Android Device Risk Assessment Tool:

Using Common Permissions to Identify Applications Used in Intimate Partner Violence

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Abstract

* Write after finishing report
* 120 – 500 words, or 1-2 paragraphs
  + 25% on purpose/importance of research (Introduction)
  + 25% on what I did (Methods)
  + 35% on what I found (Results/Evaluation)
  + 15% on implications of research (Discussion)

1 Introduction

* Problems my project addresses

Intimate partner violence (IPV) is considered a public health concern in the United States by the CDC. This fact can be shocking for the uninformed whose idea of a public health concern is heart disease or a viral pandemic, but the four abusive behaviors of physical violence, sexual violence, stalking, and psychological aggression can lead to injury and death as assuredly as any disease [1]. The statistics differ slightly depending on the source, but approximately 1 in 4 women and 1 in 10 men have reported experiencing some form of IPV. One method that abusers use to control, manipulate, and harm their victims is surveillance spyware installed on their victim’s devices. This topic has only recently been researched, but it is a security issue of great importance because the abusers do not have to be technologically savvy to employ their attacks. Additionally, many victims are uninformed about the abuser’s tech capabilities and do not know how to deal with it even once the surveillance is suspected or discovered.

* Goals of research

This project aims to continue the burgeoning research and security solutions begun by students and faculty primarily at Cornell Tech and New York University [2, 3, 4, 5, 6, 7]. The work done by Sam Havron et al. in creating a clinical computer security procedure and spyware scanning tool (ISDi) is the major inspiration for the project [5]. Further work by Kevin Roundy et al. also provided ideas during the research phase [7]. I had several goals for the project, the first of which was to improve ISDi’s efficacy with a sort of “signature”-based spyware detection, as ISDi relies on blacklisting. The second goal was to obtain the permissions of known spyware applications and analyze them for commonalities in a guilt-by-association approach where any permission that was frequently used in spyware was more likely to indicate that an unknown app was also spyware. The third goal was to inspect victim devices without arousing suspicion of the attacker. The fourth goal was to programmatically assess the likelihood of an app being spyware with accuracy, as false negatives can be dangerous for the client (victim) while false positives obfuscate the danger. The final goal was to do everything in a way that is easy for a client to understand, leading to informed decision making regarding their device.

* Threat model
  + What does the adversary know?
    - Algorithms? Typical user behavior?
  + What can the adversary access?
    - Access communication contents? Metadata?
  + What can the adversary do?
    - Passive or active? Computing power?

Since IPV has evolved into a computer security problem, it is important to create a threat model that contextualizes the roles of attacker and victim and answers the questions of what the attacker knows, has access to, and can do. We must have a model both for the initial attack on the victim device and in the use of project’s tool. In the first case, these questions have been answered by the previous researchers [3]. As an aside, we use the terms attacker and victim here in the sense of an adversary model, though they align with the role of abuser and the target of abuse. “Victim” is not meant to be a slight or implication toward any person who is a target of or survivor of abuse. As for who the attacker and victim are, they tend to be intimate partners—spouses, boyfriends or girlfriends, exes, etc. There are other types of relationships, such as that of parent and child (where either party may play either role depending on age and circumstances) or even platonic friendships [8], but the relationships described in anecdotes by clients of IPV studies were only those of a romantic partner, ex-partner, and/or parent of their child(ren). The attacker and victim may live together, have lived together in the past, or never together at all. This is an important distinction for this threat model; while there are insider attacks wherein the attacker uses their organizational status to carry out an attack on that organization, it is easier to imagine a hacker thousands of miles away carrying out a remote attack. This is also not an attack on some faceless corporation, but one on a specific individual, and one whom the attacker knows very well.

What the attacker knows in this situation is both much and very little. On the social engineering side, the attacker may know many secrets that allow them to compromise the victim’s devices or accounts. Over the course of their relationship with the victim, they may come to know or compel the victim to tell them answers to security questions, like favorite color or birthday; they can watch or compel the victim to type passwords and PINs. On the other hand, it has been found that these attackers are not technically sophisticated, and Freed et al. go so far as to term them “UI-bound adversaries,” as they employ their attacks through a standard user interface with which they can be authenticated, or download the applications examined in this project to do their surveillance [3].

Another drastic difference from the typical adversary model is the attacker’s access to the victim device since most, if not all, assume the attacker’s target is someone else’s device [11]. One commonly reported scenario in cases of IPV is the device or its service is bought or paid for by the attacker. This gives the attacker control in innumerable ways, with such examples as the attacker confiscating or destroying the device, controlling associated digital accounts such as the mobile family plan or iCloud, and even manipulating relationships by giving a child a device with the intention to harass the adult target through it. Physical access to the device is key, especially since many of the spyware apps marketed towards these attackers require it.

Finally, what the attacker can do varies and has changed over time. In the past, an attacker could search for simple terms on the Google Play store like “track my girlfriend’s phone without them knowing” or “read SMS from another phone” and found many apps to chose from [4]. Following the warnings of security researchers, Google has removed many spyware apps from its store and filtered out IPV-related search terms, and it seems Android also has made changes to its APIs to make certain features of spyware apps unusable. Still, there were and still are apps that can be found from a Google search, and it is simple to disable a device’s protections, e.g., Google’s Play Protect, to install such off-store apps. One particularly nasty app called Cerberus boasts of uninstall protection, remote wipe, lock with password, blocking the power menu, and those are only the capabilities that prevent the victim from reclaiming their privacy. Apps claim they can track the device’s location, take pictures, record video and audio, forward text messages, read deleted messages, and practically any other type of privacy breach one can imagine. This makes them powerful and scary tools indeed. On the other hand, some apps are not as they appear. Some did not work past an introductory screen, and some apps tested for this project triggered anti-virus software which flagged it as a phishing attempt, and the Zscaler research term confirmed another case when analyzing the code of the keylogger app SPYMIE, finding a hard-coded email address with a timer to send surveilled data every minute [12].

* Markers of evaluation—“I am successful if…”

2 Background and Related Work

* Summary of work from Cornell Tech and NYU
* Brief description of security clinic and ISDi tool

3 Dataset Description and Properties

* Describe apps used for analysis and how/why they were obtained/chosen
* How were permissions analyzed
* Sorting permissions by protection level

4 Using Guilt-by-Association

* Brief description of CreepRank algorithm
* Permissions grouped by usage
* Deciding which permissions are guilty of spyware use
* Heuristic weights and rationale

5 The Risk Assessment Tool

* How the Horoscope app and risk assessment tool are intended to be used

1. The Horoscope app

* How it works
* Why it is designed the way it is
* What it provides for the main tool

1. The Risk Assessment tool

* How it works
* What it shows
* How results should be interpreted

6 Evaluating Efficacy

* Show testing examples
* Evaluate results—satisfactory? Does it meet established goals? Mixed results?
* Thoughts about why results are such

7 Discussion

* Did I achieve my goals? Which ones?
* Limitations
* Implications of research
* Future work/context of project beyond this experimental stage

8 Conclusion

* Summarize accomplishments

References

Appendix

Code

Screenshots

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