AppSec IL 2014

Mobile Security Attacks

A Glimpse From the Trenches

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OWASP
Open Web Application
Security Project

About the Presenters

Adi Sharabani

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

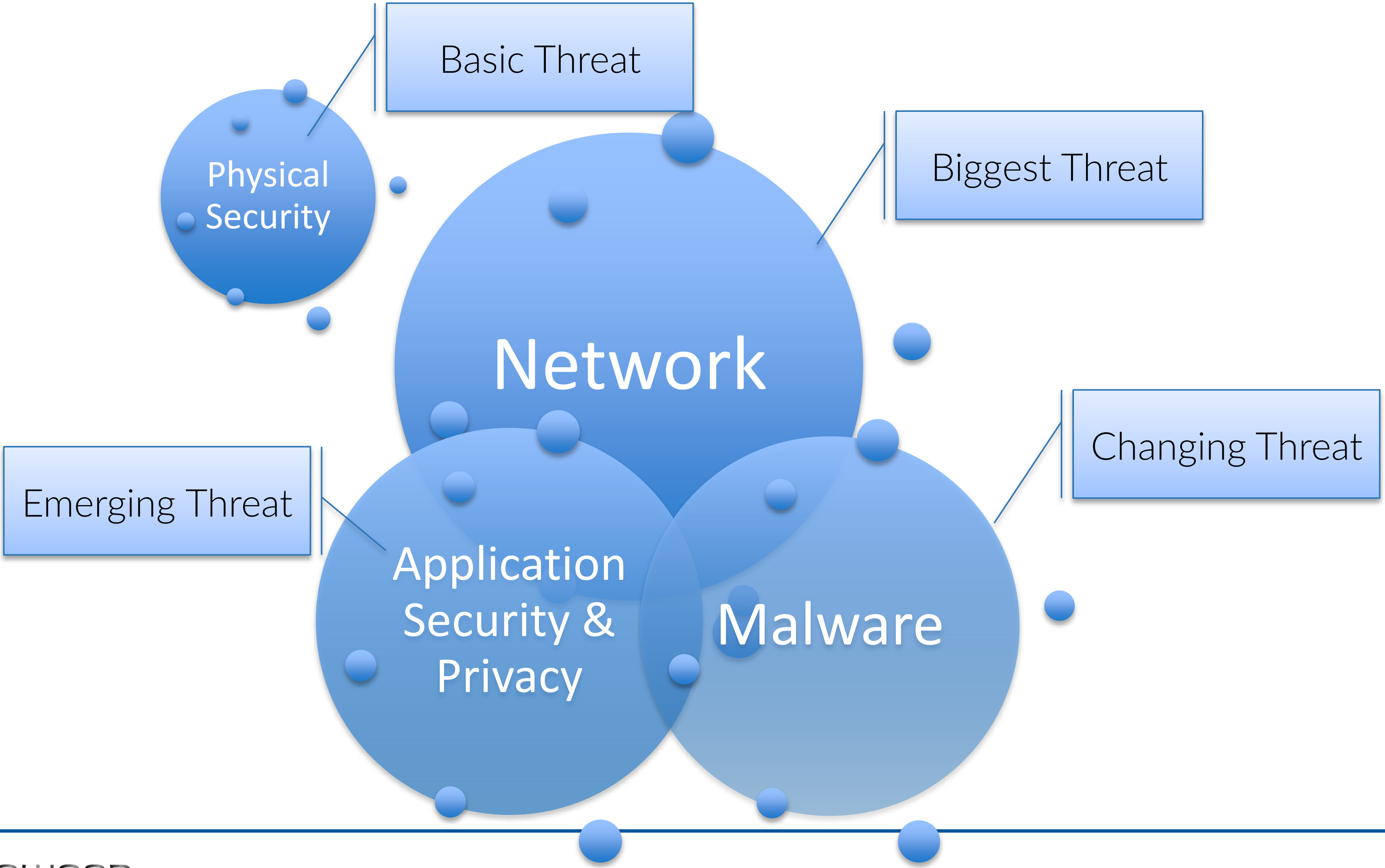
Yair Amit

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

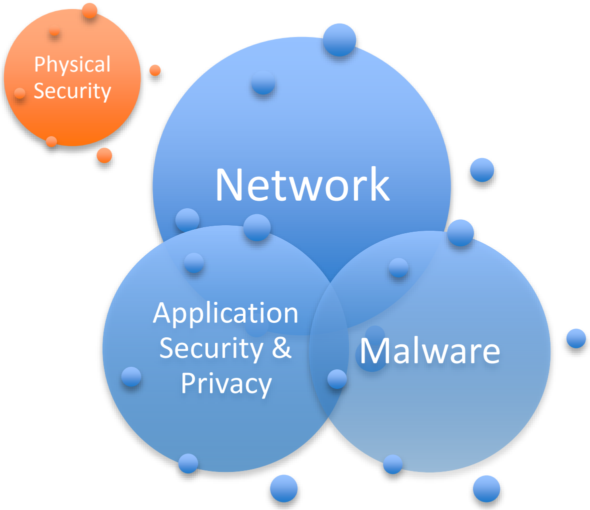
Seamless Mobile Security

Skycure

A Holistic Outlook on Mobile Security



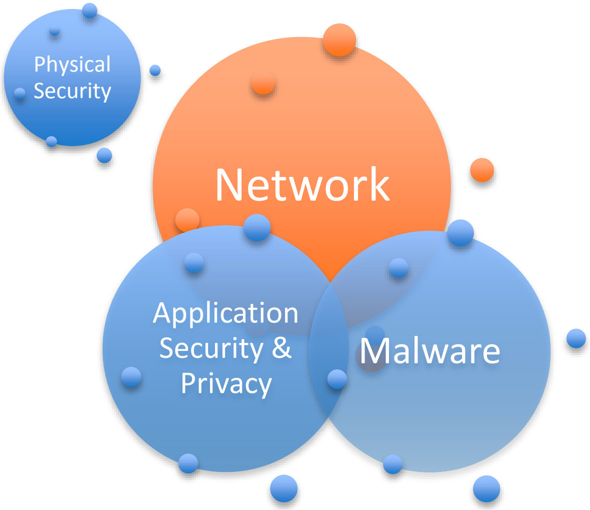
The Physical Layer



The Physical Layer

- Threat vector
  - Device lost / Device stolen / Temporary physical access
- Basic physical security needs:
  - Remote wipe
  - Locate device
  - Backup
  - Local storage
  - Passcode protection
- The above becomes OS responsibility
- MDM provides the above OS features together with management and policy enforcement

