Mobile Device Security

Mobile Device Security

The number of Mobile Computers is growing

Over 1 Billion Android devices have been activated since 2008

Over 1.2 Billion iOS (iPods, iPhones and iPads) devices have been sold

In the US in Q4 of 2014, Apple iOS overtook Android for the first time since this time in 2012

41 Million Blackberry smartphone users world wide

3.5 new threats created per second, including malicious URLs and phishing sites that can be accessed by mobile web browsers.

The average smart phone user installed 35 apps on their device

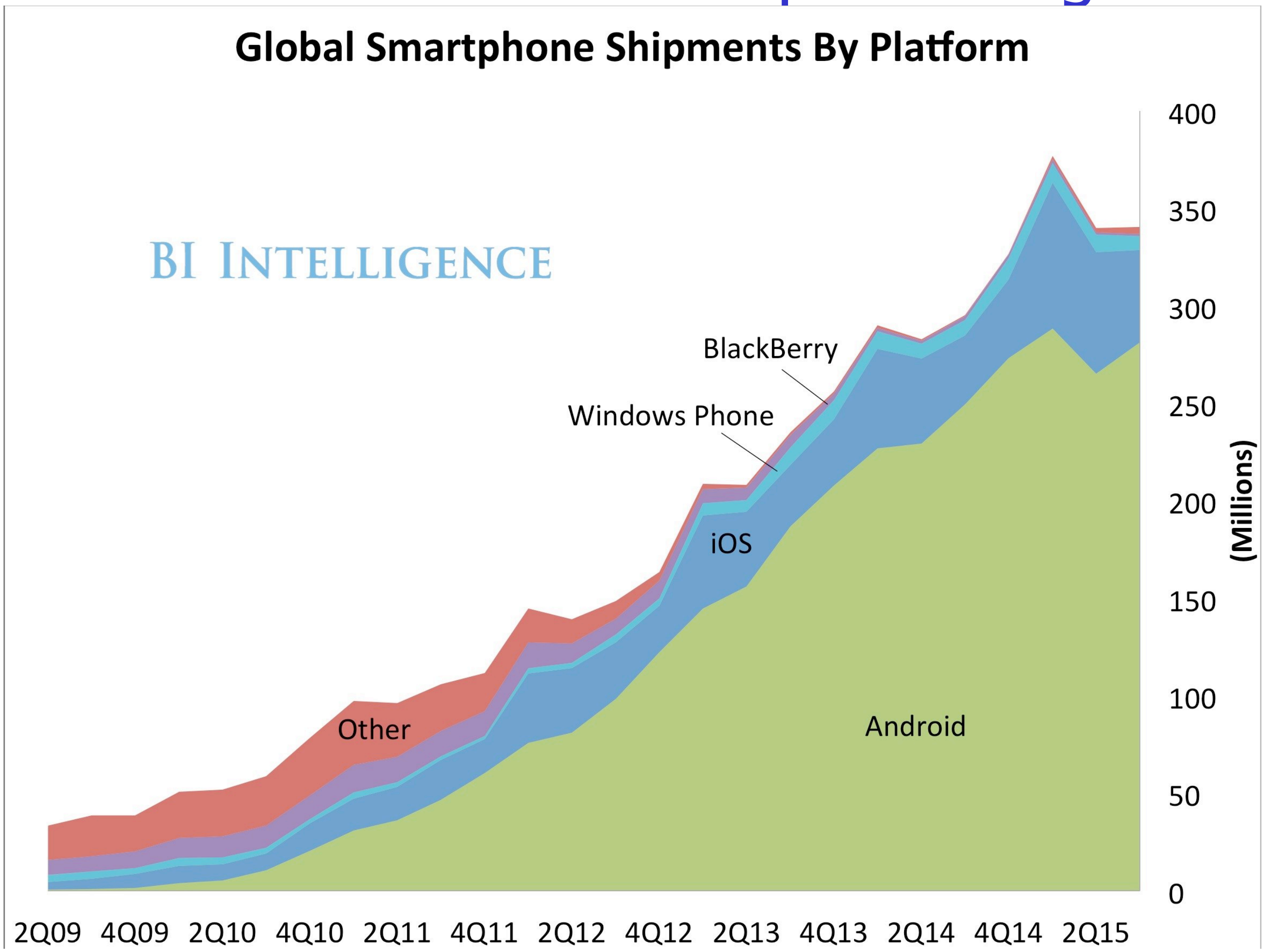
- Android market place has over 1 Billion apps available
- Apple Appstore has over 1.1 Billion apps available
- Blackberry market place has over 130,000 apps available

80% of Facebook users access the site using mobile devices
77% of consumers use their smartphone for both business and personal use

39% of U.S. adults use their smartphones and tablets to conduct banking transactions
60% said access to mobile banking was either "important" or "very important" when choosing a bank

Mobile Device Security

The number of Mobile Computers is growing



Mobile Device Security

Mobile Device Operating Systems

iOS is based on Apple's OS X operating system
Android is based on Linux (v5.0 & v6.0 SE Linux)

Each employ elaborate security models that are designed into their core implementations

The goals of their creators: to make the platforms inherently secure rather than to force users to rely upon third-party security software.

Each platform's security model protects against today's major threats, including:

- Web-based and network-based attacks
- Malware
- Social engineering attacks
- Resource and service availability abuse
- Malicious and unintentional data loss
- Attacks on the integrity of the device's data

Mobile Device Security

Mobile Device Operating Systems

The designers of iOS and Android based their security implementations, to varying degrees, upon five distinct concepts:

Traditional Access Control:

• Traditional access control seeks to protect devices using techniques such as passwords and idle-time screen locking.

Application Signing:

• Each application is stamped with the identity of its author and then made tamper resistant (using a digital signature).

This enables a user to decide whether or not to use an application based on the identity of its author.

In some implementations, a publisher (appstore or marketplace) may also analyze the application for security risks before publication, further increasing the trust in an app.

Encryption: Encryption seeks to conceal data at rest on the device to address the risk from device loss or theft

Isolation: Isolation techniques attempt to limit an application's ability to access the sensitive data or systems on a device

Mobile Device Security

Mobile Device Operating Systems

The designers of iOS and Android based their security implementations, to varying degrees, upon five distinct concepts:

Permission based access control:

Permission-based access control grants a set of permissions to each application and then limits each application to accessing device data/systems that are within the scope of those permissions, blocking the applications if they attempt to perform actions that exceed these permissions

Mobile Device Security

iOS Operating System

iOS leverages all five of the security concepts, its security model is primarily based on four of the five:

- Traditional access control
- Application signing
- Encryption
- Isolation
- Permission based access control

Traditional Access Control

iOS provides traditional access control security options, including password configuration options as well as account lockout options, remote device wipe and device tracking

For example, an administrator may choose the strength of the passcode and specify how frequently the user must update their passcode

Administrative policies can also specify such items as the maximum number of failed login attempts before the device wipes itself

Mobile Device Security

iOS Operating System

Application Signing

Before software developers can release software to iPhone, iPod, and iPad users, they must go through a registration process with Apple and pay an annual licensing fee. Developers must then “digitally sign” each app with an Apple-issued digital certificate before its release.

This signing process embeds the developer’s identity directly into to the app guarantees that the app author is an Apple-approved developer (since only these developers are issued such a certificate), and ensures that the app’s logic cannot be tampered with after its creation by the author.

Apple gives developers two different ways to distribute their applications to customers.
First, anyone wishing to sell their iOS app to the general public must do so by publishing their app on Apple’s App Store.

To post an app on the App Store, the software developer must first submit the app for certification by Apple—this certification process typically takes one to two weeks. Once an app has been certified, Apple posts it for sale on its App Store. Free apps go through the same process.

Mobile Device Security

iOS Operating System

Application Signing

Second, corporations wishing to deploy privately-developed apps to their internal workforce may register with Apple's iOS Developer Enterprise program. To be approved for this program, Apple requires that the applicant corporation be certified by Dun and Bradstreet, indicating that they're an established corporation with a clean track record. As a member of this program, enterprises may distribute apps developed in-house via an internal corporate website or by pushing the app using Apple's iOS management platform.

As before, each app must be digitally signed by the enterprise before distribution to the internal workforce. Moreover, internally developed apps can only be used on devices on which the enterprise has installed a digital certificate called a "provisioning profile". If the certificate is ever removed from the device or expires, then all apps signed with the certificate will cease to function.

While Apple explicitly permits corporations to distribute internal applications to their workforces, they prohibit sale/distribution of internally developed apps to third parties.

Apple presumably can simply issue a global revocation for the corporation's provisioning profile, immediately disabling all apps released by the vendor. This certificate requirement also enables a corporation to instantly disable its internally developed applications by simply removing the certificate from a device.

Mobile Device Security

iOS Operating System

Application Signing

It is possible that a malware author could use a stolen identity to register for an account to sell malicious apps on the Apple App Store.

Apple does not discuss its app certification approach and it is possible that an attacker could slip malware past this certification process.

Apple has the ability to rapidly remove apps (that are found to be malicious or that violate their licensing agreement) from their App Store, but does not yet appear to posses an automated mechanism to remove malicious apps directly from iPhones/iPads once an app has been installed on the device.

Code Signing changes in iOS 9

In iOS 9, Apple has dropped the necessity of joining the paid $99 iOS developer program to run your applications on devices

When you provision your App in Xcode 7, a provisioning profile is automatically created. This profile can be installed on devices linked to your developer account and iOS9 allows them to run on devices registered to the same developer ID

Mobile Device Security

iOS Operating System

Encryption

The latest iPhones, iPads, and iPod Touch devices (that is, those using the iOS 4 operating system and beyond) employ a hybrid encryption model

First, iOS uses hardware-accelerated AES-256 encryption to encrypt all data stored in the flash memory of the device.

Second, iOS protects specific additional data items, such as email, using an additional layer of encryption.

At first glance, iOS's full-device encryption approach would appear to offer a high degree of protection. However, since iOS runs background applications even when the user is not logged in to their device, and since these background applications need to access the device's storage, iOS needs to keep a copy of the decryption key around at all times so it can decrypt the device's data and provide it to these background apps.

