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iOS Security

The Never-Ending Story of Malicious Profiles

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Adi Sharabani

CEO & Co-Founder
Skycure

@AdiSharabani

Yair Amit

CTO & Co-Founder
Skycure

@YairAmit

About the Presenters

Yair Amit

- CTO & co-founder of Skycure
- Web, network and mobile researcher
- Inventor of 15 patents
- Former manager of the Application Security & Research group at IBM

Adi Sharabani

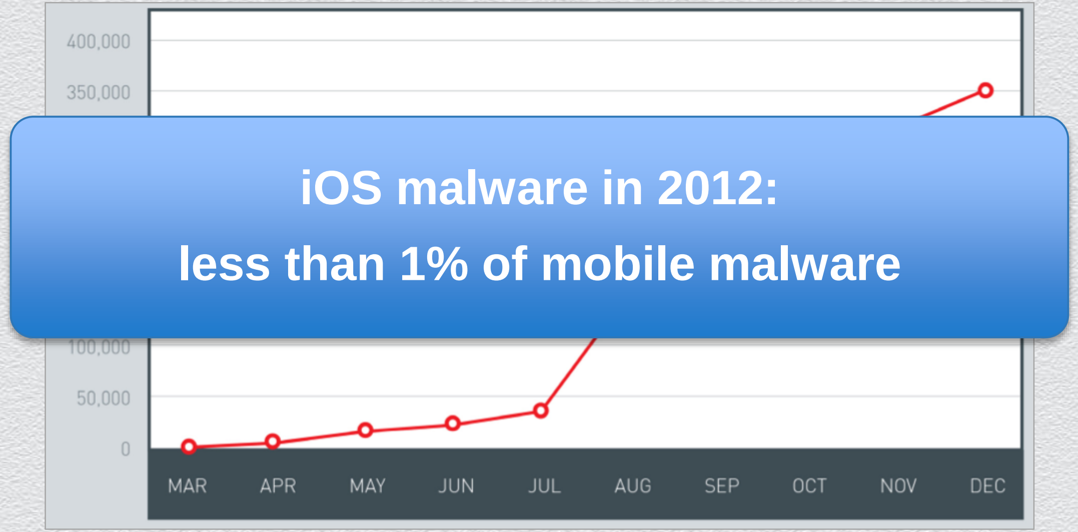
- CEO & co-founder of Skycure
- Watchfire's research group [Acquired by IBM]
- Lead the security of IBM software
- Fellow at Yuval Neeman's workshop
- Teacher at Ohel Shem high-school

Agenda

- iOS security model
- Malicious profiles
- iOS 7.1 security fix
- Impact on MDMs
- Afterthoughts

Starting With the Obvious

- Android malware threat growth:



iOS malware in 2012:

