Chatbot Security and Privacy in the Age of Personal Assistants

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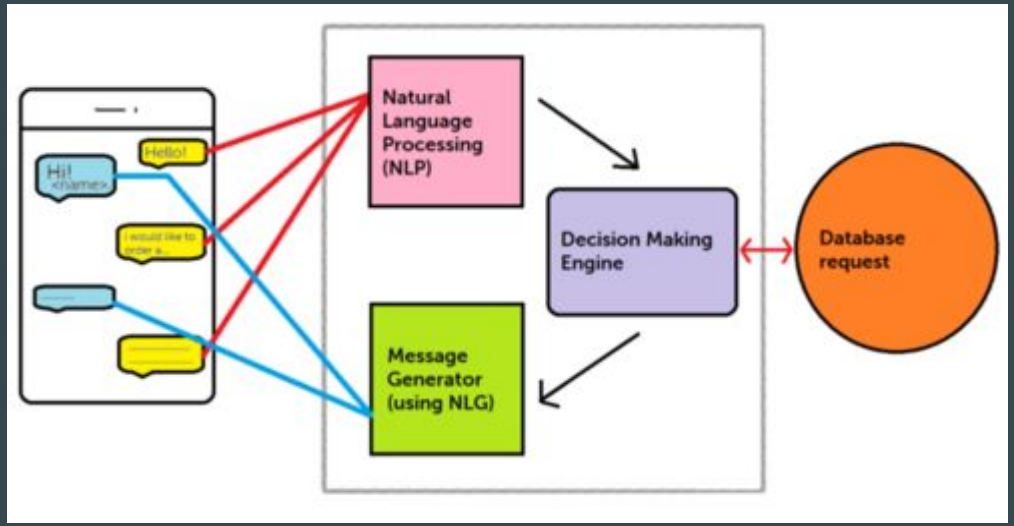
Introduction

A. Client Module
B. Communication Module
C. Response Generation Module
D. Database Module



Client Module: Unintended Activation Attacks

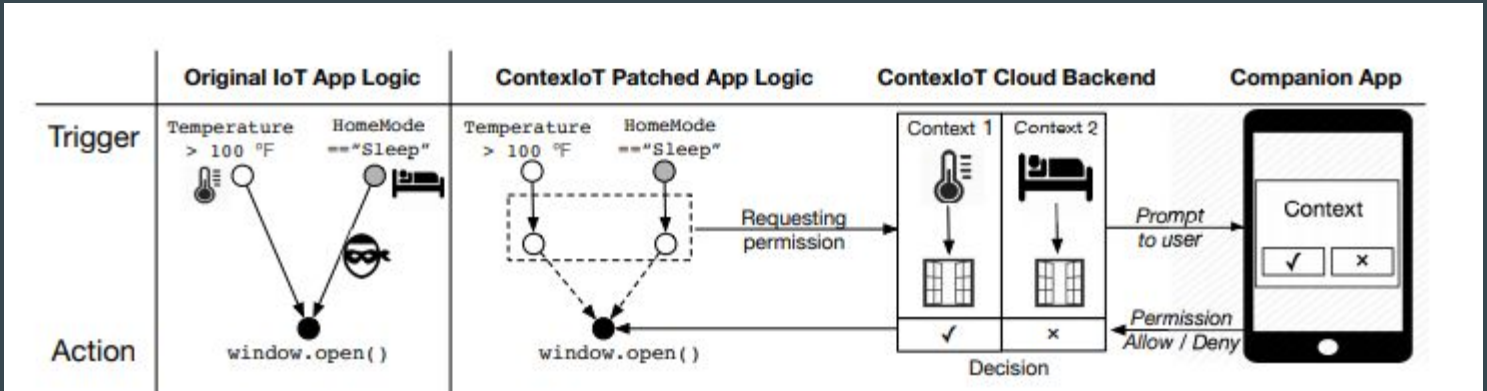
- Wake-up phrases are used to activate the smart device
  - What if the device confuses words?
  - What if the device records other people in the same room?
  - What if the device is tricked by a recording?
- What are some solutions?
  - Use Wifi to detect human motion
  - Detect whether user is talking to human or device