In other words, the majority of the data on each device is encrypted in such a manner that it can be decrypted without the need for the user to input the device's master passcode.

An attacker with physical access to an iOS device and with a functional jailbreak attack can potentially read most of the device's data without knowing the device's passcode.

Mobile Device Security

iOS Operating System

Encryption

A small subset of iOS's data is secondarily encrypted in such a way that it may only be accessed if the device is unlocked via the user passcode.

If the attacker doesn't have access to the device's passcode, then this data is essentially 100 percent secure while the device is locked, whether or not an attacker has physical access to the device.

iOS encrypts emails and attachments using this secondary level of encryption. (In April 2014, a security researcher discovered that Apple had turned off this encryption at some point)

Third-party applications can also manually leverage this encryption if they implement the required programming logic.

iOS's device-level encryption allows rapid device wiping. Since every byte of data on the device is hardware encrypted with an encryption key, a device can be wiped by simply throwing away this key.

iOS devices can be configured to automatically throw away their hardware encryption key if the user enters an incorrect passcode too many times, rendering the data wholly unreadable.

Mobile Device Security

iOS Operating System

Encryption

An attacker that has physical access to a device and a functional jailbreaking tool can potentially obtain access to the data on the device:

Whether or not an iOS device is locked and in the user's pocket, or unlocked in their hand, apps running on the device may freely access iOS's calendar, contact list, photos (many of which are tagged with GPS coordinates), etc., since Apple's hardware decrypts this data on behalf of every running app.

A malicious app could bypass Apple's vetting process, or should an attacker compromise a legitimate app on the device (for example, by using a Web-based attack to compromise the Safari Web browser), the attacker could easily access and steal data from many of the device's systems.

http://tweakimg.net/files/upload/sc_iPhone%20Passwords_tcm502-80443.pdf

Decryption is possible since on current iOS devices the required cryptographic key does not depend on the user's secret passcode. Instead the required key material is completely created from data available within the device and therefore is also in the possession of a possible attacker.

Mobile Device Security

iOS Operating System

iOS 9 enhancements

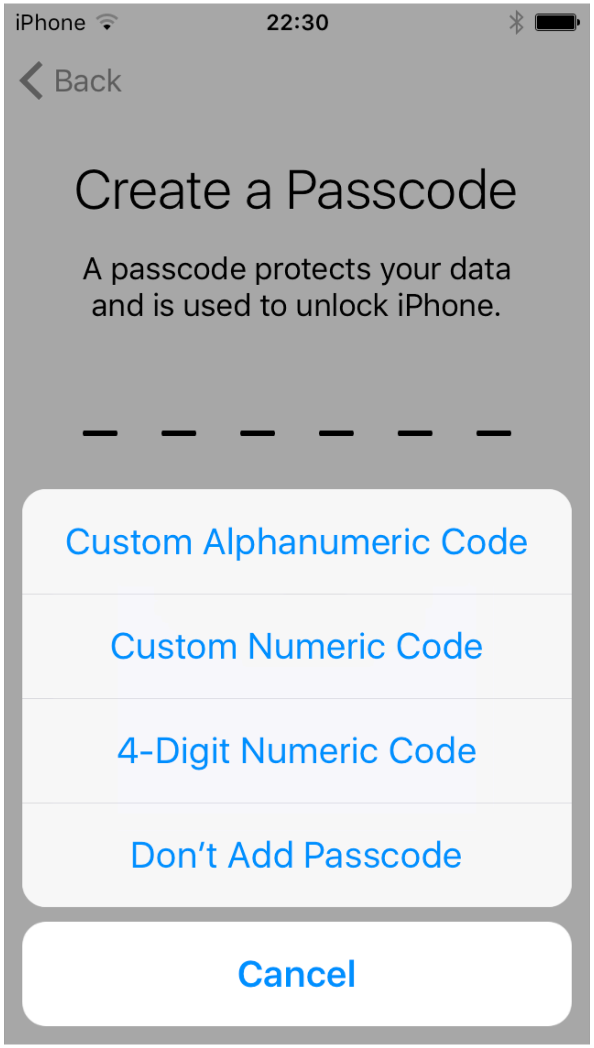
Six-digit passcodes

The passcodes you use on you Touch ID – enabled iPhone and iPad will now have six digits instead of four. This means there are one million possible combinations instead of 10,000

On first boot up, Apple iOS 9 does not let you continue without making a 6-digit password or selecting another passcode option

As of iOS 8, *Apple notes that it no longer stores encryption keys for devices with iOS 8*, meaning agencies are unable to gain access even with a valid search warrant. This includes data store on a physical device protected by a passcode, including photos, call history, contacts and more

http://images.apple.com/privacy/docs/legal-process-guidelines-us.pdf



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iOS Operating System

iOS 9 enhancements

MAC Address Randomization

With iOS 8, Apple started randomizing MAC addresses in some cases

This is a countermeasure against intrusive location tracking techniques based on the Wi-Fi MAC address

In iOS 9, location scans and auto-join scans (until authentication) will be done with randomized MAC addresses

VPN API extensions

iOS 9 adds several new extensions to the VPN client:

- Use the Packet Tunnel Provider extension to implement custom client side VPN tunneling
- Use the App Proxy provider extension to implement a client side custom transparent network proxy protocol
- Use the Filter Data Provider and the Filter Control Provider extension to implement dynamic, on-device network content filtering

These allow tunneling via TOR or filtering of all traffic going to known analytics or tracking networks even if using public Wifi

SSL updates

iOS 9 SSL is based on LibreSSL instead of OpenSSL which was used by previous versions of iOS

LibreSSL is a fork of OpenSSL created by the OpenBSD group

Mobile Device Security

iOS Operating System

iOS 9 enhancements

HSTS for apps

Called ATS, App Transport Security, this forces apps to use HTTPS, which according to Apple's standards means:

1) TLS 1.2 and PFS (perfect forward secrecy) cipher suites.
2) The OS will not downgrade to previous versions of TLS and non-PFS ciphers

Certificate Transparency

One of the best features of ATS is Certificate Transparency, a system invented by Google to more easily audit new digital certificates and ensure that they aren't forged or malicious

This year, Google removed China's Certificate Authority from Chrome's certificate root store and said it won't allow it back until China's CA adopts Certificate Transparency

Apple has had some problems with the Chinese government in the past regarding forged certificates and TLS interception

There aren't that many certificate authorities that support Certificate Transparency, this feature is disabled by default in ATS. However, if developers have CT-enabled certificates, then they can opt-in into the feature.

Mobile Device Security

iOS Operating System

Bypassing Encryption

An attacker that has physical access to a device and a functional jailbreaking tool can potentially obtain access to the data on the device:

C:\windows\system32\cmd.exe

```
Jailbreak and Install custom bundle CydiaAndSoftwarePack.tgz!
Now boot in tethered jailbreak mode!
Creating SSH Tunnel...
Copying Script to device...
Executing the Keychain Script:


Account Information (description|service|accountname):
|AirPort|TestWifi WPA2
2011-01-28 15:25:03.828 ShowKeychain[120:107] Password: WiFiTestpassword


Account Information (description|service|accountname):
IPSec XAuth Password|55C084C6-0C23-4FBC-B88E-F219B3531B3A.XAUTH|TestUserAccount
2011-01-28 15:25:03.916 ShowKeychain[124:107] Password: testpasswortvpn


Account Information (description|service|accountname):
IPSec Shared Secret|55C084C6-0C23-4FBC-B88E-F219B3531B3A.SS|TestUserAccount
2011-01-28 15:25:04.012 ShowKeychain[127:107] Password: TestSharedSecretofVPNAcc


Account Information (description|service|accountname):
PPP Password|19C401DD-4811-47AC-8257-84FF38229758|TestAccount
2011-01-28 15:25:04.107 ShowKeychain[130:107] Password: othertestpassword
```

Decryption is possible since on current iOS devices the required cryptographic key does not depend on the user's secret passcode. Instead the required key material is completely created from data available within the device and therefore is also in the possession of a possible attacker.

Mobile Device Security

iOS Operating System

Isolation (Sandboxing)

The iOS operating system isolates each app from every other app on the system
Apps are not allowed to view or modify each other's data, logic, etc.

One app can't even find out if another app is present on the device.
Nor can apps access the iOS operating system kernel, install drivers or obtain root-level (administrator) access to the device.

All third-party applications running on iOS run with the same limited level of device control
Every third-party application running on an iOS device is subject to termination if the device is running low on available memory

The user may also terminate any app at any time with a few taps of the touchscreen.

In addition applications are isolated from the phone's SMS, email in/out-boxes and email attachments within these mailboxes.

Apps are also prohibited from sending SMS messages (without user participation) and from initiating or answering phone calls without the user's participation.

Mobile Device Security

iOS Operating System

Isolation (Sandboxing)

iOS apps are allowed to freely access the following system-level resources without any explicit granting of permission by the user:

- Communicate to any computer over the wireless Internet.
- Access the device's address book including mailing addresses, notes associated with each contact, etc.
- Access the device's calendar entries.
- Access the device's unique identifier (a proprietary ID issued to each device by Apple).
- Access the device's phone number (this may be disabled via a simple configuration change by the user).
- Access the device's music/video files and its photo gallery.
- Access the recent safari search history.
- Access items in the device's auto-completion history.
- Access recently viewed items in the YouTube application.
- Access the Wi-Fi connection logs.

