

Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

Future Work: Smartphones

Conclusions

Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

Future Work: Smartphones

Conclusions

Introduction

- Internet telephony is popular
 - VoIP (1.8 billion active users by 2013),
 - Mobile VoIP (139 million by 2014)

Traditional telephone devices are reachable through the Internet

Threats arise from this **interconnection**

Motivation

Access to a telephone device is vital

- Impact
 - Life threatening (fire-stations, police departments)
 - Financial (targeting rival business)
 - Social
- Malicious adversaries may target telephone devices and render them useless

Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

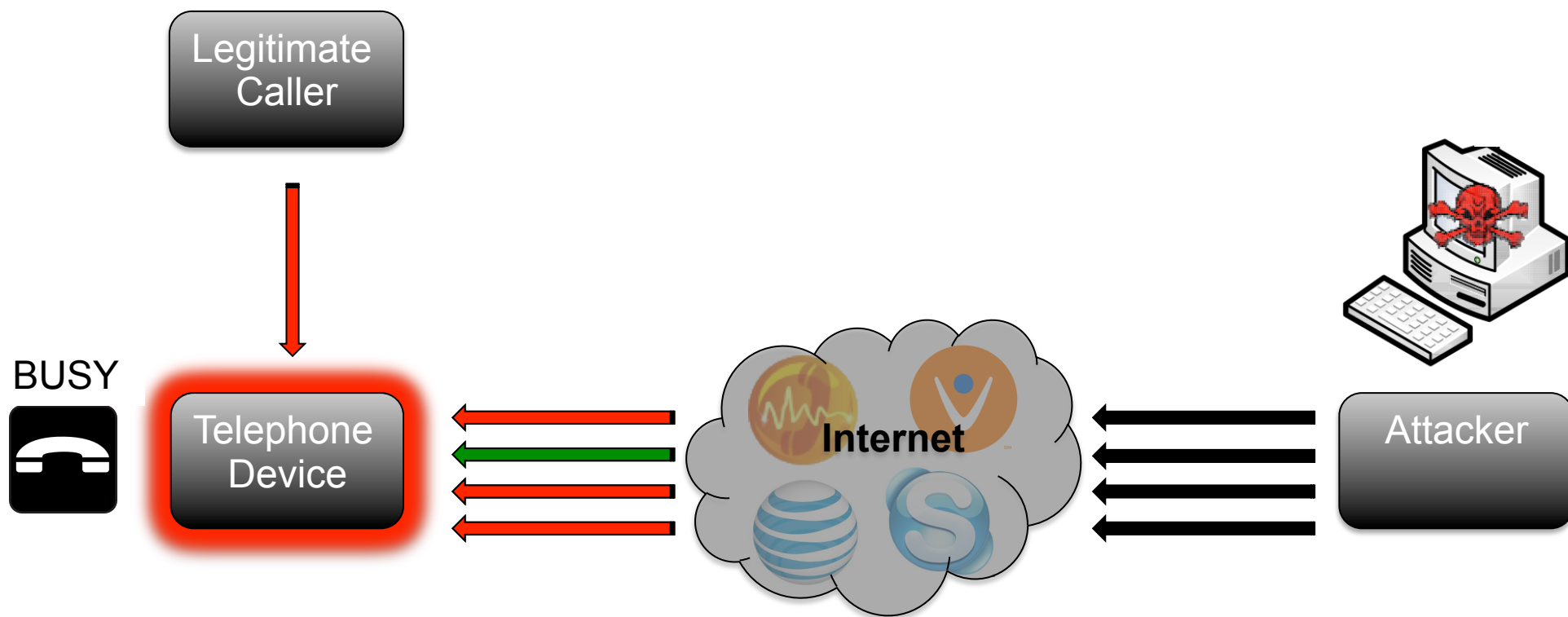
Future Work: Smartphones

Conclusions

Background: DIAL attacks

- Kapravelos et al., ESORICS 2010
- DIAL: Digitally Initiated Abuse of telephones
 - Use VoIP technology to issue calls towards target
 - Call initiation automatic
 - ***Flood target device with missed calls***
- Key characteristics
 - No financial resources
 - Missed calls
 - Negligible computational resources

