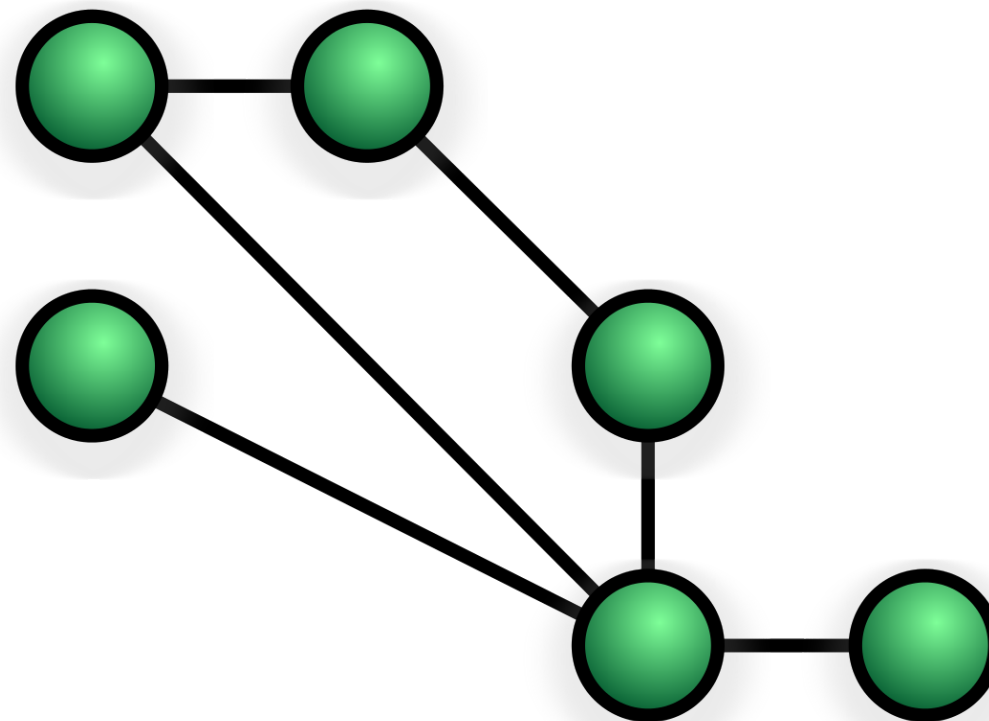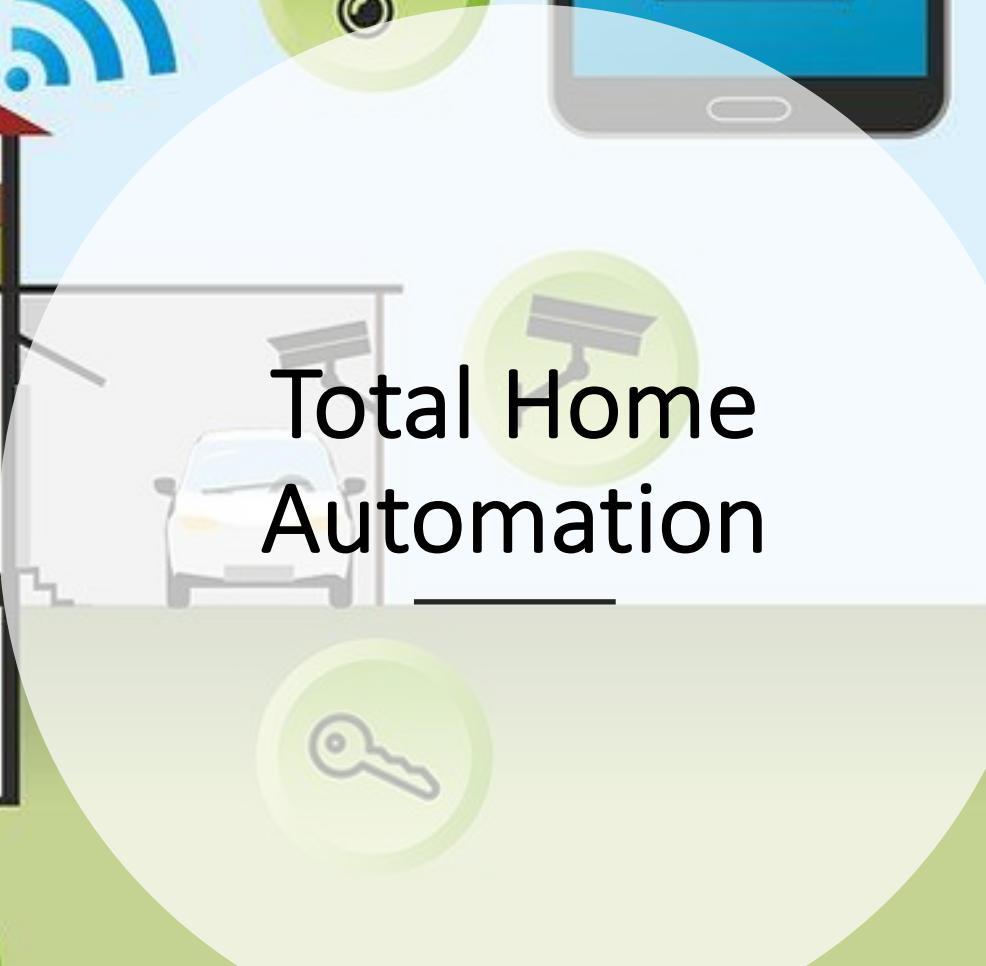
Total Home
Automation