Mobile Device Security

iOS Operating System

Apps can record audio or video and transmit it to their servers if they have permission

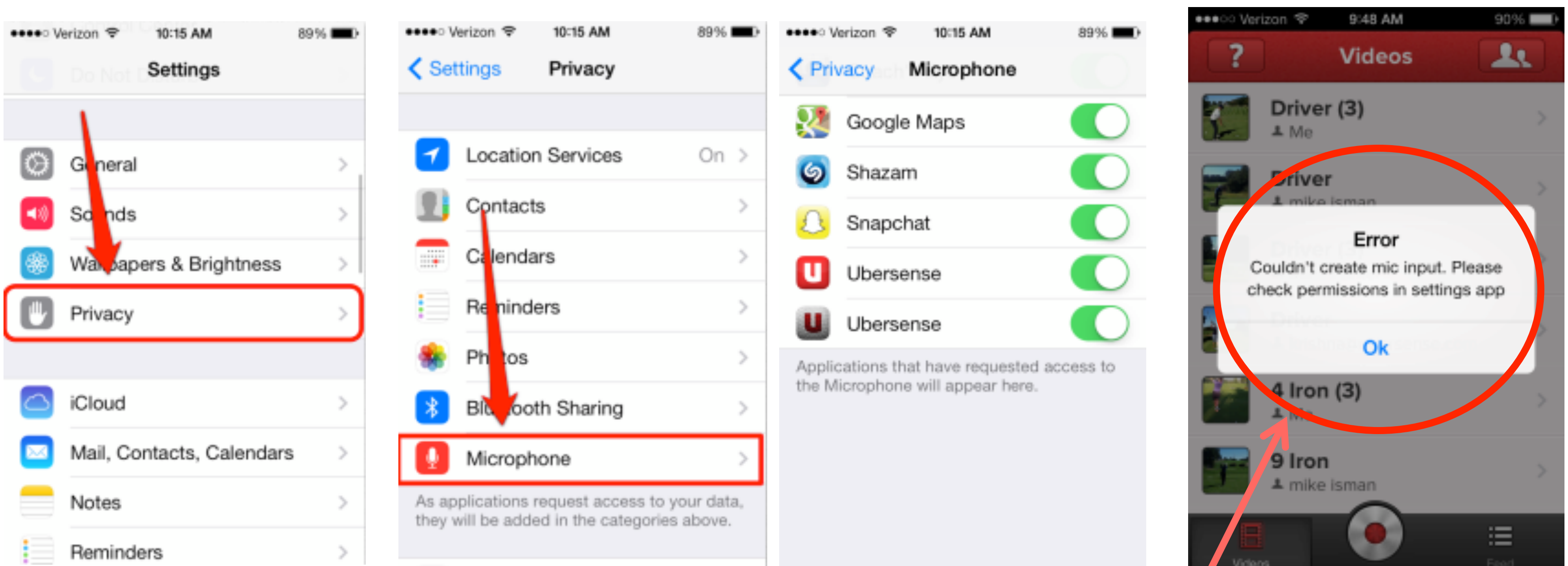
What about the security of devices like the Square or similar credit card readers that use the audio jack?

Mobile Device Security

iOS Operating System

Apps can record audio or video and transmit it to their servers if they have permission

In iOS 7, 8 and 9, Apple changed the permissions model to require Apps get specific permissions to use the microphone input



Error if permission denied

Mobile Device Security

iOS Operating System

<u>Isolation (Sandboxing)</u>

Application isolation prevents a number of different attacks, including preventing Web-based and network-based attacks, limiting the impact of malware, preventing malicious data loss, preventing attacks on the integrity of the device's data, and ensuring the availability of the device's services and data.

iOS isolates each app from every other app on the system, this means that if an attacker compromises an app, they will not be able to attack other apps or the iOS operating system itself (unless an unpatched vulnerability in iOS is attacked).

If an attacker were to deliver an attack via a malicious Web page, once malware was running in the Web browser process, it could still access system-wide resources such as the calendar, the contact list, photos, the device's unique ID, etc., since these resources are available for access by all apps under the default iOS isolation policy.

The malicious code could then exfiltrate this sensitive data to the attacker without his code having to ever escape the confines of the browser's sandbox.

Also, resident malicious code within the browser process can also steal any data hosted in or that flows through the browser process itself, including Web passwords, credit card numbers, CCV security codes, account numbers, browsing history, bookmarks, etc. And such a malicious agent in the browser could also initiate malicious transactions on behalf of the user, without their consent.

Mobile Device Security

iOS Operating System

Sandboxing limits the impact of malware

iOS’s isolation framework is effective at preventing classic malware attacks on the iPhone.

Apps can’t access or modify other apps on the system, this prevents a malicious app from infecting or maliciously modifying other apps on the system, as a traditional parasitic computer virus might do.

Sandboxing prevents apps from installing operating system kernel drivers (such as kernel-based malware or root-kits) capable of running with the same administrator-level access as the operating system’s kernel.

Preventing Resource Abuse

iOS’s isolation system can prevent a subset of resource abuse attacks.

iOS apps are given unrestricted access to the Internet, so technically they could be used to launch email-based spam campaigns, search engine optimization campaigns (the attacker tricks a search engine into raising the ranking/visibility of a particular website) and some types of denial of service attacks against websites or a carrier’s network.

On the positive side, iOS’s isolation system prevents the automated transmission of SMS messages or automated initiation of phone calls.

This prevents SMS-based DoS attacks, telephony-based DoS attacks, and SMS-based SPAM attacks on non-jailbroken devices.

Mobile Device Security

iOS Operating System

<u>Preventing Malicious Data Loss</u>

iOS prevents each app from accessing other apps' data—this policy is enforced regardless of whether apps encrypt their data or not, so long as the device has not been jailbroken.

Beyond the library of media files, the calendar, and the contact database which are all accessible to any app, iOS has no centralized repository of shared data that might pose a serious compromise risk.

However, the calendar, media library, etc. often store sensitive information, such as:

- Conference call numbers and passwords.
- Passwords for other systems (for example, bank accounts or enterprise logins).
- Credit card or bank account numbers that might be easily forgotten.
- Key codes for alarms and secure corporate offices.
- Employee names and phone numbers.
- Possibly sensitive audio or video content
- All of these items can obtained by any third-party app and exfiltrated off the device over the Internet without any warning from the iOS's security systems.

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iOS Operating System

<u>Preventing Attacks on the Integrity of the Device's Data</u>

iOS's isolation policy allows apps to modify or delete the contents of the calendar and the contact list, but completely prevents modification or deletion of content from the user's media and photo libraries and from other device systems.

A malicious app could easily delete or modify all of the user's contacts and calendar entries, but these can easily be recovered from a local backup (automatically created by iTunes during local syncs) or by synchronizing with a cloud-based data source like Exchange, MobileMe, or Google Calendar.

Mobile Device Security

iOS Operating System

Permissions-based Access Control

Apple has built a relatively limited permission system into iOS.
Four system resources that apps may access that first require explicit permission from the user

All other access to system services or data is either explicitly allowed or blocked by iOS's built-in isolation policy. Here are the permissions that an app may request:

- To access location data from the device's global positioning system.
- To receive remote notification alerts from the Internet (used by cloud-based services to send real-time notifications to apps running on a user's iPhone or iPad).
- To initiate an outgoing phone call.
- To send an outgoing SMS or email message.

If an app attempts to use any of these features, the user will first be prompted for permission before the activity is allowed.
If the user grants permission to either the GPS system or the notification alert system, then the app is permanently granted access to these systems.

In contrast, the user is prompted every time an app attempts to initiate an outgoing call or send an SMS message.

Mobile Device Security

iOS Operating System

Vulnerabilities

Security researchers have discovered roughly 300 different vulnerabilities in various versions of the iOS operating system since its initial release.

Most of these vulnerabilities were of lower severity, allowing an attacker to take control of a single process (for example, the Safari process) but not permitting the attacker to take administrator-level control of the device.

The remaining vulnerabilities were of the highest severity, and when exploited, enabled an attacker to take administrator-level control of the device, granting them access to virtually all data and services on the device.

These more severe vulnerabilities are classified as privilege escalation vulnerabilities because they enable an attacker to escalate their privileges and gain total control over the device.
It appears that most of these were developed for the purpose of jail-breaking rather than as a means to maliciously compromise devices.

Apple took an average of 12 days to patch each vulnerability once it was discovered.

https://www.yahoo.com/tech/you-need-to-update-your-iphone-right-now-heres-how-77621183150.html

Apple patches iOS 7 for SSL flaws – February 2014 Apple fixed the 'gotofail' bug

Mobile Device Security

iOS Operating System

Vulnerabilities

Apple patches iOS 7 for SSL flaws – February 2014 Apple fixed the ‘gotofail’ bug

An attacker could capture or modify data transferred with Mobile Safari, Mail, iCloud and other Apple-created applications even though the communication streams were supposed to be securely encrypted.

Apple iOS prior to 7.0.6 did not properly validate the certificate chain of trust.

Mobile Device Security

iOS Operating System

Vulnerabilities fixed in iOS 9

https://support.apple.com/en-us/HT205212

With the release of iOS 9, Apple disclosed dozens of vulnerabilities that were fixed in the new version. iOS 8 is considered one of the buggiest versions of iOS.

These vulnerabilities require the ability to execute code on the device, but that could be accomplished with one of the many remote code execution vulnerabilities also disclosed.

Many of these are in the Webkit browser engine, meaning that such an attack could be launched if the user visited a malicious web page.

Here are some examples:

Access credentials are also being secured in iOS 9 with a patch to the iTunes Store component. CVE-2015-5832, is a vulnerability in which AppleID credentials remained persistent in iOS even after a user signed out.

An attacker can send an email that appears to come from a contact in the recipient's address book even though it didn’t

Mobile Device Security

iOS Operating System

Vulnerabilities fixed in iOS 9

CVE-2015-5837 flaw, which could have enabled a malicious enterprise application to install extensions, even if the application is not yet trusted by the enterprise

CVE-2015-5858, a Web address parsing flaw in handling HSTS (HTTP Strict Transport Security). The flaw allowed an attacker to bypass HSTS, potentially leaking sensitive data

iOS 9 patched 34 flaws found in the WebKit rendering engine. 25 of these were memory corruption issues that could lead to arbitrary code execution when visiting a maliciously crafted web page

CVE-2015-5850 flaw by which a local attacker may be able to reset failed passcode attempts with an iOS backup

CVE-2015-5898

A person with physical access to an iOS device may read cache data from Apple apps

Cache data was encrypted with a key protected *only by the hardware UID*. This issue was addressed by encrypting the cache data with a key protected by the hardware UID and the user's passcode.