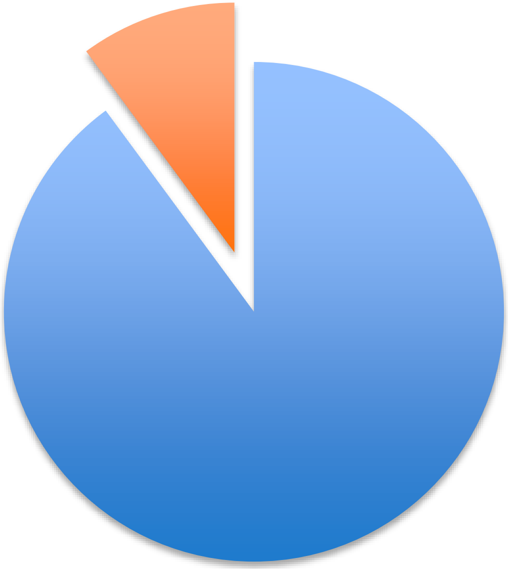
Network Based Attacks



Real World Incident Statistics

10.1%

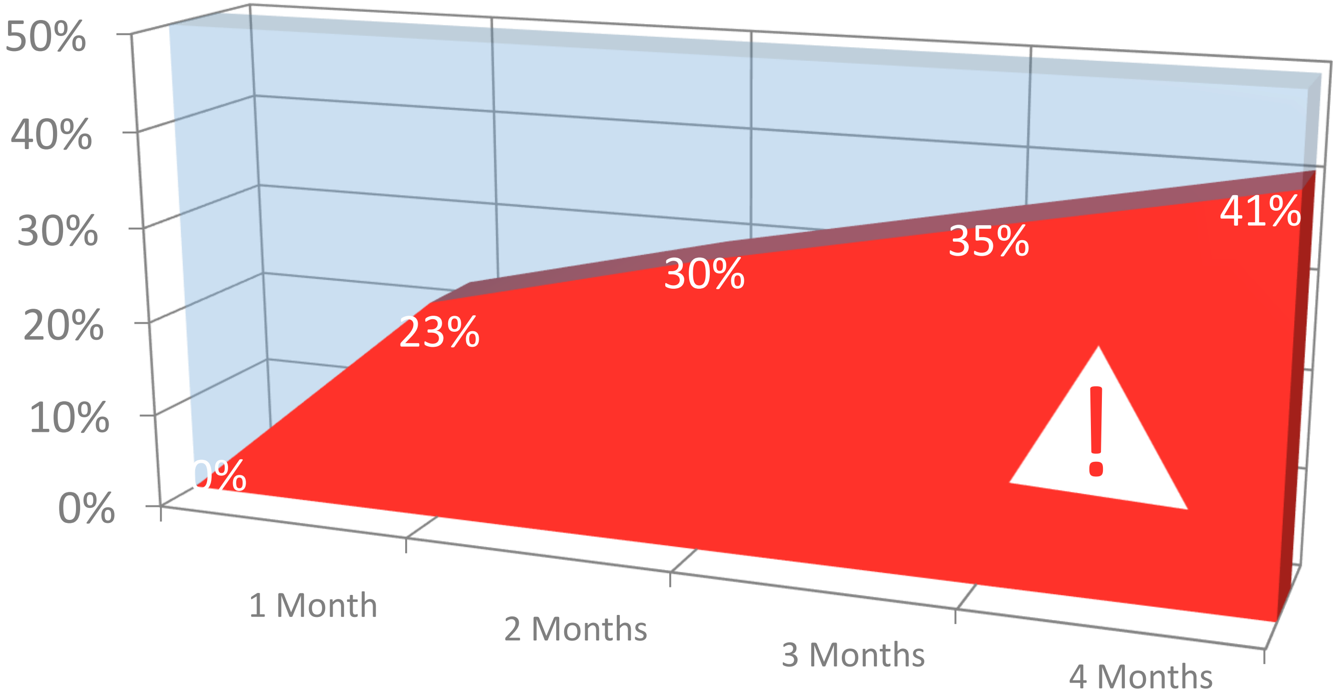
of scanned networks **pose a threat**



Based on over 40,000 scanned networks

Real World Incident Statistics

Affected Devices Over Time



Based on Skycure enabled devices worldwide

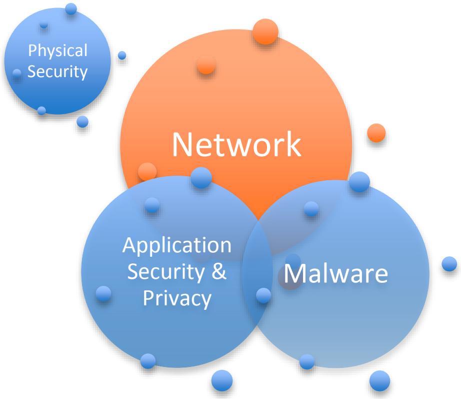
OWASP
Open Web Application Security Project

Network Based Attacks

Implementation-Based Vulnerabilities

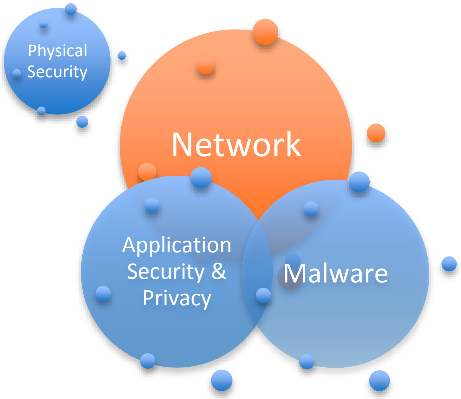
Vs.

