DETECTING MALICIOUS FACEBOOK APPLICATIONS

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ABSTRACT

With 20 million installs a day, third-party apps are a major reason for the popularity and addictiveness of Facebook. Unfortunately, hackers have realized the potential of using apps for spreading malware and spam. The problem is already significant, as we find that at least 13% of apps in our dataset are malicious. So far, the research community has focused on detecting malicious posts and campaigns. In this paper, we ask the question: Given a Facebook application, can we determine if it is malicious? Our key contribution is in developing FRAppE—Facebook's Rigorous Application Evaluator—arguably the first tool focused on detecting malicious apps on Facebook. To develop FRAppE, we use information gathered by observing the posting behavior of 111K Facebook apps seen across 2.2 million users on Facebook. First, we identify a set of features that help us distinguish malicious apps from benign ones. For example, we find that malicious apps often share names with other apps, and they typically request fewer permissions than benign apps. Second, leveraging these distinguishing features, we show that FRAppE can detect malicious apps with 99.5% accuracy, with no false positives and a high true positive rate (95.9%). Finally, we explore the ecosystem of malicious Facebook apps and identify mechanisms that these apps use to propagate. Interestingly, we find that many apps collude and support each other; in our dataset, we find 1584 apps enabling the viral propagation of 3723 other apps through their posts. Long term, we see FRAppE as a step toward creating an independent watchdog for app assessment and ranking, so as to warn Facebook users before installing apps.

I. INTRODUCTION

ONLINE social networks (OSNs) enable and encourage third-party applications (apps) to enhance the user experience on these platforms. Such enhancements include interesting or entertaining ways of communicating among online friends and diverse activities such as playing games or listening to songs. For example, Facebook provides developers an API [2] that facilitates app integration into the Facebook user experience. There are 500K apps available on Facebook [3], and on average, 20M apps are installed every day [1]. Furthermore, many apps have acquired and maintain a really large user base. For instance, FarmVille and CityVille apps have 26.5M and 42.8M users to date.

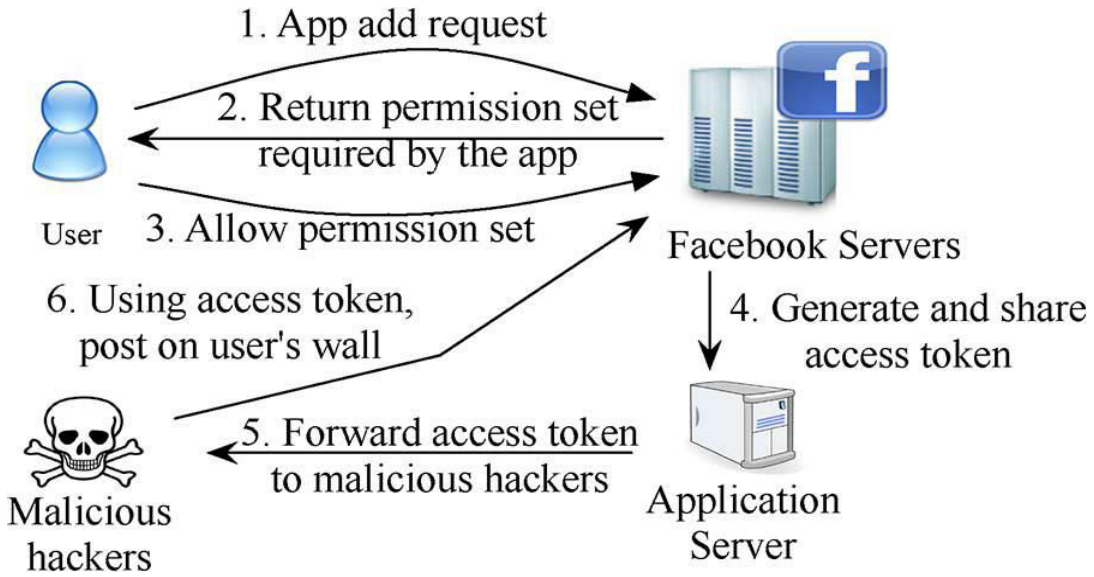
Recently, hackers have started taking advantage of the popularity of this third-party apps platform and deploying malicious applications [4]–[6]. Malicious apps can provide a lucrative business for hackers, given the popularity of OSNs, with Facebook leading the way with 900M active users [7]. There are many ways that hackers can benefit from a malicious app: 1) the app can reach large numbers of users and their friends to spread spam; 2) the app can obtain users' personal information such as e-mail address, home town, and gender; and 3) the

app can "reproduce" by making other malicious apps popular. To make matters worse, the deployment of malicious apps is simplified by ready-to-use toolkits starting at $25 [8]. In other words, there is motive and opportunity, and as a result, there are many malicious apps spreading on Facebook every day [9].

Despite the above worrisome trends, today a user has very limited information at the time of installing an app on Facebook. In other words, the problem is the following: Given an app's identity number (the unique identifier assigned to the app by Facebook), can we detect if the app is malicious? Currently, there is no commercial service, publicly available information, or research-based tool to advise a user about the risks of an app. As we show in Section III, malicious apps are widespread and they easily spread, as an infected user jeopardizes the safety of all its friends.

So far, the research community has paid little attention to OSN apps specifically. Most research related to spam and malware on Facebook has focused on detecting malicious posts and social spam campaigns [10]–[12]. At the same time, in a seemingly backwards step, Facebook has dismantled its app rating functionality recently. A recent work studies how app permissions and community ratings correlate to privacy risks of Facebook apps [13]. Finally, there are some community-based feedback-driven efforts to rank applications, such as WhatApp? [14]; though these could be very powerful in the future, so far they have received little adoption.