less than 1% of mobile malware

Source: Trend Micro 2012 Mobile Threat and Security Roundup

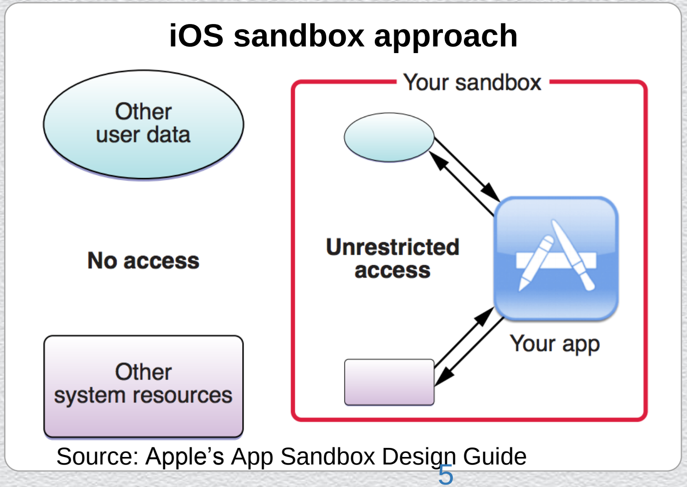
iOS Security Model

App Characteristics

- One Store
- Heavy Screening
- App Sandboxing

Profile Characteristics

- No Store
- No Screening
- No Sandboxing

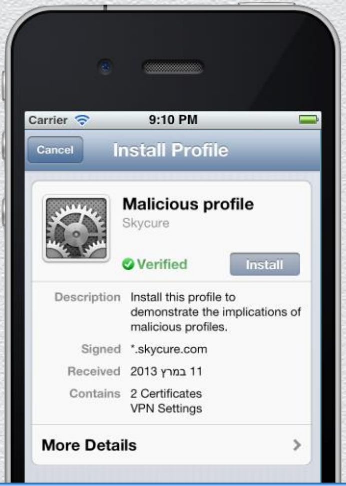


Source: Apple's App Sandbox Design Guide

Configuration Profiles – Where Do We Find Them?

- Mobile Device Management (MDM)
- Cellular carriers
  - Usually used for APN settings
- Mobile applications
- Service providers

Malicious Profiles



Malicious profile
Skycure

Description: Install this profile to demonstrate the implications of malicious profiles.
Signed: *.skycure.com
Received: 11 במרץ 2013
Contains: 2 Certificates
VPN Settings

Hacker gains access to your mail, business apps, cloud services, bank accounts and more**, even if traffic is encrypted**

Time for a demo

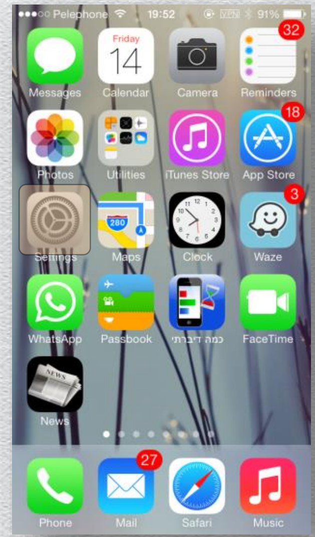
(so take out your iOS device)

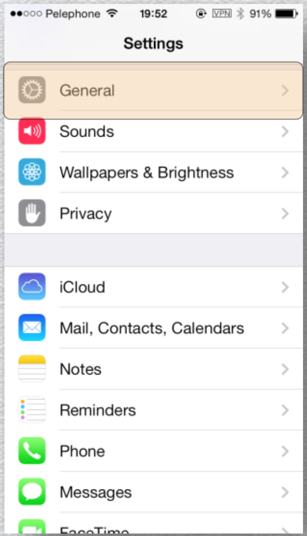
Malicious Profiles – Where Do We Find Them?

- Malicious “service providers” (apps/services/etc.)
- Malicious Wi-Fi networks
- Vulnerable services

Am I Safe?

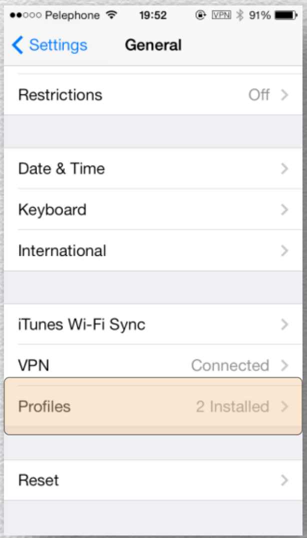
- Profile listing could indicate suspicious profiles
- Cat-and-mouse game: attackers can name their profile to look benign




●●○○○ Pelephone 19:52 VPN 91%

Settings

- General
- Sounds
- Wallpapers & Brightness
- Privacy
- iCloud
- Mail, Contacts, Calendars
- Notes
- Reminders
- Phone
- Messages
- FaceTime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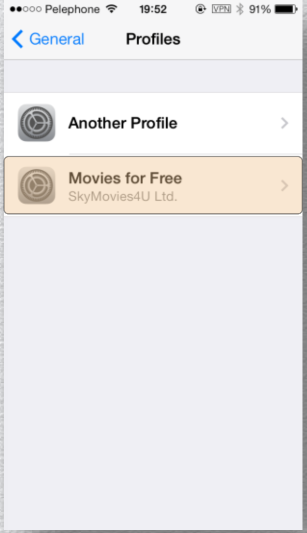
< Settings General