CVE-2015-5876 allowed a malicious application could execute arbitrary code with system privileges do to a memory corruption problem in dyld

CVE-2015-5839 allowed an application to bypass code signing due to improper bounds checking

Mobile Device Security

iOS Operating System

<u>iOS malware</u>

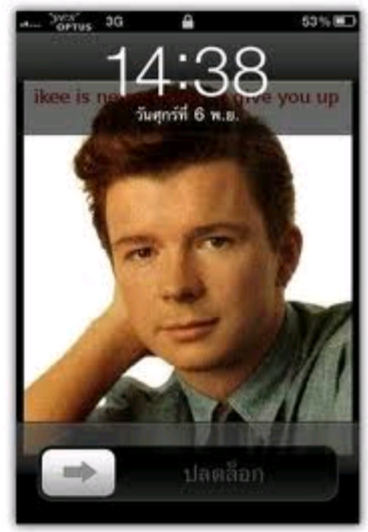
iPhone.Ikee worm Worm (November, 2009):

This computer worm spread over-the-air (for example, across cellular and Wi-Fi networks) to jailbroken iOS devices, changing the device's background wallpaper to display a picture of 80's pop-star Rick Astley.

The worm was only capable of attacking devices that met three criteria:

1) The device had to have been previously jailbroken by its owner.
2) The owner must have previously installed an SSH (secure shell) application on the device
3) The root password had not been changed.

The root password was: alpine



Mobile Device Security

iOS Operating System

<u>iOS malware</u>

iPhone.Ikee Worm.B (November, 2009):

This computer worm also spread over-the-air to jailbroken iOS devices using the same SSH default password attack used by iPhoneOS.Ikee.

Once the worm infected a new device, it would lock the screen and display the following text:

"Your iPhone's been hacked because it's really insecure! Please visit doiop.com/iHacked and secure your iPhone right now!"

In order to unlock an infected phone, the user was required to pay a €5 ransom to the attacker's PayPal account.

Mobile Device Security

iOS Operating System

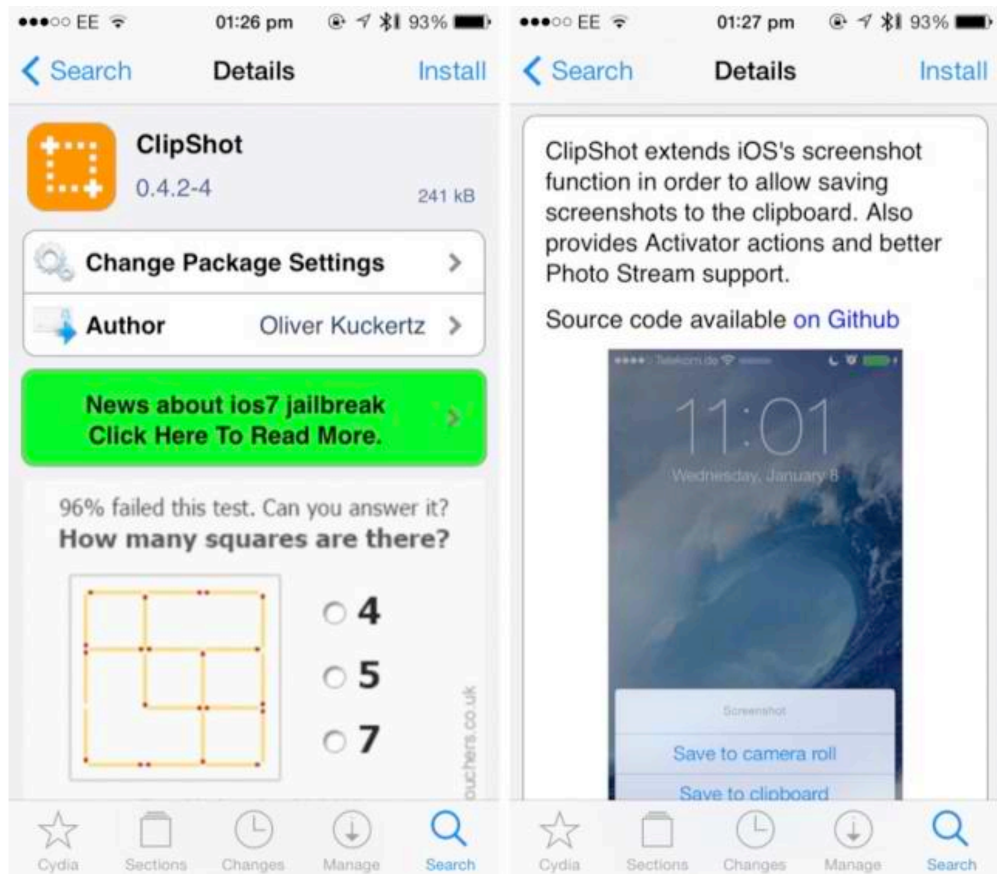
iOS malware

Malware known as AdThief infected 75000 jailbroken iphones running Cydia

The AdThief malware relied on the Cydia Substrate extension present only on jailbroken Apple devices to hijack advertising bucks.

AdThief malware hooks various advertisement functions and modifies the developer ID (promotion ID) to match that of the attacker, thus the attacker gets paid Ad fees, not the App developer

It targeted 15 mobile advertising kits including Google Mobile Ads and Weibo, four of which were based in the US, two in India and the remainder in China.



http://www.tripwire.com/state-of-security/top-security-stories/malware-infects-75000-jailbroken-iphones-hijacks-ad-revenue

Mobile Device Security

iOS Operating System

iOS malware

KeyRaider iOS malware discovered in August 2015 targets jailbroken iOS devices and is distributed through third-party Cydia repositories in China.

In total, it appears this threat may have impacted users from 18 countries

The malware hooks system processes through MobileSubstrate, and steals Apple account usernames, passwords and device GUID by intercepting iTunes traffic on the device.

KeyRaider steals Apple push notification service certificates and private keys, steals and shares App Store purchasing information, and disables local and remote unlocking functionalities on iPhones and iPads

KeyRaider has successfully stolen over 225,000 valid Apple accounts and thousands of certificates, private keys, and purchasing receipts. The malware uploaded stolen data to its command and control (C2) server, which itself contains vulnerabilities that expose user information

Some victims have reported that their stolen Apple accounts show abnormal app purchasing history and others state that their phones have been held for ransom.

Mobile Device Security

iOS Operating System

<u>iOS malware</u>

Masque Attack affecting iOS 8.1 and earlier:

An iOS app installed using enterprise/ad-hoc provisioning could replace another genuine app installed through the App Store, as long as both apps used the same **bundle identifier**. Ex: com.google.Gmail

This in-house app may display an arbitrary title (like "New Flappy Bird") that lures the user to install it, but the app can replace another genuine app after installation. All apps can be replaced except iOS preinstalled apps, such as Mobile Safari.

This vulnerability exists **because iOS doesn't enforce matching certificates for apps with the same bundle identifier.**
An attacker can leverage this vulnerability both through wireless networks and USB.

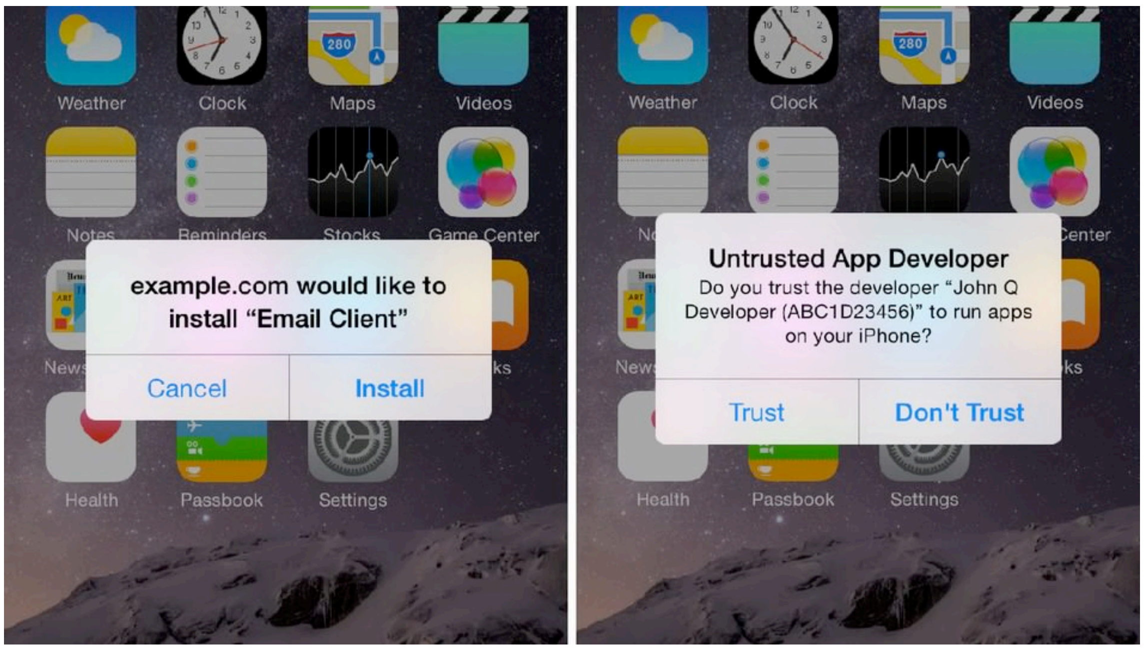
In a demo, an in-house app with a bundle identifier "com.google.Gmail" with a title "New Flappy Bird" was used. The rogue app was signed using an enterprise certificate. When installed, this app, replaced the original Gmail app on the phone and had access to all the cached mail and email password of the original Gmail App.