Here's how it works

- Each device on the network, such as lamp, light switch, thermostat, garage door opener, pool control and others have an individual code, selected from more than 4 billion options. When you program one of the controller options, it automatically IDs what those codes are. Then when you press the appropriate button, the controllers sends a signal to the device telling it what to do.

What is the cost

- The cost of a smart home greatly depend on how "smart" you really want it.

Water sensor
$15 - $700

Motion sensor
$20 - $40

Door sensor
$20 - $80

Smoke detector
$40 - $60

Camera
$100 - $2,500

Lock
$150 - $400
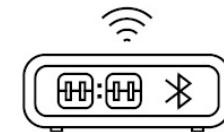
Alarm
$250 - $500

$ ———— $$$

Smart home security cost per device

FIXr

Amazon Alexa Technology

- Intelligent Personal Assistant
- Amazon's Cloud-based Voice Service
- Provide Capabilities/Skills
  - Play Music
  - Answer General Questions
  - Set Alarms / Timers
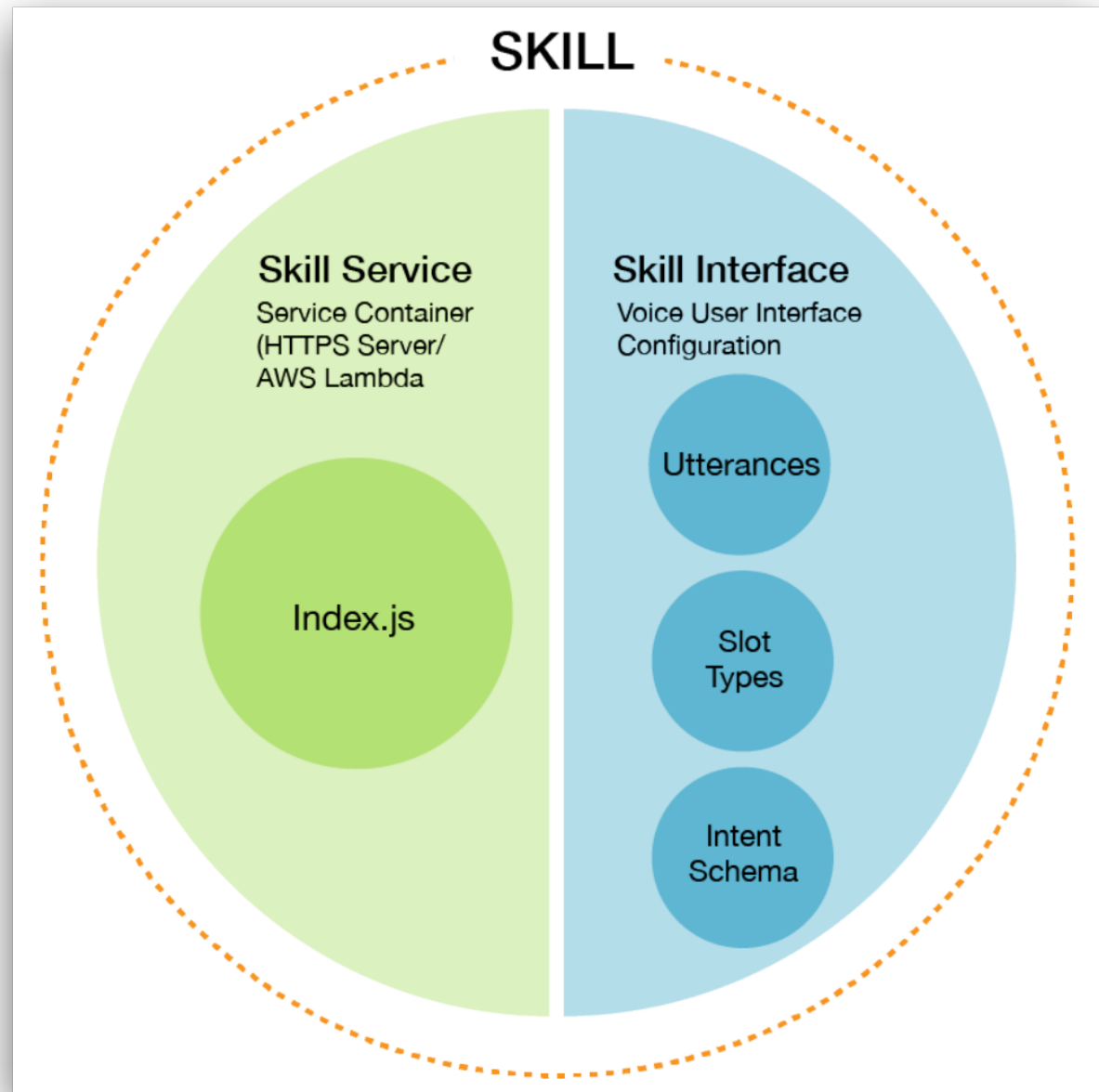 - Read the news
  - Play Audible Books

Amazon Echo & Dot

- Always on, always connected, hands free device

- Connects to Amazon Alexa

- Continually learns and adapts to your speech patterns

- Echo has 7 microphones & beam forming tech

- Can hear you across a room

- Just say wake up word: "Alexa"

Alexa Skills Kit (ASK)

Alexa Skills Kit Architecture

Sample Custom Alexa Skill Architecture

3
1. Identifies skill name
2. Analyzes & understands req.
3. Sends custom Alexa Skill a structured representation of user's req.

4
1. Custom Alexa skill receives the req.
2. Processes the req. and returns text (image - opt) response.

Alexa Skill (Alexa Skill Kit)

1

2

5
REST service

API Gateway & Management

"Alexa, Ask for..."

Req. Voice Stream

Resp. Voice Stream

7

6

9

8
1. Alexa converts the returned text to speech.
2. Streams to Echo/Dot device.

AWS Lambda
(Server-less Compute in Cloud)

Services

User(s)