Restrictions	Off
Date & Time	
Keyboard	
International	
iTunes Wi-Fi Sync	
VPN	Connected
Profiles	2 Installed
Reset	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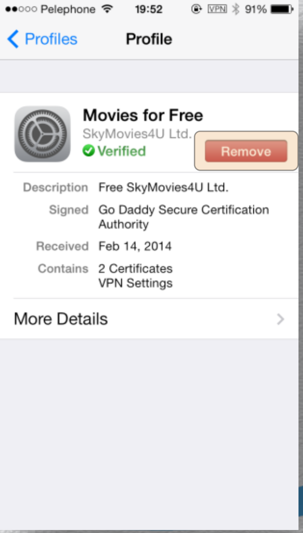
< General Profiles

- Another Profile
- Movies for Free
SkyMovies4U Ltd.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< Profiles Profile

Movies for Free
SkyMovies4U Ltd.
✓ Verified
Remove

Description	Free SkyMovies4U Ltd.
Signed	Go Daddy Secure Certification Authority
Received	Feb 14, 2014
Contains	2 Certificates VPN Settings

More Details

So let’s remove the attack

The Invisible Profile

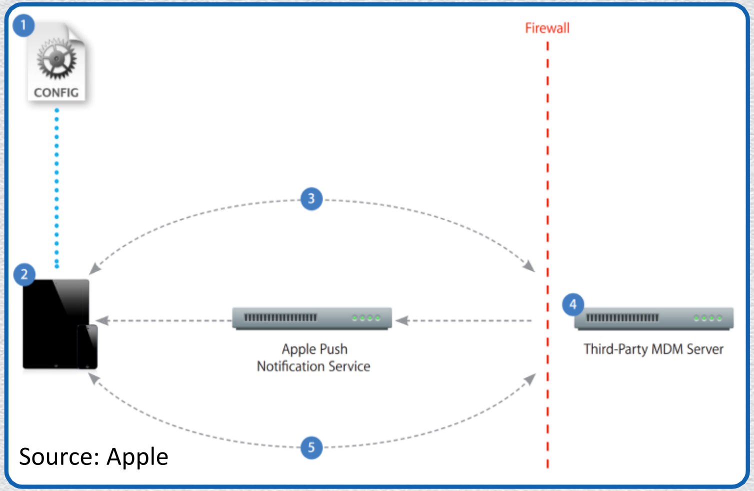
- iOS vulnerability allowing a profile to hide itself.
- Identified by Assaf Hefetz, researcher and developer, Skycure
- So what happened:
  - Victim was lured into installing a special crafted profile
  - Due to iOS bug, profile is not listed in the Profiles pane
  - Malicious profile is active and yet hidden

- Additional technical details pending on iOS 7.1 release

Malicious Profiles and MDMs

Mobile Device Management

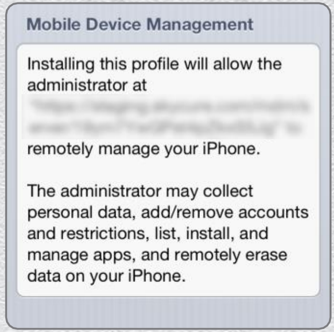
- Enrollment:
  1. A configuration profile is sent to the device
  2. User installs the MDM profile
  3. Device connects to MDM Server to enroll
- Commands:
  4. Server sends an APNS command
  5. Device connects directly to the server over HTTPS (Server sends commands or requests information)



Source: Apple

Mobile Device Management

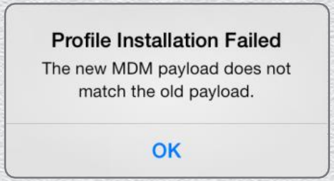
- MDM profile could potentially act as a powerful “malicious profile”.
- However:
  - Alarming installation message
  - Barriers to become an MDM
  - Only one MDM is allowed on device



Mobile Device Management

Installing this profile will allow the administrator at [redacted] to remotely manage your iPhone.