Design-Based Vulnerabilities



Network Based Attacks

Implementation issues



Implementation-Based Vulnerabilities

iOS vs. **Android**

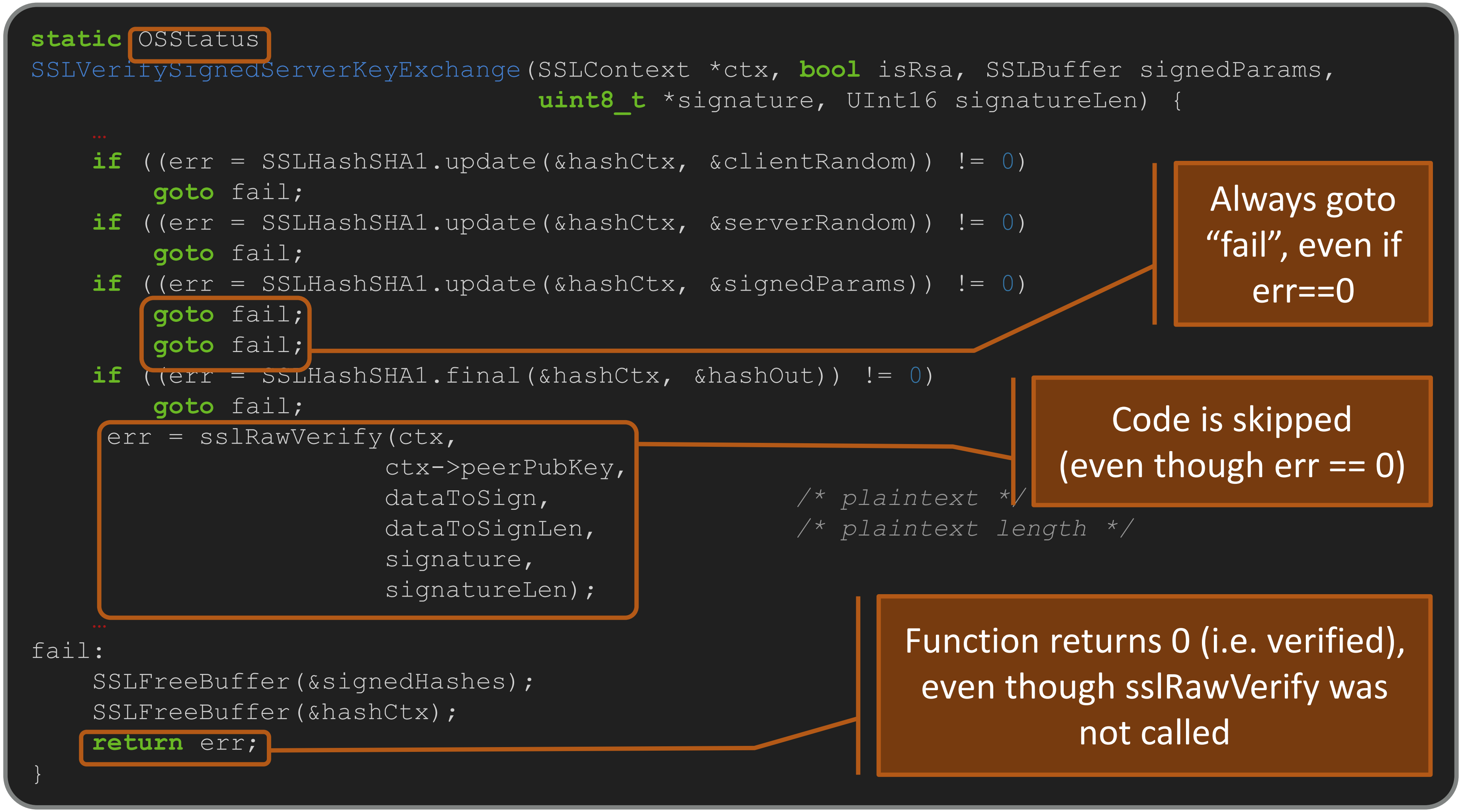
Implementation-Based Vulnerabilities

- Example I:

>> Read more

gotofail

Gotofail – The Code



```
static OSStatus
SSLVerifySignedServerKeyExchange(SSLContext *ctx, bool isRsa, SSLBuffer signedParams,
                                 uint8_t *signature, UInt16 signatureLen) {
    …
    if ((err = SSLHashSHA1.update(&hashCtx, &clientRandom)) != 0)
        goto fail;
    if ((err = SSLHashSHA1.update(&hashCtx, &serverRandom)) != 0)
        goto fail;
    if ((err = SSLHashSHA1.update(&hashCtx, &signedParams)) != 0)
        goto fail;
        goto fail;
    if ((err = SSLHashSHA1.final(&hashCtx, &hashOut)) != 0)
        goto fail;
     err = sslRawVerify(ctx,
                       ctx->peerPubKey,
                       dataToSign,                /* plaintext */
                       dataToSignLen,             /* plaintext length */
                       signature,
                       signatureLen);
    …
fail:
    SSLFreeBuffer(&signedHashes);
    SSLFreeBuffer(&hashCtx);
    return err;
}
```

Always goto “fail”, even if err==0

Code is skipped (even though err == 0)

Function returns 0 (i.e. verified), even though sslRawVerify was not called

Implementation-Based Vulnerabilities

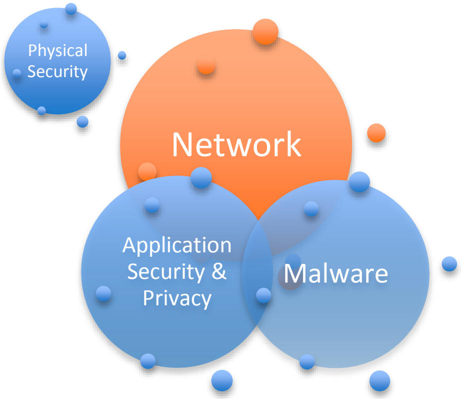
- Example II:

>> Read more

Heartbleed

Network Based Attacks

Design issues



Design-Based Vulnerabilities

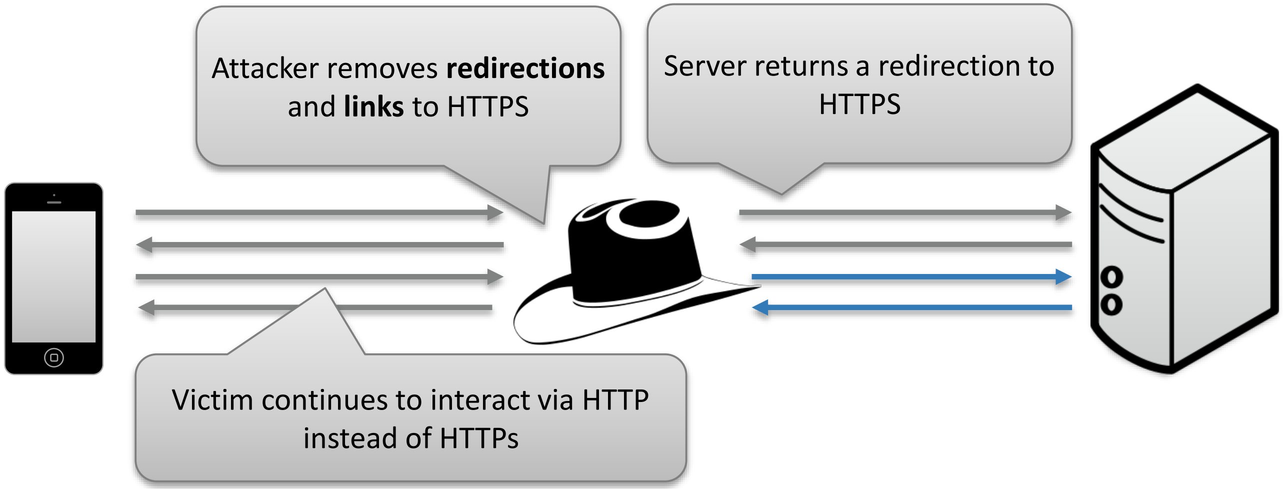
- Design issues are much more interesting
  - … and much harder to fix
- These are divided into two types:
  - General "protocol" vulnerabilities
  - Design issues affecting mobile OS
- Mobile devices are more susceptible:
  - Lack of adequate security solutions
  - Excessive use of untrusted networks

Design-Based Vulnerabilities (Generic)

- Example I:

>> Read more

sslstrip



Attacker removes **redirections** and **links** to HTTPS

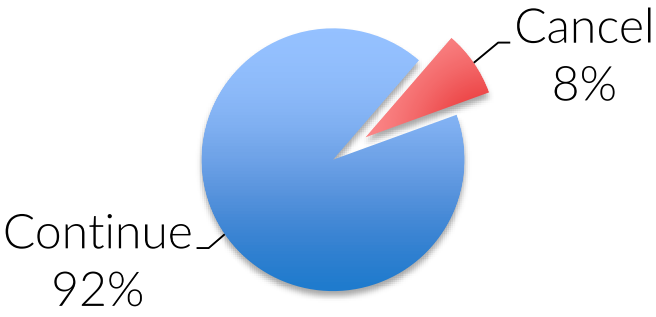
Server returns a redirection to HTTPS

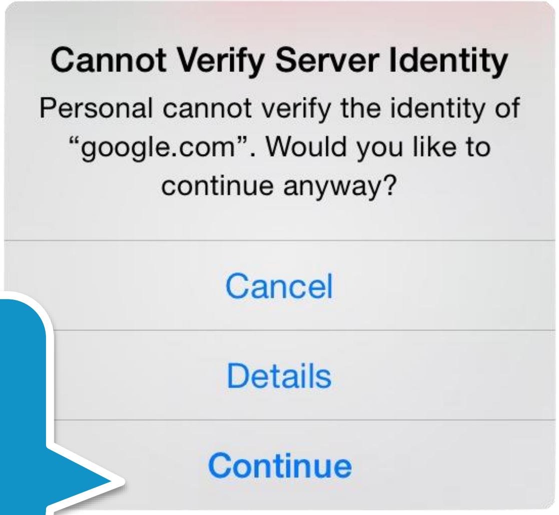
Victim continues to interact via HTTP instead of HTTPs

Design-Based Vulnerabilities (Generic)

- Example II:

SSL decryption




Cannot Verify Server Identity

Personal cannot verify the identity of "google.com". Would you like to continue anyway?

92% of users click on "Continue" compromising their Exchange identity (username and password)

Design-Based Vulnerabilities (Generic)

- Example III:

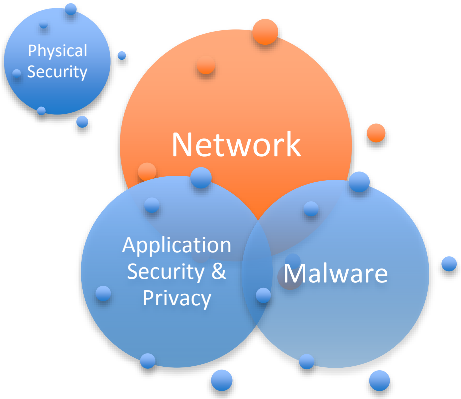
>> Read more

Karma

Hak5's WiFi Pineapple

Network Based Attacks

Mobile-specific design issues



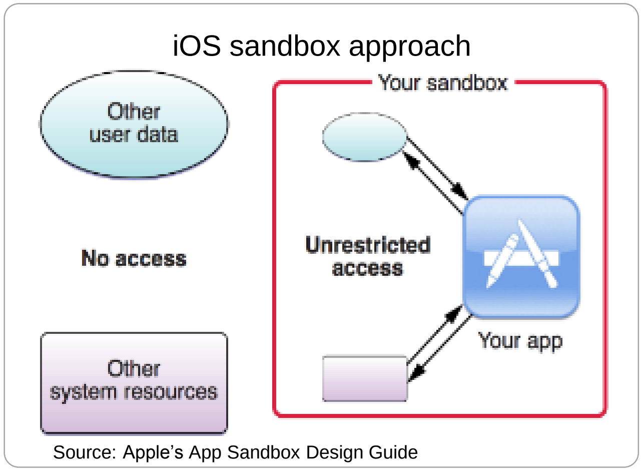
iOS Security Model

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?

