Real time Alexa packets profiling analysis

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ABSTRACT

Nowadays, the introduction of home virtual assistents like Alexa Echo or Google Home became a practice, just considering that over 27% of families owns one.

It's obvious that those devices simplified the life by creating a smart house with few money; but what's the impact these devices have on people privacy? There are a lot of cases in the United States in which the judge asked to Amazon to provide the recording done by the Echo Dot in order to find helpful evidences for the case; so, the question is: "It's possible to prevent the sending of sensible informations to the servers when the weak word is not pronunced?"

In this project we will profile each packet exchanged between the Alexa Echo and the Server in order to classify the nature of the packets and consequentially we will use a machine learning model to discover when the Echo Dot is sending an inappropriate packet.

KEYWORDS

data analytics, alexa, packets profiling

1 INTRODUCTION

TODO

2 ALEXA ARCHITECTURE & SECURITY

The Alexa architecture isn't really easy to explain, we will resume just the keypoint in order to better understand the main functionalities for our purpose.

(1) Alexa is always in listening waiting for the weak word to be pronunced to start the recording of the voice;
(2) From the weak word, till the end of commands, Alexa will record the speech and partially sends it to Alexa Voice Service, that can be considered as the brain of Alexa;
(3) Alexa Voice Service will process the audio using Natural Language Processing and Natural Language Understanding in order to retrieve a response for the given request.
   (a) Natural Language Processing (NLP) improve the Word Segmentation that separate a chunk of continuous text into separate words.
   (b) Natural Language Understanding (NLU) is a subtopic of NLP and uses the AI to map text to the meaning[**?**] in order to understand the speech and the request.
(4) Depending on the sent command, the Voice Service will take an action (turn on the light) or send the information back to the device and Alexa may speech.

3 ALEXA FLOW OF COMMUNICATION

Describe here the entire flow of communication

4 PACKETS ANALYSIS

In order to create a good dataset we will classify the packets sent by the Echo. The classification it's been done using a Python script, and an accurate review of the data produced. The main classes considered are the following:

- **handshake**: this packet is sent at the beginning of SSL/TLS communication between the Echo and a server. Echo changes server very frequently, about each 2 minutes.
- **syn**: two synchronization packets are sent from the device in a fixed interval. In a more detailed way, Echo communicates with two different server with different interval:
  - A packet of 100 byte is sent each 30 seconds (30002 milliseconds)
  - A packet of 99 byte is sent each 90 seconds (90820 milliseconds)
- Application Data
- Spotify Ack
- Ack
- TCP Data
- Retry Packet
- Not Relevant

When the first classification is completed, we need to label the legitimate Application Data packets by manually analyzing in which case they have been sended, in particular this kind of packet can be sended in three context:

- First Encrypted Packet after SSL Handshake
- Data needed for the legitimate communication between Echo and Server
- Illegitimate Data

5 DATASET

TODO

6 MACHINE LEARNING

TODO

7 CONCLUSIONS

TODO