Video Demo: https://www.youtube.com/watch?v=76ogdpbBlsU

Mobile Device Security
iOS Operating System

<u>iOS malware</u>

Masque Attack



Video Demo: https://www.youtube.com/watch?v=76ogdpbBlsU

Mobile Device Security

iOS Operating System

iOS malware More Masque Attacks June 2015

All the masque attacks were only POC. No malware was found in the wild using these methods

Masque Attack	Impact
App Masque	* Replace an existing app * Harvest sensitive data
URL Masque	* Bypass prompt of trust * Hijack inter-app communication
Manifest Masque	* Demolish other apps (incl. Apple Watch, Health, Pay, etc.) during over-the-air installations
Plugin Masque	* Bypass prompt of trust * Bypass VPN plugin entitlement * Replace an existing VPN plugin * Hijack device traffic * Prevent device from rebooting * Exploit more kernel vulnerabilities
Extension Masque	*Access another app's data * Or prevent another app to access its own data

Mobile Device Security

iOS Operating System

iOS malware

Xcode Ghost   Sept. 2015

The largest outbreak of malicious iOS apps in the official Apple App store (over 50 Apps)

iOS malware arising from a malicious version of Xcode

A malicious version of Xcode was uploaded to Chinese cloud file sharing service Baidu and downloaded by some iOS developers in China

Popular apps such as WeChat, NetEase Cloud Music, WinZip, Didi Chuxing, Railway 12306, China Unicom Mobile Office and Tonghuashun were infected by the compiler malware and made available in App stores

For iOS 8 users: Antivirus software like LookOut detected the infected Apps

For iOS 9 users: Due to limitations Apple placed on apps, Lookout Mobile Security is not able to detect whether an infected app is installed

Xcode Ghost could be used for phishing attacks by opening Safari and showing a login window. The malware also copied information, like UUID and device name, from the infected device

Mobile Device Security

iOS Operating System

iOS malware **Oct. 2015**

YiSpecter attacks both jailbroken and non-jailbroken iOS devices (unmodded iPhones can be infected)

The first malware seen in the wild that abuses private APIs in the iOS system to implement malicious functions

Spread via hijacking of traffic (via DNS changes), an SNS worm on Windows, and an offline app installation (fake Video player) and community promotion

YiSpecter has been in the wild for over 10 months, but out of 57 security vendors in VirusTotal, only one is detecting the malware at the time of this writing.

YiSpecter consists of four different components that are signed with enterprise certificates

By abusing private APIs, these components download and install each other from a command and control (C2) server

Three of the malicious components use tricks to hide their icons from iOS's SpringBoard, which prevents the user from finding and deleting them. The components also use the same name and logos of system apps to trick iOS power users

Mobile Device Security

Android Operating System

Android

Android combines the Linux operating system and a Java-based platform called Dalvik

Developers write their apps in the Java programming language and then using Google's Android SDK convert their Java programs to run on the proprietary Dalvik platform on Android devices

Once converted, such an app can run on any Android device

Each Android app runs within its own virtual machine (just as Java applications do), and each virtual machine is isolated in its own Linux process

This model ensures that no process can access the resources of any another process (unless the device is jailbroken).

While Java's virtual machine was designed to be a secure, "sandboxed" system capable of containing potentially malicious programs, Android does not rely upon its virtual machine technology to enforce security

Instead, all protection is enforced directly by the Linux-based Android operating system

Mobile Device Security

Android Operating System

Android

Android's security model is primarily based on three of the five security concepts:

- Traditional access control
- Isolation
- Permission-based security model

Traditional Access Control

Android 2.X versions provide rudimentary password configuration options, including the ability to specify the strength of the device passcode, specify the phone's lockout time span, and specify how many failed login attempts must occur before the device wipes its data.

Android 3.0 introduced the notion of password expiration, enabling administrators to compel users to update their password on a regular schedule.

Android 4.4 and older had an integrated way to bypass your pattern, PIN, or other password if you forgot it.

In Android 5.0 Lollipop, so you'll have to enter an incorrect pattern or PIN five times at the lock screen before you'll see a "Forgot pattern," "forgot PIN," or "forgot password" button appear.

You'll be prompted to enter the username and password of the Google account associated with your Android device and then allowed to reset the pass code

Mobile Device Security

Android Operating System

Isolation

Like iOS, Android employs a strong isolation system to ensure that apps only access approved system resources. This isolates each *app from other apps* on the system, and also prevents apps from accessing or modifying the operating system kernel, ensuring that a malicious app can't gain administrator-level control over a device.

The default isolation policy prohibits access to virtually every subsystem of the device, with the following noteworthy *exceptions*:

- Apps may obtain the list of apps installed on the device and examine each application's programming logic (but not its private data).
- Apps may read (but not write to) the contents of the user's SD flash card, which typically holds the user's music, video files, installed programs, and possibly documents or saved attachments.
- Apps may read all of the data on the SD card without restriction (regardless of which app created a particular piece of data, all apps can read that data).
- Apps may launch other applications on the system, such as the Web browser, the maps application, etc.

Android permits applications to request á-la-carte access to the device's other subsystems—the isolation system then enforces each app's expanded set of permissions.

Mobile Device Security

Android Operating System

Is Isolation Effective?

Web browsers are by far the most targeted class of legitimate application, since attackers know that Web browsers often have security flaws that can easily be exploited by a properly crafted malicious Web page.

If an attacker posted a malicious Web page that attacked a known flaw of Android's Web browser and a user used a vulnerable browser to visit it, the attack could inject itself into the Android browser and begin running.

Once running in the Web browser's process, would this attack pose a threat?

Android's isolation policy would ensure that the attack could not spread beyond the browser to other apps on the system or to the operating system kernel itself.

However, such an attack could access any parts of the system that the Web browser app had been granted permission to access. For example, the Web browser could have permission to save or to modify data on the user's SD storage card.

Mobile Device Security
Android Operating System

Web browser exploits

Also, malicious code within the attacked process can also steal any data that flows through the process itself. In the case of a Web browser, the attack could easily obtain login names, passwords, credit card numbers, CCV security codes, account numbers, browsing history, bookmarks, etc.

Mobile users often access internal enterprise applications via their mobile Web browser, this could lead to leakage of highly sensitive enterprise data, even if VPN or SSL encryption are employed.

And such a malicious agent in the browser could also initiate malicious transactions on behalf of the user, without their consent.

Mobile Device Security

Android Operating System

Is Isolation Effective?

Consider the ability of Android's isolation system to protect against malicious apps such as Trojan horses and spyware.

Since Android's isolation system is designed to isolate each app from other apps on the system, this ensures that a malicious app can't tamper with other apps on the system, access their private data or access the Android operating system kernel.

However, an application can request excessive permissions and if allowed, it could access: the email inbox, the GPS system, the network and more.

This allows many categories of attacks to operate in the isolation mechanisms of Android.

Mobile Device Security

Android Operating System

Permissions-based Access Control

Android applications can do very little without explicitly requesting permission from the user to do so.

If an app wants to communicate over the Internet, at install time, it must explicitly request permission from the user to do this; otherwise the default isolation policy blocks it from initiating direct network communications.

Each Android app contains an embedded list of permissions that it needs in order to function properly.

This list of requests is presented to the user in non-technical language at the time an app is installed on the device, and the user can then decide whether or not to allow the app to be installed based on their tolerance for risk. If the user chooses to proceed with the installation, the app is granted permission to access all of the requested subsystems.

Mobile Device Security

Android Operating System

Permissions-based Access Control

Third-party apps can request permission to use the following high-level subsystems:
Networking subsystems:

• Apps can establish network connections with other networked devices over Wi-Fi or using the cellular signal

In the newest version of Android, android.permission.INTERNET and android.permission.WRITE_EXTERNAL_STORAGE have been downgraded from a rating of **dangerous** to **normal**. This means that you do not need to prompt the user before use.

Device identifiers:
• Apps can obtain the device's phone number, the device ID (IMEI) number, its SIM card's serial number, and the device's subscriber ID (IMSI) number.
These codes can be used by criminals to commit cellular phone fraud.

Messaging systems:
• Apps can access emails and attachments in the device's inbox, outbox, and SMS systems.
Apps can also initiate transmission of outgoing emails and SMS messages without user prompting and intercept incoming emails and SMS messages.

Mobile Device Security

Android Operating System

Permissions-based Access Control

Calendar and Address book:

• Apps can read, modify, delete, and add new entries to the system calendar and address book.

Multimedia and image files:

• Apps may access multimedia (for example, MP3 files) and pictures hosted by the device's photo application

Apps can request to save, modify, or delete existing data on external plug-and-play SD memory cards.

Once granted this permission, apps have unrestricted access to all of the data on the SD card, which is not encrypted by default

Mobile Device Security

Android Operating System

<u>Permissions-based Access Control</u>

Global positioning system:
• Apps may obtain the device's location.

Telephony system:
• Apps can initiate and potentially terminate phone calls without the user's consent.

Logs and browsing history:
• Apps may access the device's logs (such as the log of outgoing and incoming calls,
the system's error log, etc.) as well as the Web browser's list of bookmarks and surfing history.

Task list:
• An app may obtain the list of currently running apps.

Mobile Device Security

Android Operating System

Application Signing

Android's Digital Signing Model

The goal of digitally signing an application is ensure that the app's logic is not tampered with, to allow a user of the app to determine the identity of the app's author.

Google's approach undermines both of these goals.

Like Apple, the Android operating system will only install and run apps that have been properly signed with a digital certificate.

However, unlike Apple, software developers need not apply to Google to obtain a code-signing certificate. Instead, application developers can generate their own signing certificates, as often as they like, without any oversight. The software developer can place any company name and contact information in their certificate that they like.

The result is that a malware author can generate "anonymous" digital certificates as often as they like and none of these certificates or malware signed with them can be traced back to the author.

Mobile Device Security

Android Operating System

Application Signing

In order for developers to sell their apps on Google's official Android Marketplace, developers must pay a $25 fee via credit card.

This enables Google to associate the payee with the digital certificate used to digitally sign the developer's apps and should act as a mild deterrent against malware authors posting malware on the Android Marketplace (if they use their own credit card).

However, given that developers have the ability to distribute their apps from virtually any website on the Internet—not just the Android marketplace—malware programs can also be distributed with anonymity without any vetting by Google.

This approach makes it easier for attackers to add Trojan horses to existing legitimate apps. The attacker can obtain a legitimate app, add some malicious logic to the app, and then re-sign the updated version with an anonymous certificate and post it onto the Internet.

While the newly signed app will lose its original digital signature, Android will certify and install the newly signed malicious app with its anonymous digital signature.

Android's model does not realistically prevent tampering.

Mobile Device Security

Android Operating System

Application Signing

Like iOS, Android will never silently install an app onto a device. The user is always notified before a new application is installed.