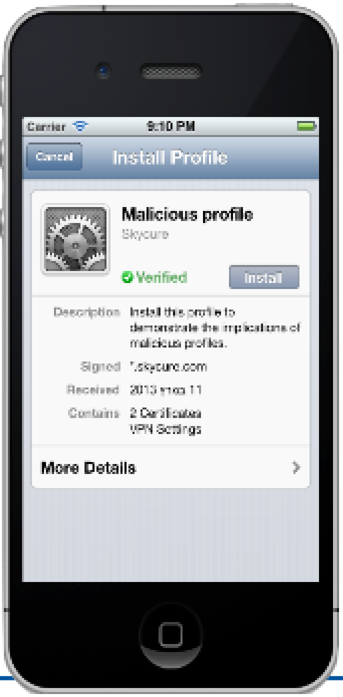
- Mobile Device Management (MDM)
- Cellular carriers
  - Usually used for APN settings
- Mobile applications
- Service providers

Malicious Profiles

>> Read more

Configuration profiles can also be malicious

- Malicious “service providers” (apps/services/Wi-Fis/etc.)
- Vulnerable services
- Privacy violating services



Carrier 9:10 PM

Cancel **Install Profile**

Malicious profile
Skycure
✓ Verified Install

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

More Details >

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

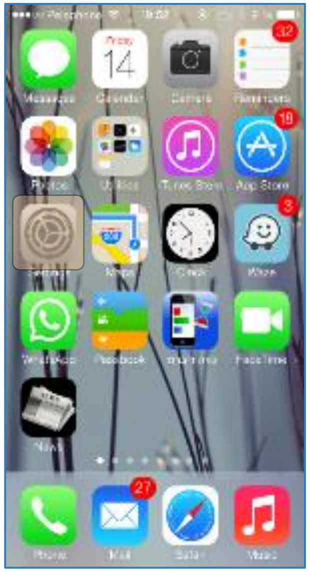
Malicious Profiles

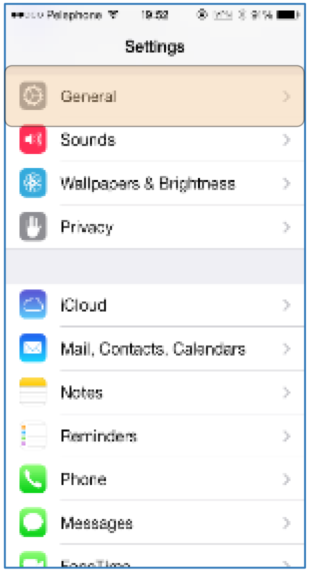
Going Viral

- Attacker hijacks victim’s key identities
  - Corporate Exchange
  - Facebook
  - LinkedIn
- Attacker sends mass messages to victim’s contacts, luring them to install the malicious profile
- Attack propagates

Am I Safe?

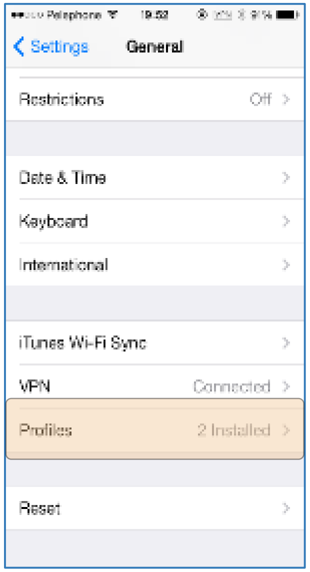
- Profile listing could indicate suspicious profiles
- Cat-and-mouse game: attackers can name their profile to look benign





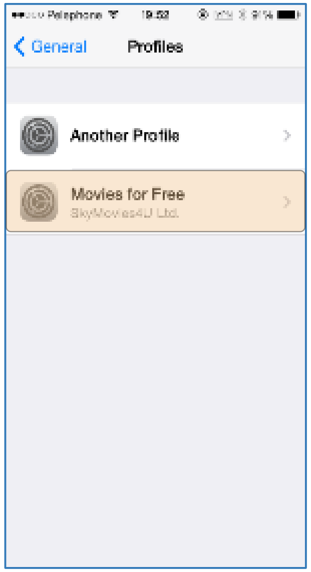
Settings

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



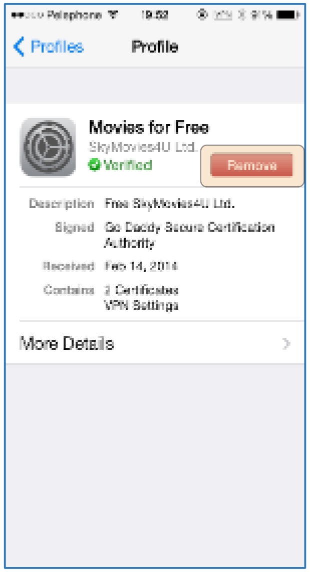
Settings — General

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



General — Profiles

- Another Profile
- Movies for Free
SkyMovies4U Ltd.