The administrator may collect personal data, add/remove accounts and restrictions, list, install, and manage apps, and remotely erase data on your iPhone.



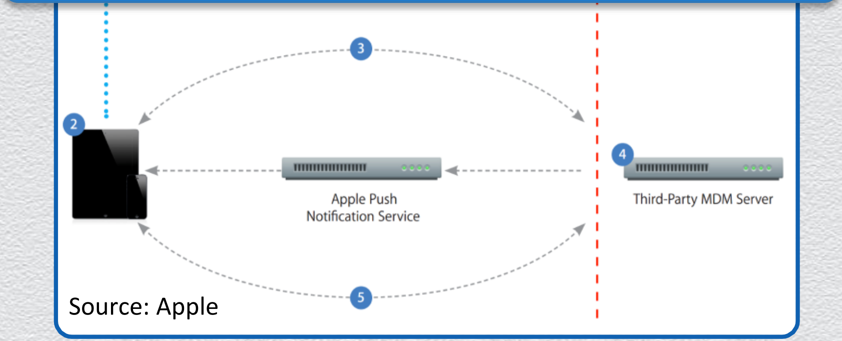
Profile Installation Failed

The new MDM payload does not match the old payload.

MDM Security Issues

SSL communication between client and MDM server lacks certificate-pinning

- David Schuetz presented a great research on MDM security



Source: Apple

- Problem increases when malicious profiles are used to exploit MDM protocol shortcomings

MDM Piggybacking

- Attack scenario:
  - IT/user enrolls an iOS device to a legitimate MDM service
  - Victim installs a malicious profile
  - Attacker waits …
  - MDM server sends an APNS command

    (attacker has no control over this part)
  - iOS device asks the MDM server for commands
    - (attacker does have control over this)
  - Attacker impersonates the MDM server

Possible Attacks – Removal of MDM

- A simple 401 HTTP response leads to the removal of the MDM (and associated settings or apps) from the device

```
HTTP/1.1 401 Unauthorized
Content-Type: text/html
Cache-Control: must-revalidate,no-cache,no-store
Transfer-Encoding: chunked
Content-Encoding: gzip
```

Full Demo Flow

Impact

- Things an attacker can do:
  - Remove the MDM profile (along with associated apps, configuration and data)
  - Send MDM query commands (e.g., list apps, profiles, certificates)
  - Perform an action (lock, remote wipe)
  - Configure additional stuff (Wi-Fi/APN proxy settings, install apps)

Some Challenges

- Challenge: Client-side certificate validation
  - Not all MDMs enforce them
  - Mdm-Signature HTTP header
- Challenge: Reliance on APNS calls
  - Chaining consequent commands
- Challenge: MDM can query the profile list
  - The “invisible profile” is also hidden from the MDM

Current Status

- We reported to Apple the issue at the end of September, 2013
- Apple fixed the issue in 7.1 code (GA should be released soon)
- We are not aware of live exploitation of the issue
- We acknowledge Apple’s security team for dedication to the security of their products

Recommendations

- **End users:**
  - Maintain an up to date OS
  - Check your iOS for suspicious profiles
  - If you don't have profiles, make sure you don't have the profile menu
- **Organizations:**
  - Enforce OS updates
  - Implement network based solutions for your mobile devices
- **MDM Vendors:**
  - Verify client side certificates
  - Work with Apple on the MDM protocol issues

Thank you!

- twitter: @YairAmit, @AdiSharabani
- email: {yair,adi}@skycure.com
- blog: http://www.skycure.com/blog

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