Echo/Dot Service

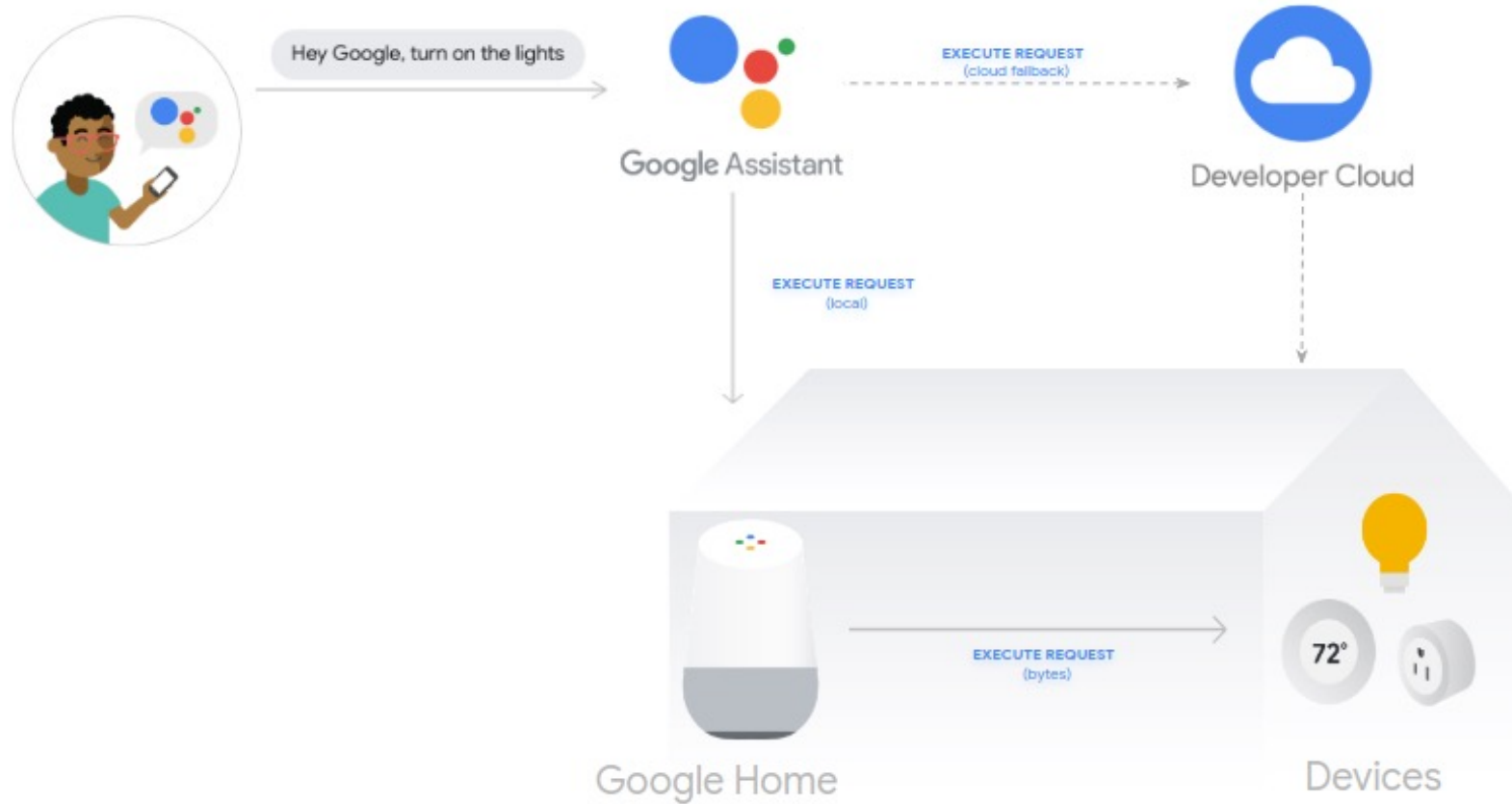Alexa Voice Service (AVS)
(Cloud)

amazon
web services

Microservices

Google Home

- It is a smart speaker from Google to compete with the popular Amazon Echo.

- It is also always listening to its environments, but it won't record what you're saying or respond to your commands until you say one of its pre-programmed wake words either "OK, Google", or "Hey, Google"

Google Home Architecture

Hey Google, turn on the lights

Google Assistant

EXECUTE REQUEST
(cloud fallback)

Developer Cloud

EXECUTE REQUEST
(local)

EXECUTE REQUEST
(bytes)

Google Home

72°

Devices

AI in Voice Assistants

A S S I S T A N T
R E Q U I R E D

BY PAUL SARCONI

AI in Google Home

- The wake word is based on a Neural Network Algorithm. These Neural Networks (NN) need to be trained to work the way we want them too. It can be thought of as working out at the gym. When you work out, you're training your muscles.

- The more training data that is fed into the NN, the more accurate the results are. However, this training data needs to be diverse. If the training data only consist of women speaking, even if its millions of them, there will be more errors when men try to activate the system. The same problem will occur when people with different accents try to activate the device. So, it is important that the training sets used to train the system are diverse.

AI in Google Home