This mostly prevents drive-by attacks common on PCs and requires attackers to employ social engineering (offer for free) to trick users into agreeing to install malicious apps on their devices.

Implementation Problems with the App Signing

The majority of devices running Google's Android operating system are susceptible to hacks that allow malicious apps to bypass a key security sandbox so they can steal user credentials, read e-mail, and access payment histories and other sensitive data

Android, like iOS, was found not to be authenticating the chain of trust correctly in older versions of Android, v2.1 – v4.4

Mobile Device Security

Android Operating System

Implementation Problems with the App Signing

The vulnerability stems from the failure of Android to verify the validity of cryptographic certificates that accompany each app installed on a device.

The OS relies on the credentials when allocating special privileges that allow a handful of apps to bypass Android sandboxing. Under normal conditions, the sandbox prevents programs from accessing data belonging to other apps or to sensitive parts of the OS. Select apps (and Device management extensions), are permitted to break out of the sandbox. Adobe Flash in all but version 4.4, for instance, is permitted to act as a plugin for any other app installed on the phone, presumably to allow it to add animation and graphics support. Similarly, Google Wallet is permitted to access Near Field Communication hardware that processes payment information.

Older versions of Android failed to verify the chain of certificates used to certify an app belongs to this elite class of super privileged programs. As a result, a maliciously developed app can include an invalid certificate claiming it's Flash, Wallet, or any other app hard coded into Android.

The OS, in turn, will give the rogue app the same special privileges assigned to the legitimate app without ever taking the time to detect the certificate forgery.

Mobile Device Security

Android Operating System

Encryption

The latest generation of Android tablet devices (running Android 3.0, 4.0, 5.0 and 6.0) support hardware encryption to protect data.

Devices running earlier versions of Android (including virtually all Android-based mobile phones) rely upon the isolation model, instead of encryption, to protect data such as passwords, user names, and application-specific data. Some version 2.3 devices encrypt data using software.

This means that if an attacker is able to jailbreak a device or otherwise obtain administrator-level access to a device by exploiting a vulnerability or by obtaining physical access to a device, they can access virtually every byte of data on the device, including most of the passwords, Exchange/ private email account credentials, etc.

Mobile Device Security

Android Operating System

Android 5.0

Full device encryption occurs at first boot, using a unique key that is not stored on the device.

Android 5.0, (Security Enhanced Linux) SELinux Enforcing mode is required for all applications on all devices.

Share your device securely with guest user mode
Create multiple user accounts to enable friends to log in on your device

Android Smart Lock to secure your phone or tablet by pairing it with a trusted device like your wearable or even your car.

Mobile Device Security

Android Operating System

<u>Android 6.0</u>

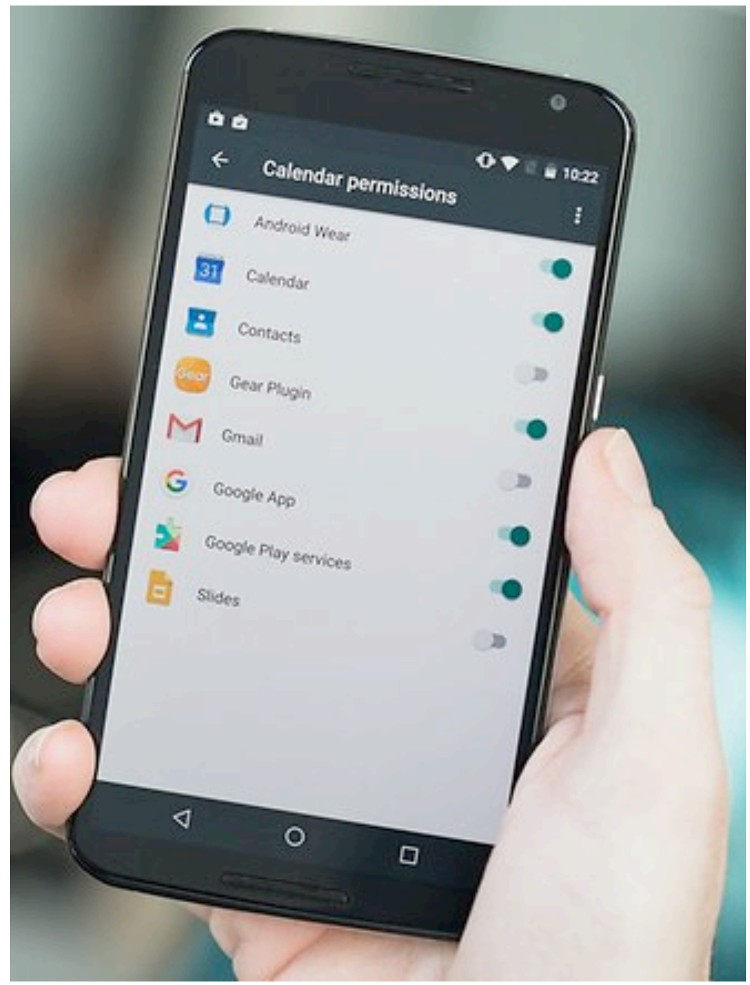
Marshmallow lets you check permissions
- By App
- Permission type

The first time an app needs access to your camera, microphone, contacts list or location, you'll see a pop-up requesting permission for that action alone.

You can grant or deny it as you choose.

Permissions classed as "normal" from a security standpoint, like internet access or the alarm clock, will be granted automatically upon install.

Permissions classed by the Android framework as "dangerous" – those included in the granular permissions list – are also reversible, meaning you can grant access when you need to, and then flip the switch again to protect your privacy.



Mobile Device Security

Android Operating System

<u>Android 6.0</u>

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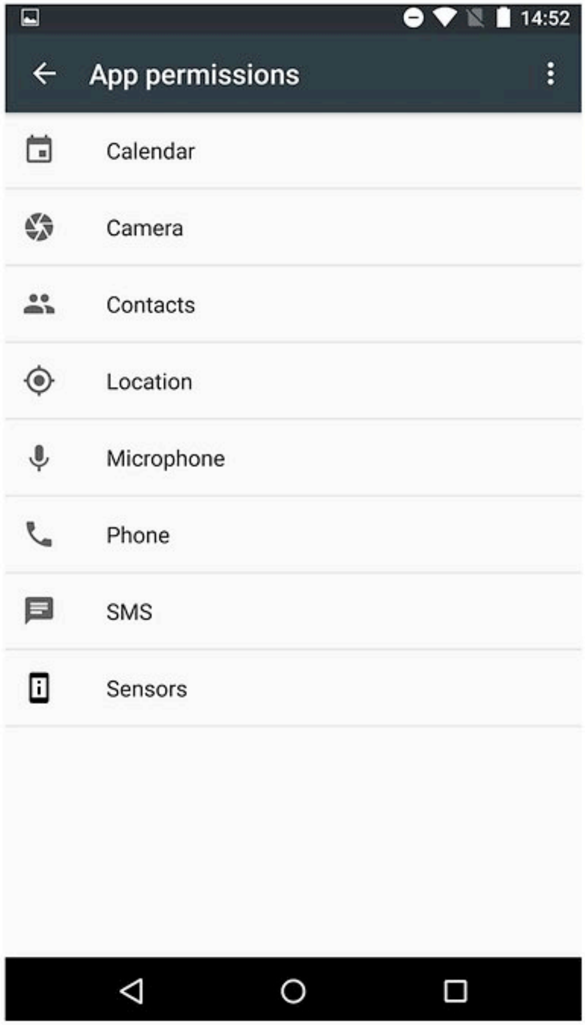

Mobile Device Security

Android Operating System

Android 6.0

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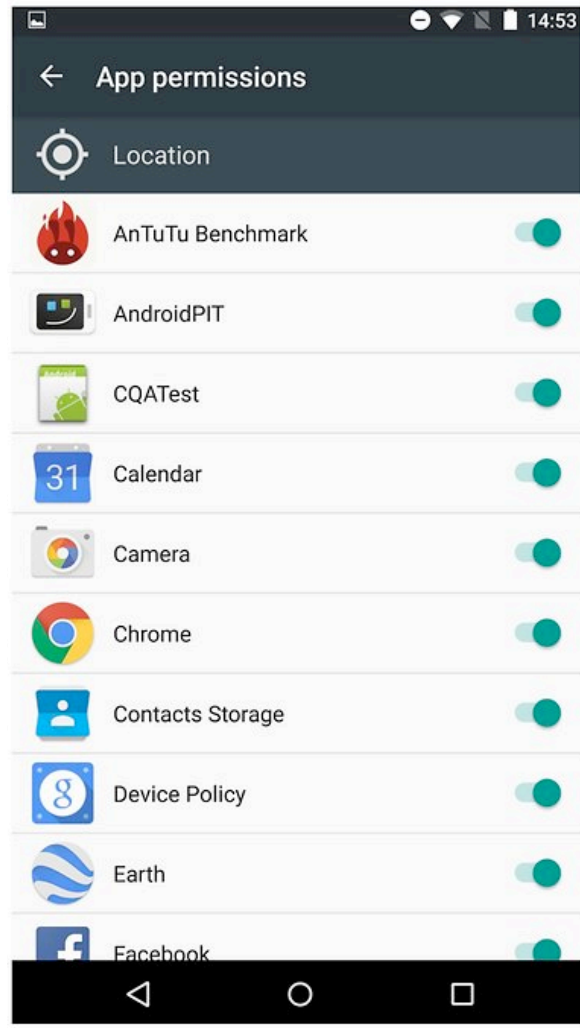