Threat Model



Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

Future Work: Smartphones

Conclusions

Client-side countermeasures

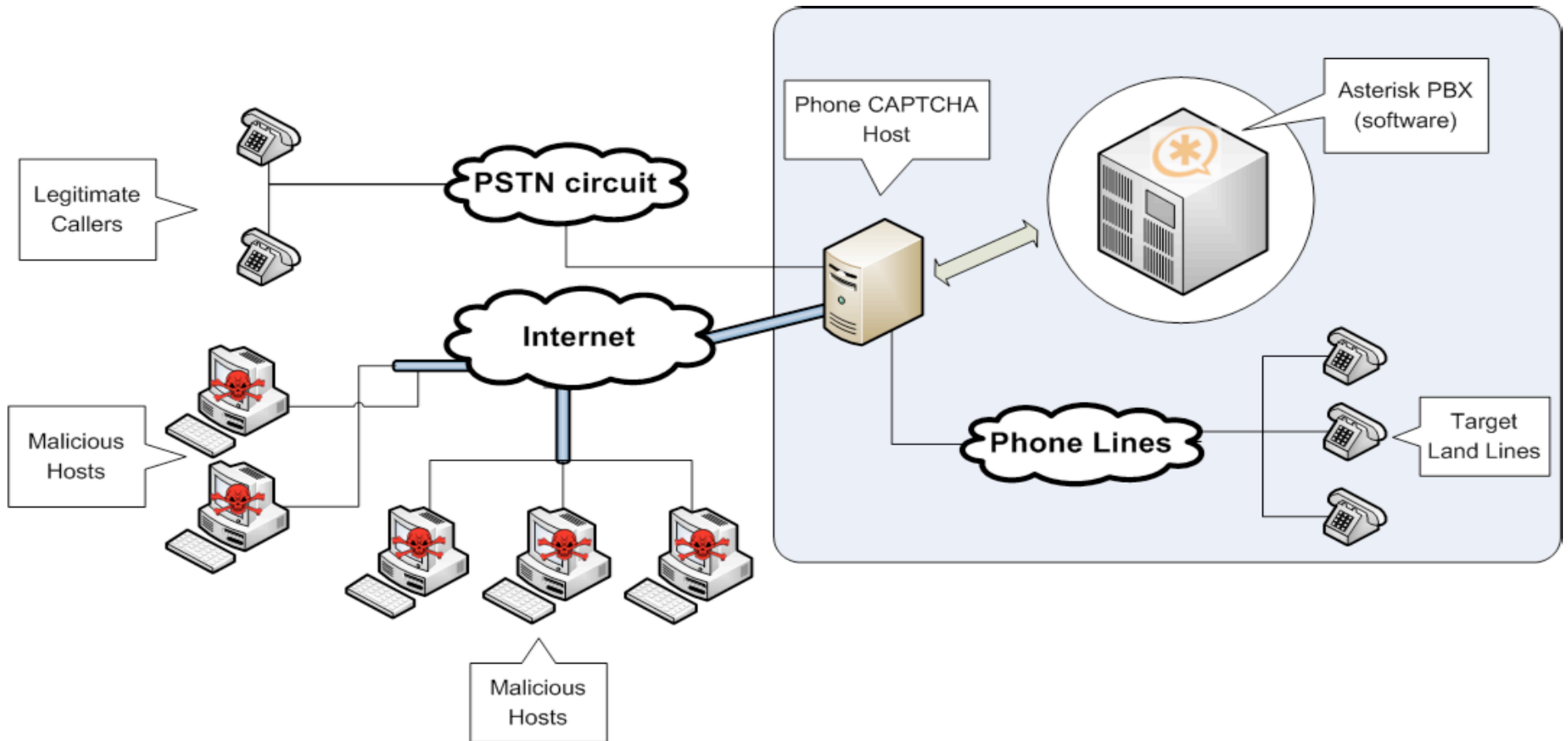
- Goal: Protect landlines from DIAL attacks
- System Components
 - Asterisk open-source software
 - Turn computer into communications server
 - Interactive Voice Response Technology
 - Detects touch tones
 - PCI-Card to connect landline
- Use Phone CAPTCHAs



Phone CAPTCHAs

- Audio CAPTCHA designed for software call centers
- Randomly select CAPTCHA test
 - Pre-recorded
 - Speech synthesis software
- Caller provides answer using phone's dialpad
- Dialplan implements system's logic
 - Defines users (devices), extensions, actions, priorities

Architecture



Phone CAPTCHA system

1. Incoming call placed in queue
 2. Caller is presented with Phone CAPTCHA test
 3. Test must be solved in limited amount of time
 4. Dialpad used to submit answer
 5. If caller provides correct answer, he is forwarded to destination
- Automated calls prohibited from getting through

Limitations

- Attack infrastructure
- Break Phone CAPTCHA
- Block legitimate callers

Phone CAPTCHA enhancements

Traditional CAPTCHAs contain series of digits

Can easily be broken by speech recognition software

➤ Enhancements

- Expand vocabulary
 - Use words – caller must spell with dialpad
- Incorporate semantics
 - “How many tires does a car have?”
- Speech distortion ?

User Case Study

- 14 subjects divided in 2 groups, non-native speakers
- Informed Group: informed of experiment
- Uninformed Group: asked to dial a number
- Users presented with 15 Phone CAPTCHAs
 - 5 spelling, 5 math calculations, 5 random

User Group	Spelling Set	Calculation Set	Random Set
Informed Group	83	74	71
Uninformed Group	74	63	71

Table I
SUCCESS RATES(%) OF THE USER STUDY.

Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

Future Work: Smartphones

Conclusions

Smartphone attacks

- Attacks against smartphones rising
 - 1 billion devices by 2014
 - Smartphones suffer from same flaws as PCs
 - ALSO have ***built-in billing*** system
- “Smart” Dialers
 - Similar to dial-up Internet dialers
 - Call premium numbers
 - *Direct* profit for attacker
- 2nd Generation DIAL attacks
 - Exploit vulnerabilities to initiate calls (web browser)
 - Hide attack in “benign” application
 - Use GSM network as attack medium

Protecting Smartphones

- Prohibit automated initiation of calls
 - Protect API calls (e.g., Talk(number))
 - Create wrappers for “sensitive” API calls
 - Implement challenge logic
 - Decides when to call original API function
 - Present user with Phone CAPTCHA
 - If dialed number not in (recent) call history
 - Whitelist calls towards emergency numbers
 - Present CAPTCHA upon rapid consecutive calls
- Limitation: bypassed if OS compromised

Outline

Introduction

Background: DIAL attacks

Countermeasure: Phone CAPTCHAs

Future Work: Smartphones

Conclusions

Conclusions

- Built Phone CAPTCHA calling center to protect landlines
- Proposed enhancements for Phone CAPTCHAs
- Conducted user study, demonstrated applicability of our solution
- Described new type of DIAL attack using smartphones
- Outlined incorporation of Phone CAPTCHAs in smartphones
- Several aspects need further exploration

Questions