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

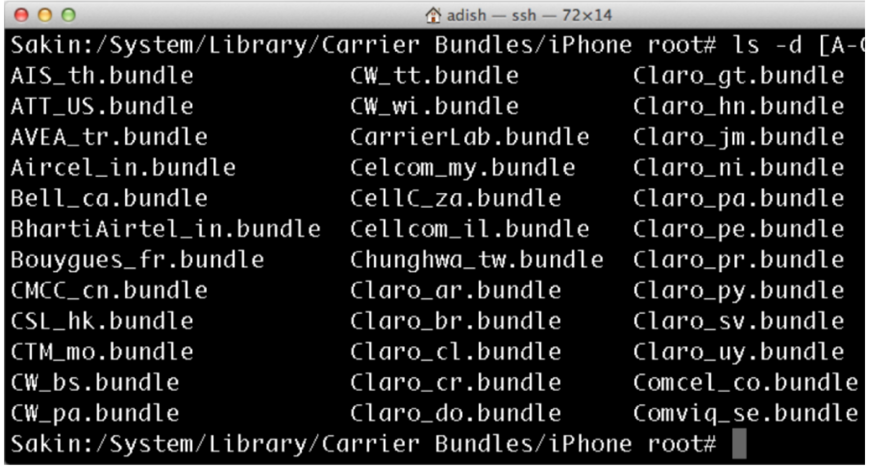
More Details

Design-Based Vulnerabilities (Mobile)

- Example II:

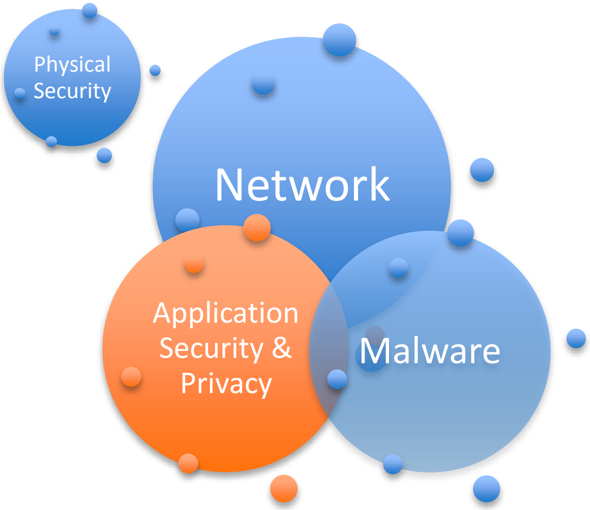
>> [Read more]

WiFiGate



```
Sakin:/System/Library/Carrier Bundles/iPhone root# ls -d [A-
AIS_th.bundle            CW_tt.bundle        Claro_gt.bundle
ATT_US.bundle            CW_wi.bundle        Claro_hn.bundle
AVEA_tr.bundle           CarrierLab.bundle   Claro_jm.bundle
Aircel_in.bundle         Celcom_my.bundle    Claro_ni.bundle
Bell_ca.bundle           CellC_za.bundle     Claro_pa.bundle
BhartiAirtel_in.bundle   Cellcom_il.bundle   Claro_pe.bundle
Bouygues_fr.bundle       Chunghwa_tw.bundle  Claro_pr.bundle
CMCC_cn.bundle           Claro_ar.bundle     Claro_py.bundle
CSL_hk.bundle            Claro_br.bundle     Claro_sv.bundle
CTM_mo.bundle            Claro_cl.bundle     Claro_uy.bundle
CW_bs.bundle             Claro_cr.bundle     Comcel_co.bundle
CW_pa.bundle             Claro_do.bundle     Comviq_se.bundle
Sakin:/System/Library/Carrier Bundles/iPhone root#
```

App Level Security

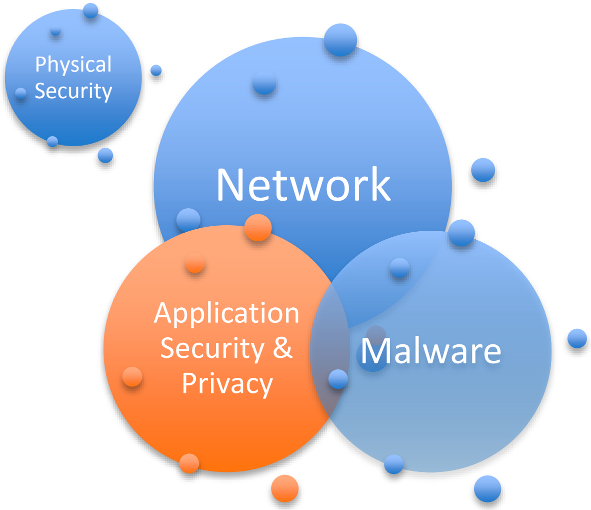


App Level Security & Privacy

- Mobile OS enforce additional security models
  - Sandbox
  - Better updates
  - Controlled application stores

- App-level issues are now on the rise

App Vulnerabilities



App Level Vulnerabilities

- Example I:

Plain HTTP

Daaa!

App Level Vulnerabilities

- Example II:

>> Read more

Certificate Pinning

Certificate Pinning

A Long Way to Go

- Almost all major apps today lack SSL Pinning
  - Susceptible to attacks such as malicious profiles by design
  - Also exploited when attacker gains access to a trusted CA
- Slow adoption should not come as a surprise
  - Implementation challenges
    - Less flexibility
    - Can become a nightmare if done wrong…