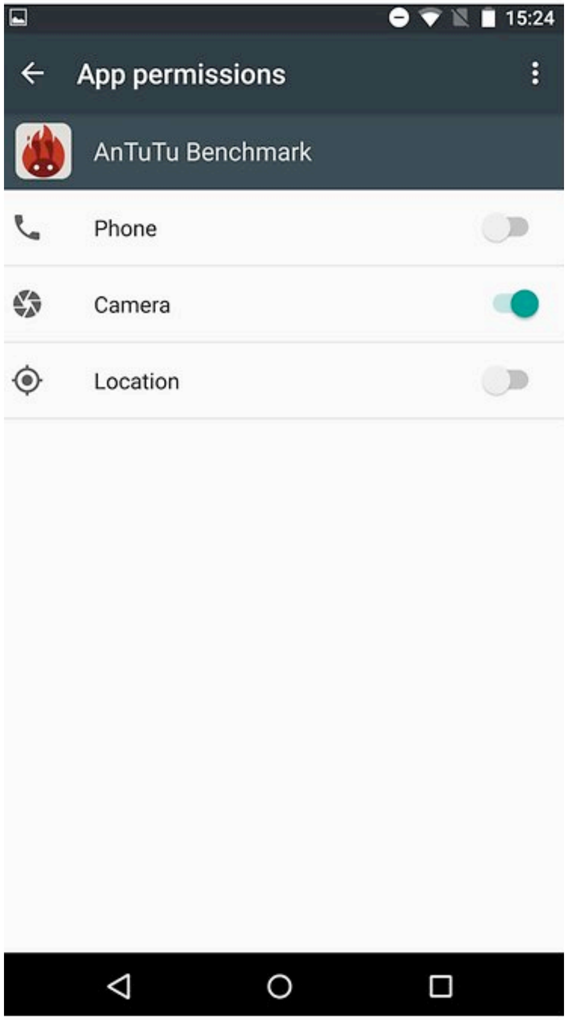
Mobile Device Security

Android Operating System

Android 6.0

Marshmallow lets you check permissions
- **By app** or
- Permission type

Legacy apps – those apps that were targeted at Android versions prior to Android M – will continue to behave like apps do now: with a long list of permission requests at install that must be accepted to proceed. However, once the app is installed a user can go into M's permission manager and revoke permissions as they wish. Android M's permissions structure is backwards and forwards compatible.



Mobile Device Security

Android Operating System

Android 6.0

Fingerprint API

Android Marshmallow introduces system-level fingerprint support via the new fingerprint API.

New devices have a fingerprint scanner

Android Pay and other touchless payment systems that rely on fingerprint scanners for authentication can now be handled by Android itself rather than a manufacturer add-on

Google has set minimum standards for scanner accuracy in order to pass its device certification.

Mobile Device Security

Android Operating System

Android 6.0

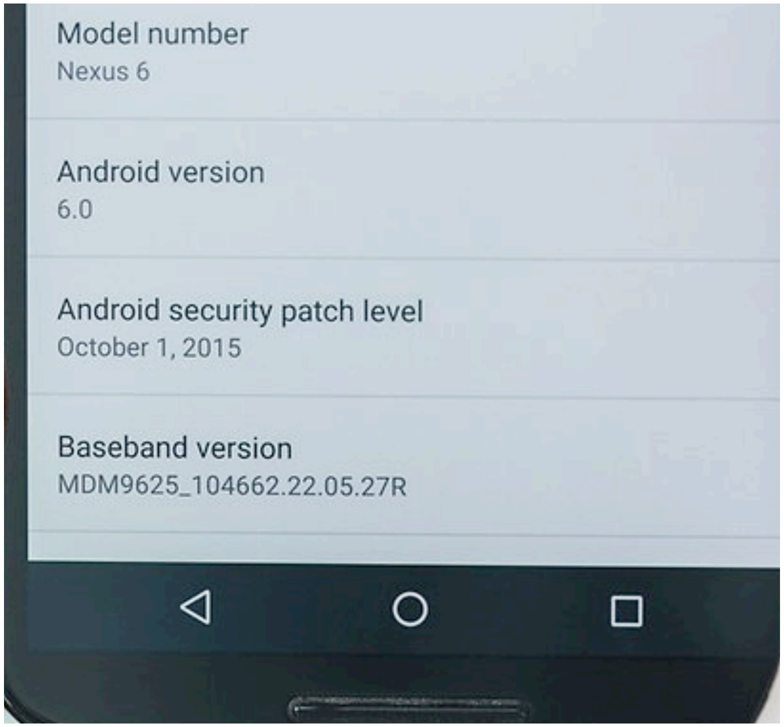
Network security reset

Network security reset allows you to remove all passwords, settings and connections associated with Bluetooth, cellular data and Wi-Fi

Monthly security patches

Following the Stagefright scare, Google and a number of manufacturers pledged to provide monthly security updates to keep on top of any security weaknesses in Android

Marshmallow now displays your device's Android security patch level section in the About phone section



Mobile Device Security

Android Operating System

Android 6.0

Encryption

New Android devices running Marshmallow are required to use full-disk encryption by default, but devices updated from a previous version of Android do not

Devices with minimal processing power are also exempt, as are devices without a lock screen, such as Android Wear watches

Encrypted devices will also be subject to Marshmallow's verified boot process to ensure the trustworthiness of their software during each boot sequence

If Android suspects changes have been made, the user will be alerted to potential software corruption

Mobile Device Security

Android Operating System

Android 6.0

Android for Work

Android Marshmallow is also pushing the enterprise angle with sandboxing for Bring Your Own Device (BYOD) environments

Through better handling of security, notifications, VPNs, access and storage, the same device can be used both for work and at home

Mobile Device Security

Android Operating System

<u>Android 6.0</u>

Smart Lock

Smart Lock was added to Android 5.0. Smart Lock on Marshmallow provides options for unlocking your device or keeping your device unlocked depending on various intuitive scenarios.

Smart Lock is found in the security settings and requires the use of some form of lock screen security.

Smart Lock includes options for trusted devices (for example, paired smartwatches or Bluetooth speakers), trusted places (home or office, via GPS and Wi-Fi data), trusted faces and on-body detection.

The last of these won’t lock your phone again until you put it down. Each Smart Lock feature is opt-in and reversible.

Mobile Device Security

Android Operating System

<u>Android 6.0</u>

Smart Lock for Passwords

Smart Lock for Passwords and it is basically a Google password manager allowing your website and app passwords to be saved to your Google account (which is why it lives in the Google section and not the Security section of Marshmallow)

You can also exclude apps or view your Smart Lock for Passwords content

microSD support – Adaptable Storage Devices

Expandable storage used to be a mainstay of Android devices, but then Google decided it was bad for security and removed support for it in Android KitKat.

Developers fought back and partial support was added in Lollipop.

Android Marshmallow fully supports microSD expansion in Android devices.

Under Marshmallow, microSD cards can be formatted to a specific device – meaning they will be unusable elsewhere – and treated as another part of internal storage by the Android system.

Mobile Device Security

Android Operating System

Vulnerabilities

Security researchers have discovered a couple dozen different vulnerabilities in various versions of the Android operating system since its initial release. Most were of lower severity and would only allow an attacker to take control of a single process (for example, the Web browser process) but not permit the attacker to take administrator-level control of the device.

The high severity vulnerabilities, when exploited, enabled an attacker to take root-level control of the device, granting them access to virtually all data on the device.

Many carriers don't release AndroidOS upgrades to their customers. As a result some 50% of devices in use have severe unpatched vulnerabilities.

Google took an average of eight days to patch each vulnerability once it was discovered.

Vulnerabilities Grant Elevated Permissions to Malicious Apps' When Android Updates 3/23/2014

Flaws recently found in Android puts devices running the mobile operating system at risk of privilege elevation attacks.
The newly-defined class of vulnerabilities increase permissions of malicious apps when Android is updated.
http://www.zdnet.com/android-bugs-leave-every-smartphone-and-tablet-vulnerable-to-privilege-escalation-7000027589/
http://www.informatics.indiana.edu/xw7/papers/privilegescalationthroughandroidupdating.pdf

Mobile Device Security

Android Operating System

Stagefright Vulnerability

Stagefright is the MPEG4 processor for Android

The Stagefright process is named mediaserver which runs with many privileges due to media user being in many (8) Unix groups including:

File, camera, MRPC (for talking to trusted zone), system, inet, bluetooth, graphics,

Input keylogger, shell and radii

Anything with system privileges can get root via half a dozen unpatched privilege escalation vulnerabilities in Android

Mediaserver is automatically restarted if it crashes

Mpeg4extractor function parses MP4 metadata values - these functions contain many buffer overflow/ heap overflow vulnerabilities

Mobile Device Security

Android Operating System

Stagefright Vulnerability

The Stagefright exploit can be triggered by:

- Loading a web page   don't have to load MP4 file or click on it
- Receiving an MMS
- Receiving or opening an email attachment push to download
- Anything that uses Download manager
- Inserting an SDCard
- Vcards

Scanning media after download is optional, but all apps seem to do it and this triggers the exploit

Making a thumbnail triggers the exploit

Scanning to find the length of a video triggers the exploit

Mobile Device Security

Android Operating System

Stagefright Vulnerability

Google removed com.android.MMS in newer versions of Android
But this application in older versions of Android had the bug too

Same code that handles MPEG4 also handles M4A and 3gp file formats

Stagefright is wormable, but that is complicated by all the versions of Android

MMS server auto restart means you can try the exploit over and over
Bypassing ASLR can be brute forced

Android 5.0 used gcc 5.0 which implements integer overflow prevention in the compiler

Of all protections in Android 5, ASLR is the only one that has to be bypassed to exploit Stagefright

Exploit POC MMS message was over 2 Mb

Two stage exploit process:

1. send Text with MMS
2. Run Privilege escalation exploit to get root

Mobile Device Security

Android Operating System

Android Auto-rooting Adware Nov. 2015

Distributed in trojan versions of legitimate top applications, including Candy Crush, Facebook, GoogleNow, NYTimes, Okta, Snapchat, Twitter, WhatsApp

This particular adware is silent, working in the background.

The apps root the device and install as system apps that cannot be removed without reflashing the system ROM

Even erasing the device doesn't remove the malicious app.

Instructions on reflashing the ROM of your device are available on websites like:

http://lifehacker.com/how-to-flash-a-rom-to-your-android-phone-30885281

Android 6 (Marshmallow) added verified boot and the kernel feature called Verity(https://source.android.com/devices/tech/security/verifiedboot/verified-boot.html)

These two together should at least warn users when their system partition has been changed

Mobile Device Security

Android Operating System

Some Android Malware

Android.Bgserv (March, 2011):

In response to the Android.Rootcager threat, Google deployed a tool over-the-air to clean up infected Android devices. Shortly after this cleanup tool was released, attackers capitalized on the hype and released a malicious fake version of the cleanup tool.