Client Module: Faked Response

- User misconceptions abound
  - 30% of users have trouble turning off smart device
  - 78% did not use LED to check for proper termination
- What if a malicious skill tricks the user into thinking they switched to a different app?
- What if a malicious skill fakes termination?
- What are some solutions?
  - Check smart device responses against a black list

Client Module: Access Control Attacks

- Some apps may grant very broad permissions to the user
  - What if a hacker can take advantage of this to break into the house?
- What are some possible solutions?
  - Defensive coding strategies
  - Security profilers

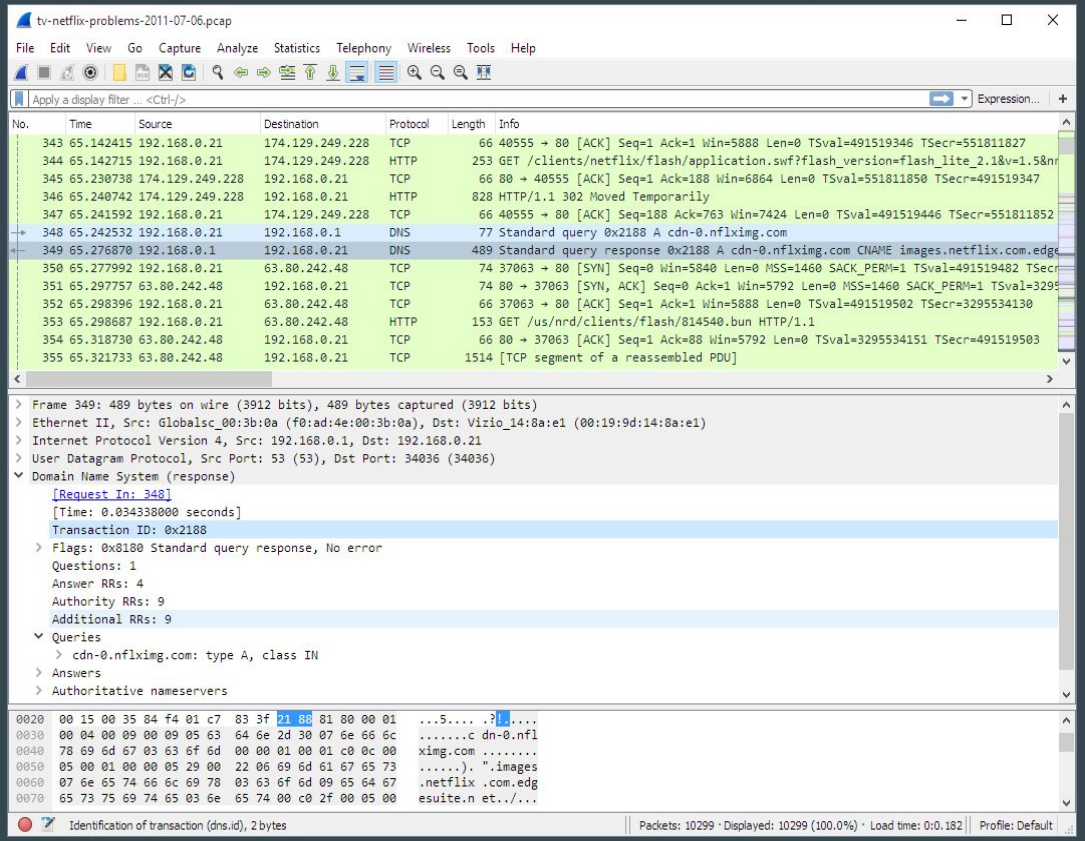


Client Module: Adversarial Voice Samples

- Voice recognition technology is essential for personal assistants
  - What if we can perturb the voice command such that the personal assistant misinterprets it?
  - What if we can hide voice commands in songs?
- What are some possible solutions?
  - Retrain the model
  - Keep the architecture secret

Communication Module

- DDos Attacks
  - Flood the server with as many requests as possible
- Wiretapping
  - Use packet metadata to predict voice command
- MitM Attacks
  - Intercept messages and delete/modify them



Response Generation Module: Out of Domain Attacks

- Chatbot is generally very adept at a select few domains
  - What if we make out of domain requests?
- What are some potential solutions?
  - Train a classifier to detect out of domain requests
  - Improve network's ability to quantify uncertainty