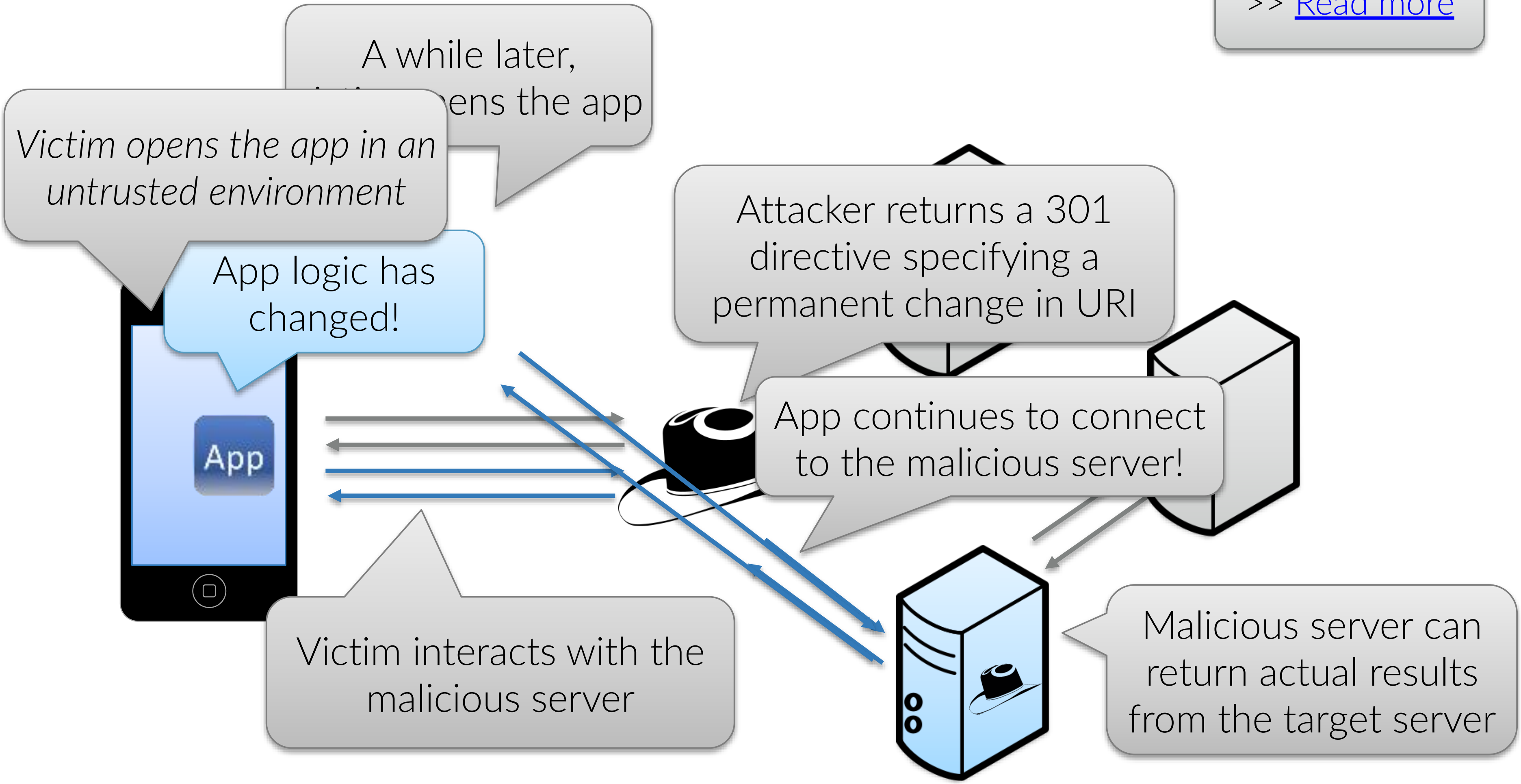
App Level Vulnerabilities

- Example III:

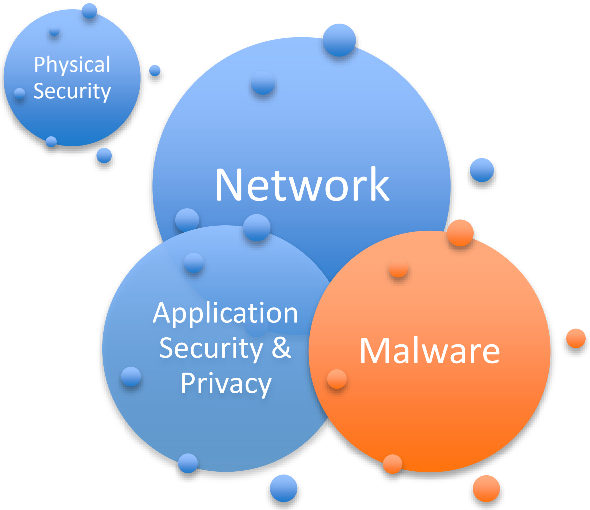
HTTP Request Hijacking

HRH – Attack Flow

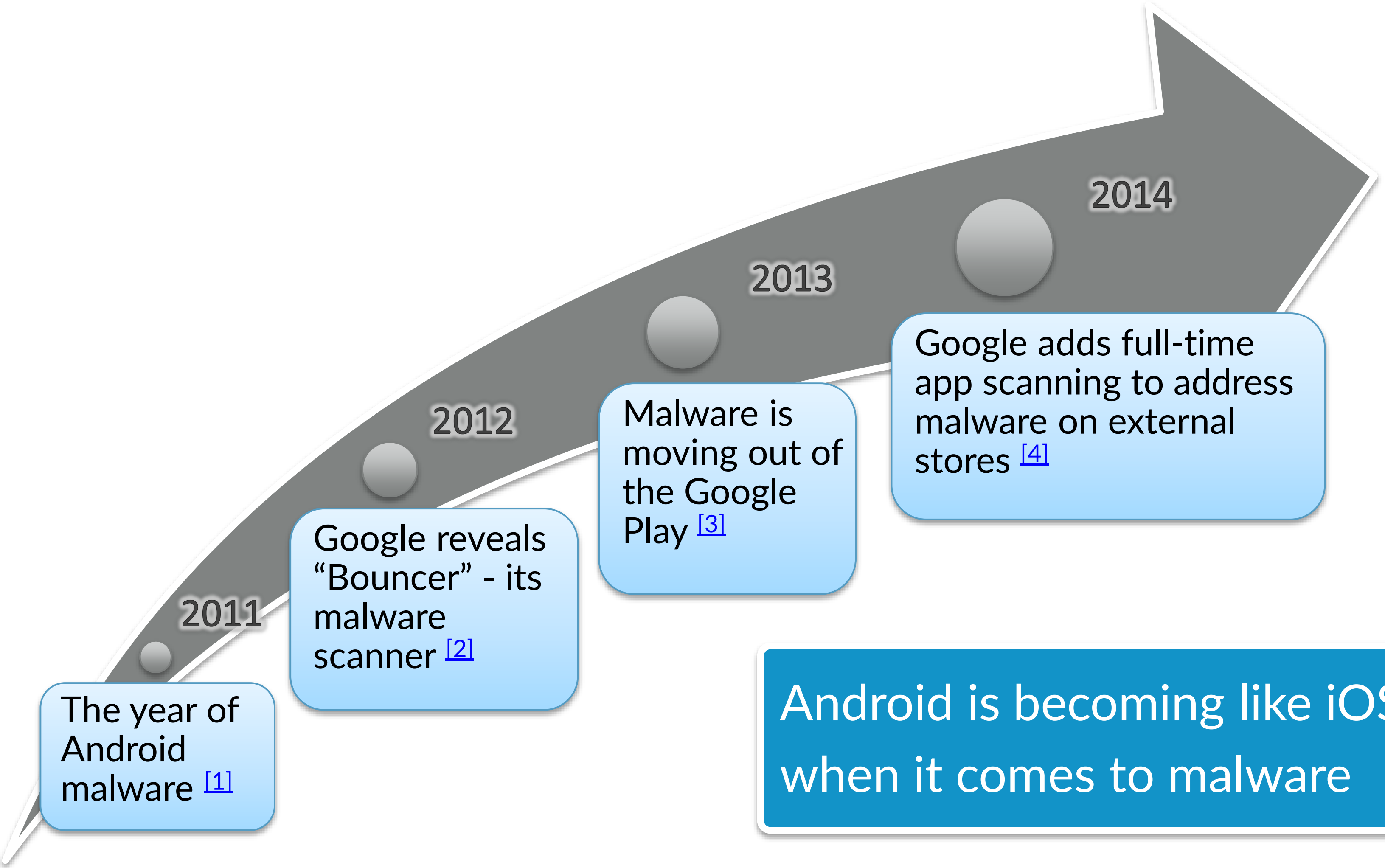
>> Read more


A while later, victim opens the app
Victim opens the app in an untrusted environment
App logic has changed!
App
Attacker returns a 301 directive specifying a permanent change in URI
App continues to connect to the malicious server!
Victim interacts with the malicious server
Malicious server can return actual results from the target server

Malicious Apps



Google's Focus on Malware



2011

The year of Android malware [1]

2012

Google reveals "Bouncer" - its malware scanner [2]

2013

Malware is moving out of the Google Play [3]

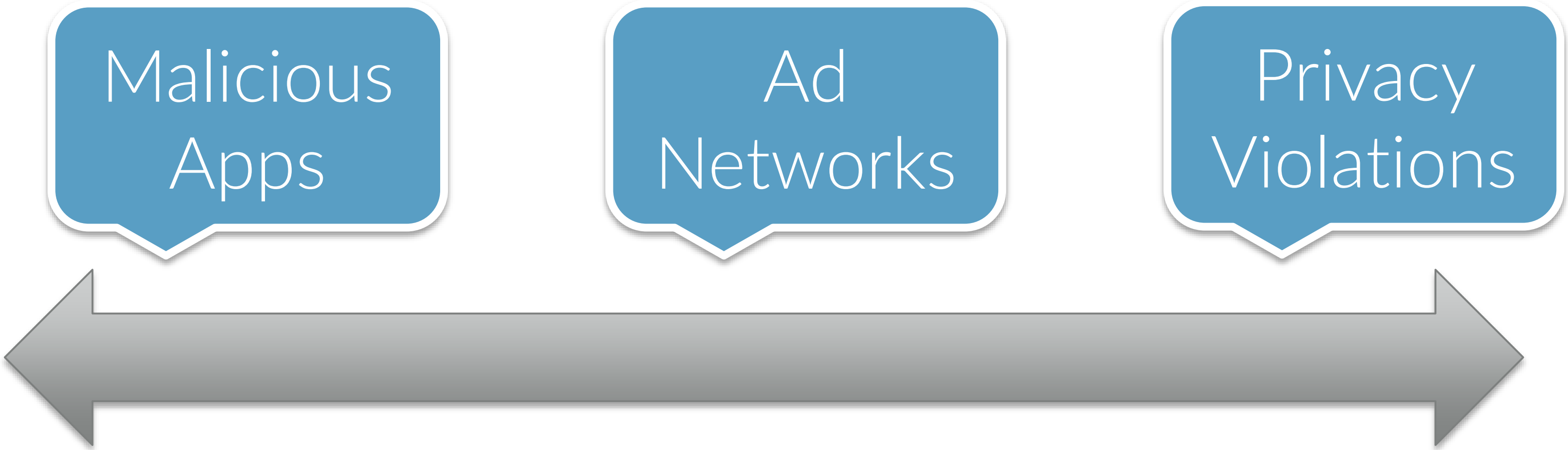
2014

Google adds full-time app scanning to address malware on external stores [4]

Android is becoming like iOS when it comes to malware

The Maliciousness Axis

- While OS anti-malware techniques advance, there are other similar problems (harder to address)



The Maliciously Vulnerable App

- Malicious services sometimes try to justify their actions
  - “I need all your key-strokes to provide you with a better service”
- We are concerned about the Maliciously-Vulnerable app:
  - App with semi-naive service is created
  - App does not pose a privacy/security issue
  - App is approved to go on AppStore/Google Play.
  - App has a special crafted carefully thought vulnerability
  - Vulnerability used as a backdoor to escalate app for malicious activity

Summary

Summary

- The physical layer
  - Becomes the OS responsibility
- Network based attacks
  - Implementation vulnerabilities
  - Design vulnerabilities
    - Generic vs. mobile specific
- App level
  - Vulnerabilities
    - HTTP/S, Certificate Pinning, HTTP Request Hijacking
  - The “maliciousness” axis
    - Malware ↔ Ad Networks ↔ Privacy Violations

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Thank you!

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