This Trojan horse exfiltrates user data such as the devices IMEI number and its phone number to a server in China.

2011: Zeus malware for Android steals financial data

2012: Spam Soldier

Spam Soldier sent spam messages with infected links to contacts in the address book of the infected phone.

Spam sent from the phone and any replies to those messages were hidden from the operator by the malware.

http://www.csoonline.com/article/729394/sms-becoming-meaty-attraction-for-spammers

Mobile Device Security

Android Operating System

Android Malware

Android Botnet Infects Up to 1 Million Phones in China

http://threatpost.com/en_us/blogs/new-android-botnet-infects-1m-phones-china-011513

Up to a million Android users in China could be part of a large mobile botnet according to research unveiled by Kingsoft Security, a Hong Kong-based security company, this week.

The botnet has spread across phones running the Android operating system via Android.Troj.mdk, a Trojan that researchers said exists in upwards of 7,000 applications available in the non-Google marketplaces, including the popular Temple Run and Fishing Joy games.

According to reports, the strain of malware was discovered in 2011 but recent analysis has shown the botnet has ramped up infection rates and at this point might have infected one million smartphones.

One report states that the botnet opens phones to remote hijacks and unauthorized purchases. A separate news entity, which first reported about the botnet, claims the malware has caused some phones to randomly open "strange software" that is tricky to remove.

Mobile Device Security

Android Operating System

Android Malware

Trojan SMS malware infect 300,000 devices, net crooks $6m (13th February 2014)

The trojan reportedly infects users' handsets via a bogus permissions notification, which when agreed to instigates a complex process that forces the victim to send text messages to a premium-rate number owned by the hackers.

http://www.v3.co.uk/v3-uk/news/2328691/android-apps-with-trojan-sms-malware-infect-300-000-devices-net-crooks-usd6m

Mobile malware: http://www.csoonline.com/article/2834571/malware-cybercrime/**new-technique-allows-attackers-to-hide-stealthy-android-malware-in-images**.html

Mobile Device Security

Android Operating System

Android Malware

Google Bouncer was introduced in February 2012 to scan all Google marketplace apps for malicious code. Several security experts have tested Bouncer and found that its detection rate is around 25%. http://www.csc.ncsu.edu/faculty/jiang/appverify/

Many different ways have been found to bypass Bouncer as it is possible for an app to tell it is running in the Bouncer environment and modify its behavior.

April 2014: Google announces continuous app scanning:

https://www.yahoo.com/tech/androids-new-security-feature-will-regularly-scan-your-82298930780.html

Android Botnet Targets Banks in Middle East (April 2, 2014)

A recently detected botnet targets Android users who do business at banks in the Middle East. More than 2,700 Android phones have been infected, and more than 28,000 text messages intercepted.

http://krebsonsecurity.com/2014/04/android-botnet-targets-middle-east-banks/

Mobile Device Security

Android Operating System

Android Malware – Bootkit for Android

http://thehackernews.com/2014/04/most-sophisticated-android-bootkit.html

Malware called Oldboot.A infected more than 500,000 Smartphone users worldwide with Android operating system, mostly in China.

Oldboot is designed to re-infect Mobile devices even after a thorough cleanup. It resides in the memory of infected devices; It modifies the devices' boot partition and booting script file to launch a system service and extract malicious application during the early stage of system's boot process.

Oldboot.B variant has advanced stealth techniques to defend it against antivirus software, and automatic analysis tools.

Mobile Device Security

Android Operating System

Android Malware – Bootkit for Android

http://thehackernews.com/2014/04/most-sophisticated-android-bootkit.html

Oldboot.B, Android Bootkit malware has following capabilities:

- It can install malicious apps silently in the background.
- It can inject malicious modules into system process.
- It can prevent malware apps from uninstalling.
- Oldboot.B can modify the browser's homepage.
- It has ability to uninstall or disable Mobile Antivirus software.

Android bootkit can’t be removed with antivirus

http://www.ehackingnews.com/2014/01/first-android-bootkit-virus-found.html

Threat gets into the device when user reflash their smartphones with the modified firmware containing this Trojan.

Mobile Device Security

Malware for mobiles can be divided into major categories of:

Data Stealer & Spying Tools - steal passwords, personal information, text messages and even voice calls

Premium Service Abusers - use your phone to make expensive toll calls and TXT messages with per message charges

Click Fraudster - use your smartphone's internet connection to fill out surveys or click on advertising where the virus writer gets paid per survey or clicked ad.

Malicious Downloader - malware that is not itself malicious, but downloads other malware that is.

The following is a list of mobile device operating systems ranked by the amount of malware in the wild for each:

1. Android
2. SymbianOS
3. Windows Mobile
4. Blackberry RIM
5. Apple iOS

The most common way malware gets on a smartphone is through trojan app downloads (including JAVA apps) where the application does something you want, but in the background also has malicious features.

Mobile Device Security

Android Malware Analysis Sandboxes

anubis.iseclab.org

mobilesandbox.org

joesecurity.org – apk-analyzer.net

www.virustotal.com

Linux Distro for mobile forensics, malware analysis, and security testing (Santoku)
https://santoku-linux.com/download

http://damnvulnerableiosapp.com/#downloads – iOS app for practicing PenTest and app auditing

Artifacts like Web browsing history, deleted files, deleted text messages, call history and downloaded email can be recovered from the file system of mobile phones

Mobile app Audit framework:
https://www.mwrinfosecurity.com/products/drozer/

Mobile Device Security

Recent Android Malware

Trojan Mobile Antivirus App:

http://www.androidauthority.com/armor-for-android-342192/

Android Ransomware

Scares the victim into believing their phone is overrun with malware and then kills key processes and deletes a significant amount of files in the attempt to prevent the victim from restoring their phone from a backup file.

Finally, after a short period of time the malware presents the victim with a special lock screen where the only option is to pay the attacker $99.99 via credit card for the “full” version of the antivirus software.

In the case of *Fake Defender*, paying the ransom has no effect: nothing is downloaded and nothing is restored.

The only option for the victim is to wipe the phone and start from scratch

Ransomware that changes the PIN code on the infected device:

http://www.pcworld.com/article/2983138/security/android-ransomware-changes-a-devices-pin-code.html

Mobile Device Security

Cross Device Infections

2013 also saw a new vector of infection for Windows: through Android.

Android/Claco is disguised as a harmless 'cleaner' application, but when plugged into the victim's Windows PC, Claco attempts to autorun a malicious file it placed in the root of the phone's filesystem.

The beginning of 2014 saw a new piece of Windows malware designed to infect Android devices.

Mobile Device Security

Cross Device Infections

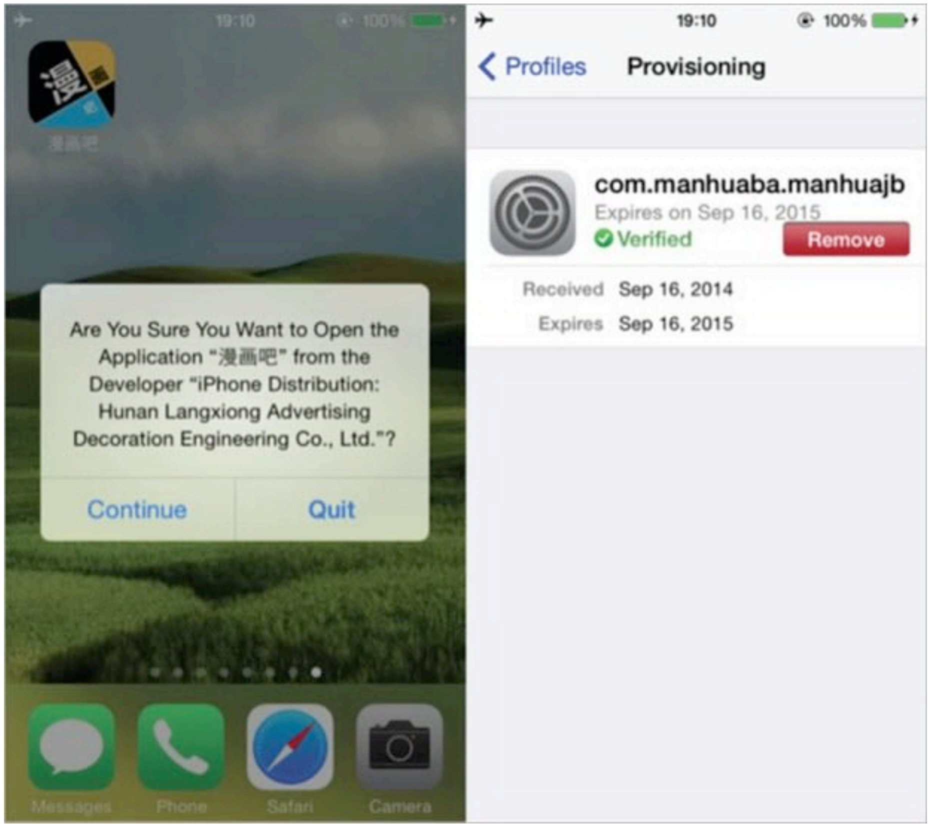
WireLurker Malware (November 6, 2014)

WireLurker infects iOS devices through apps downloaded to OS X machines from unauthorized, 3rd party app stores. The malware then infects iOS devices when they are plugged into infected OS X machines with a USB cable.

The malware is able to install malicious and infected programs on non-jailbroken iOS devices, by using enterprise provisioning techniques, thus appearing to be an in-house application.

Apple has revoked a cryptographic certificate that was being used to sign WireLurker.

So far, the malware appears to be affecting users in China. Apple urges customers to obtain apps only from the legitimate app store.



Securing Your Mobile Device

Antivirus software for Mobiles: Android

LOOKOUT – antivirus scanner and phone locator
AVG antivirus – scans apps and media
Norton Android mobile Security Lite – scans downloaded apps and app updates

NetQin Mobile Security – virus scanning and phone locator

All of these Apps are free