II. SYSTEM ARCHITECTURE



III. EXISTING SYSTEM

- So far, the research community has paid little attention to OSN apps specifically. Most research related to spam and malware on Facebook has focused on detecting malicious posts and social spam campaigns.
- Gao *et al.* analyzed posts on the walls of 3.5 million Facebook users and showed that 10% of links posted on Facebook walls are spam. They also presented techniques to identify compromised accounts and spam campaigns.

- Yang *et al.* and Benevenuto *et al.* developed techniques to identify accounts of spammers on Twitter. Others have proposed a honey-pot-based approach to detect spam accounts on OSNs.
- Yardi *et al.* analyzed behavioral patterns among spam accounts in Twitter.
- Chia *et al.*investigate risk signaling on the privacy intrusiveness of Facebook apps and conclude that current forms of community ratings are not reliable indicators of the privacy risks associated with an app.

DISADVANTAGES OF EXISTING SYSTEM:

- Existing system works concentrated only on classifying individual URLs or posts as spam, but not focused on identifying malicious applications that are the main source of spam on Facebook.
- Existing system works focused on accounts created by spammers instead of malicious application.
- Existing system provided only a high-level overview about threats to the Facebook graph and do not provide any analysis of the system.

IV. PROPOSED SYSTEM

- In this paper, we develop FRAppE, a suite of efficient classification techniques for identifying whether an app is malicious or not. To build FRAppE, we use data from MyPage-Keeper, a security app in Facebook.
- We find that malicious applications significantly differ from benign applications with respect to two classes of features: On-Demand Features and Aggregation-Based Features.
- We present two variants of our malicious app classifier— FRAppE Lite and FRAppE.
- FRAppE Lite is a lightweight version that makes use of only the application features available on demand. Given a specific app ID, FRAppE Lite crawls the on-demand features for that application and evaluates the application based on these features in real time.
- FRAppE—a malicious app detector that utilizes our aggregation-based features in addition to the on-demand features.

ADVANTAGES OF PROPOSED SYSTEM:

- The proposed work is arguably the first comprehensive study focusing on malicious Facebook apps that focuses on quantifying, profiling, and understanding malicious apps and synthesizes this information into an effective detection approach.
- Several features used by FRAppE, such as the reputation of redirect URIs, the number of required permissions, and the use of different client IDs in app installation URLs, are robust to the evolution of hackers.

V. IMPLEMENTATION

Data collection

The data collection component has two subcomponents: the collection of facebook apps with URLs and crawling for URL redirections. Whenever this component obtains a facebook app with a URL, it executes a crawling thread that follows all redirections of the URL and looks up the corresponding IP addresses. The crawling

thread appends these retrieved URL and IP chains to the tweet information and pushes it into a queue. As we have seen, our crawler cannot reach malicious landing URLs when they use conditional redirections to evade crawlers. However, because our detection system does not rely on the features of landing URLs, it works independently of such crawler evasions.

Feature extraction

The feature extraction component has three subcomponents: grouping of identical domains, finding entry point URLs, and extracting feature vectors.

To classify a post, MyPageKeeper evaluates every embedded URL in the post. Our key novelty lies in considering only the social context (e.g., the text message in the post, and the number of Likes on it) for the classification of the URL and the related post. Furthermore, we use the fact that we are observing more than one user, which can help us detect an epidemic spread.

It detects Presence of Spam keywords like ‘FREE’, ‘DEAL’ and ‘HURRY’.

Training

The training component has two subcomponents: retrieval of account statuses and training of the classifier. Because we use an offline supervised learning algorithm, the feature vectors for training are relatively older than feature vectors for classification. To label the training vectors, we use the account status; URLs from suspended accounts are considered malicious whereas URLs from active accounts are considered benign. We periodically update our classifier using labeled training vectors.

Classification

The classification component executes our classifier using input feature vectors to classify suspicious URLs. When the classifier returns a number of malicious feature vectors, this component flags the corresponding URLs information as suspicious.

The classification module uses a Machine Learning classifier based on Support Vector Machines, but also utilizes several local and external white lists and blacklists that help speed up the process and increase the over-all accuracy. The classification module receives a URL and the related social context features extracted in the previous step.

These URLs, detected as suspicious, will be delivered to security experts or more sophisticated dynamic analysis environments for an in-depth investigation.

Detecting Suspicious

The Detecting Suspicious and notification module notifies all users who have social malware posts in their wall or news feed. The user can currently specify the notification mechanism, which can be a combination of emailing the user or posting a comment on the suspect posts.

VI. CONCLUSION

Applications present convenient means for hackers to spread malicious content on Facebook. However, little is understood about the characteristics of malicious apps and how they operate. In this paper, using a large corpus of malicious Facebook apps observed over a 9-month period, we showed thatmalicious apps differ significantly from benign apps with respect to several features. For example, malicious apps aremuchmore likely to share names with other apps, and they typically request fewer permissions than benign apps. Leveraging our observations, we developed FRAppE, an accurate classifier for detecting malicious

Facebook applications.Most interestingly, we highlighted the emergence of app-nets—large groups of tightly connected applications that promote each other. We will continue to dig deeper into this ecosystem of malicious apps on Facebook, and we hope that Facebook will benefit from our recommendations for reducing the menace of hackers on their platform.

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