Response Generation Module: Adversarial Text Samples

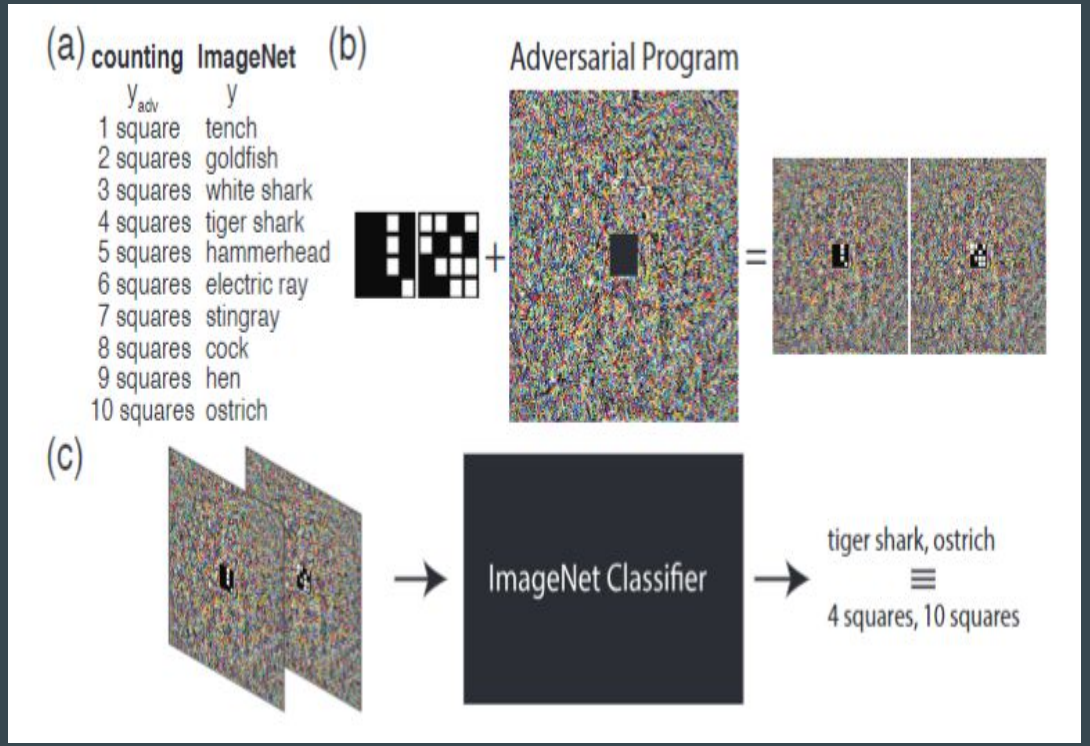
- Chatbot is constantly learning from its environment
  - What if we purposely poison the environment?
- What are some potential solutions?
  - Employ a hate speech detector

Response Generation Module: Language Model Attacks

- State of the art chatbots reply on language models like BERT
  - What if we can create malicious language models that sabotage the chatbot very discretely?
- What are some potential solutions?
  - Search for trigger words
  - Constantly vet language models

Response Generation Module: Adversarial Reprogramming

- The chabot replies on a number of different deep learning modules
  - What if we can repurpose these modules for our malicious tasks?
- What are some potential solutions?
  - Make it harder for the adversary to learn the weaknesses of the model



Response Generation Module: Feedback Engineering

- Chatbot usually gets a reward signal from the user
- The system improves itself through either:
  - Retraining
  - Reinforcement learning
- What if we can discretely retrain the chatbot to use offensive language after hearing certain trigger words?
- What if we can alter the reward signal and get the chatbot to adopt our malicious policy?
- What are some possible solutions?
  - Make it harder to query the model multiple times
  - Separate training examples and response generation module

Database Module

- Database module houses a lot of sensitive information
  - What if we launch an injection attack against it?
  - What if we manipulate the knowledge graph?
- What are some possible solutions?
  - Search database for injection vulnerabilities before deployment
  - Clean the data used to train the knowledge graph

Conclusion

- Contact Information
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